

ABSTRACT

Exploring the Usability Issues Encountered by Individuals with Visual Impairments on Social Networking Sites: Problem Description, System Evaluation and Semantic Web Solution

by

Julian Brinkley

April, 2014

Director of Thesis: Dr. M. H. Nassehzadeh Tabrizi

Major Department: Computer Science

While social networking sites (SNSs) like Facebook are widely used and have been broadly studied, investigations of their use by individuals with visual impairments are scarce within the academic literature. Anecdotal complaints regarding their usability however can be found in abundance online; an extension of the well documented difficulty that users with visual impairments have in interacting with the web generally relative to the sighted. The investigation of this issue began with a pilot study of the online behavioral habits of 46 internet users; 26 of whom self-identified as having a visual impairment (either blind or low vision). This was followed by an ethnographic usability study of the Facebook mobile interface, involving six blind participants, using JAWS screen reading software on desktop computers. Of the features evaluated participants were most severely challenged by the process of creating a user profile and identifying other users with whom to establish relationships. A portable profile architecture based on semantic web technologies is presented as a potential solution that may improve usability by decoupling the profile and relationship maintenance activity from any single system.

Exploring the Usability Issues Encountered by Individuals with Visual Impairments on Social
Networking Sites: Problem Description, System Evaluation and Semantic Web Solution

A Thesis

Presented To the Faculty of the Department of Department of Computer Science
East Carolina University

In Partial Fulfillment of the Requirements for the Degree
Master of Science in Software Engineering

by

Julian Brinkley

April, 2014

©Copyright 2014

Julian Brinkley

Exploring the Usability Issues Encountered by Individuals with Visual Impairments on Social
Networking Sites: Problem Description, System Evaluation and Semantic Web Solution

by

Julian Brinkley

APPROVED BY:

DIRECTOR OF DISSERTATION/THESIS:

M. H. N. Tabrizi, PhD

COMMITTEE MEMBER:

Junhua Ding, PhD

COMMITTEE MEMBER:

Sergiy Vilkomir, PhD

CHAIR OF THE DEPARTMENT OF COMPUTER SCIENCE:

Karl Abrahamson, PhD

DEAN OF THE GRADUATE SCHOOL:

Paul J. Gemperline, PhD

ACKNOWLEDGMENTS

I would like to thank my wife, Nathalie Brinkley, for her patience and support during the research process. I would also like to thank Dr. M. H. N. Tabrizi for his tremendous guidance during my graduate studies and Jennifer Jacobs for the instrumental logistical support that she provided.

Table of Contents

LIST OF FIGURES.....	x
LIST OF TABLES.....	xii
CHAPTER 1: INTRODUCTION	1
CHAPTER 2: BACKGROUND AND RELATED WORK.....	3
2.1 Visual Impairment.....	3
2.2 Accessibility versus Usability	3
2.2.1 Accessibility Technology.....	7
2.2.2 Screen Reading Software.....	7
2.3 Social Networking Sites.....	10
2.3.1 SNSs and Disabled Users.....	11
2.3.2 Facebook.....	13
2.3.3 Scenario: Screen Reader Social Networking Interaction.....	16
CHAPTER 3: ONLINE SURVEY	20
3.1 Method	20
3.1.1 Participants.....	20
3.1.2 Procedure	23
3.2 Results	23

3.2.1	Information Seeking and Online Exploratory Behavior	23
3.2.2	Website Usage Habits	28
3.2.3	Use of Social Networking Sites	30
3.3	Discussion	31
CHAPTER 4: ETHNOGRAPHIC USABILITY STUDY OF THE FACEBOOK SNS		32
4.1	Study Design	32
4.2	Method	36
4.2.1	Participants.....	36
4.2.2	Apparatus	37
4.2.3	Procedure	38
4.3	Results	48
4.3.1	Scenario 1 – Profile Creation.....	50
4.3.2	Scenario 2 – Social Search.....	54
4.3.3	Scenario 3 – Information Sharing.....	58
4.3.4	Scenario 4 – Privacy, Terms and Conditions and Account Visibility	59
4.3.5	Post Scenario Interview and System Usability Scale Questionnaire	59
4.4	Discussion	62
4.4.1	Limitations	62
4.4.2	Overview of Identified Usability Issues	62
4.4.3	Implications.....	63

CHAPTER 5: PORTABLE PROFILE ARCHITECTURE	64
5.1 Related Work.....	64
5.1.1 Linked Data.....	64
5.2 Portable Profile Architecture (Personal Profile Manager)	70
5.2.1 System Components.....	71
5.3 Use Case: Portable Social Network Profile.....	72
5.4 Implementation: eXtensible Accessible Portable Profile Application	73
5.5 Discussion	80
CHAPTER 6: CONCLUSION.....	81
REFERENCES	82
APPENDIX A: Online Survey.....	101
APPENDIX B: Informed Consent Document	108
APPENDIX C: Facebook Usability Test Screener.....	111
APPENDIX D: Study Checklist	115
APPENDIX E: Post Task Questionnaire	116
APPENDIX F: System Usability Scale Questionnaire.....	117
APPENDIX G: Post Scenario Questionnaire	118
APPENDIX H: Study Transcript.....	119
APPENDIX I: Institutional Review Board Documentation	175

LIST OF FIGURES

Figure 1: Screen reader interaction: using the arrow keys to traverse a web page.	8
Figure 2: Facebook standard UI accessed using the Google Chrome browser.....	14
Figure 3: Alternative version of the Facebook standard UI.....	15
Figure 4: Facebook mobile UI accessed using the Internet Explorer browser	15
Figure 5: Facebook mobile UI accessed using the Google Chrome browser	16
Figure 6: The typical process of a sighted user browsing his Facebook wall.....	17
Figure 7: Exploded view of the standard UI.....	18
Figure 8: Visualization of the Behavior Chain Model.....	33
Figure 9: Visualization of social networking site activities drawn from the literature.....	35
Figure 10: Testing scenarios as associated with user activities and phases of the BCM.....	41
Figure 11: Screen capture of the “People You May Know”	43
Figure 12: Screen capture of the edit profile page	52
Figure 13: Screen capture of the work history pag	53
Figure 14: Screen capture of a search for “Mary Jones”	56
Figure 15: Close up of the “People You May Know” feature	57
Figure 16: SUS scores as associated with participants’ responses.	60
Figure 17: An hCard representation of the author, Julian Brinkley.....	66
Figure 18: An hCalendar representation of ECU’s 2012 RCAW	66
Figure 19: The “Item Attribute” portion of an XML response.....	67
Figure 20: An RDF/XML description of the author.	68
Figure 21: An RDFa description of the author	69
Figure 22: Portable profile architecture.	72

Figure 23: Sequence diagram of the XappApp prototype	75
Figure 24: XappApp homepage.....	75
Figure 25: OAuth registration using Facebook.....	76
Figure 26: Returned Facebook profile information for the author in JSON format.	77
Figure 27: XappApp profile edit page	78
Figure 28: FOAF file of the author.....	79

LIST OF TABLES

Table 1: W3C Web Content Accessibility Guidelines	5
Table 2: Nielsen's 10 Usability Heuristics for User Interface Design	6
Table 3: The 15 Most Visited Social Networking Sites	11
Table 4: Breakdown of study participants	21
Table 5: Information Seeking and Online Exploratory Behavior	24
Table 6: Mean Scores Regarding Subjects' Online Exploratory Behavior	25
Table 7: Responses Related To Website Usage.....	29
Table 8: Responses Related To Social Networking Websites	30
Table 9: Participant Characteristics	37
Table 10: Scenario One Description and Task List	42
Table 11: Scenario Two Description and Task List.....	44
Table 12: Scenario Three Description and Task List.....	46
Table 13: Scenario Four Description and Task List	47
Table 14: Task Times and Completion Percentage	49
Table 15: Partial Description of the FOAF Vocabulary	70

CHAPTER 1: INTRODUCTION

The use of social networking sites (SNSs) like Facebook, LinkedIn, Twitter and others has become an important part of the online experience for many internet users. These systems which are generally characterized by a user's ability to construct a profile, establish connections with other users and view the connections of others [1], are increasingly used in a variety of personal, educational and professional contexts as a means to communicate, socialize and seek information [2]. Some reports suggest that as many as 72% of all online adults in the United States use SNSs [3] and that the use of these systems accounts for the majority of time that these individuals spend online [4].

Perhaps due in no small part to their popularity these systems have been broadly studied, to include research which has focused on their use by individuals with a variety of physical and cognitive disabilities [5], [6], [7], [8]. Despite the significant presence of SNS research in the academic literature, research which focuses on the use of these systems by individuals with visual impairments is limited. Where studied however SNSs categorically have been described as having a degree of technical accessibility [9], [10] while generally possessing a number of significant usability issues which may contribute to their relatively low rates of use by individuals who are blind [11]. The limited empirical data available appears to mirror the numerous anecdotal complaints about the usability of many of the most popular systems which can be found within any number of online communities of visually impaired users and among the content of the systems themselves.

This thesis aims to: (1) investigate the heretofore anecdotal complaints regarding the usability of SNSs, (2) document the user experience of blind users through an evaluation of the

Facebook social network and (3) propose a solution to the identified usability issues that capitalizes on existing and emerging semantic web technologies.

This thesis is organized as follows:

Chapter 2 defines visual impairment, describes common web accessibility concepts, discusses the most common accessibility technologies and provides a distinction between web accessibility and usability as it is discussed within this thesis.

Chapter 3 presents a pilot study involving 46 participants (26 blind or low vision and 20 sighted) designed to evaluate the online behavior of individuals with visual impairments relative to that of sighted individuals.

Chapter 4 presents an ethnographic study of the Facebook social network designed to identify the specific usability issues suggested by the preceding pilot study. The study's six blind participants utilized the configuration most commonly associated with blind users in this context; the JAWS screen reader, the Facebook mobile interface and a desktop or laptop computer.

Chapter 5 presents a portable profile architecture and system prototype (XappApp) designed to address the usability issues identified in the ethnographic study using semantic web technologies.

Chapter 6 concludes the thesis and discusses future directions for work of this type.

CHAPTER 2: BACKGROUND AND RELATED WORK

2.1 Visual Impairment

Visual impairment is a term that encompasses a range of visual disabilities and is often discussed ambiguously in accessibility and usability research. The International Statistical Classification of Diseases and Related Health Problems (ICD) currently recognizes three levels of visual impairment: (1) moderate, (2) severe or (3) full blindness [12], [13]. In the academic literature these classifications are joined by the descriptors “fully blind”, “partially blind” or “visually impaired” [14], [15]. Additionally, there exists any number of legal or statutory definitions of blindness which, when coupled with the aforementioned descriptions make visual impairment a generally subjective term when presented absent context. This thesis uses two categories of classification: referring to individuals who self-identify as blind or have been legally determined to be so as (1) blind and to individuals with some degree of sight not correctable by traditional means (e. g. glasses or contact lenses) as being individuals with (2) low vision.

Worldwide it is estimated that approximately 285 million individuals live with some form of visual impairment based on ICD classifications (39 million blind, 246 million low vision); 90% of these individuals live in developing countries [13]. Approximately 7% of U.S. adults self-identify as blind or as individuals with low vision [16].

2.2 Accessibility versus Usability

The close relationship between the terms *accessibility* and *usability* often result in their inconsistent, interchangeable and often overlapping use in the academic literature. Definitions are provided to clearly distinguish these terms from one another within this thesis however. Web

accessibility [17], [18], [19] is used to describe the degree to which a website adheres to established standards, heuristics or regulatory requirements to provide access to online resources whereas usability is used to describe the qualitative characteristics of user interaction.

It is a generally accepted contention that the web poses significantly greater usability challenges for individuals with visual impairments than for those with sight [20], [21], [22], [23]. While this broad, persistent and multifaceted problem cannot be simply characterized, these usability issues are often the direct result of: (1) websites poorly designed with respect to the needs of visually impaired users [21], (2) websites with little to no implementation of common accessibility standards [14], [24] (3) the overwhelmingly visual nature of the web itself and (4) deficiencies with current accessibility technologies [1]. Web accessibility revolves around the concept of mitigating or eliminating these issues to enhance the ability of users with disabilities to, “perceive, understand, navigate and interact with the web” [19]. To assist developers in their desire to make online content more accessible to individuals with disabilities, the World Wide Web Consortium (W3C) has established 14 recommendations which it refers to collectively as the Web Content Accessibility Guidelines (WCAGs) as outlined in Table 1 [25]. The WCAGs are joined by several existent and proposed recommendations which claim to facilitate more accessible online resources [26], [27].

The WCAGs are not per se standards in that the W3C has no enforcement authority and has no practical influence over how these recommendations are implemented. This stands in contrast however to the legally enforceable requirements that are expressed in many federal and state statutes. Section 508 of the Rehabilitation Act of 1973 [28], the Americans with Disabilities Act (ADA) [29] and the California Application Development Accessibility Statute are only a handful of the many laws relating to the accessibility of electronic information [30], [31]. It is against

any, some or all of these recommendations that technical accessibility may be measured (e. g. evaluations of technical accessibility with respect to the WCAGs or ADA guidelines [32]) and metrics have been developed to represent a web page or site’s degree of adherence to one or more of these recommendations [33].

Table 1: W3C Web Content Accessibility Guidelines

Number	Guideline Description
1	Provide equivalent alternatives to auditory and visual content.
2	Don’t rely on color alone.
3	Use markup and style sheets to do so properly.
4	Clarify natural language usage.
5	Create tables that transform gracefully.
6	Ensure that pages featuring new technologies transform gracefully.
7	Ensure user control of time-sensitive content changes.
8	Ensure direct accessibility of embedded user interfaces.
9	Design for device-independence.
10	Use interim solutions.
11	Use W3C technologies and guidelines.
12	Provide context and orientation information.
13	Provide clear navigation mechanisms.
14	Ensure that documents are clear and simple.

Where accessibility may be generally viewed as referring to a site’s somewhat subjective satisfaction of defined requirements to facilitate access to information, usability is a user’s entirely subjective perception of the quality of an interaction. Unlike assertions regarding

accessibility which may be based on a site’s generally measurable adherence to a standard or guidelines, the subjective nature of usability renders any concrete assertions in this regard questionable. While the WCAGs possess a *degree* of subjectivity (e. g. guidelines 4, 13 and 14) usability is *entirely* subjective given that what is deemed usable for one individual may not be so for another. Despite the incompatibility with concrete definitions recommendations to support the development of more usable systems are not uncommon. Nielsen’s 10 Usability Heuristics for User Interface Design [34], one of the more well-known examples of usability recommendations, are outlined in Table 2.

Table 2: Nielsen's 10 Usability Heuristics for User Interface Design

Number	Heuristic
1	Visibility of system status.
2	Match between the system and the real world.
3	User control and freedom.
4	Consistency and standards.
5	Error prevention.
6	Recognition rather than recall.
7	Flexibility and efficiency of use.
8	Aesthetic and minimalist design.
9	Help users recognize, diagnose and recover from errors.
10	Help and documentation.

Based on the provided descriptions and definitions accessibility and usability are used as follows within this thesis: A website may be viewed as technically *accessible* in terms of its

adherence to the fourteen WCAGs or ADA guidelines. This same website however may also be viewed as lacking functional *usability* given that usability is rooted in a user's perception of the quality of an interaction and is independent of any heuristic or guideline.

2.2.1 Accessibility Technology

While real and imagined alternative interaction technologies exist [35], this thesis concentrates on the most widely used and by inference the most effective accessibility technology for blind users; a class of software generally referred to as screen reading applications [36], [37], [38].

2.2.2 Screen Reading Software

More than 90% of individuals with visual impairment report the use of some type of screen reading application to support their computer use [36], [37]. These applications are implemented in one of two ways; either as standalone product that operates in conjunction with a standard web browser or as specialized web browser with text-to-speech capabilities. In either implementation, the markup of a given page is analyzed for relevant content which is then converted to synthetic speech. The practical result is that the content of a given web page is literally read to the user who responds using predefined keyboard commands or individual keys (Figure 1).



Figure 1: Screen reader interaction: using the arrow keys to traverse a web page.

Two of the more commonly used standalone products, according to the American Foundation of the Blind (AFB) [39], are Job Access with Speech for Windows (JAWS) [40] and NonVisual Desktop Access (NVDA) [41]. Examples from the specialized browser category would include the IBM Home Page Reader [42], the Brookes Talk browser and pw Web Speak [38] each of which have been discontinued.

While screen reading technology is an effective means of providing access to a web that would be otherwise inaccessible to individuals with visual impairments, the method of interaction that screen readers facilitate is not without its limitations. The navigational and spatial orientation difficulties experienced by blind screen users which are partially born of the highly visual nature of online media have been well documented [43]. These *virtual* mobility problems have been described as being analogous to the real world mobility challenges faced by blind individuals [43], [44]. The resultant disparities in task efficiency between sighted users and

blind screen reader users is also a topic that has been thoroughly investigated [21], [23], [37]. In general, most studies suggest that while screen reader users are generally able to accomplish desired tasks it takes longer to do so and is often significantly more difficult than for sighted individuals. These limitations appear to be the result of both limitations with the technology itself and the inconsistent adherence to web content accessibility standards.

There exist any number of well documented accessibility regulations and standards to include those previously described [25], [28], [29], [30] and many others. Even the most comprehensive standard is useless however if its adoption is limited, its implementation is inconsistent or its enforcement is lax or nonexistent. A number of studies have documented the degree to which an overwhelming majority of websites fail to fully comply with *any* standard for accessibility [24], [45]. This reality is problematic in that screen reading applications work optimally when these standards and best practices are fully implemented (e. g. “alt” text for images, proper hyperlink descriptions and appropriately descriptive buttons and form inputs). These same applications respond poorly when this information is absent or incomplete. An unlabeled hyperlink for instance may be vocalized by a screen reading application as simply “Link” and an unlabeled button as simply “Button” (violations of the WCAGs; guidelines one and twelve see Table 1). While these elements may be visually descriptive enough to convey the appropriate meaning to a sighted user, “Link” and “Button” are meaningless to users with visual impairments without accompanying contextual information.

The opposite end of this vocalization spectrum is information overload that largely relates to deficiencies with the software itself. Many screen reading applications have difficulty distinguishing between relevant content and HTML markup which results in confusing, vocalized jumbles that are difficult for many users to interpret [21].

The cost of screen reading software itself is also a significant issue. JAWS software, the most widely used according to some data [9], [46], varies in price between \$895.00 and \$1,095.00 depending upon the version [40]. The \$895.00 base price is more than double reports of the estimated average cost of a tablet computer (\$386) [47] and is nearly twice the cost of the average “everyday desktop” (\$488.32) sold by Dell Computer [48]. While lower cost and free options like NVDA exist, the market dominance of JAWS suggest that these lower cost options may be viewed as somehow inferior by screen reader users. This issue is exacerbated by the economic realities of many individuals with visual impairments who generally have higher unemployment rates and lower wages than the general population based on recent US employment data [49]. Cost is also a factor of some significance in the governmental and educational environments as well given that this expenditure is in addition to the cost of acquiring compatible and suitably configured personal computers [36].

2.3 Social Networking Sites

Social networking sites are online services that: (1) permit the construction of a public or semi-public user profile, (2) within a bounded system and (3) permits users to construct a list of other users with whom they share a connection while also viewing similar lists created by others [1]. These systems are also generally persistent and searchable and capable of obscuring the offline identity of their online account holders [50]. The 15 most popular SNSs [51], ranked by their estimated unique monthly visitors are presented in Table 3.

Table 3: The 15 Most Visited Social Networking Sites

Name	Estimated Unique Monthly Visitors^a	Purpose
Facebook	900,000,000	Social/Entertainment
Twitter	290,000,000	Social/Entertainment
LinkedIn	250,000,000	Business
Pinterest	150,000,000	Social/Entertainment
GooglePlus	126,000,000	Social/Entertainment
Tumblr	125,000,000	Blogging
Instagram	100,000,000	Photos
Flickr	80,000,000	Photos
VK	79,000,000	Social/Entertainment
MySpace	40,000,000	Social/Entertainment
Tagged	38,000,000	Social/Entertainment
Meetup	35,000,000	Social/Entertainment
Ask.fm	34,000,000	Social/Entertainment
MeetMe	10,500,000	Social/Entertainment
Classmates	10,000,000	Social/Entertainment

^aAccording to Alexa.com as of 2/7/2014.

2.3.1 SNSs and Disabled Users

There have been any number of SNSs marketed towards individuals with visual impairments; some intentionally designed to be more compatible with the type of specialized accessibility devices used by many blind and low vision users and others where this compatibility was a byproduct of a non-traditional design. The now defunct Inclusive Planet

(inclusiveplanet.com) for instance was designed specifically for users with visual impairments and with recognition that the site would be accessed predominantly by those using text to speech and screen magnification technology [52]. AudioBoo (audioboo.fm) is an SNS designed around the use of recorded audio and as a byproduct of this design has been promoted as a more accessible option for individuals who use sound as a primary means to consume web based content [53]. Whereas AudioBoo, marketed primarily towards the general public, reports nearly 8 million unique users [54], sites like Inclusive Planet have generally failed to attract enough committed users to sustain economic viability.

While the specific cause of failure of any one SNS specifically targeted towards individuals with disabilities is likely complex, these systems may be doomed to failure due to user motivations and the perception that these systems are representative of what can be characterized as a type of digital isolation of the disabled. A number of studies have demonstrated that the use of SNSs generally is motivated by a desire to connect and communicate with individuals that a user has met offline and by the opportunity to establish new relationships [55], [56], [57]. Users thus go where their offline friends and *potential* online friends are even if doing so is met with some difficulty. As a result, attracting blind users to a system specifically geared towards individuals with disabilities may be significantly difficult, despite the promise of a superior user experience, given that many of the target users' friends may not necessarily be disabled and will likely have an active account on one or more SNSs marketed towards the general public. The use of these systems may in turn become stigmatized as something separate and less than the systems used by "everyone else".

2.3.2 Facebook

With nearly one billion unique monthly users Facebook is the world's largest and most visited SNS [58] (see Table 3), is the world's second most visited website generally [59] and is commonly viewed as the most widely used SNS by individuals with visual impairments [9], [60]. While largely ignored within the academic literature, Facebook's significant usability issues for users with visual impairments have been a topic of significant discussion in online communities and within the content of Facebook itself. Within the context of screen reader interaction, many of these complaints describe issues with one or more versions of the Facebook user interface (UI), accessed using a desktop or laptop computer equipped with screen reading software that vocalizes web based content. This configuration, while not necessarily exclusive to blind users, is most commonly associated with blind users and is the focus of our investigation. While it is not the author's contention that Facebook is free of usability issues aside from those related to screen reader interaction, studies exist which suggest otherwise [61], this issues serves as the focus of this thesis given its limited discussion in the academic literature.

In a 2009 study [46], Facebook was identified as one of the five least accessible websites by screen reader users. These findings mirror other complaints which suggest that the Facebook standard UI is largely incompatible with commonly used screen reading software like JAWS and NVDA. Facebook's corporate position on this topic has fluctuated over the years, at times encouraging the use of the purportedly more screen reader accessible HTML-only mobile interface (m.facebook.com) [62], and more recently recommending the specific combination of the standard interface (facebook.com), the JAWS screen reader and either the Internet Explorer or Firefox web browser [63].

This issue is further clouded by the numerous Facebook UIs which have been observed to vary depending upon the web browser used and the features associated with a particular user account; a topic that has become a common topic in the Facebook help center [64]. Multiple concurrent variations of the both the standard and mobile UIs may exist although the specifics of Facebook's UI versioning are unpublished by the company and are unknown beyond what has been observed. Figure 2 and Figure 3 illustrates variations in the appearance of the home page of the standard interface when accessed using two different user accounts and the Google Chrome web browser on a desktop computer. Figure 4 and Figure 5 illustrates variations in the appearance of the home page of the mobile interface when accessed using the same user account with two different web browsers on a desktop computer.

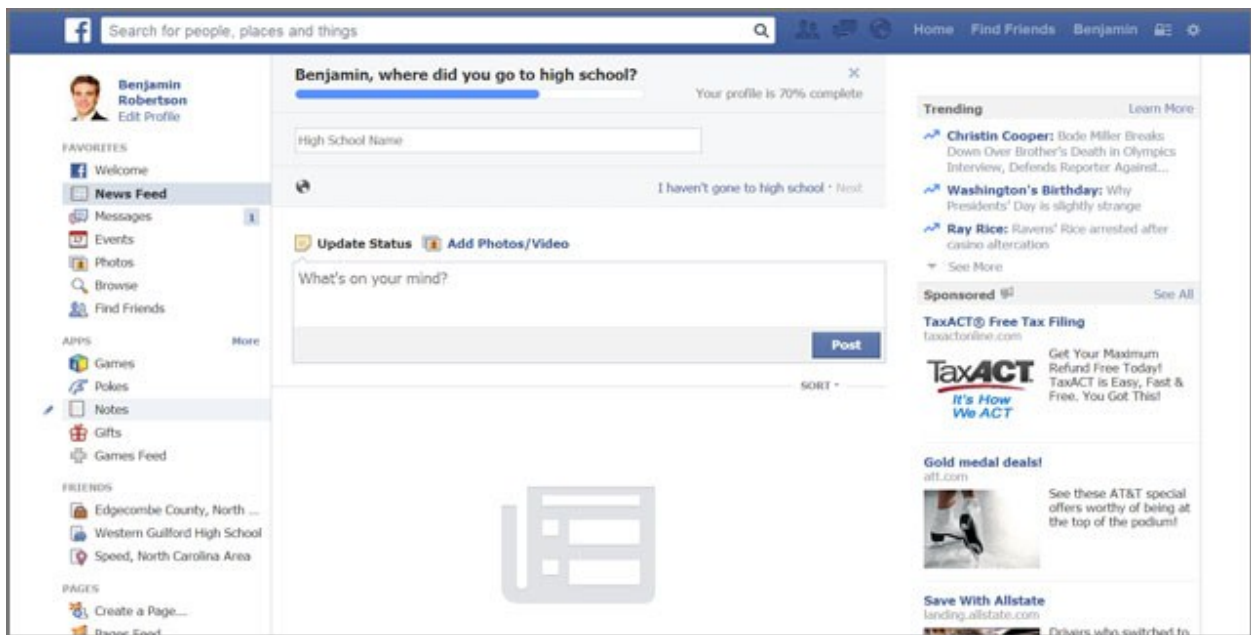


Figure 2: Facebook standard UI (facebook.com) accessed using the Google Chrome browser.



Figure 3: Alternative version of the Facebook standard UI (facebook.com) accessed using the Google Chrome browser.



Figure 4: Facebook mobile UI (m.facebook.com) accessed using the Internet Explorer browser.

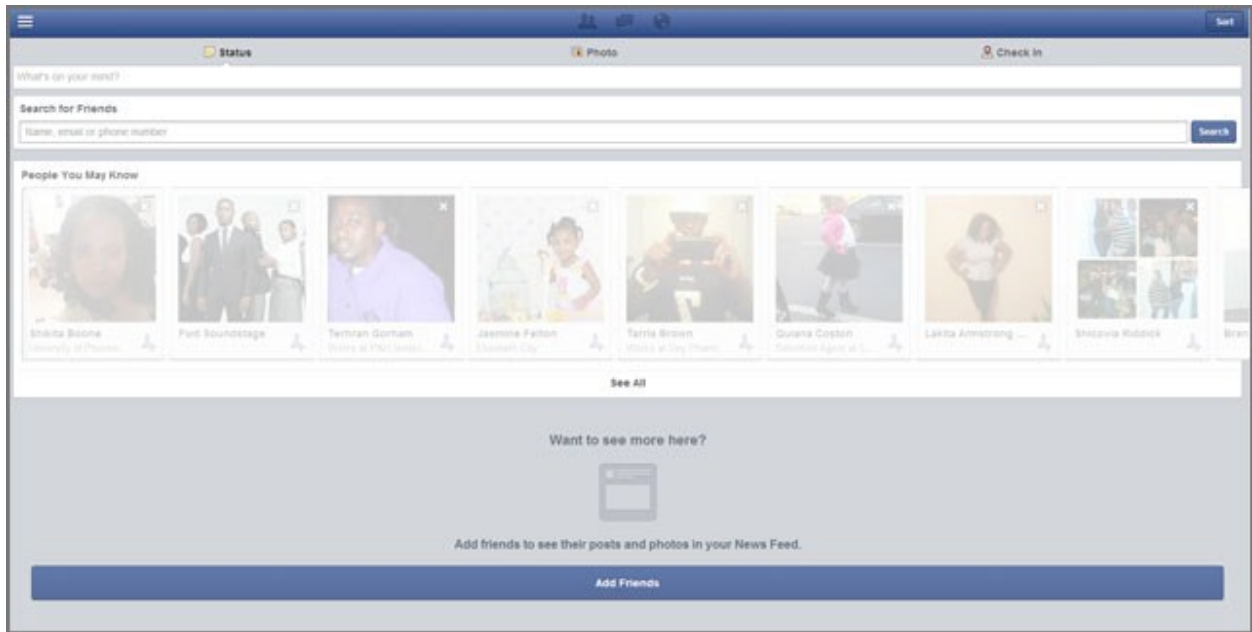


Figure 5: Facebook mobile UI (m.facebook.com) accessed using the Google Chrome browser.

2.3.3 Scenario: Screen Reader Social Networking Interaction

To better describe the SNS-specific usability challenges encountered by individuals with visual impairments, a scenario is presented which describes the likely interaction of a sighted individual with the Facebook UI (Figure 6). This is followed by the description of the same interaction attempted by the author using screen reading software (Figure 7).

To begin, the sighted user provides an email address and password for authentication and access to the secure area of the website. Upon authentication, a multi column user interface is displayed to the user with social activity data displayed in both the center and far right columns. As illustrated in Figure 6 this activity data is listed in descending chronological order (by date and time posted). For a sighted user, a review of the full activity timeline is as easily accessible as scrolling to the bottom of the displayed web page. From this cursory scan a sighted user can

then select any specific post of interest and perform any number of content specific tasks (e.g. share with other users, comment, or ‘like’ in the parlance of Facebook). The highly illustrative and linear visual organization implies the steps necessary to accomplish common tasks. While this reliance on visual cues is a clear asset for sighted users it is an impediment to users with visual impairments.



Figure 6: The typical process of a sighted user browsing his “wall” on the Facebook standard interface (facebook.com).

The author attempted this same interaction using the Google Chrome web browser and the Vox screen reading extension [65]. The difficulty of using screen reading technology within the illustrated social networking context is apparent. Figure 7 illustrates the order in which the same page highlighted in Figure 6 would be rendered as audio output by the screen reader; broken down into individual components for explanation purposes. As the illustration indicates,

orientation would likely be exceedingly challenging given the screen reading application's irregular movements across the page. Unlike the vertical, linear scrolling of the sighted user, movement using the keyboard's up and down keys shifts the content sections under focus irregularly across the page (see Figure 7, content sections numbered in order of vocalization from 1 to 10). The Vox screen reader then vocalizes the content under focus, uncovering several unlabeled buttons, unlabeled links and hidden HTML elements which are not vocalized at all and are indicated by a red 'X' in Figure 6.



Figure 7: Exploded view of the standard UI demonstrating the order in which content sections are vocalized by the ChromeVox screen reader (numbered 1 – 10).

A number of unrelated page components must be fully traversed before any actual recognizable social content is encountered and vocalized. A screen reader user would likely be lost within the first few movements, given the highly irregular page focus, notwithstanding the many unlabeled page elements. The dashed arrow (Figure 7, arrow a) indicates the likely order with which a sighted user might scan the central elements of interest within the UI to arrive at the same destination; a decidedly more linear process. While the difficulties highlighted within this common task are significant, they are in no way unique. These types of significant usability problems have been reported anecdotally and with varying degrees of severity on a number of SNSs.

As the aforementioned example suggests, even a relatively simple layout may present navigational challenges in the context of SNSs and screen reading technology. But unlike the static example given, the real world user interfaces of social networking applications change constantly and in real time given that the structure of the UI largely revolves around user generated content. In many cases the real time addition of new content affects cursor positioning as well, which makes a likely confusing environment even more so. The result is that spatial orientation becomes virtually impossible.

CHAPTER 3: ONLINE SURVEY

Given that the modern World Wide Web is a largely visual medium, it would stand to reason that some usability disparity would exist between sighted users and individuals with some degree of blindness. This contention is bolstered by the fact that these visually impaired users, by virtue of the nature of their disability, access the web using technologies with a number of documented deficiencies [23], [36], [37], [38]. While the quantification of this disparity varies, several studies have indicated that the web is roughly three times more difficult to use for individuals with visual impairments than it is for sighted users [21], [23]. Few studies however have directly addressed the degree to which this problem impacts the online behavior of individuals with visual impairments leaving many questions in this regard unanswered:

- 1) Are the types of usability issues faced by individuals with visual impairments largely universal or do they vary depending upon the website type in question?
- 2) Do individuals with visual impairments avoid new or unfamiliar websites due to fears regarding ease of use and accessibility?
- 3) What impact do these issues have on these users' participation in highly interactive social networking sites?

3.1 Method

3.1.1 Participants

A convenience sample of 46 individuals participated in the pilot study, the composition of which is outlined in Table 4. Of the 46 participants, 25 (18 men, 7 women) were categorized as having some type of visual impairment; the remaining 21 participants (6 men, 15 women) were identified as “sighted”. While a large, more representative sample would have been preferable, it

was determined that a convenience sample of as few as 10 participants with visual impairments was acceptable in this initial phase of the research effort although 25 individuals with visual impairments ultimately participated in the study. The added complexity and expense of random sampling with a large number of participants was deemed unnecessary for this preliminary work given that this study was conducted largely to provide direction for further investigation.

Table 4: Breakdown of study participants

Participants	Sighted		Visually Impaired		Combined	
	%	Number	%	Number	%	Number
Sex						
Male	29	6	72	18	52	24
Female	71	15	28	7	48	22
Age						
18 to 25	58	12	48	12	52	24
26 to 35	19	4	8	2	13	6
36 or older	23	5	44	11	35	16

While research involving the general population typically requires a representative sample of 20-30 participants at a minimum, it is generally acceptable for Human-Computer Interaction (HCI) research involving users with disabilities to have as few as 5-10 participants in some cases [66]. In the case of individuals with significant visual impairments issues with physical mobility, chiefly lack of transportation and scheduling difficulties, have been well documented as barriers to study participation [66]. These individuals often utilize any number of specialized web browsers or screen reading applications with personalized configurations, therefore the ability to

precisely duplicate a specific user's configuration in its totality within a research setting has its difficulties; an issue which exacerbates the aforementioned mobility problem. Distributed research methods, like online questionnaires, have a number of attractive qualities within the context of usability research involving disabled populations. While there may exist some trade off in terms of study control relative to direct observation or interview, the added convenience of distributed research methods may potentially increase participation by eliminating roadblocks to participation. As a result, distributed research methods like diaries or surveys are often ideal tools for HCI research involving these users. These methods allow participation using accessibility configurations that are most familiar to the participants as well as participation at a time and location of the greatest convenience. Recognizing these factors an online questionnaire was chosen for this study.

Participants were recruited through the assistance of organizations for individuals with visual impairments and through Facebook posts. In the case of the former, study information was distributed via email to the respective membership of the National Association of Blind Students (NABS), the North Carolina Association of Blind Students (NCABS) and the Massachusetts Association of Blind Students (MABS); with the assistance of each organization's respective leadership. Each e-mail contained a detailed description of the study, consent information and a clickable text hyper-link to the online questionnaire (Appendix A). In the latter case, distribution via SNS, this same explanatory and consent information was made available with a text hyper-link to the online questionnaire using a Facebook page administered by the authors. The study protocol was approved by the East Carolina University, University and Medical Center Institutional Review Board (see Appendix I).

3.1.2 Procedure

A 33 question, mixed type, online questionnaire was developed which also included user ratings on a five point Likert scale (from 1 = *strongly disagree* to 5 = *strongly agree*) [67]. In addition to collecting demographic information, questions focused specifically on participants' online exploratory behavior, web usage habits, general opinion of web usability, opinions regarding website interactivity and use of SNSs. Some emphasis was given to social networking within the study given the rise of social networking applications and the increasing incorporation of social networking capabilities into all manner of websites. Five questions within the study addressed social networking specifically.

3.2 Results

3.2.1 Information Seeking and Online Exploratory Behavior

Table 5 and Table 6 provide a comparison of the information seeking and online exploratory behavior of both the sighted and visually impaired participant groups. Overall, both groups felt that they could relatively easily find what they were looking for online as expressed within a series of questions on a five point Likert scale (from 1 = *strongly disagree* to 5 = *strongly agree*). However this feeling of ease was more pronounced in sighted participants than with the visually impaired group. While both groups felt that most websites are easy to navigate (visually impaired $M = 3.86$, Mode = 4; sighted $M = 4.14$, Mode = 4), the visually impaired group expressed a strong desire for a web that is easier to use ($M = 3.59$, $SD = 1.43$, Mode = 4) whereas the sighted group expressed general satisfaction with current levels of web usability ($M = 2.38$, $SD = 1.20$, Mode = 1,2).

Table 5: Coding of Responses regarding Information Seeking and Online Exploratory Behavior

	Sighted	Visually Impaired
Statement	%	%
The approximate number of websites I visit on a daily basis		
0	5	0
1 to 5	43	28
6 to 10	47	28
11 or more	5	44
The number of NEW websites I visit on a daily basis		
0	33	20
1 to 5	62	68
6 to 10	5	12
11 or more	0	0
I avoid visiting new websites		
True	5	4
False	95	96
I usually find new online content like stories, videos and images from		
A link from another website	10	21
Search engines like Google, Yahoo and Bing	52	66
Social networking websites	33	13
Word of mouth	5	0
I don't know where I find new website content	0	0

Table 6: Mean Scores Regarding Subjects' Online Exploratory Behavior, Information Seeking and Web Usage

Statement	Mean	SD	N	<i>t-test</i>	df	p
I frequently visit new websites						
Visually Impaired	3.76	1.20	25	1.37	44	.176
Sighted	3.29	1.10	21			
I have trouble finding my way around new websites						
Visually Impaired	3.04	1.33	24	1.60	43	.116
Sighted	2.43	1.21	21			
I avoid trying new websites because I am concerned about being able to find the information that I am looking for						
Visually Impaired	2.00	1.38	22	0.47	41	.639
Sighted	2.19	1.25	21			
I OFTEN have trouble finding what I am looking for online						
Visually Impaired	2.32	1.39	22	1.32	41	.193
Sighted	1.81	1.12	21			
I SOMETIMES have trouble finding what I am looking for online						
Visually Impaired	3.41	1.37	22	1.27	41	.211
Sighted	2.90	1.26	21			

Table 6: Mean Scores Regarding Subjects' Online Exploratory Behavior, Information Seeking and Web Usage (continued)

Statement	Mean	SD	N	<i>t-test</i>	df	p
Generally it is easy for me to find what I am looking for online						
Visually Impaired	4.41	0.80	22	0.78	41	.437
Sighted	4.19	1.03	21			
I am more comfortable visiting websites that I am familiar with						
Visually Impaired	4.22	1.11	22	2.13	41	.039
Sighted	3.57	0.87	21			
I wish the internet was easier to use						
Visually impaired	3.59	1.44	22	2.98	41	.004
Sighted	2.38	1.20	21			
Most websites are easy to navigate						
Visually impaired	3.86	1.04	22	1.05	41	.298
Sighted	4.14	0.65	21			
I enjoy using social networking websites						
Visually impaired	2.86	1.70	22	2.25	41	.030
Sighted	3.86	1.15	21			
I would like to use social networking websites but I find them too difficult to use						
Visually impaired	2.55	1.50	22	2.02	41	.049
Sighted	1.76	1.00	21			

The visually impaired group visited a greater number of websites on a daily basis than sighted participants with 44% of the visually impaired group indicating that they visited “11 or more” websites on a daily basis compared to 5% of the sighted group. Users with visual impairments also visited more new websites on a daily basis than the sighted group with 80% of participants with visual impairments visiting between 1 and 10 new websites daily compared to 67% of the sighted group. The visually impaired group however expressed some difficulties navigating these new websites ($M = 3.04$, $SD = 1.33$, Mode = 4) whereas the sighted group expressed minimal difficulty in this regard ($M = 2.43$, $SD = 1.21$, Mode = 1,3).

Both groups expressed minimal website avoidance behavior with fewer than 5% of both groups indicating an avoidance of new websites. While the visually impaired group indicated significantly more comfort with familiar websites ($M = 4.22$, $SD = 1.11$, Mode = 5) relative to the sighted participants group ($M = 3.57$, $SD = 0.87$, Mode = 3,4), visually impaired participants ($M = 2.00$, $SD = 1.38$, Mode = 1) expressed a comparable and minimal avoidance of new websites due to apprehension regarding the ability to find information of interest. Sighted participants ($M = 2.19$, $SD = 1.25$, Mode = 1) indicated a slightly greater avoidance of new websites due to these information seeking concerns though both groups indicated that this apprehension did not result in an outright avoidance of new websites. Both groups indicated a significant reliance on search engines for new content with 52% of sighted participants and 66% of visually impaired participants identifying this as a primary source of new stories, videos and images. However social networking websites were a significantly more popular source of this information for sighted individuals (33%) than for the visually impaired group (13%).

3.2.2 Website Usage Habits

Table 7 provides a comparison of website usage habits by website type. Of the nine website types provided, both visually impaired (33%) and sighted (52%) participants indicated that social networking websites were the most visited. This number was significantly higher for sighted participants than for the participants with visual impairments however. Sighted participants expressed the most difficulty using Web-logs or “Blogs” (13%) whereas social networking websites (21%) were identified as the most difficult to use by those with visual impairments. The most popular response however for both groups when referencing online difficulties was that no difficulties existed relative to most websites (sighted = 67%, visually impaired = 42%).

Table 7: Responses Related To Website Usage

	Sighted	Visually Impaired
Statement	%	%
I normally visit this type of website the most often		
Blogs	0	4
Lifestyle Websites	0	0
Medical Websites	0	0
News Websites	24	17
Online Encyclopedias	0	4
Shopping Websites	19	25
Social Networking Websites	52	33
Sports Websites	5	0
Other or I don't know	0	17
I normally have the most difficulty using this type of website		
Blogs	13	8
Lifestyle Websites	0	4
Medical Websites	0	0
News Websites	0	13
Online Encyclopedias	0	0
Shopping Websites	10	4
Social Networking Websites	5	21
Sports Websites	5	8
I don't have difficulty using most websites	67	42

3.2.3 Use of Social Networking Sites

Table 8 provides a comparison of the use of social networking websites between the visually impaired and sighted participants. While some commonalities were exposed between the two groups overall, the frequency with which online social networks were used, as well as the perceptions regarding the usability of these websites, differed substantially.

Table 8: Responses Related To Social Networking Websites

	Sighted	Visually Impaired
Statement	%	%
Do you have an account on a social networking website?		
Yes	95	67
No	5	33
Which social networking website do you visit most often?		
Facebook	81	67
Instagram	0	4
LinkedIn	0	8
Pinterest	5	0
Twitter	0	25
Other	19	0
None	5	29

A majority of participants in both groups indicated that they held an online social networking account though the social network participation rate for sighted participants (95%) was significantly higher than for the visually impaired group (67%). In an open ended question, both groups indicated a preference for Facebook.com with 81% of sighted participants and 67% of individuals with visual impairments indicating that it was their most used social networking website. 77% of these sighted participants indicated a “moderate” to “extreme” frequency of social network usage compared to 42% of visually impaired participants.

Perceptions regarding the usability of social networking websites differed substantially between the two groups with sighted participants indicating both a greater enjoyment of these websites as well as significantly greater ease of use. 36% of individuals with visual impairments indicated that they would like to use social networking websites but found them too difficult to use compared to only 10% of sighted participants. 72% of sighted participants indicated some degree of “enjoyment” in their use of online social networks as compared to 41% of participants with visual impairments. An additional 45% of the visually impaired users group indicated some degree of dislike of social networking websites compared to 15% of the sighted group.

3.3 Discussion

While the results of this pilot study indicated that web accessibility generally may be improving, *comparable usability* between users with visual impairments and those with sight is still elusive. These findings provide additional support to the contention that differences exist between the online behavior of sighted users and users with visual impairments. Participants with visual impairments indicated significant difficulties using SNSs and were most severely challenged by social networking websites within the context of the options provided; findings mirrored by other studies [9], [46].

CHAPTER 4: ETHNOGRAPHIC USABILITY STUDY OF THE FACEBOOK SNS

The results of the online survey documented in chapter 3 provide additional support to the contention that SNS usability may be a significant issue for individuals with visual impairments. The nature of the usability issues and their severity remains largely unknown however due to the lack of formal research in this area. In an effort to identify and describe specific usability problems and to gauge user attitudes regarding distinct system features, an ethnographic investigation of the Facebook mobile interface was conducted; a study involving six blind, frequent Facebook users. It is believed that this work is the first formal ethnographic study of Facebook usability utilizing the configuration most commonly associated with blind users; the Facebook mobile interface (m.facebook.com), a desktop or laptop computer running a version of the Windows operating system and JAWS screen reading software. It is also believed that this work is one of the few ethnographic studies to have investigated social network interaction involving blind users generally which furthers the ultimate goal of contributing to the understanding of SNS usability as it pertains to the needs of individuals who are blind.

4.1 Study Design

It is undeniable that attracting a base of committed users is an existential issue for web services that are heavily dependent upon user generated content. Marketing is consequently a crucial activity for these services as they seek to quickly build an active user community. Often these external marketing efforts are supplemented by persuasive system features which attempt to transform casual visitors into committed users while encouraging these new users to invite and engage others. The account creation process for instance may include tools to support the migration of a user's contacts into the system; often combined with an ability to send bulk invitations to those contacts without an existing account. Features which enable users to upload

and share image and video content may also support the ability to simultaneously share this content on other services thus introducing the service to a host of potential new users. These types of persuasive features were found to be common among the 50 popular web services evaluated by Fogg and Eckels [68]. This observation led to the development of the behavior chain model (BCM) of user engagement which has been used as conceptual lens for the evaluation of a number of SNSs to include Facebook [69].

The BCM, as visualized in Figure 8, proposes that successful web services are designed with features which encourage a series of sequential behaviors which are viewed as increasing a user’s attachment to a particular service. The specific activities associated with this influence strategy can be classified into one of three phases of increasing user-service engagement: (1) discovery, (2) superficial involvement or (3) true commitment. In the discovery phase prospective users are made aware of the service and are encouraged to visit the website. In the superficial involvement phase these prospective users decide to try the service and ultimately register for an account. In the true commitment phase this previously casual user creates content, engages others and become part of an active user community.

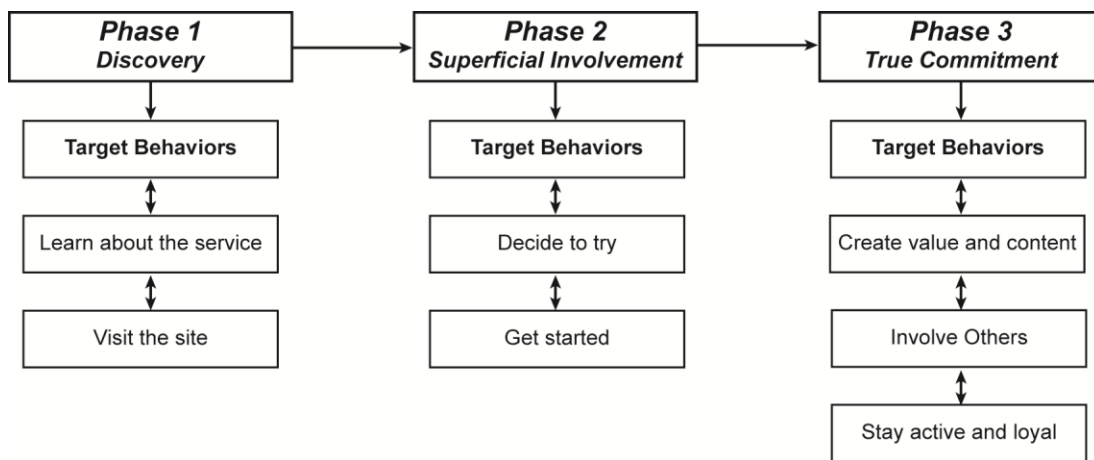


Figure 8: Visualization of the Behavior Chain Model as adapted from Fogg and Eckels [68]

The authors of the BCM [68] present their work as a user engagement framework to be referenced by designers when conceptualizing the feature set of a web service although examples of its use outside of this context can be found in the literature [70]. It can be argued that this factor alone makes the BCM an ideal model for the development of a comprehensive usability testing strategy for social networking sites like Facebook. If it can be assumed that a designer's ultimate intent is to increase a user's attachment to a particular service then those system features which further this goal may be viewed as those most critical to a service's success. To begin, user activities that have been described in the related research of Facebook [56], [57], [68], [71], [72] were identified and associated with specific system features. These activities were then categorized into an appropriate phase of the BCM based on existing categorizations [56], [68] [70] combined with the author's observations as illustrated in Figure 9. While not including each of these described user activities in the present study, this categorization has been drawn upon to develop tasks which are representative of each phase's respective activities. These tasks have been grouped into appropriate scenarios for testing purposes.

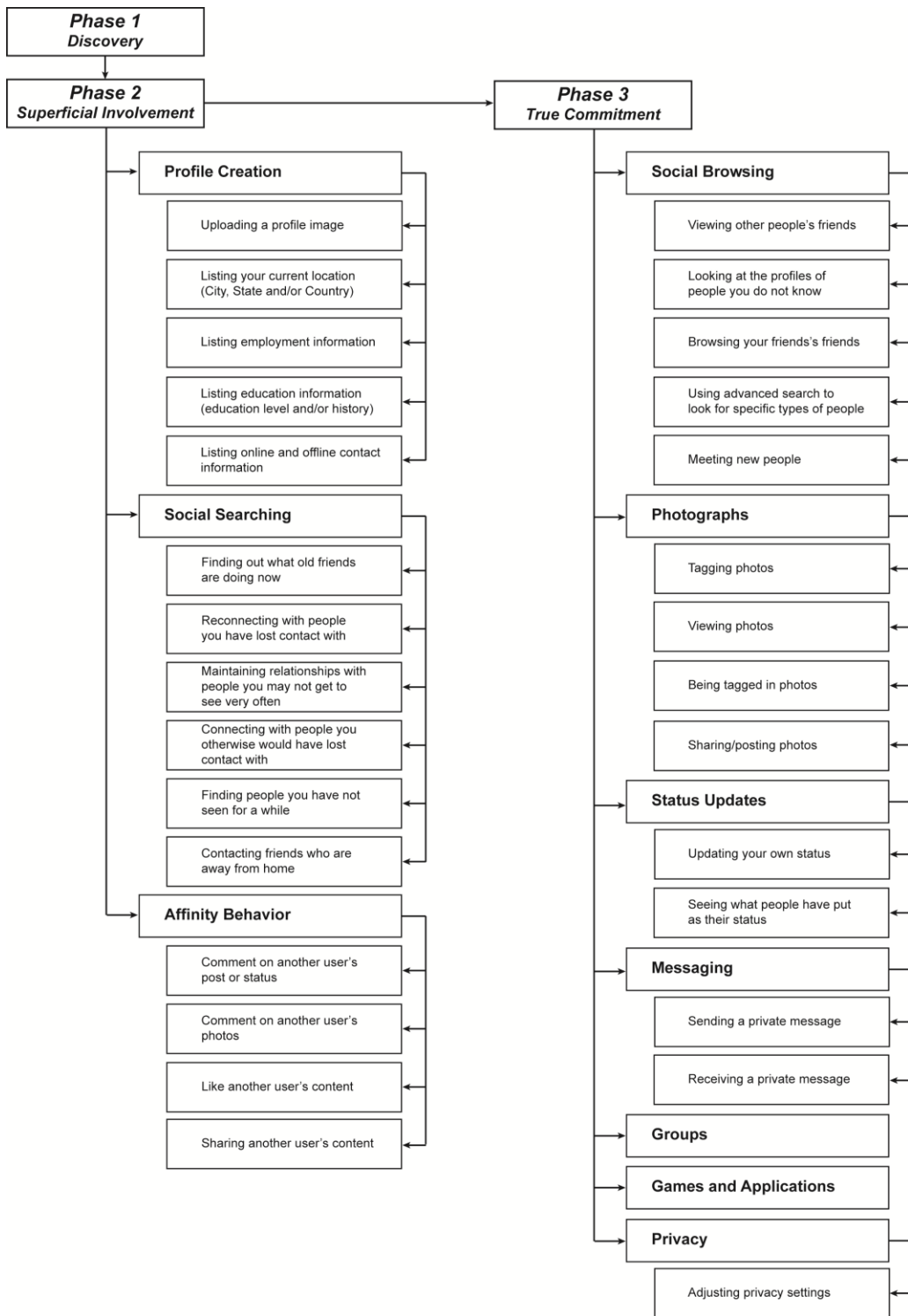


Figure 9: Visualization of social networking site activities drawn from the literature and categorized according to the phases of the BCM as adapted from Fogg and Eckles [68].

4.2 Method

4.2.1 Participants

Participants were recruited throughout the state of North Carolina (NC) by field agents of the North Carolina Division of Services for the Blind (NCDSFB), a division of the North Carolina Department of Health and Human Services (NCDHHS). NCDSFB field agents throughout the state informed potential participants about the study, directed interested individuals to the study website and provided both telephone and email contact information for the study coordinator. Participation was restricted to adult desktop or laptop computer users, who self-identified as blind, indicated an absence of motor skill challenges which prevent the use of a keyboard or mouse, expressed a use of online social networks and indicated an exclusive use of screen reading technology to access the web. This latter factor, the use of screen reading software, is a categorization criteria recommended by the AFB for usability studies involving users with visual impairments given the observation that the usability concerns of screen reader users and individuals who use screen magnification technology tend to differ [73]; mirroring other studies which have described individuals with visual impairments as a heterogeneous group with diverse needs [74]. Six blind adults (four women, two men, $M_{\text{age}} = 42.66$ years, age range: 24-70 years) took part in the study (see Table 9 for demographics). All participants were frequent users of Facebook, using the system more than once per week, with all but one individual reporting daily use. Each participant was compensated with a \$50 prepaid gift card which was provided the day of the study prior to the study session. The study protocol was approved by the East Carolina University, University and Medical Center Institutional Review Board (see Appendix I).

Table 9: Participant Characteristics

Subject	Gender	Age	Number of Years of JAWS use	Self-Ranking of Facebook Proficiency ^a	Frequency of Facebook Use	User Type
1	M	24	11	10	Daily	Command
2	F	68	8	3	Once to twice a week	Arrow
3	F	22	7	7	Daily	Command
4	F	70	12	10	Daily	Arrow
5	F	25	8	7	Daily	Command
6	M	47	15.5	9	Daily	Command

^aRanking of proficiency on a 1 to 10 scale (1 = *least proficient* to 10 = *most proficient*).

4.2.2 Apparatus

Although study participation was limited to those meeting the aforementioned criteria the specific device type, operating system (OS) and screen reading software used by participants varied given the ethnographic nature of the study. Three participants used a laptop running a version of the Windows 7 OS, one a laptop running a version of the Windows XP OS and one a desktop running a version of Windows XP. Each machine had a working screen to allow for the video recording of the user's interactions. All participants used a version of the JAWS screen reading software; four used version 13, one version 12 and one version 14. All but one participant used a version of the Internet Explorer web browser while a single participant used Mozilla Firefox. Study sessions took place in the home setting typically used by each participant when online with each session ultimately conducted in either a home office, living room or kitchen.

4.2.3 Procedure

The procedure was designed to fit within a single three hour session (2 hours for the study itself and 1 hour for setup and take down) and consisted of four scenarios and their corresponding tasks. While a number of methods exist in the literature for assessing website usability each has its own advantages and limitations [75], [76]. A multi-method approach consisting of the Think Aloud Protocol (TAP), the System Usability Scale (SUS) questionnaire and a series of interviews was chosen to overcome the deficiencies of any one method [77], [78], [79]. The use of complimentary methods to investigate system usability has been recommended by a number of studies [80], [81] and has been practically utilized in many others [82], [83], [84].

4.2.3.1 *Think Aloud Protocol*

The Think Aloud Protocol (TAP) is a commonly used qualitative usability research technique that requires a study participant to speak aloud his or her thoughts while interacting with a system under test [85], [86]. A number of studies have demonstrated the method's effectiveness in the context of scenario based testing [87], [88], [89] and it was consequently deemed an ideal choice for our present investigation. Testing sessions utilizing the TAP are typically video recorded for later analysis which is a best practice followed in this study.

4.2.3.2 *System Usability Scale*

The System Usability Scale (SUS) is a 10-item, five point Likert scale (from 1 = *strongly disagree* to 5 = *strongly agree*), that provides a global view of system usability through a weighted score in the range of 0-100 (Appendix F) [77], [90]. The SUS has been shown to perform comparably to other light weight usability questionnaires [91], [92] while out

performing a number of others [93]. The SUS was ultimately viewed as the ideal option given its aforementioned effectiveness and its relative ease of implementation.

4.2.3.3 Session Setup

As a preliminary activity to the testing itself each participant was read an informed consent document that had been emailed in an accessible format of the participant's choice prior to the day of the study (Appendix B); permission was also requested to video record the study session. After obtaining consent, participants were logged in to the mobile version of the Facebook website (m.facebook.com) using the web browser that each participant stated that they most commonly used for this purpose. Participants remained logged in throughout the four scenarios. To avoid the use of personal information, email and Facebook accounts that had been created specifically for testing purposes were used along with stock images that were copied to a folder on each participant's computer desktop. Participants were subsequently given instructions regarding the TAP and participated in one to two brief exercises to practice the method until they expressed a degree of comfort with it (e.g. "Please think aloud while turning on your computer." and "Please think aloud while opening any file."). Participants were encouraged to ask questions about the procedure and given clarification as necessary.

Tasks were videotaped and task times were measured using a standard stopwatch and recorded on corresponding forms. These times were later verified using measurements collected from the corresponding video tapes. In all cases participants were instructed to ask for spelling assistance as needed, that the task instructions could be repeated if requested and were reminded to "think aloud" while attempting each task. Participants were additionally instructed to indicate verbally when they were finished attempting each task or if they would like to discontinue the attempt because the task could not be completed; in the latter case the elapsed time was recorded

and the attempt was marked as incomplete. These directives were standard instructions for each scenario. Individual task attempts were limited to a maximum of 13 minutes based on preliminary testing and the time allotted for each session. Any attempt that exceeded this threshold was marked as incomplete and task time was recorded as 13 minutes. Of the 108 total task attempts there was only a single instance where this limit was reached.

4.2.3.4 Scenarios

Four scenarios were developed, each of which contained tasks which are representative of one of the three phases of the Behavior Chain Model as illustrated in Figure 10 and discussed in section 2.2. Participants were read each scenario as well as the standard instructions. At the conclusion of each scenario's tasks an interview was conducted which consisted of a three item, four point qualitative scale and a brief interview. Participants were asked to rate the ease of use of the scenario's respective tasks, comment positively or negatively on the system features used in the scenario and indicate changes that may improve the usability of the system features in question.

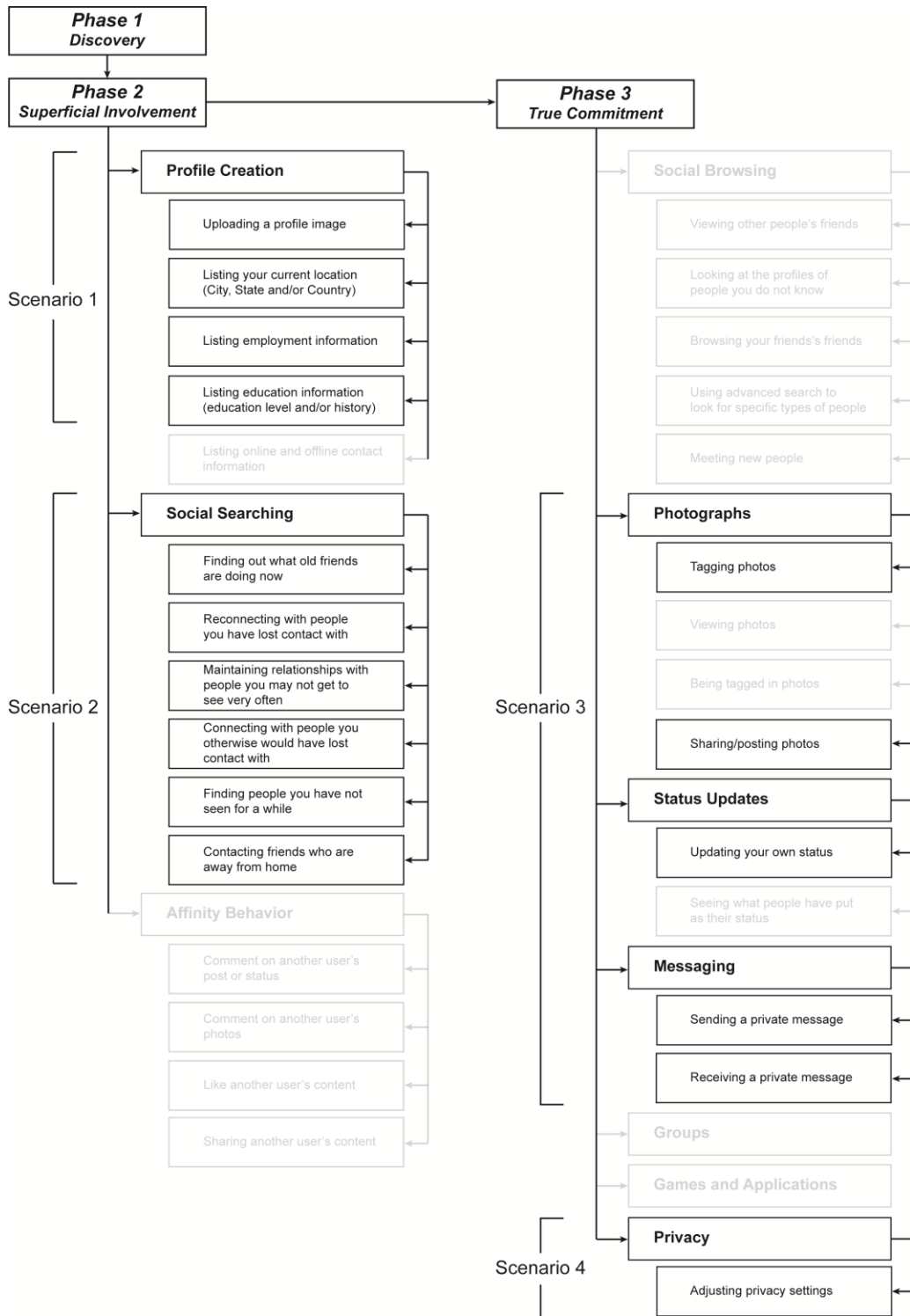


Figure 10: Testing scenarios as associated with user activities and phases of the BCM as adapted from Fogg and Eckels [68]. Semi-transparent activities were excluded from testing.

Scenario 1 – Profile Creation. The first scenario, outlined in Table 10, includes tasks that are associated with the creation and management of user profile information. These tasks are representative of user behavior that is indicative of the superficial involvement phase of the BCM (phase 2, see Figure 10). Awareness of the existence of the system is assumed therefore the discovery phase has been bypassed (phase 1).

Table 10: Scenario One Description and Task List

Scenario: You have heard a lot about the Facebook online social network and are interested in using it to interact with your friends and family. Please complete the following tasks using the homepages as a starting point:	
Task	Description
1	Set your profile picture, the photo is saved on your desktop in a folder called “Study” and is called “My Profile Image”.
2	Edit your current city to “Speed, North Carolina”.
3	Edit your company to “Edgecombe County, North Carolina”. You are a teacher and have worked there since last month.
4	Edit your college to “The University of North Carolina at Chapel Hill”; you graduated in 2012.
5	Edit your high school to “Western Guilford High School”; you graduated in 2012.

The choice of the input values for current city, company, college and high school (e.g. current city = “Speed, North Carolina”) were based on what is known about the current version of the search feature available from the Facebook mobile interface and what has been observed during preliminary testing conducted during study design. While the specific algorithm used is proprietary and unpublished, it is known that a user’s current city, hometown, education information, employment information and relationships are used to recommend other users for connection as illustrated in Figure 11.

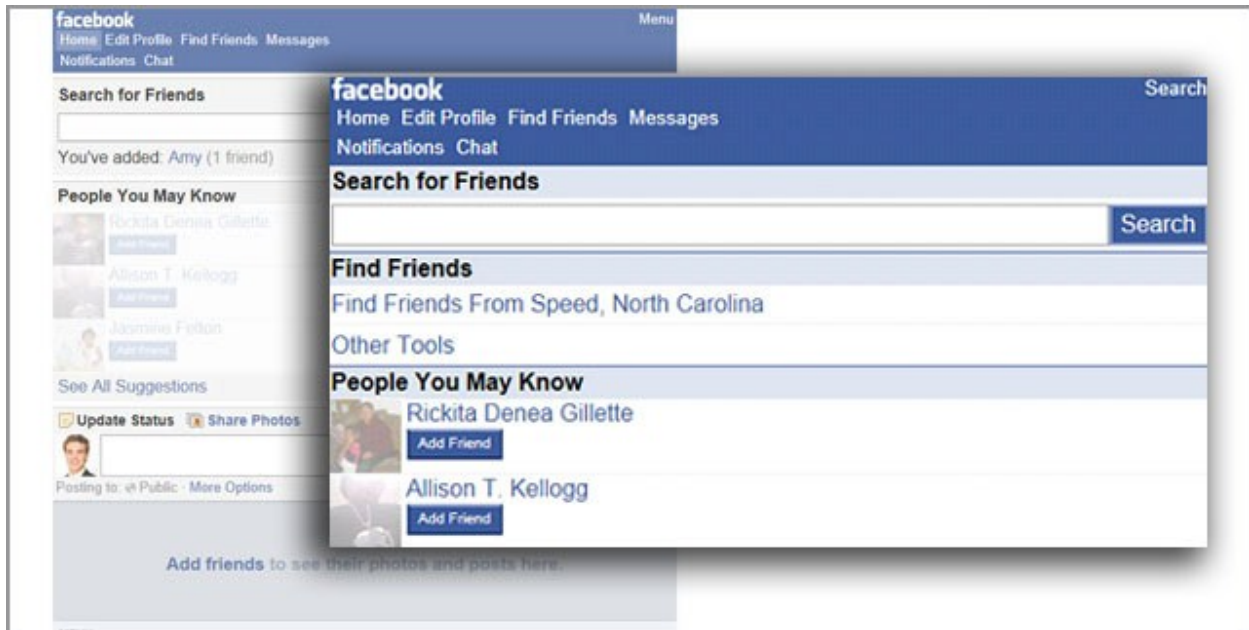


Figure 11: Screen capture of the “People You May Know” feature of the mobile interface accessed using Internet Explorer.

In preliminary testing it was observed that this information also appears to influence what information is returned (e.g. a “friend” search for “John Smith” will order returned results by geographic proximity, related employer, mutual friends and other factors). User accounts used for testing purposes were pre-populated with a city, state and employer in order to establish a common factor with the target accounts of scenario two in the event that that the participant was unable to successfully complete the profile creation tasks. Unlike the Facebook natural language Graph Search feature which is unavailable from the mobile interface, details regarding the inner workings of the current version of the search feature available from the mobile interface under test are unpublished and unavailable.

Scenario 2 – Social Search. The second scenario, outlined in Table 11, includes tasks that are associated with identifying other users with whom to establish a connection or

“friending” in Facebook parlance. According to Lampe et al. [57] this type of activity takes two forms; social searching or social browsing. Social searching is characterized by the investigation of offline contacts whereas social browsing focuses on seeking new contacts or connections. This type of activity has been discussed heavily in the literature [56], [57] has been discussed as one of the major uses of Facebook and has been previously associated with the true commitment phase of the BCM (phase 3, see Figure 10) by [68], [70]. The social search activity was tested within this current study given that each task in the scenario presumes an existing offline relationship.

Table 11: Scenario Two Description and Task List

<p>Scenario: You are unsure how many of your friends and family are registered Facebook users. You would like to find people that you know who have Facebook accounts and you would like to add these people as friends. Please complete the following tasks using the homepage as a starting point:</p>	
Task	Description
1	You are looking for James Smith from Speed, North Carolina. James has worked at IBM as a computer programmer since January 2011. He is a 2000 graduate of East Chapel Hill High School and a 2004 graduate of the University of North Carolina at Chapel Hill.
2	You are looking for Mary Jones from Speed, North Carolina. Mary is currently unemployed but previously worked as a cashier at Bank of America for two years. She is a 1995 graduate of east Guilford High School. Mary currently lives in New York City.
3	You are looking for Peter Wilson from Speed, North Carolina. Peter currently works at Walmart as a cashier and has been there since May of this year. Peter is a 2011 graduate of Ragsdale High School and currently lives in Greenville, North Carolina.

In addition to the standard instructions participants were also instructed that the desired user’s email address could be provided as a last resort. Participants began the session with one existing friend relationship that would be necessary to attempt the tasks in the third scenario. The

target accounts used in this scenario had been created prior to the study session and populated with the biographical data described in each task. Each account was also associated with an email address that had been created specifically for testing purposes and could ostensibly be used to search for friends although this email address information was only provided at the participant's request once all other means of identification had been exhausted.

Scenario 3 – Information Sharing. The third scenario, outlined in Table 12, includes tasks that are associated with information sharing and have been previously associated with the true commitment phase of the BCM (phase 3, see Figure 10) [70]. Prior to the study session a “friend” relationship between the Facebook account used by the study participant and an account created for testing purposes had been established; this account was separate from the three target accounts used in the second scenario. This separate account was used to send a message to the participant account prior to the study session and was also necessary for tasks four and five.

Table 12: Scenario Three Description and Task List

<p>Scenario: This morning you received a telephone call from an electronics company that you interviewed with a week ago. They were impressed with your interview and have offered you a job as sales person. You have just returned from the mall where you purchased a new outfit and shoes for your first day of work next week. You would like to share this information and pictures of the items you purchased with your Facebook friends. Please complete the following tasks using the homepage as a starting point:</p>	
Task	Description
1	Update your status by writing a post which states that you just accepted a job offer.
2	Share a photo of the shoes you just purchased and write a caption about them. The picture is saved on your desktop in a folder called “Study” and is called “Shoes”.
3	You have one new message. Please open the message and read it.
4	Send a message to any one of your Facebook friends that states that you are starting a new job.
5	Update your status by writing a post which states that you start your new job next week. Tag on one of your friends on the status message.

Scenario 4 – Privacy and Account Visibility. The fourth scenario, outlined in Table 13, includes tasks that are associated with privacy and account visibility. While the activities of scenario three have not been previously associated with the true commitment phase of the BCM (phase 3, see Figure 10) explicitly in the literature, Joinson [56] identified the adjustment of privacy settings as a significant user activity; an issue which has been studied by others as well [72], [94]. In this scenario, unlike the others, the participant began with Facebook’s default values which had not been modified prior to the study session. Facebook accounts by default allow any registered user to submit a connection request to any other user and allow all shared information posted by a user to be visible to a user’s connections.

Table 13: Scenario Four Description and Task List

Scenario: You are interested in reading about and adjusting the Facebook privacy settings. Please complete the following tasks using the homepage as a starting point:	
Task	Description
1	Locate the Facebook Terms and Policies section and find the data use policy titled, “Information We Receive and How it is Used”.
2	Locate the Facebook Terms and Policies section and find the data use policy titled “Sharing and finding you on Facebook”.
3	Locate the Facebook Settings and Privacy section.
4	Locate the Privacy settings in the Facebook Settings and Privacy section. Select “Limit the audience for posts you’ve shared with friend of friends or Public” and select “Limit Old Posts”.
5	Locate the Privacy settings in the Facebook Settings and Privacy section. Change who the people who can send you friend requests from “Everyone” to only “Friends of Friends”.

4.2.3.5 System Usability Scale Questionnaire and Post Scenario Interview

After completing or attempting all four scenarios users were read the System Usability Scale (SUS) questionnaire and asked to provide their opinions (Appendix F). Following the SUS a final semi structured interview was conducted where participants were asked to rate the overall ease of use of the Facebook social network, comment positively or negatively on the system as a whole, indicate changes that may improve the usability of the system and provide any additional information that they felt pertinent.

4.2.3.6 Data Analysis

Task completion times, questionnaire responses and additional notes were taken during each study session. Interviews were transcribed verbatim (Appendix H) from the video

recordings and two expert evaluators from among the study team conducted content analysis and categorized the usability problems detected through coded text data. Demographic data and task completions times were represented by descriptive statistics and SUS scores were calculated using the previously described methodology [77], [90].

4.3 Results

Table 14 provides information regarding the success rates and mean time of success and failure of all study tasks. Overall participants experienced the most difficulty completing the three tasks of scenario two which focused on finding and submitting a friend request to three target users (33% completion), followed by the profile creation tasks of scenario one (60% completion). Participants were most successful completing the tasks of scenario four which focused on the privacy features of Facebook (77% completion). All participants were able to locate the settings associated with user account visibility (scenario four, task three) and Facebook's terms and policies (scenario four, task four).

Participants spent the most time on those tasks associated with user profile creation (M successful = 243.48 seconds, M unsuccessful = 322.36 seconds; total time = 2829.24 seconds) and the least time with those associated with privacy (M successful = 67.36 seconds, M unsuccessful = 146.86 seconds; total time = 1071.14 seconds).

Two types of user behavior were observed throughout the study prompting the characterization of users as either "arrowers" or "command users" (see Table 9); terms based largely on participants' characterization of their behavior while thinking aloud during the study's four scenarios. Users described as "arrowers" were observed to predominantly utilize keyboard up and down arrow keys to traverse individual pages whereas those described as "command

users” also used arrow keys but predominantly used JAWS keyboard commands for page orientation and navigation.

Table 14: Task Times and Completion Percentage

Scenario and Task Descriptions	Completion Percentage	Successful/ Unsuccessful	Mean Time Success	Mean Time Failure	Total Time
Scenario 1 – Edit User Profile	60%	18/12	243.48	322.36	8478
Task 1: Set your profile picture.	66%	4/2	246.5	243	1472
Task 2: Edit your current city.	50%	3/3	218.66	322.33	1623
Task 3: Edit your company.	66%	4/2	292.25	466.5	2102
Task 4: Edit your college.	50%	3/3	261	542	2409
Task 5: Edit your High School.	66%	4/2	199	38	872
Scenario 2 – Find and add friends	33%	6/12	193.5	263.91	5429
Task 1: Find James Smith.	33%	2/4	246	405.75	2115
Task 2: Find Mary Jones.	33%	2/4	182	142.75	2036
Task 3: Find Peter Wilson.	33%	2/4	152.5	243.25	1278
Scenario 3 - Share information with Facebook friends.	73%	22/8	146.12	256.76	5078
Task 1: Update your status.	66%	4/2	196	135	1054
Task 2: Share a photo.	50%	3/3	264.66	285.33	1650
Task 3: Read a private message.	100%	6/0	47.16	N/A	283
Task 4: Send a private message.	83%	5/1	74.6	602	975
Task 5: Update your status.	66%	4/2	148.25	261.5	1116
NOTE 1 – Task descriptions have been abbreviated.					

Table 14: Task Times and Completion Percentage (*continued*)

Scenario and Tasks	Completion Percentage	Total Successful	Mean Time Success	Mean Time Failure	Total Time
Scenario 4 - Read and adjust Facebook privacy settings.	77%	23/7	67.36	146.86	2967
Task 1: Locate the data use policy titled, “Information We Receive and How it is Used”.	66%	4/2	79.75	266	851
Task 2: Locate the data use policy titled, “Sharing and finding you on Facebook”.	50%	3/3	38.66	98.66	412
Task 3: Locate the Facebook Settings and Privacy section.	100%	6/0	16.83	N/A	101
Task 4: Select “Limit the audience for posts you’ve shared with friend of friends or Public” and select “Limit Old Posts”.	100%	6/0	102.33	159.66	786
Task 5: Change who can send you friend requests to “Friends of Friends”.	66%	4/2	99.25	210	817
NOTE 1 – Task descriptions have been abbreviated.					

4.3.1 Scenario 1 – Profile Creation

The tasks of scenario one were generally viewed as among the more difficult and time consuming of the study. Participants expressed significant difficulties with the scenario’s five user profile creation tasks (1 = *very difficult* to 4 = *very easy*; $M = 2.33$, $SD = 1.21$) and felt that the time required was somewhat excessive ($M = 2.00$ on a 4-point qualitative scale, $SD = 0.63$). Participants expressed significant frustration during the scenario’s corresponding interview;

“the time that it took...it really wasn’t straightforward (participant 3)”, “I don’t understand the inability to edit those fields with the usual JAWS commands (participant 4)” and “I can see why people want to quit (participant 4)” were representative of participant opinions generally.

The interest in using the features associated with the scenario’s tasks was the lowest of any features exercised within the study (1 = *very unlikely* to 4 = *very likely*; $M = 3.00$, $SD = 1.10$). While participants expressed a general appreciation for the existence of the profile creation features stating that, “I like that the features were there (participant 4)” and “I like that there is a way for me to go onto Facebook and change my information (participant 3)”, most indicated that they were rarely used outside of the study due to significant usability issues. Some participants indicated that they were avoided due to an inability to concretely determine what information would be made public and who would be able to view it. Others had developed a fear of using these features due to previous experiences. One individual, participant 2, indicated that she had inadvertently indicated that she was married to her brother in law in a previous attempt to customize her profile and had become reluctant to use the profile features since the incident. All complaints were associated with issues regarding the usability of the features in question. Participant 4, who stated that she was very unlikely to use the profile creation features in their current form, indicated that she would be very likely to use these features if the usability issues she experienced were eliminated.

Of the scenario’s five tasks, one involved the submission of an account profile image and the remainder involved the submission of biographical data associated with user location, education and work history. Despite an indication by most participants that they had never set a profile image on their personal accounts 4 out of 6 completed this task with limited difficulty. Editing biographical data however required a multi-step process that proved universally

challenging for study participants. Insufficient labeling of the 18 edit links on the central profile information page (Figure 12) led many to believe that the links themselves were actually text input fields given that JAWS vocalizes “edit” when encountering such fields. As a result of this ambiguity several participants attempted to use the JAWS keyboard commands associated with entering text (space or the enter key) to no avail.

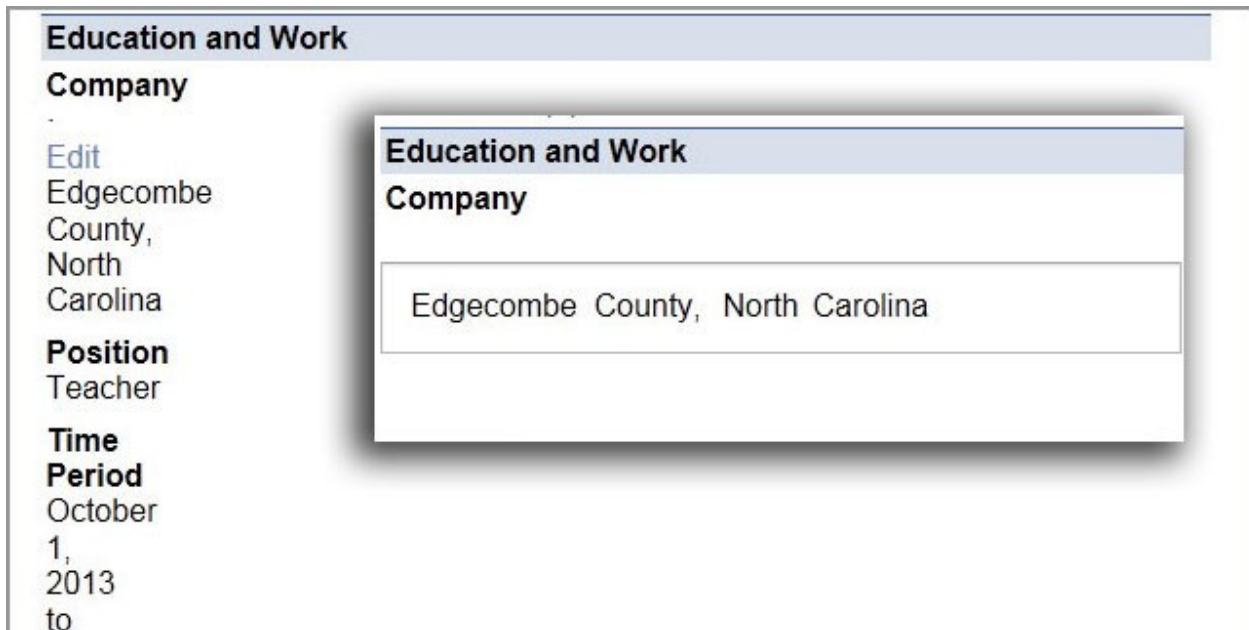


Figure 12: Screen capture of the edit profile page of the Facebook mobile UI (background); user interpretation of UI elements (foreground).

This ambiguity continued with the presence of a search button in the education, work history and user location sections; step two of the editing process in most cases. The purpose of the search button (e.g. “to search for an employer” in the context of the work history editing process) would likely have been readily apparent to a sighted user given the physical proximity of the button to the input field and “Add work history” section heading as illustrated in Figure 13. The button’s intended use was generally unclear to study participants however given the

absence of visual context. Statements like, “I didn’t know why I was supposed to be searching for something” (participant 5) were representative of post-task interview responses and user comments during the scenario itself.

The presence of two such search fields in close proximity to one another also proved confusing. Given that the need to search for information was not generally associated with the process of editing biographical data and most participants were familiar with the presence of a search field on each page, many assumed that the cursor position had inadvertently shifted to the search field at the bottom of each page (see Figure 13). The confusion was compounded by the identical labeling of each field and its corresponding search button.

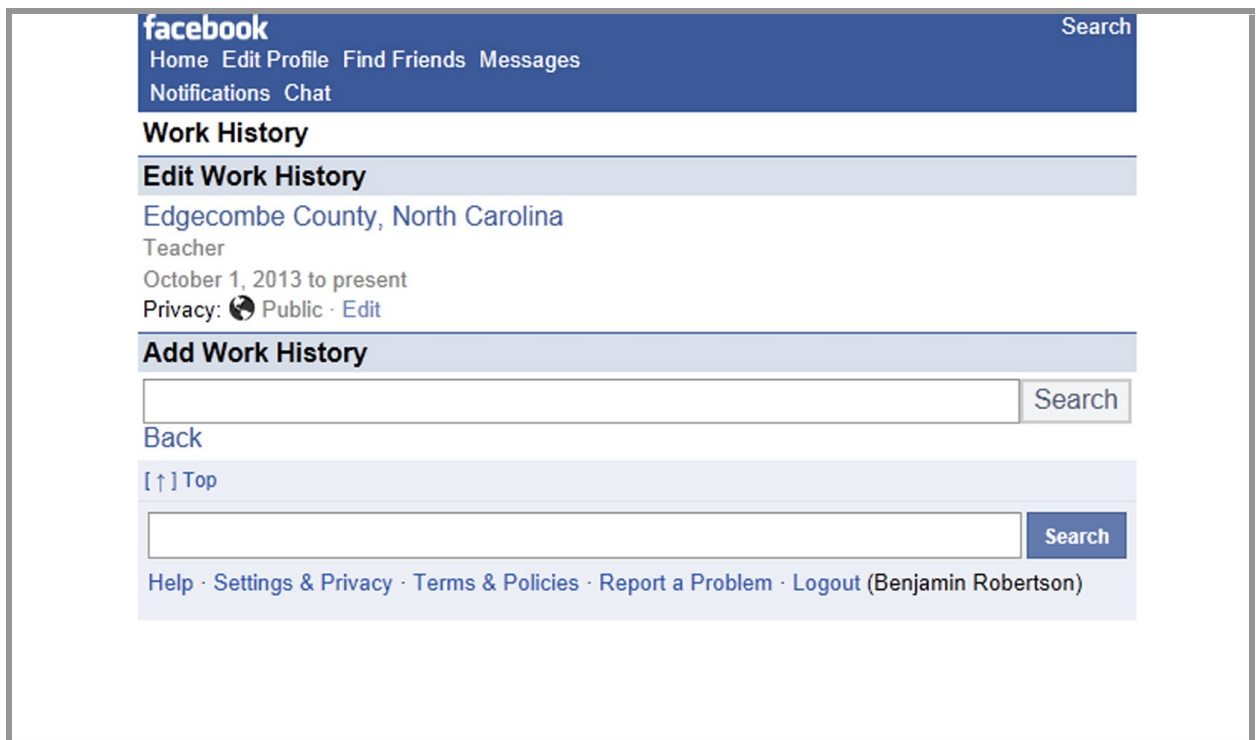


Figure 13: Screen capture of the work history page of the Facebook mobile interface accessed using Internet Explorer.

When participants were successful in determining that “edit” referred to a link instead of a text field and associated the search button with the biographical data in question, they were then challenged with selecting one of often many very similar options. Of the 10 returned search results for the phrase “university of north carolina chapel hill” for instance, four were identical apart from their profile image which eliminated the ability to tell each apart non-visually. This type of duplication problem would reappear in subsequent scenarios and calls into question the presumed time savings of this type of entity search itself.

4.3.2 Scenario 2 – Social Search

Of the study’s four scenarios, participants expressed the most difficulty with the social search tasks of scenario two on a 4-point qualitative scale (1 = *very difficult* to 4 = *very easy*; $M = 2.00$, $SD = 0.89$); opinions reflected in the scenario’s study-low 33% task completion. Participant perceptions of the amount of time necessary to complete each of the scenario’s tasks was also decidedly poor and were unsurpassed in the study ($M = 2$ on a 4-point qualitative scale, $SD = 0.63$). Of the system features evaluated during the study the greatest expressed frustration and most scathing comments were those related to scenario two, with one participant characterizing the experience as feeling like she was, “being tricked” (participant 2).

Nearly all participants expressed a familiarity with the types of usability issues experienced during the scenario with statements like, “I have never gotten search to work” (participant 2) and “I usually give up” (participant 2) being representative of user comments during the scenario itself and the post-task interview. Perhaps due to the intrinsic connection between the types of social search activities represented by the tasks of scenario two and the reasons people use SNSs generally, participants still indicated that they were more than

somewhat likely to use the features associated with the scenario (1 = *very unlikely* to 4 = *very likely*; $M = 3.17$, $SD = 1.17$).

Despite a general familiarity with existence of Facebook's search features participants experienced problems creating both the search query itself and identifying the appropriate user accounts from among any returned results. While awareness of the search field at the bottom of nearly every page was widespread, participants were unsure of exactly what information could be used to search, how this information should be formatted and what results to expect. The search field itself provides no information in this regard, visual or otherwise, leaving users to guess as what inputs are likely valid or invalid.

Most participants began each task by conducting a search using the provided first and last name of the target user. In the event that this search was unsuccessful, either returning too many results or too few, the next step in many cases was the addition of the target user's city, state or employer to the query (e.g. "John Smith, New York, NY" or "John Smith, ACME Company USA"). The search mechanism itself performed inconsistently; in some cases returning the appropriate result, in others a list of results and in others nothing at all. Search by email appeared to be more effective than first and last name based queries, returning single results, although these email based searches worked as sporadically as the other queries.

When results were returned participants generally experienced significant difficulty in selecting an individual option from a list of nearly identical results (Figure 14). Many of these identically named accounts could only be differentiated from each other by their profile image and occasionally a biographical item like a university name, current city or employer. Often they

could not be differentiated at all non-visually without entering each otherwise identical account individually.

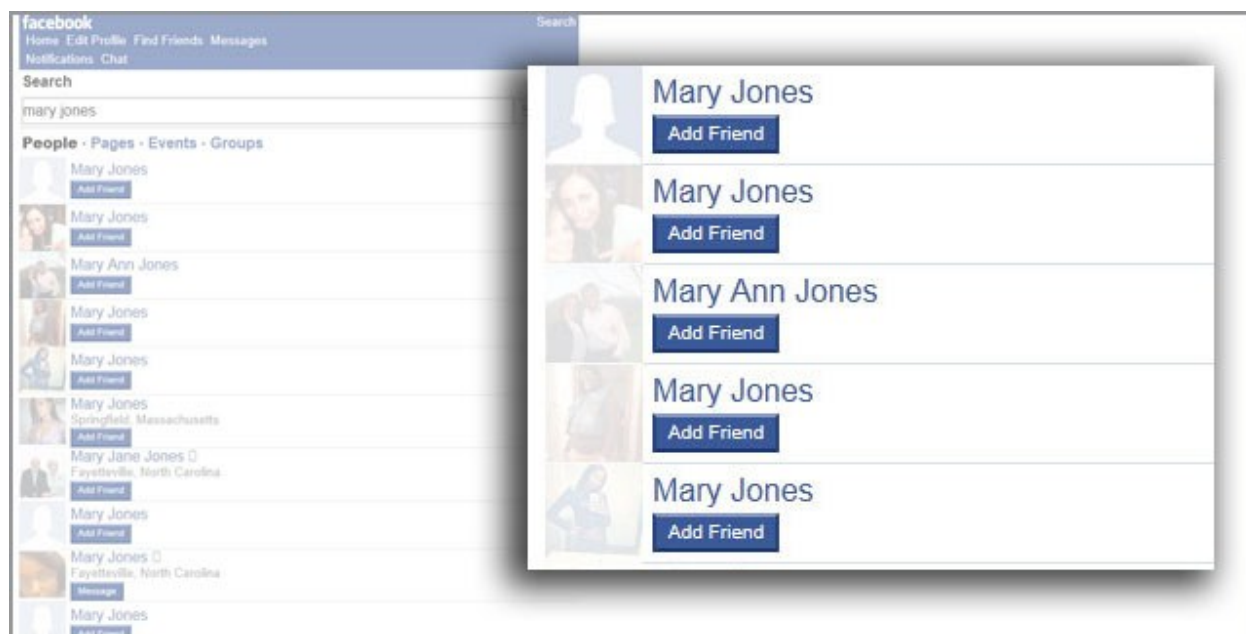


Figure 14: Screen capture of a search for “Mary Jones” using the Facebook mobile UI (IE). Profile images obscured.

Within the context of the “friends you may know” feature even this limited biographical information was omitted leaving the user to rely on the name and image alone (Figure 15). Participants generally expressed a recognition of the impact of users’ privacy settings on the availability of biographical information, however frustrations with the impact of the absence of this information were encapsulated by participants 5’s comment that, “I [would] like for it to be easier to sort of match people with their information...But at the same time I know that people may not want to be found.”

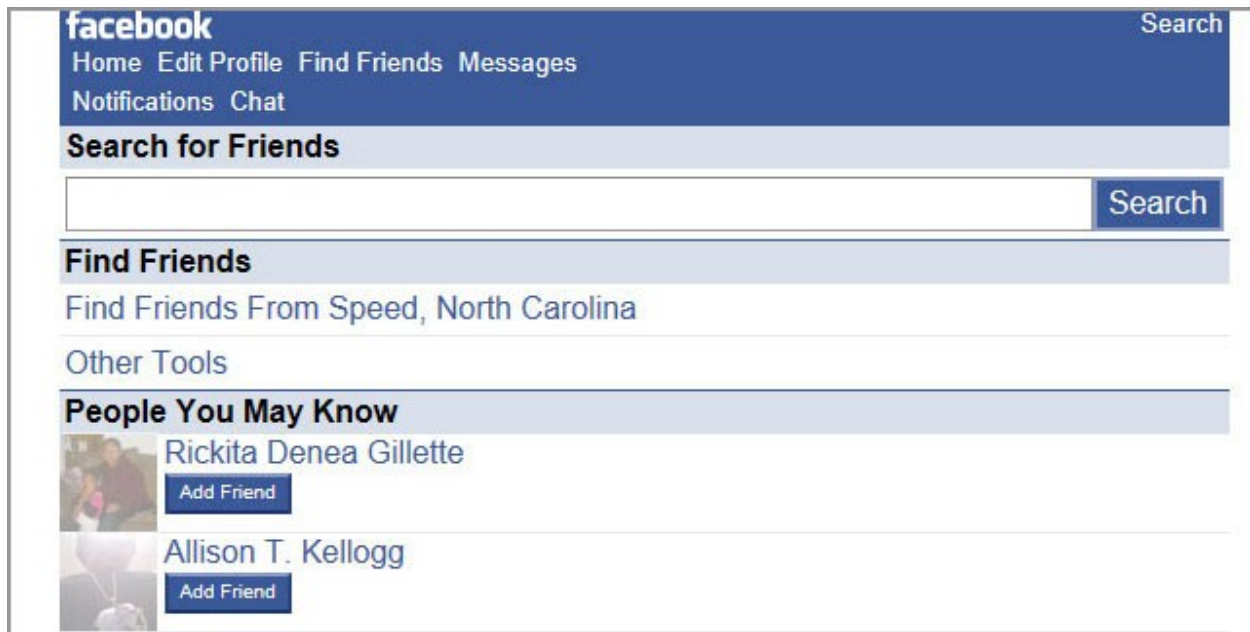


Figure 15: Screen capture of the “People You May Know” feature using the Facebook mobile interface accessed using Internet Explorer.

All but one participant indicated that they generally avoided the use of the search feature when attempting to send friend requests outside of the study due to the issues identified. The predominant means of establishing connections with other users was universally described as the “friends of friends” method whereby a user peruses the friends list of an existing connection to identify potential contacts. Even this method was described by some users as somewhat challenging with “give up” a commonly used phrase in this context. Participant 6 characterized his task attempt as, “like real life because I have given upon searches just like this.” Most users expressed a desire for a more specific search mechanism available from the mobile interface with several specifically stating a desire for specific search fields for specific biographical information (e.g. school, age).

4.3.3 Scenario 3 – Information Sharing

The information sharing tasks of scenario three were generally well received. The scenario's five information sharing tasks were viewed as somewhat easy (1 = *very difficult* to 4 = *very easy*; $M = 3.17$, $SD = 0.75$) while the amount of time necessary to complete the tasks was viewed as somewhat less than expected ($M = 2.5$ on a 4-point qualitative scale, $SD = 1.05$). Interest in using the features associated with the scenario's tasks was the highest of any in the study (1 = *very unlikely* to 4 = *very likely*; $M = 3.5$, $SD = 0.55$).

Participants spent the least amount of time and were most successful in reading a message that they had been sent by another user (task three, 100% task completion, total time = 283 seconds), with several utilizing the JAWS keyboard shortcut to directly access the single pending message (alt key + three). The ability to use keyboard shortcuts was viewed favorably by many with statements like, "I like using the shortcut keys rather than having to arrow all the time (participant 2)" and "I am familiar with the [keyboard] commands (participant 4)" being representative of common participant responses.

Participants experienced the most difficulty with the single task associated with sharing an uploaded photo (task two, 50% task completion, total time = 1,650 seconds). While the features used in scenario three were generally viewed as being more usable than those involved in other scenarios, the photo upload process was characterized as "not straightforward" (participant 4) and "unclear" (participant 6); opinions which appeared to be rooted in poor labeling.

Three participants indicated that the ability to tag was a relatively new feature in the mobile version with statements such as, "the tagging feature is new because we usually can't tag

people” (participant 3) common. All three participants expressed a desire for more options however given that tagging features available in the standard interface are unavailable in the mobile interface. The ability to tag within the body of a status update and add mood information (e.g. happy, sad, etc.) were identified as missing options.

4.3.4 Scenario 4 – Privacy, Terms and Conditions and Account Visibility

Participants experienced the least difficulty with the privacy and account visibility tasks of scenario four. On a 4-point qualitative scale participants generally felt that the scenario’s five tasks were somewhat easy (1 = *very difficult* to 4 = *very easy*; $M = 3.17$, $SD = 0.75$); opinions supported by the scenario’s study-high 77% success rate. While participant perceptions of the amount of time necessary to complete tasks within the study were universally poor, these negative opinions were less pronounced in scenario four ($M = 2.67$ on a 4-point qualitative scale, $SD = 0.82$). Participants also indicated a significant likelihood that they would use the features associated with the scenario (1 = *very unlikely* to 4 = *very likely*; $M = 3.17$, $SD = 0.75$).

All participants were able to locate the settings associated with user account visibility (task three) and Facebook’s terms and policies (task four); comments about these features were generally positive. Participants remarked favorably about the ability to limit who had access to their personal information with statements like, “I just know that the whole world can’t look at my name and see everything” (participant 3) and “[I like] how easy they were to use” (participant 4) representative of participant comments.

4.3.5 Post Scenario Interview and System Usability Scale Questionnaire

The post scenario interview provided participants with an opportunity to comment on Facebook as an entire system first through the system usability scale questionnaire (SUS)

followed by a semi-structured interview. Overall participants felt good about the potential of Facebook as a tool to communicate and interact but felt generally that the system fell short of this promise. The mean SUS score was 55.83 (poor); individual scores assigned by all participants are illustrated in Figure 16.

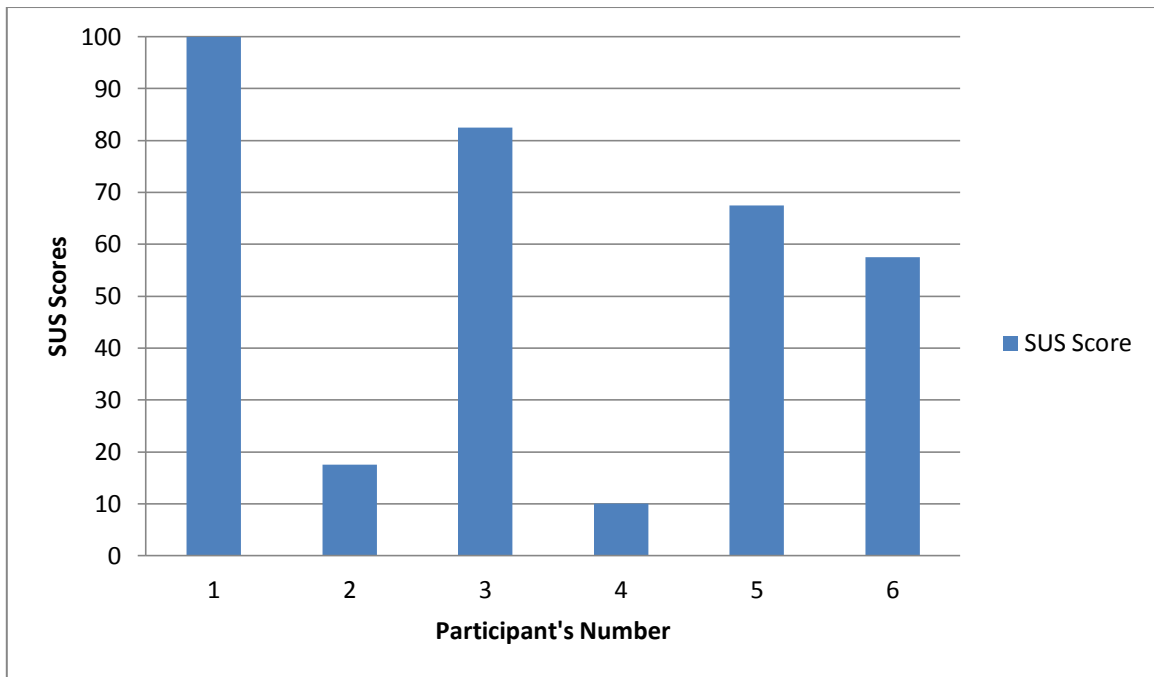


Figure 16: SUS scores as associated with participants' responses.

This overall assessment was reflected in the comments elicited during the post-scenario interview sessions. Participants responded most favorably to the potential of Facebook as a communication tool, specifically referencing the ability to communicate with friends and family. Meeting new people and rekindling offline relationships was an important use as well within the communication context. While not a universally shared opinion, several participants also remarked favorably regarding the system's tagging features. The ability to "tag", a term which

describes the process of associating another user with new content, was described as a new feature by participants 3, 5 and 6; being introduced sometime within the 60 day period preceding the study. Comments regarding this tagging feature, while positive, also reflected on a broader issue that was expressed about the mobile version of Facebook; limited functionality. While the recent changes to the mobile version apparently enabled an ability to tag, participants felt that the mobile version of the feature fell short of the implementation available on what was described as the “regular” version of the site (Facebook’s standard UI). Several participants indicated that they had been told by friends that the standard UI enabled the ability to tag within the body of the message, provide mood information (happy, sad etc.) and other customizations; all features absent from the mobile implementation. Comments regarding the mismatch between the features on the mobile interface and those on the standard interface were common.

The primary criticisms of the system as a whole were focused on the perceived lack of overall usability, instances of poorly labeled HTML elements and navigational difficulties born of poor user interface design. These comments are perhaps best encapsulated by the comments of participant 6:

“I would like to see the Facebook engineers do these tasks that you requested today using a screen reader. So that goes for Amazon or any of the big companies. If they had to spend the whole day using only a screen reader it would show the inaccessibility issues. Because what they’re doing now is complying with a very low standard on accessibility which has little to do with using a screen reader daily.”

4.4 Discussion

4.4.1 Limitations

As has been previously stated, primary goal of the study was to identify the usability issues of the Facebook SNS when used by blind screen reader users. While significant body of research exists which offers varying degrees of support to the contention that usability testing with five participants reveals roughly 85% of usability issues [95], [96], [97] other research has countered this assertion from varying perspectives [98], [99]. The author argues that the relatively homogenous nature of the usability issues identified provide support for the viability of our six participant sample however it is acknowledged that the number of participants may be considered a limitation of this study.

4.4.2 Overview of Identified Usability Issues

The discussion of usability issues by individuals with visual impairments on the web is not new; this topic has been discussed significantly in the literature. We believe however that this current investigation adds to the literature specific usability issues that can be corrected in Facebook and perhaps avoided all together in future SNSs. While the issues identified are diverse their underlying causes are shared; complexity and ambiguity. The features evaluated that proved generally troublesome required either a process that was overly complex or required actions that were ambiguous in their requirements. This ambiguity was the result of the system burdening the user with a requirement to draw visual context or ambiguity cause by inappropriate or missing element labeling. In either case the net result was a user who lacked confidence in their ability to determine what actions were necessary to accomplish a task or who questioned their ability to discern the current state of the system itself.

4.4.3 Implications

The motivations to use Facebook expressed by participants mirrored reasons given in the literature thus adding additional emphasis to the implications of the issues identified within this study [55], [56] [57]. Participants experienced the most difficulty accomplishing tasks associated with the second phase of the BCM; profile creation (scenario one) and social searching (scenario two). While this undermines two of the three core purposes of online social networks [1] it also calls into question the ability of a blind SNS user to become fully engaged and truly committed to a specific system as described by Fogg and Eckels [68].

Several studies suggest that the use of SNSs may have a number of positive benefits to include improved academic performance, enhanced feelings of social inclusion and an increase in interpersonal relationships to name a few [22], [50], [71]. In the case of users with visual impairments the benefits are arguably more profound, with a number of studies suggesting that feelings of diminished self-value and of disability related social stigmatization may be reduced through the type of virtual interaction that these systems facilitate [100], [101], [102]. While the aforementioned benefits of SNSs have been recognized, data regarding the actual utilization of these systems by individuals with visual impairments is limited rendering information about their use largely anecdotal. The ability of blind users specifically to capitalize on these benefits may be several impeded if the results of this current study are reflective of blind users' experiences on these systems.

CHAPTER 5: PORTABLE PROFILE ARCHITECTURE

Semantic Web [103], [104] proponents imagine a near future where structure is introduced to the largely unstructured World Wide Web. They imagine a future where machine readable, standards-based information is the rule rather than the exception; largely eliminating the existing technological barriers to the free exchange of data. The Friend of a Friend (FOAF) [105] vocabulary furthers this goal by introducing a standard format for the description of a person and their online relationships. FOAF, combined with other semantic web technologies, potentially decouples the user and his or her contacts from any specific SNS by enabling the creation of portable, machine readable profiles that may be reused across systems or otherwise shared. This potential is especially significant within the context of blind users given the difficulties identified within chapter 4 regarding the creation and maintenance of this profile and relationship information. The portable SNS user profile architecture presented in this chapter, designed around the FOAF vocabulary, may be effective in mitigating these problems by enabling blind users to maintain profile and relationship information in a central Personal Information Hub (PIH) designed around their usability needs.

5.1 Related Work

5.1.1 Linked Data

If the semantic web is viewed as the concept of the exchange of information on a massive, web-wide scale then *linked data* may be viewed as the actual implementation [106]. Linked data extends the broadly familiar web technologies Hyper Text Transfer Protocol (HTTP) [107], Resource Description Framework (RDF) [108] and Uniform Resource Identifiers (URIs) [109] to share information in a machine readable format while also including links to related information.

Berners-Lee has specified four rules for linked data which are designed to encourage the sharing of data in the same manner that HTTP natively supports shared documents [110]:

- Use URIs as names for things.
- Use HTTP URIs so that people can look up those names.
- Provide useful information when someone looks up a URI
- Include links to other URIs.

The ability to share data on the web in a manner amenable to computer processing requires the introduction of structure. While HTML documents provide a degree of structure, the intermingling of data with text creates significant processing challenges that are often insurmountable by contemporary software. Several methods have been introduced to address this issue with some more effective in facilitating the linked data concept than others.

5.1.1.1 Microformats

Microformats [111] are relatively simple HTML-based specifications that may be used to describe, among other things, people, events and locations in a structured manner. The hCard Microformat for instance is used to describe people, companies and organization as illustrated in Figure 17 whereas hCalendar describes events as illustrated in Figure 18. While the simplicity of Microformats makes them easy to implement, this simplicity also restricts their use to a limited number of entities in circumstances of limited complexity. The lack of namespaces for instance may prove problematic when more than one Microformat is used on a page (e. g. two distinct types of entities with a shared “title” property).

```
<div class="vcard">
  <a class="url fn" href="http://myweb.ecu.edu/jbrin">Julian Brinkley</a>
</div>
```

Figure 17: An hCard representation of the author, Julian Brinkley.

```
<span class="vevent">
  <span class="summary">ECU Research and Creative Achievement Week 2012</span>
  on <span class="dtstart">2012-03-26</span> through
  <span class="dtend">2012-03-30</span>
  at the ECU Mendenhall Student Center
  in <span class="location">Greenville, NC, USA</span>.
</span>
```

Figure 18: An hCalendar representation of ECU's 2012 Research & Creative Achievement Week.

5.1.1.2 Web APIs

Server-side Web Application Programming Interfaces (Web APIs) expose data via the web generally in JavaScript Object Notation (JSON) [112] or eXtensible Markup Language (XML) [113] format. An example of a response from the Amazon Product Advertising API is illustrated in Figure 19 [114]. While these APIs facilitate relatively simple querying of data over HTTP, their specialized nature requires a specific understanding of each API in order to enable their use. API data is also often deficient in terms of providing links to related information outside the scope of the data itself. This is exemplified by the API response of Figure 19 which provides relatively detailed information regarding a book titled, *Saving Miss Oliver's: A Nobel of Leadership, Loyalty and Change* but provides no link to either the author or publisher (listed as <Manufacturer>).

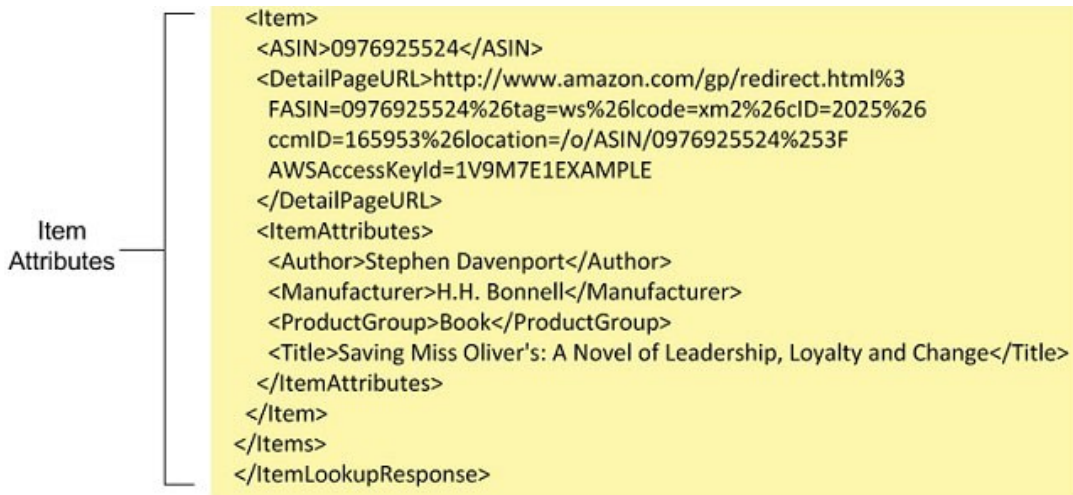


Figure 19: The “Item Attribute” portion of an XML response from the Amazon Product Advertising API.

5.1.1.3 Resource Description Framework

Resource Description Framework (RDF) [108] addresses the weaknesses of Microformats and WebAPIs by describing entities, their relationships with other entities and the nature of these relationships in a machine readable format. RDF facilitates the creation of applications with the ability to generically process data from a range of datasets which make reference to data from any number of sources. Resources are described in RDF as a number of triples composed of a *subject*, *predicate* and an *object*. The subject of a triple is a URI which identifies the resource, a predicate which describes the relationship between the subject and the object and the object itself which is either a literal value (e. g. a person’s height) or the URI of another resource. The RDF data model is commonly implemented using one of two W3C standardized formats; RDF/XML [108] or RDFa [115]; each with strengths and weaknesses. RDF/XML is widely used but can be difficult for humans to read due to its XML-based format (see Figure 20). RDFa intermingles RDF with HTML which results in a more human readable document but one with more overhead

than the XML-based RDF/XML (Figure 21). Additional formats like Turtle [116] and N-Triples [117] exist outside of W3C standards, each like RDF/XML and RDFa, carrying its own advantages, disadvantages and ideal usage scenarios. Regardless of differences in implementation however the RDF data model readily lends itself to use within the context of linked data given its use of HTTP URIs, standards based descriptive information and references to others URIs; satisfying each of the aforementioned four rules of linked data [110].

```

- <rdf:RDF>
  - <rdf:Description rdf:about="">
    <dc:date>2014-02-16</dc:date>
    - <dc:description>
      Friend of a Friend (FOAF) description, containing personal metadata for Julian Brinkley
    </dc:description>
    <dc:title>FOAF Description for Julian Brinkley</dc:title>
    <j.0:errorReportsTo rdf:resource="mailto:info@foaf-o-matic.org"/>
    <j.0:generatorAgent rdf:resource="http://www.foaf-o-matic.org"/>
    <foaf:primaryTopic rdf:resource="http://myweb.ecu.edu/students/brinkleyju11"/>
    <rdf:type rdf:resource="http://xmlns.com/foaf/0.1/PersonalProfileDocument"/>
  </rdf:Description>
  - <rdf:Description rdf:about="http://myweb.ecu.edu/students/brinkleyju11">
    <foaf:name>Julian Brinkley</foaf:name>
    <foaf:surname>Brinkley</foaf:surname>
    <foaf:firstName>Julian</foaf:firstName>
    <rdf:type rdf:resource="http://xmlns.com/foaf/0.1/Person"/>
  </rdf:Description>
</rdf:RDF>

```

Figure 20: An RDF/XML description of the author, Julian Brinkley using the FOAF vocabulary.


```

<div vocab="http://xmlns.com/foaf/0.1/" typeof="Person">
  <p>
    <span property="name">Julian Brinkley</span>,
    Email: <a property="mbox" href="mailto:julianbrinkley@example.com">
      julianbrinkley@example.com
    </a>,
    Phone: <a property="phone" href="tel:+1-555-555-5555">
      +1 555.555.5555
    </a>
  </p>
</div>

```

Figure 21: An RDFa description of the author, Julian Brinkley using the FOAF vocabulary.

5.1.1.4 Friend of a Friend Vocabulary

The Friend of a Friend (FOAF) [118] vocabulary is used to describe both individual characteristics and relationship data using RDF and Web Ontology Language (OWL) [119] (see Figure 20). The vocabulary, as partially illustrated in Table 15, describes people (foaf:Person), their personal information (e. g. foaf:birthday) and their relationships to other people (foaf:knows). FOAF readily lends itself to the concept of online social networking and its use in this context has broadly studied [120], [121], [122]. FOAF is often discussed within the context of the Semantically Interlinked Online Communities (SIOC) initiative which aims to link users with their content; primarily self-generated information like posts, comments, images. [123], [124]. Both FOAF and SIOC may be viewed as an implementation of the Social Object concept which conceptualizes the relationship between users and SNS content [125]. Social objects can be viewed as the connective tissue of these relationships. From a practical perspective these social objects may take the form of posts on Facebook, a Twitter “tweet” or even streaming video on YouTube. These objects are all user created, can be shared with other users, and there is generally some method to indicate affinity.

Table 15: Partial Description of the FOAF Vocabulary

Term	Description	Example
foaf:Person	A class that represents a person. Is a subclass of the Agent class.	The <i>person</i> Julian Brinkley
foaf:name	The name of a person	“Julian Brinkley”
foaf:mBox	The personal internet mailbox of an agent (a person is a subclass of the agent class)	brinkleyju@students.ecu.edu
foaf:familyName	The family name of a person	“Brinkley”
foaf:firstName	The first name of a person	“Julian”
foaf:gender	The gender of an agent	male
foaf:interest	A reference to a document that represents an agent’s interests	
foaf:schoolHomepage	A reference to the homepage of a school attended by a person	http://www.ecu.edu/
foaf:skypeID	The SkypeID of a person	JBrinkley
foaf:birthday	The birthday of an agent	“01-30”

5.2 Portable Profile Architecture (Personal Profile Manager)

Profile portability may aid in the elimination of many of the usability issues identified by the study documented in chapter 4 by decoupling the creation and maintenance of user profile and relationship information from any single system. As envisioned, the proposal would enable a blind user to create and maintain a portable user profile independent of any specific SNS using a single Personal Information Hub (PIH) designed specifically for usability needs of individuals with visual impairments. The need to engage in profile administration tasks across a number of often inaccessible systems in this context would be largely eliminated. This proposed

architecture borrows heavily from similar architectures described in the literature [120], [122], [126]. It is differentiated from these approaches however by its motivation, emphasis on accessibility, implementation and centralization of FOAF profile data (e. g. profile hosted by PIH). The latter factor, profile centralization, is perhaps the most significant differentiator given that one of the driving factors behind the concept of profile portability is the *decentralization* of user profile information to enhance user privacy and reclaim data ownership (e. g. FOAF profiles hosted by the resource owner) [126]. The driving factor behind the approach proposed within this thesis however is to improve the usability of SNSs generally and it is the author's opinion that while the proposed approach potentially sacrifices a degree of privacy and decentralization, usability improvements may justify this compromise.

5.2.1 System Components

The system as conceptualized is composed of components fulfilling one or more of the following roles (see Figure 22):

1. Personal Information Hub (PIH): The PIH aggregates FOAF profile information from any number of user-identified sources and publishes a single, master FOAF profile via a private URI accessible via explicit access granted by the user.
2. Data Provider: A system exporting user profile information in FOAF format.
3. Data Consumer: A system which imports user profile information in FOAF format.

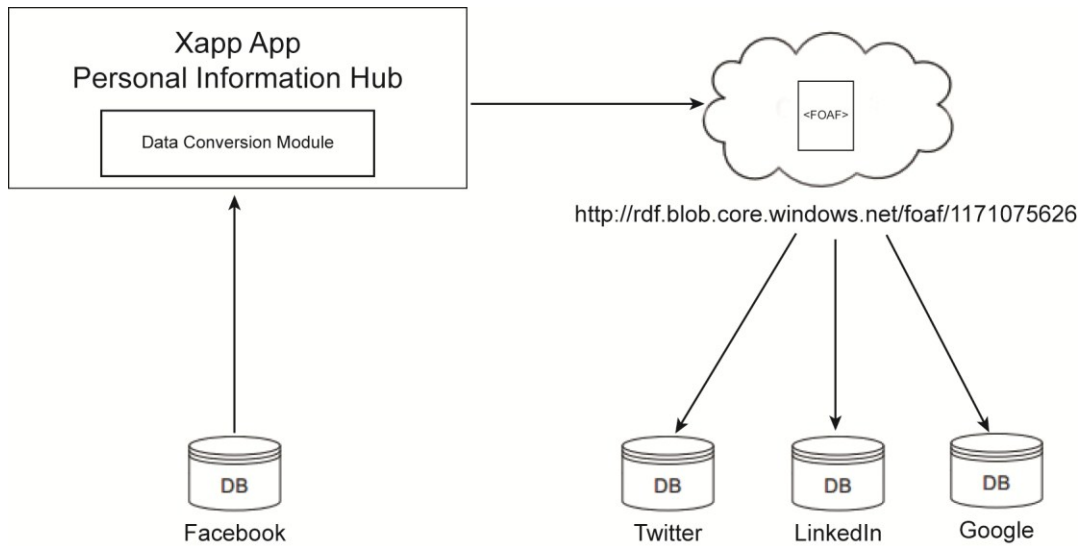


Figure 22: Portable profile architecture.

5.3 Use Case: Portable Social Network Profile

As an exercise to evaluate the practicality of the proposed architecture while identify potential shortcomings a prototype was developed based on a hypothetical use case that corresponds with the likely motivations for the use of a system like the one proposed. The usability challenges faced by blind users on SNSs were anecdotally discussed in section 2.3.3, were examined within the context of these users’ online behavior in chapter 3 and were specifically defined through the ethnographic study presented in chapter 4. Within the context of the user activities evaluated, participants were most severely challenged by the profile creation and user connection processes. One solution to this problem is to decouple a user’s profile and connections list from any single SNS altogether. The concept of a Personal Information Hub (PIH), an online repository for user profile information, would allow a user to: (1) manage profile and relationship information in one location, (2) “move” this data easily between

specification supporting applications and (3) within a system specifically designed for maximum accessibility.

In this use case the user's SNS profile is composed of a single resource, accessible via URI that is hosted by the PIH provider. This private FOAF profile contains information which mirrors the type of data typically found in an SNS user profile; name, email address, gender and other related data. The profile also contains a list of individuals with whom the user has a relationship.

5.4 Implementation: eXtensible Accessible Portable Profile Application

As a prototype designed to directly address the aforementioned usage scenario the eXtensible Accessible Portable Profile Application (XappApp) enables a user to: (1) retrieve their Facebook profile information in FOAF format (2) modify or add to this information as desired and (3) create a hosted FOAF file accessible via URI. The system has been implemented as a Windows Azure Cloud Service [127] with a web role that serves as the sole UI of the XappApp system (Xappapp.com). Windows Azure Storage [128], which provides redundant Binary Large Object (BLOB) storage, was selected as the FOAF file storage provider. While other options like Amazon's Secure Storage Service (S3) [129] enable access to appropriately configured data via URI, Azure storage was chosen due to its implementation of this feature as well as its native compatibility with Azure cloud services. The system's exported FOAF files have been successfully tested against the W3C RDF Validation Service [130] and the FOAF-O-Matic [131] RDF file creation system to verify file compatibility.

The application communication sequence between the Azure cloud service web role, Facebook SNS and Azure storage service is illustrated in Figure 23:

1. The user learns about the PIH and visits the website (Figure 24). Deciding to try the service the user initiates the registration process which opens an OAuth 2.0 [132] registration dialog followed by an authorization request that is submitted to Facebook (Figure 25).
2. An authorization grant is returned to the client.
3. An access token request is sent to the Facebook authorization server.
4. An access token is returned to the client.
5. A user profile information request is initiated to the Facebook GraphAPI which includes the access token.
6. The user profile information is returned to the client in JSON format (Figure 26) and displayed to the user (Figure 27).
7. The user modifies the information as desired and saves the data at which time a FOAF file is created and stored in the Azure storage cloud (Figure 28)

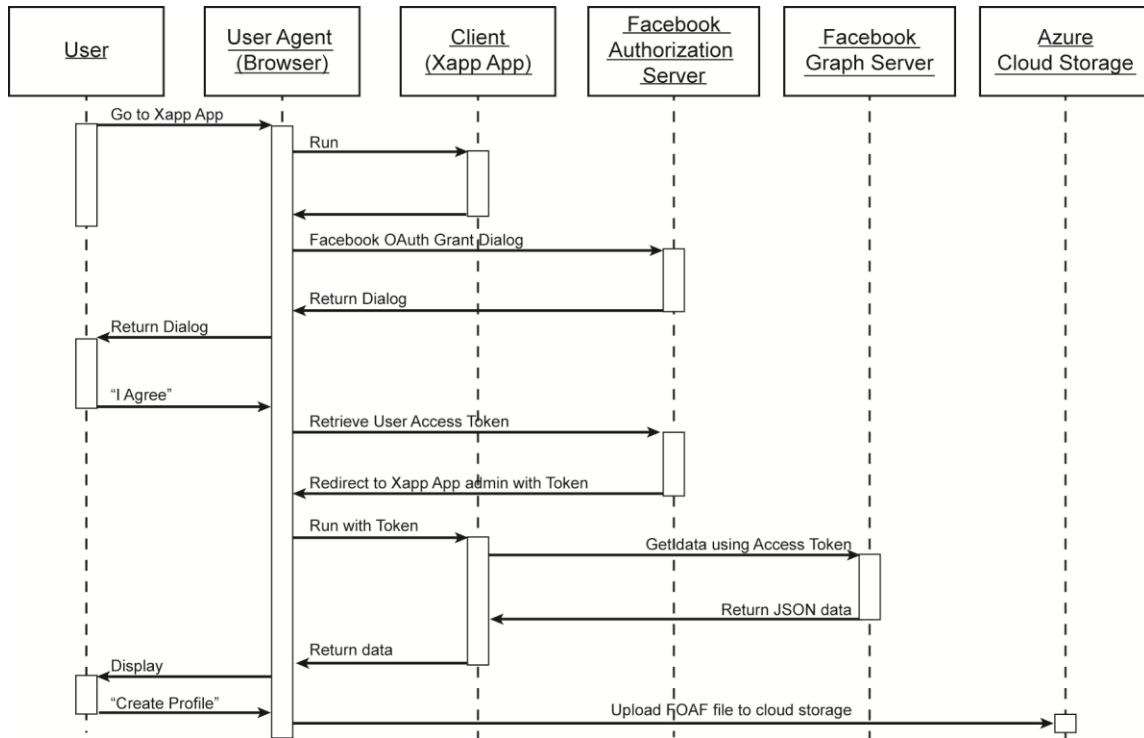


Figure 23: Sequence diagram depicting the communication sequence between the XappApp cloud service, Facebook SNS and Azure BLOB storage container

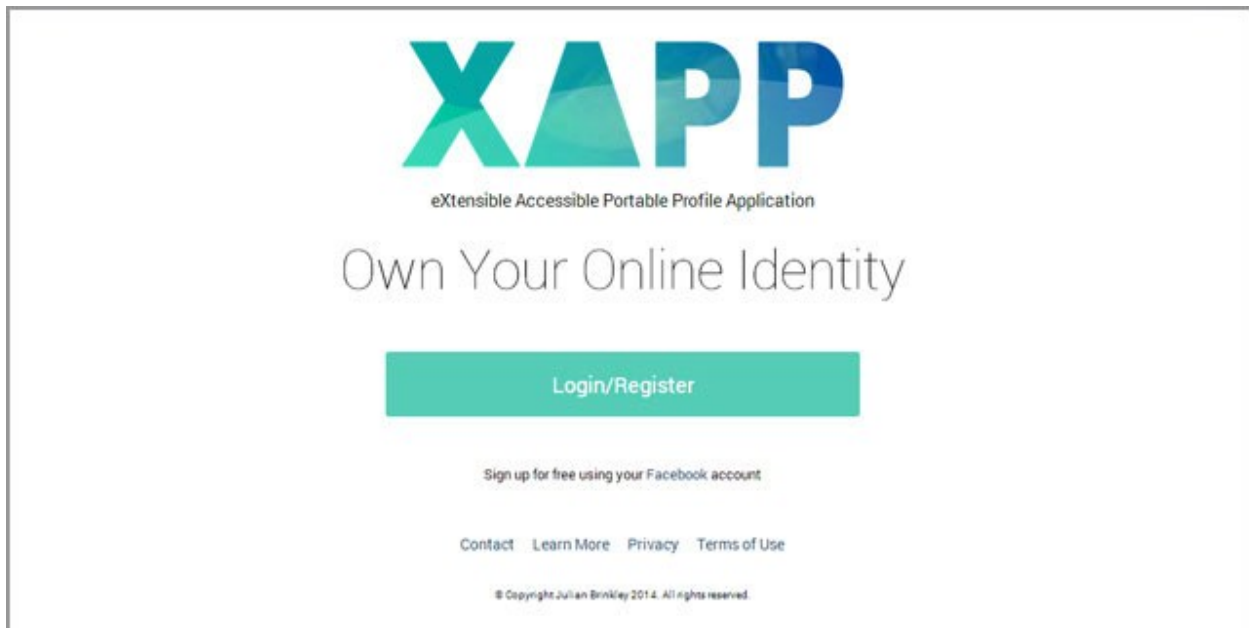


Figure 24: XappApp homepage.



Figure 25: OAuth registration using Facebook.


```
{
  "id": "117175626",
  "name": "Julian Brinkley",
  "friends": {
    "data": [
      {
        "first_name": "Cameron",
        "id": "1525432"
      },
      {
        "first_name": "Robert",
        "id": "11201340"
      },
      {
        "first_name": "Nathan",
        "id": "11251934"
      },
      {
        "first_name": "Megan",
        "id": "33114250"
      },
      {
        "first_name": "Amy",
        "id": "55140341"
      },
      {
        "first_name": "william",
        "id": "62315398"
      },
      {
        "first_name": "Patrice",
        "id": "62336343"
      }
    ]
  }
}
```

Figure 26: Returned Facebook profile information for the author in JSON format.

Edit Personal Profile Information

Name

First Name:

Last Name:

Nick Name:

Title:

Contact Information

Phone Number:

Email Address:

Skype ID:

Biographical Information

Friends (181)

[Edit Friend Information](#)
[Add a Friend](#)
[Delete a Friend](#)

Name

First Name:

Last Name:

Nick Name:

Title:

Figure 27: The profile edit page with prepopulated form data in the foreground.

```

<foaf:knows rdf:resource="http://graph.facebook.com/1814205906"/>
<foaf:knows rdf:resource="http://graph.facebook.com/1836261011"/>
<foaf:knows rdf:resource="http://graph.facebook.com/1840685060"/>
<foaf:knows rdf:resource="http://graph.facebook.com/1847540740"/>
<foaf:knows rdf:resource="http://graph.facebook.com/33614250"/>
<foaf:knows rdf:resource="http://graph.facebook.com/504819236"/>
<foaf:knows rdf:resource="http://graph.facebook.com/504879630"/>
<foaf:knows rdf:resource="http://graph.facebook.com/506770507"/>
<foaf:knows rdf:resource="http://graph.facebook.com/507742359"/>
<foaf:knows rdf:resource="http://graph.facebook.com/519695603"/>
<foaf:knows rdf:resource="http://graph.facebook.com/548436204"/>
<foaf:knows rdf:resource="http://graph.facebook.com/549757731"/>
<foaf:knows rdf:resource="http://graph.facebook.com/55100341"/>
<foaf:knows rdf:resource="http://graph.facebook.com/576631001"/>
<foaf:knows rdf:resource="http://graph.facebook.com/580969575"/>
<foaf:knows rdf:resource="http://graph.facebook.com/589567196"/>
<foaf:knows rdf:resource="http://graph.facebook.com/617712618"/>
<foaf:knows rdf:resource="http://graph.facebook.com/622802969"/>
<foaf:knows rdf:resource="http://graph.facebook.com/62301398"/>
<foaf:knows rdf:resource="http://graph.facebook.com/62305343"/>
<foaf:knows rdf:resource="http://graph.facebook.com/62306431"/>
<foaf:knows rdf:resource="http://graph.facebook.com/628703132"/>
<foaf:knows rdf:resource="http://graph.facebook.com/636659595"/>
<foaf:knows rdf:resource="http://graph.facebook.com/645162255"/>
<foaf:knows rdf:resource="http://graph.facebook.com/659178040"/>
<foaf:knows rdf:resource="http://graph.facebook.com/695730684"/>
<foaf:knows rdf:resource="http://graph.facebook.com/698422054"/>
<foaf:knows rdf:resource="http://graph.facebook.com/701962484"/>
<foaf:knows rdf:resource="http://graph.facebook.com/771861966"/>
<foaf:knows rdf:resource="http://graph.facebook.com/795813146"/>
<foaf:knows rdf:resource="http://graph.facebook.com/800530623"/>
<foaf:knows rdf:resource="http://graph.facebook.com/846035396"/>
<foaf:name>Julian Brinkley</foaf:name>
<foaf:nick>Jules</foaf:nick>
<foaf:surname>Brinkley</foaf:surname>
</foaf:Person>
</rdf:RDF>

```

Figure 28: FOAF file of the author with resource references to the author's friends (foaf:knows).

5.5 Discussion

The XappApp has been designed as a prototype to demonstrate the relative ease with which the profile creation process may be decoupled from any specific system in practical terms. As a result this work intentionally avoids any direct discussion of profile security, profile consolidation, or the usability of the XappApp interface itself as these issues fall outside of the scope of discussing the problem from the perspective of the usability issues identified in Chapter 4. Other work has proposed the use of semantic technologies to address accessibility issues. Fernandes et al. discussed the concept of semantic processes for improving page navigation for instance [133]. Externalizing the profile creation process *specifically* to further accessibility is a novel approach that is but one of many FOAF driven approaches that may be effective in addressing the issues of SNS account portability. An appropriately configured email service, like Yahoo mail could be used as PIH for instance. An individual may also securely host their own FOAF profile securely using a combination of WebIDs, FOAF and SSL which is in keeping with the current thinking around the decentralized approach to profile portability. SNSs themselves may also serve as PIHs and Facebook itself is essentially a de facto PIH, given the ability to export FOAF data, despite its lack of support for the importation of this information. Regardless of implementation however the important point is that the technologies current exist to support this type of profile portability. The limiting factor is the lack of support that Facebook and other SNS provide for the ability to actually import FOAF profile information.

CHAPTER 6: CONCLUSION

While the issues discussed and identified within this thesis are problematic from a number of perspectives, demographically they are unsustainable. Approximately 7% of U.S. adults self-identify as visually impaired [16]; either blind or with vision that is not correctable by traditional means like glasses or contact lenses (low vision). Worldwide it is estimated that approximately 285 million individuals live with some form of visual impairment (39 million blind, 246 million low vision); 90% of these individuals live in developing countries [13] where only a fraction of the population is online.

It is not claimed that the portable profile approach presented in chapter 5 would eliminate the usability issues that effectively serve as barriers of access to blind screen reader users. It is the author's opinion that this approach would largely eliminate the specific profile creation and connection issues identified in the study of the Facebook SNS described in chapter 4. While the optimal approach would be a redesign of the site to address the identified usability issues, the portable profile approach presented would likely require very limited modifications to the underlying system. In fact this functionality could largely be implemented within XappApp and systems like it however Facebook currently only provides "read" access to user profile and relationship data. It is hoped that, at a minim, this work will make a small contribution towards starting a conversation about the use of semantic web technologies to direct address issues related to accessibility and usability.

REFERENCES

- [1] D. M. Boyd and N. B. Ellison, "Social network sites: Definition history and scholarship," *Journal of Computer-Mediated Communication*, vol. 13, no. 1, pp. 210-230, 2007.
- [2] M. R. Morris, J. Teevan and K. A. Panovich, "Comparison of Information Seeking Using Search Engines and Social Networks," in *Proceedings of the 4th International AAAI Conference on Weblogs and Social Media*, Washington, 2010.
- [3] J. Brenner and A. Smith, "72% of Online Adults are Social Networking Site Users," 2013. [Online]. Available: <http://pewinternet.org/Reports/2013/social-networking-sites.aspx>. [Accessed 15 Jan. 2014].
- [4] Nielsen, "State of the Media," 2013. [Online]. Available: <http://www.nielsen.com/us/en/reports/2012/state-of-the-media-the-social-media-report-2012.html>. [Accessed 22 Jan. 2014].
- [5] K. Bahiss, S. Cunningham and T. Smith, "Investigating the usability of social networking sites for teenagers with autism," in *Proceedings of the 11th International Conference of the NZ Chapter of the ACM Special Interest Group on Human-Computer Interaction*, Auckland, 2010.
- [6] M. Burke, R. Kraut and D. Williams, "Social Use of Computer-Mediated Communication by Adults on the Autism Spectrum," in *Proceedings of the 2010 ACM Conference on Computing Supported Cooperative Work*, Savannah, 2010.

- [7] T. Tsaousides, Y. Matsuzawa and M. Lebowitz, "Familiarity and prevalence of Facebook use for social networking," *Brain Injury*, vol. 25, no. 12, pp. 1155-1162, 2011.
- [8] E. Brady, Y. Zhong, M. R. Morris and J. P. Bigham, "Investigating the Appropriateness of Social Network Question Asking as a Resource for Blind Users," in *Computer Supported Cooperative Work (CSCW '13)*, San Antonio, 2013.
- [9] WebAIM (Web Accessibility in Mind), "Screen Reader User Survey #4 Results," 2014. [Online]. Available: <http://webaim.org/projects/screenreadersurvey4/#mobil>. [Accessed 6 Jan. 2014].
- [10] Observatory on ICT Accessibility, "Accessibility of Social Networking Services," Observatory on ITC Accessibility, Madrid, 2010.
- [11] J. L. Brinkley and N. Tabrizi, "A Pilot Study Examining the Online Behavior of Web Users with Visual Impairment," *International Journal of Advanced Computer Science Applications*, vol. 4, no. 11, pp. 150-155, 2013.
- [12] World Health Organization, *International Statistical Classification of Diseases and Related Health Problems*, Geneva: World Health Organization, 2010.
- [13] World Health Organization, "Visual Impairment and Blindness," Oct. 2013. [Online]. Available: <http://www.who.int/mediacentre/factsheets/fs282/en/>. [Accessed 1 Feb. 2014].
- [14] R. Bavani, A. Jaafar and N. F. M. Yatim, "A study on web experience among visually impaired users in Malaysia," in *Proceedings of the 2010 International Conference on*

User Science and Engineering (i-USEr), Shah Alam, 2010.

- [15] N. Rajput, S. K. Agarwal and A. A. Nanavati, "An Alternative Information Web for Visually Impaired Users in Developing Countries," *IBM Journal of Research and Development*, vol. 54, pp. 1-15, 2008.
- [16] S. Fox, "Americans Living with Disability and Their Technology Profile," 2011. [Online]. Available: <http://pewinternet.org/Reports/2011/Disability.aspx>. [Accessed 7 Jan. 2014].
- [17] G. Brajnik, "Automatic web usability evaluation: what needs to be done?," in *Proceedings of the 6th Conference on Human Factors and the Web*, Austin, 2000.
- [18] S. Krug, *Don't Make Me Think: A Common Sense Approach to Web Usability*, 2nd ed., Berkeley, CA: New Riders Press, 2006.
- [19] W3C Web Accessibility Initiative, "Introduction to Web Accessibility," Sep. 2005. [Online]. Available: <http://www.w3.org/WAI/intro/accessibility.php>. [Accessed 1 Feb. 2014].
- [20] J. Craven and P. Brophy, "Non-visual Access to the Digital Library: The Use of the Digital Library Interfaces by Blind and Visually Impaired People," Manchester Metropolitan University, Centre for Research in Library and Information Management, Manchester, 2003.
- [21] S. Harper, C. Goble and R. Stevens, "A Pilot Study to Examine the Mobility Problems of Visually Impaired Users Traveling the Web," *ACM SIGCAPH Computers and the*

Physically Handicapped, vol. 9, no. 2000, pp. 10-19, 2000.

- [22] P. Collin, K. Rahilly, I. Richardson and A. Third, "The Benefits of Social Networking Services," Cooperative Research Centre for Young People Technology and Well Being, Abbotsford, Australia, 2010.
- [23] H. Petrie, F. Hamilton and N. King, "Tension, what tension?: Website accessibility and visual design," in *Proceedings of the International Cross Disciplinary workshop on Web Accessibility*, New York, 2004.
- [24] J. Huang, "Usability of E-government web sites for people with disabilities," in *Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS '03)*, Waikola, 2003.
- [25] World Wide Web Consortium, "Web Content Accessibility Guidelines 1.0," 1999. [Online]. Available: <http://www.w3.org/TR/WAI-WEBCONTENT/>. [Accessed 14 Feb. 2014].
- [26] B. Kelly, L. Nevile, D. Sloan, S. Fanou and R. Ellison, "From Web accessibility to Web adaptability," *Disability and Rehabilitation: Assistive Technology*, vol. 4, no. 4, pp. 212-226, 2009.
- [27] British Standards Institution, "BS 8878: 2010 Web Accessibility. Code of Practice," 2014. [Online]. Available: <http://shop.bsigroup.com/ProductDetail/?pid=000000000030180388>. [Accessed 15 Feb. 2014].

- [28] United States Department of Labor, "Section 508, Rehabilitation Act of 1973," 23 Jul. 2002. [Online]. Available: <http://www.dol.gov/oasam/regs/statutes/sec508.htm>. [Accessed 14 Feb. 2014].
- [29] United States Department of Labor, "Americans with Disabilities Act," [Online]. Available: <http://www.dol.gov/dol/topic/disability/ada.htm>. [Accessed 14 Feb. 2014].
- [30] State of California, "Government Code Section 11135-11139.7," 1 Jan. 2007. [Online]. Available: <http://www.leginfo.ca.gov/cgi-bin/displaycode?section=gov&group=11001-12000&file=11135-11139.7>. [Accessed 14 Feb. 2014].
- [31] Federal Communications Commission, "Twenty-First Century Communication and Video Accessibility Act," 1 Jan. 2012. [Online]. Available: <http://transition.fcc.gov/cgb/dro/cvaa.html>. [Accessed 7 Apr. 2012].
- [32] K. S. Fuglerud and T. H. Røssvoll, "An evaluation of web-based voting usability and accessibility," *Universal Access in the Information Society*, vol. 11, no. 4, pp. 359-373, 2012.
- [33] M. Vigo and G. Brajnik, "Automatic web accessibility metrics: Where we are and where we can go," *Interacting with Computers*, vol. 23, no. 2011, pp. 137-155, 2011.
- [34] J. Nielsen, "10 Usability Heuristics for User Interface Design," 1 Jan. 1995. [Online]. Available: <http://www.nngroup.com/articles/ten-usability-heuristics/>. [Accessed 14 Feb. 2014].

- [35] W. Yu, G. McAllister, E. Murphy, R. Kuber and P. Strain, "Developing Multi-Modal Interfaces for Visually Impaired People to Access the Internet," in *Proceedings of the 8th ERCIM Workshop - User Interfaces for All*, Vienna, 2004.
- [36] C. S. Fichten, J. V. Asuncion, M. Barile, V. Ferraro and Wolforth, "Accessibility of e-learning and computer information technologies for students with visual impairments in post secondary education," *Journal of Visual Impairment & Blindness*, vol. 103, pp. 543-557, 2009.
- [37] K. Pernice and J. Nielsen, "Beyond ALT Text: Making the Web easy to User for Users with Disabilities," Nielsen Norman Group, Fremont, 2001.
- [38] F. Fernandes, F. Martins, H. Paredes and J. Pereira, "A Different Approach to Real Web Accessibility," in *Proceedings of the International Conference on Univeral Access in Human-Computer Interaction*, Beijing, 2001.
- [39] American Foundation for the Blind, "The Visually Impaired Web User's Technology," [Online]. Available: <http://www.afb.org/Section.asp?SectionID=57&TopicID=167&DocumentID=2175>. [Accessed 1, Feb. 2014].
- [40] Freedom Scientific, "JAWS for Windows Screen Reading Software," 2014. [Online]. Available: <http://www.freedomscientific.com/products/fs/jaws-product-page.asp>. [Accessed 14 Feb. 2014].
- [41] NVAccess, "What is NVDA," 15 May 2013. [Online]. Available:

<http://www.nvaccess.org/>. [Accessed 1 Feb. 2014].

- [42] J. Maeda, K. Fukuda, H. Takagi and C. Asakawa, "Web accessibility technology at the IBM Tokyo Research Laboratory," *IBM Journal of Research and Development*, vol. 48, pp. 735-749, 2004.
- [43] C. Goble, S. Harper and R. Stevens, "The Travails of Visually Impaired Web Travellers," in *Proceedings of the 11th ACM Conference on Hypertext and Hypermedia*, San Antonio, 2000.
- [44] E. Hill and P. Ponder, *Orientation and Mobility Techniques*, New York, NY: American Foundation for the Blind, 1976, p. 3.
- [45] N. E. Youngblood and J. Mackiewicz, "A usability analysis of municipal government website home pages in Alabama," *Government Information Quarterly*, vol. 29, no. 4, pp. 582-588, 2012.
- [46] WebAIM (Web Accessibility in Mind), "Survey of Preferences of Screen Reader Users," 2014. [Online]. Available: <http://webaim.org/projects/screenreadersurvey/>. [Accessed 9 Jan. 2014].
- [47] IHS Technology, "The Average Price of Tablet PCs Declined Significantly in 1Q 2012," 8 Jun. 2012. [Online]. Available: http://www.imsresearch.com/press-release/The_Average_Price_of_Tablet_PCs_Declined_Significantly_in_1Q_2012&cat_id=195&type=LatestResearch. [Accessed 19 Feb. 2014].

- [48] Dell Computer, "Desktops and All in One Computers - Everyday Desktops," 23 Jan. 2014. [Online]. Available: <http://www.dell.com/us/p/desktops?~ck=mn#!all-in-one-desktops&cid=everyday-desktops>. [Accessed 19 Feb. 2014].
- [49] M. W. Brault, "Americans With Disabilities: 2010 Household Economic Studies," United States Economics and Statistics Administration and United States Bureau of the Census, Washington, 2012.
- [50] d. boyd, "Why Youth (Heart) Social Network Sites: the Role of Networking Publics in Teenage Social Life," in *MacArthur Foundation on Digital Learning - Youth, Identity and Digital Media Volume* (ed. David Buckingham), Cambridge, MA, MIT press, 2007.
- [51] eBiz|MBA, "Top 15 Most Popular Social Networking Sites | February 2014," 7 Feb. 2014. [Online]. Available: <http://www.ebizmba.com/articles/social-networking-websites>. [Accessed 12 Feb. 2014].
- [52] P. Tilve, "Inclusive Planet: Lending a voice to the print-impaired," *CHIP*, vol. 7, no. 10, pp. 20-21, Sept. 2010.
- [53] AudioBoo, "Social Network for Blind People," 2014. [Online]. Available: https://audioboo.fm/about/social_blind. [Accessed 2 Feb. 2014].
- [54] AudioBoo, "Recent Press Stories," 3 Oct. 2013. [Online]. Available: <https://audioboo.fm/about/press>. [Accessed 2 Feb. 2014].
- [55] N. B. Ellison, C. Steinfield and C. Lampe, "The Benefits of Facebook "Friends:" Social Capital and College Students' Use of Online Social Network Sites," *Journal of Computer-*

Mediated Communication, vol. 12, no. 4, pp. 1143-1168, 2007.

- [56] A. N. Joinson, "Looking at, looking up or keeping up with people? Motives and use of facebook," in *Proceedings of the 2008 ACM Conference on Human Factors in Computing*, Florence, 2008.
- [57] C. Lampe, N. B. Ellison and C. Steinfield, "A Face(book) in the crowd: social searching vs. social browsing," in *Proceedings of the 2006 Conference on Computer Supported Cooperative Work*, Alberta, 2006.
- [58] Facebook, "Investor Relations - Earnings," 29 Jan. 2014. [Online]. Available: <http://investor.fb.com/results.cfm>. [Accessed 2 Jan. 2014].
- [59] Alexa, "Facebook.com Site Info," 9 Jan. 2014. [Online]. Available: <http://www.alexa.com/siteinfo/facebook.com>. [Accessed 9 Jan. 2014].
- [60] American Foundation for the Blind, "AFB AccessWorld Magazine," May 2009. [Online]. Available: <http://www.afb.org/afbpres/pub.asp?DocID=aw100306>. [Accessed 9 Jan. 2014].
- [61] J. Hart, C. Ridley, F. Taher, C. Sas and A. Dix, "Exploring the Facebook Experience: A New Approach to Usability," in *Proceedings of NordiChi 2008*, Lund, 2008.
- [62] B. Wentz and J. Lazar, "Are Separate Interfaces Inherently Unequal? An Evaluation with Blind Users of the Usability of Two Interfaces for a Social Networking Platform," in *iConference 2011*, Seattle, 2011.

- [63] Facebook, "Accessibility for People with Disabilities," 2014. [Online]. Available: <http://www.facebook.com/help/141636465971794>. [Accessed 9 Jan. 2014].
- [64] Facebook, "Why does my facebook look different than my friend's?," 2013. [Online]. Available: <http://www.facebook.com/help/community/question/?id=10151647648643728>. [Accessed 19 Feb. 2014].
- [65] Google, "ChromeVox," 2012. [Online]. Available: <http://www.chromevox.com/>. [Accessed 17 Feb. 2014].
- [66] J. Lazar, J. H. Feng and H. Hochheiser, *Research Methods in Human Computer Interaction*, West Sussex: Wiley Publishing, 2010.
- [67] R. Likert, "A Technique for the Measurement of Attitudes," *Archives of Psychology*, vol. 140, pp. 1-55, 1932.
- [68] B. J. Fogg and D. Eckles, "The behavior chain for online participation: how successful web services structure persuasion," in *Lecture Notes in Computer Science: Vol. 4744. Persuasive Technology*, Y. de Kort, B. Eggen, B. J. Fogg, W. Ijsselstein and C. Midden, Eds., Berlin, Springer-Verlag, 2007, pp. 199-209.
- [69] B. J. Fogg and D. Iizawa, "Online Persuasion in Facebook and Mixi: A Cross-Cultural Comparison," in *Persuasive Technology*, vol. 5033, H. Oinas-Kukkonen, P. Hasle, M. Harjumaa, K. Segerståhl and P. Øhrstrøm, Eds., Berlin, Springer-Verlag, 2008, pp. 35-46.
- [70] A. Vasalou, A. Joinson and D. Courvoisier, "Cultural differences, experiences with social networks and the nature of "true commitment" in Facebook," *International Journal of*

Human Computer Studies, vol. 68, no. 10, pp. 719-728, 2010.

- [71] K. N. Hampton, L. S. Goulet, L. Rainie and K. Purcell, "Social networking sites and our lives," 2011. [Online]. Available: <http://www.pewinternet.org/Reports/2011/Technology-and-social-networks.aspx>. [Accessed 12 1 2014].
- [72] F. Stutzman, R. Capra and J. Thompson, "Factors mediating disclosure in social networking sites," *Computers in Human Behavior*, vol. 27, no. 1, pp. 590-598, 2011.
- [73] E. Gerber, "Conducting Usability Testing With Computer Users Who Are Blind Or Visually Impaired," in *17th Annual International Conference of California State University Northridge (CSUN)*, Northridge, 2002.
- [74] C. A. Beverley, P. A. Bath and R. Barber, "Health and social care information for visually-impaired people," *Aslib Proceedings*, vol. 63, no. 2, pp. 256-274, 2011.
- [75] A. W. Kushniruk, V. L. Patel and J. J. Cimino, "Usability testing in medical informatics: cognitive approaches to evaluation of information systems and user interfaces," *Journal of the American Medical Informatics Association*, pp. 218-222, 1997.
- [76] J. Nielsen, "Usability metrics: tracking interface improvements," *IEEE Software*, vol. 13, no. 6, pp. 12-13, 1996.
- [77] J. Brooke, "SUS: A "quick and dirty" usability scale," *Usability evaluation in industry*, pp. 189-194, 1996.
- [78] M. W. M. Jaspers, T. Steen, M. Geenen and C. van den Bos, "The think aloud method: a

- guide to user interface design," *International Journal of Medical Informatics*, vol. 73, no. 11, pp. 781-795, 2004.
- [79] L. W. P. Peute, R. Spithoven, P. J. M. Bakker and M. W. M. Jaspers, "Usability studies on interactive health information systems: where do we stand?," *Studies in Health Technologies and Informatics*, vol. 136, pp. 327-332, 2008.
- [80] F. Adebessin, P. Kotzé and H. Gelderblom, "The complementary role of two evaluation methods in the usability and accessibility evaluation of a non-standard system," in *Proceedings of the 10th Annual Research Conference of the South African Institute of Computer Scientists and Information Technologists*, Bela Bela, 2010.
- [81] P. Y. Yen and S. Bakken, "A comparison of usability evaluation methods: heuristic evaluation versus end-user think-aloud protocol - an example from a web based communication tool for nurse scheduling," in *Proceedings of the AMIA Annual Symposium (Vol. 2009)*, San Francisco, 2009.
- [82] A. A. Mahmud and J. Martens, "Amail: Design and Evaluation of an Accessible Email Tool for Persons with Aphasia," *Interacting with Computers*, vol. 25, no. 5, pp. 351-374, 2013.
- [83] K. Boyd, C. Nugent, M. Donnelly, R. Sterritt and R. Bond, "A Usability Protocol for Evaluating Online Social," in *Lecture Notes in Computer Science*, vol. 7251, M. Donnelly, C. Paggetti, C. Nugent and M. Mokhtari, Eds., Berlin, Springer, 2012, pp. 222-225.

- [84] M. Oren, C. Harding and T. L. Bonebright, "Design and Usability Testing of an Audio Platform Game for Players with Visual Impairments," *Journal of Visual Impairment & Blindness*, vol. 102, no. 12, pp. 761-773, 2008.
- [85] K. Ericsson and H. Simon, *Protocol Analysis: Verbal Reports As Data*, Cambridge, MA: MIT Press, 1992.
- [86] G. Olson, S. Duffy and R. Mack, "Thinking-out-loud as a method for studying real-time comprehension processes," in *New methods in reading comprehension research*, D. Kieras and M. Just, Eds., Hillsdale, NJ: Lawrence Erlbaum, 1984.
- [87] S. Bozkurt, N. Zayim, K. H. Gulkesen, M. K. Samur, N. Karaağaoğlu and O. Saka, "Usability of a web-based personal nutrition management tool," *Informatics for Health and Social Care*, vol. 36, no. 4, pp. 190-205, 2011.
- [88] M. J. van den Haak, M. D. T. de Jong and P. J. Schellens, "Evaluating municipal websites: A methodological comparison of three think-aloud variants," *Government Information Quarterly*, vol. 26, no. 1, pp. 193-202, 2009.
- [89] V. L. Roberts and D. I. Fels, "Methods for inclusion: Employing think aloud protocols in software usability studies with individuals who are deaf," *International Journal of Human Computer Studies*, vol. 64, no. 6, pp. 489-501, 2006.
- [90] A. Bangor, P. Kortum and J. Miller, "Determining What Individual SUS Scores Mean: Adapting an Adjective Rating Scale," *Journal of Usability Studies*, vol. 4, no. 3, pp. 114-123, 2009.

- [91] K. Finstad, "The Usability Metric for User Experience," *Interacting with Computers*, vol. 22, no. 2010, pp. 323-327, 2010.
- [92] J. Kirakowski, M. Porteous and M. Corbett, "How to use the software usability measurement inventory: the users' view of software quality," in *Proceedings of the European Conference on Software Quality*, Madrid, 1992.
- [93] T. S. Tullis and J. N. Stetson, "A comparison of questionnaires for assessing website usability," in *Usability Professional Association Conference*, Minneapolis, 2004.
- [94] F. Kuo, C. Tseng, F. Tseng and C. S. Lin., "A Study of Social Information Control Affordances and Gender Difference in Facebook Self-Presentation," *Cyberpsychology, Behavior, and Social Networking*, vol. 16, no. 9, p. 644, 2013.
- [95] J. R. Lewis, "Sample sizes for usability studies: Additional considerations," *Human Factors*, vol. 36, no. 2, pp. 368-378, 1994.
- [96] J. Nielsen and T. K. Landauer, "A mathematical model of the finding of usability problems," in *Proceedings of the 1993 ACM Conference on Human Factors in Computing Systems*, Amsterdam, 1993.
- [97] R. A. Virzi, "Refining the test phase of usability evaluation: How many subjects is enough?," *Human Factors: The Journal of the Human Factors and Ergonomics Society*, vol. 34, no. 4, pp. 457-468, 1992.
- [98] M. Hertzum and N. E. Jacobsen, "The Evaluator Effect: A Chilling Fact About Usability Evaluation Methods," *International Journal of Human Computer Interaction*, vol. 15, no.

- 1, pp. 183-204, 2003.
- [99] J. Spool and W. Schoreder, "Testing web sites; Five users is nowhere near enough.," in *Proceedings of the 2001 ACM Conference on Human Factors in Computing Systems*, Seattle, 2001.
- [100] F. Fovet, "Impact of the use of Facebook amongst students of high school age with Social, Emotional and Behavioural Difficulties (SEBD)," in *Proceedings of the 39th IEEE Frontiers in Education Conference (FIE '09)*, San Antonio, 2009.
- [101] S. Kef, J. J. Hox and H. T. Habekothé, "Social networks of visually impaired and blind adolescents," *Social Networks*, vol. 22, pp. 73-91, 2000.
- [102] S. M. Kelly and T. J. Smith, "The Digital Social Interactions of Students with Visual Impairments: Findings from Two National Surveys," *Journal of Visual Impairment & Blindness*, vol. 102, pp. 528-539, 2008.
- [103] N. Shadbolt, W. Hall and T. Berners-Lee, "The Semantic Web Revisited," *IEEE Intelligent Systems*, vol. 21, no. 3, pp. 96-101, 2006.
- [104] T. Berners-Lee, J. Hendler and O. Lassila, "The semantic web," *Scientific American*, vol. 284, no. 5, pp. 28-37, 2001.
- [105] FOAF Project, "FOAF Project," [Online]. Available: <http://www.foaf-project.org/>. [Accessed 17 Feb. 2014].
- [106] C. Bizer, T. Heath and T. Berners-Lee, "Linked Data - The Story So Far," *International*

Journal on Semantic Web and Information Systems, vol. 5, no. 3, pp. 1-22, 2009.

- [107] W3C, "HTTP," 6 Feb. 2014. [Online]. Available: <http://www.w3.org/Protocols/>. [Accessed 7 Feb. 2014].
- [108] W3C, "RDF/XML Syntax Specification (Revised)," 10 Feb. 2004. [Online]. Available: <http://www.w3.org/TR/rdf-syntax-grammar/>. [Accessed 14 Feb. 2014].
- [109] T. Berners-Lee, "Uniform Resource Identifier - Axioms of Web Architecture," 19 Dec. 1996. [Online]. Available: <http://www.w3.org/DesignIssues/Axioms.html>. [Accessed 17 Feb. 2014].
- [110] T. Berners-Lee, "Linked Data - Design Issues," 27 July 2006. [Online]. Available: <http://www.w3.org/DesignIssues/LinkedData.html>. [Accessed 9 Feb. 2014].
- [111] Microformats.org, "Microformats," 11 Feb. 2011. [Online]. Available: <http://microformats.org>. [Accessed 9 Feb. 2014].
- [112] JSON.org, "Introducing JSON," Dec. 1999. [Online]. Available: <http://www.json.org/>. [Accessed 17 Feb. 2014].
- [113] W3C, "Extensible Markup Language (XML)," 29 Oct. 2013. [Online]. Available: <http://www.w3.org/XML/>. [Accessed 17 Feb. 2014].
- [114] Amazon, "Product Advertising API," 1 Aug. 2011. [Online]. Available: <http://docs.aws.amazon.com/AWSECommerceService/latest/DG/Welcome.html>. [Accessed 9 Feb. 2014].

- [115] W3C, "RDFa 1.1 Primer - Second Edition," 22 Aug. 2013. [Online]. Available: <http://www.w3.org/TR/rdfa-primer/>. [Accessed 14 Feb. 2014].
- [116] D. Beckett and T. Berners-Lee, "Turtle - Terse RDF Triple Language," 28 Mar. 2011. [Online]. Available: <http://www.w3.org/TeamSubmission/turtle/>. [Accessed 14 Feb. 2014].
- [117] W3C, "RDF Test Cases," 10 Feb. 2004. [Online]. Available: <http://www.w3.org/TR/rdf-testcases/#ntriples>. [Accessed 14 Feb. 2014].
- [118] Xmlns.com, "FOAF Vocabulary Specification 0.99," 14 Jan. 2014. [Online]. Available: <http://xmlns.com/foaf/spec/>. [Accessed 17 Feb. 2014].
- [119] W3C, "OWL Web Ontology Language Overview," 10 Feb. 2004. [Online]. Available: <http://www.w3.org/TR/owl-features/>. [Accessed 14 Feb. 2014].
- [120] F. Orlandi, J. Breslin and A. Passant, "Aggregated, interoperable and multi-domain user profiles for the social web," in *Proceedings of the 8th International Conference on Semantic Systems*, Graz, 2012.
- [121] J. Golbeck and M. Rothstein, "Linking Social Networks on the Web with FOAF: A Semantic Web Case Study," in *Proceedings of the 23rd AAAI Conference on Artificial Intelligence*, Chicago, 2008.
- [122] B. Heitmann, J. G. Kim, A. Passant, C. Hayes and H. G. Kim, "An architecture for privacy-enabled user profile portability on the Web of Data," in *Proceedings of the 1st International Workshop on Information Heterogeneity and Fusion in Recommender*

Systems, Barcelona, 2010.

- [123] J. G. Breslin, A. Harth, U. Bojars and S. Decker, "Towards semantically-interlinked online communities," in *The Semantic Web: Research and Applications*, Berlin, Springer Berlin Heidelberg, 2005, pp. 500-514.
- [124] S. A. Rios, F. Aguilera, F. Bustos, T. Omitola and N. Shadbolt, "Leveraging Social Network Analysis with Topic Models and the Semantic Web," in *Proceedings of the 2011 IEEE/WIC/ACM International Conference on Web Intelligence and Intelligent Agent Technology (WI-IAT)*, Lyon, 2011.
- [125] N. Marie and F. Gandon, "Social objects description and recommendation in multidimensional social networks," in *Proceedings of the 2011 IEEE Third International Conference on Privacy, Security, Risk and Trust (PASSAT)*, Boston, 2011.
- [126] C. A. Yeung, I. Liccardi, K. Lu, O. Seneviratne and T. Berners-Lee, "Decentralization: The Future of Online Social Networking," in *W3C Workshop on the Future of Social Networking Position Papers*, Barcelona, 2009.
- [127] Microsoft, "Windows Azure Cloud Services," 2014. [Online]. Available: <http://www.windowsazure.com/en-us/services/cloud-services/>. [Accessed 17 Feb. 2014].
- [128] Microsoft, "Windows Azure Storage," 2014. [Online]. Available: <http://www.windowsazure.com/en-us/services/storage/>. [Accessed 17 Feb. 2014].
- [129] Amazon Web Services, "Amazon Simple Storage Service (Amazon S3)," 2013. [Online].

Available: <http://aws.amazon.com/s3/>. [Accessed 18 Feb. 2014].

[130] W3C, "Validation Service," 28 Feb. 2006. [Online]. Available: <http://www.w3.org/RDF/Validator/>. [Accessed 20 Feb. 2014].

[131] Foaf-O-Matic, "Welcome to Foaf-O-Matic," [Online]. Available: <http://www.foaf-o-matic.org/>. [Accessed 20 Feb. 2014].

[132] Facebook, "Login Dialog," [Online]. Available: <https://developers.facebook.com/docs/reference/dialogs/oauth/>. [Accessed 20 Feb. 2014].

[133] A. Fernandes, A. Carvalho, J. J. Almeida and A. Simoes, "Transcoding for web accessibility for the blind: semantics from structure," in *Proceedings of the International Conference on Electronic Publishing*, Bansko, 2006.

APPENDIX A: Online Survey

Hello,

I am a student at East Carolina University in the Computer Science department. I am asking you to take part in my research study entitled, “Web Accessibility of Visually Impaired Computer Users Age 18 to 25”.

The purpose of this research is to determine if the difficulties that visually impaired computer users encounter in accessing websites and online information affects their online behavior. By doing this research, I hope to learn if a difference exists between the online behavior of visually impaired computer users versus sighted individuals.

You are being invited to take part in this research because you are either a visually impaired or sighted computer user between the ages of 18 to 25.

Your participation is voluntary, which means that you do not have to participate in this research unless you want to. The research will take approximately 30 minutes and we estimate that approximately 100 individuals will enroll in this study.

Thank you,

Julian Brinkley

Please click here if you would like to take the survey. (text hyperlink)

1. My sex is:

- Male
- Female

2. My age is:

[Textbox]

3. My level of visual impairment is

- Somewhat impaired / low vision
- Blind
- I have no visual impairment

4. I need assistive technology to use my computer

- True
- False
- I don't know

5. I use text-to-speech software like JAWS or Windows Eyes

- True
- False

6. The approximate number of websites I visit on a daily basis

- 0
- 1 to 5
- 5 to 10
- 10 or more

7. The number of *new* websites I visit on a daily basis

- 0
- 1 to 5
- 5 to 10
- 10 or more

8. I frequently try new websites

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

9. I normally visit (blank) number of new websites per week:

- I don't try new websites
- 1 or 2
- 3 to 5
- 5 or more
- I don't know how many new websites I visit per week

10. I avoid visiting new websites

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

11. I have trouble finding my way around new websites

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

12. I normally visit this type of website the most often

- News Websites
- Social Networking Websites
- Medical Websites
- Lifestyle Websites
- Blogs
- Online Encyclopedias
- Sports Websites
- Shopping Websites
- Other

13. I normally have the most difficulty with

- News Websites
- Social Networking Websites
- Medical Websites
- Lifestyle Websites
- Blogs
- Online Encyclopedias
- Sports Websites
- Shopping Websites
- Other

14. I usually find new online content like stories, videos and images from

- Search Engines like Google, Yahoo or Bing
- Word of mouth
- A link from another website

15. Online payment and E Commerce forms are easy for me to fill out

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

16. Online Contact forms are easy for me to fill out

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

17. I avoid trying new websites because I am concerned about being able to find the information that I am looking for

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

18. I find highly interactive websites easy to use

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

19. I sometimes have trouble finding what I am looking for online

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

20. I enjoy websites that have a large number of images

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

21. I enjoy highly interactive websites

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

22. I prefer highly interactive websites over websites with only static text content

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

23. Highly interactive websites are easier for me to use

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

24. Generally it is easy for me to find the information I am looking for online

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

25. I am more comfortable visiting websites that I am familiar with

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

26. I enjoy social networking websites like Facebook, MySpace and Twitter

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

27. I frequently use social networking websites like Facebook, MySpace and Twitter

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

28. I would like to use social networking websites but they are too difficult to use

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

29. Social networking websites are difficult for me to use

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

30. I wish the internet were easier to use

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

31. I often have trouble finding what I am looking for on the websites that I visit

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

32. I think that the internet could be made easier to use

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

33. Most websites are accessible to me

- Strongly Agree
- Somewhat Agree
- Somewhat Disagree
- Strongly Disagree

APPENDIX B: Informed Consent Document

East Carolina University



Informed Consent to Participate in Research

Information to consider before taking part in research that has no more than minimal risk.

Title of Research Study: An Evaluation of the Usability of the Facebook Online Social Network by Visually Impaired Users

Principal Investigator: Julian Brinkley

Institution/Department or Division: Computer Science Department

Address: C-112 Science & Technology Building - ECU - Greenville, NC 27858

Telephone #: (252)328-9680

Study Sponsor/Funding Source: None

Researchers at East Carolina University (ECU) study problems in society, health problems, environmental problems, behavior problems and the human condition. Our goal is to try to find ways to improve the lives of you and others. To do this, we need the help of volunteers who are willing to take part in research.

Why is this research being done?

The purpose of this research is to identify the source and severity of any online social network usability issues faced by users with visual impairments. This research will specifically focus on the Facebook online social network. The decision to take part in this research is yours to make. By doing this research, we hope to ultimately provide suggestions for the improvement of social networks like Facebook with respect to the needs of individuals with visual impairments.

Why am I being invited to take part in this research?

You are being invited to take part in this research because you have been identified as an adult computer user with no usable vision who desires to use online social networks or who has done so in the past. If you volunteer to take part in this research, you will be one of about 20 people to do so within the state of North Carolina.

Are there reasons I should not take part in this research?

I understand that I should not participate in this study if I am under 18 years of age or I use screen magnification to use computers.

What other choices do I have if I do not take part in this research?

You can choose not to participate.

Where is the research going to take place and how long will it last?

The research procedures will be conducted at your home or other facility you designate where you most frequently use a desktop computer with an active internet connection. The total amount of time you will be asked to volunteer for this study is two hours in a single session.

Page 1 of 3

Consent Version # or Date: _____

Participant's Initials

What will I be asked to do?

You will be asked to participate in three core activities in this two hour testing session:

1. The performance of a number of common social networking tasks
2. The completion of a verbal questionnaire conducted at the conclusion of each scenario
3. A final questionnaire conducted at the conclusion to gauge your general opinions

You will be given three scenarios and a number of related tasks. These tasks are common social networking tasks like creating a user account or sharing a link. We will provide you with an email address and user information that we have created for testing purposes; you will not use your personal information. We will ask you to “think aloud” while performing these tasks; a process that we will explain and demonstrate before we begin the testing process.

At the conclusion of each scenario we will ask you to complete a six question verbal questionnaire; your answers will be documented.

At the conclusion of all three scenarios and the related verbal questionnaire we will ask you a final series of questions. These questions will provide you with an additional opportunity to share your feelings about the social network (Facebook), its usability and any issues that you may have encountered.

It is anticipated that this process will take two hours.

What possible harms or discomforts might I experience if I take part in the research?

It has been determined that the risks associated with this research are no more than what you would experience in everyday life.

What are the possible benefits I may experience from taking part in this research?

We do not know if you will get any benefits by taking part in this study though you may learn more about the capabilities of the Facebook online social network. This research might help us learn more about the issues that individuals with visual impairments encounter when attempting to use online social networks like Facebook. There may be no personal benefit from your participation but the information gained by doing this research may help others in the future.

Will I be paid for taking part in this research?

We will pay you for the time you volunteer while being in this study. The total payment for your two hour study session will be in the form of a \$50.00 gift card at the beginning of the study session.

What will it cost me to take part in this research?

It will not cost you any money to be part of the research.

Who will know that I took part in this research and learn personal information about me?

To do this research, ECU and the people and organizations listed below may know that you took part in this research and may see information about you that is normally kept private. With your permission, these people may use your private information to do this research:

- Any agency of the federal, state, or local government that regulates human research. This includes the Department of Health and Human Services (DHHS), the North Carolina Department of Health, and the Office for Human Research Protections.

APPENDIX C: Facebook Usability Test Screener

Facebook Usability Test Screener

Introduction

Hello, my name is Julian Brinkley and I am a second year graduate student in the Computer Science department at East Carolina University. We are seeking individuals with no usable vision who desire to use online social networks or who have done so in the past. If you volunteer to take part in this research, you will be one of about 20 people to do so within the state of North Carolina.

The purpose of this research is to identify the source and severity of any online social network usability issues faced by users with visual impairments. This research will specifically focus on the Facebook online social network. By doing this research, we hope to ultimately provide suggestions for the improvement of social networks like Facebook with respect to the needs of individuals with visual impairments

Does this sound like something that interests you? Before I schedule you for a session, do you have a few moments to answer some questions? Some of these questions are personal in nature but if this information is used in any way it will be stripped of all identifying information.

General Questions

1. Are you male or female?
 Male
 Female

2. How old are you? _____

3. Which of the following best describes your personal income?
 under \$25,000
 \$25,000 to \$35,000
 \$35,000 to \$45,000
 \$45,000 to \$55,000
 \$55,000 to \$65,000
 \$65,000 to \$75,000
 \$75,000 or more
 Declined to provide

10. Beside read email, what are typical activities you do on the computer?

- gaming/entertainment
- reading the news
- shopping/banking
- graphic design/digital pictures
- programming/word processing
- social networking
- Other_____

11. About how many hours per week do you spend on the computer?

- 0 to 10
- 11 to 25
- 26+ hours per week
- Other_____

12. What desktop or laptop computer platform do you usually use?

- Mac
- Windows
- Other_____

13. Does your computer have a monitor?

- Yes
- No

14. What Internet browser(s) do you usually use?

- Firefox
- Internet Explorer
- AOL
- Google Chrome
- Safari
- Other_____

15. What is your connection speed?_____

Domain Knowledge

16. Have you ever used the Facebook social networking website?

Yes

No

Note: can use both user interfaces but normally uses the mobile because it is much easier.

17. On a scale of 1 to 10 how comfortable would you say you are with Facebook? (1 being the least comfortable and 10 being the most comfortable)_____

18. **IF YES** - In the last year how often have you used Facebook.com?

A couple of times in the last year

about once or twice a month

about once or twice a week

often/daily

19. Have you ever used any social networking website; websites like Twitter, MySpace?

Yes

No

20. **IF YES** – What social network(s) have you used?

Contact Information

If acceptable: Those are all the questions I have for you. Your background matches the people we're looking for. The study is conducted on-site at a location of your choosing and will be attended by myself and another study staff member. We recommend the location where you use the internet the most often. For your participation, you will be paid \$50.00. Would you be able to participate?

What date and time works best for you?

▪ Date: _____

▪ Time: _____

May I have your contact information?

- Name of participant:
- Study Address:
- City, State, Zip:
- Daytime phone number:
- Alternate [cell] phone number:
- Email address:

Before your session starts, we will email you an informed consent document and we will ask you to sign a release form the day of the study allowing us to videotape your session. The videotape will only be used internally for further study if needed and will not show your face. Will you consent to be videotaped?

Yes

No

APPENDIX D: Study Checklist

User ID #:

Study Checklist

Initial Telephone Contact

Screener (Do over the phone)

On-site

Thank you for participating in our study. We appreciate your help. We are researching which things are easy to do and which are difficult to do on the Facebook online social network. Please remember that we are not in any way testing your ability we are evaluating the website's usability.

Before we begin, I would like to start by confirming your background information and reviewing the informed consent document:

- Verify user's name, address and telephone number on the screening sheet.
- Read informed consent and have participant sign
- Pay honorarium (\$50), signed informed consent form is the receipt

With your permission I now need to take picture of your workspace and document the type of computer equipment that you are using:

- Take a picture of the workspace (not the person) if the participant consents
- Document user's hardware, software and accessibility technology
 - Windows/Mac: _____ Screen reader: _____
 - Desktop/Laptop: _____ Screen magnification: _____
 - Operating System: _____ Refreshable braille display: _____

Now we can begin.

I will read you tasks and ask you to do them while "thinking aloud". Thinking aloud means that I would like you to try to do the task and explain what you are doing and what you are thinking in the process. We will briefly practice this before beginning the study. When you feel you are finished with a task, please tell me. It's very important that you tell me when you are finished. Some tasks contain very specific information. I am happy to reread tasks any time you request. After each task, I will ask you a few questions. Then we will move on to the next task. At the end of this session, I might ask you some more questions. I will be observing you and taking notes as you work on the tasks. I will be nearby, but cannot answer any questions you may have during the session as we need to make all of the sessions as consistent as possible and answering questions will create data integrity issues. Just to reiterate, we are not testing you, we are testing the website. Do you have any questions before we move on to the "thinking aloud" practice exercise?

- Please think aloud by turning your computer on. If the computer is on please think aloud while turning it off. Remember to let me know when you are finished. You may begin.

Do you have any questions about the "think aloud method"?
If not, let's begin the study.

- | | | |
|--|--|--|
| <input type="checkbox"/> Think Aloud Scenario - 1 | <input type="checkbox"/> Post Task Questionnaire - 2 | <input type="checkbox"/> System Usability Scale |
| <input type="checkbox"/> Post Task Questionnaire - 1 | <input type="checkbox"/> Think Aloud Scenario - 3 | <input type="checkbox"/> Thank you and business card |
| <input type="checkbox"/> Think Aloud Scenario - 2 | <input type="checkbox"/> Post Task Questionnaire - 3 | |

APPENDIX E: Post Task Questionnaire

User ID #:

Post Task Questionnaire

A Study on the Usability of Online Social Networks by Visually Impaired Users

Instructions: One of these sheets is needed for each set of scenarios. Ask these questions after the tasks for each scenario.

Interview Questions

1. **Rate the overall ease or difficulty of performing the tasks in this scenario as being very easy, somewhat easy, somewhat difficult or very difficult.**

very easy

somewhat easy

somewhat difficult

very difficult

2. **Rate the time it took to complete the tasks in this scenario as taking significantly less time than expected, somewhat less time than expected, somewhat more time than expected or significantly more time than expected.**

significantly less
time than expected

somewhat less
time than expected

somewhat more
time than expected

significantly more
time than expected

3. **Rate the likelihood that you would use the features that were used in this scenario as being either very likely, somewhat likely, somewhat unlikely or very unlikely.**

very likely

somewhat likely

somewhat unlikely

very unlikely

4. **What did you like most about the features used in this scenario?**

5. **What did you like least about the features used in this scenario?**

6. **What would you like to have added or changed about the features used in this scenario?**



APPENDIX F: System Usability Scale Questionnaire

User ID #:

System Usability Scale Questionnaire

A Study on the Usability of Online Social Networks by Visually Impaired Users

Instructions: Read each of the following statements to the participant and include a brief explanation of the scale (1 Strongly Disagree to 5 Strongly Agree). For each statement mark one box that best reflects the participant's reaction to Facebook.com based on their interaction with the website *today*.

		Strongly Disagree				Strongly Agree
		1	2	3	4	5
1.	I think that I would like to use this website frequently.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	I found this website unnecessarily complex.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	I thought the website was easy to use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	I think that I would need the support of a technical person to be able to use this website.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	I found the various functions in this website were well integrated.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	I thought there was too much inconsistency in this website.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	I would imagine that most people would learn to use this website very quickly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	I found the website very cumbersome to use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	I felt very confident using the website.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	I needed to learn a lot of things before I could get going with this website.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

APPENDIX G: Post Scenario Questionnaire

User ID #:

Post Task Questionnaire - FINAL

A Study on the Usability of Online Social Networks by Visually Impaired Users

Instructions: One of these sheets is needed for each set of scenarios. Ask these questions after the tasks for each scenario.

Interview Questions

1. **Rate the overall ease or difficulty of using the SYSTEM as being very easy, somewhat easy, somewhat difficult or very difficult.**

very easy

somewhat easy

somewhat difficult

very difficult

2. **What do you like most about Facebook.com?**

3. **What do you like least about Facebook.com?**

4. **What existing features would you like to change about Facebook.com?**

5. **What features would you like to add to about Facebook.com?**

5. **Is there anything else that you would like to add or mention?**



Transcript - Study on the Usability of the Facebook SNS by Blind Users

Prepared by J. Brinkley - East Carolina University

1.17.2014

Table of Contents

Table of Contents **ii**
Revision History **ii**
1. Introduction **1**
 1.1 Purpose 1
 1.2 Abbreviations 1
 1.3 Study Sessions 2
2. Transcripts **3**
 2.1 Participant with identification number 2 3
 2.2 Participant with identification number 8 6
 2.3 Participant with identification number 17 15
 2.4 Participant with identification number 36 23
 2.5 Participant with identification number 112 33
 2.6 Participant with identification number 205 40

Revision History

Name	Date	Reason For Changes	Version

1. Introduction

1.1 Purpose

This is a transcript of usability study post task interviews, post scenario interviews and system usability scale questionnaires (read aloud).

1.2 Abbreviations

Full names and participant identification numbers (ID) have been abbreviated in this transcript. Participant ID's are also represented as follows in the accompanying written report:

Abbreviation	Name/Participant ID Number	Report ID Number
JB	Julian Brinkley	N/A
KE	Kyle Evans	N/A
P2	Participant with identification number 2	1
P8	Participant with identification number 8	2
P17	Participant with identification number 17	3
P36	Participant with identification number 36	4
P112	Participant with identification number 112	5
P205	Participant with identification number 205	6

1.3 Study Sessions

Study sessions were conducted between October 14 and November 23, 2013. All study sessions were moderated by Julian Brinkley and observed by Kyle Evans and took place on the following dates:

Participant ID	Session Date
P2	October 14, 2013
P8	October 18, 2013
P17	October 14, 2013
P36	October 25, 2013
P112	November 23, 2013
P205	November 23, 2013

2. Transcripts

2.1 Participant 2

2.1.1 Scenario 1 - Profile Creation

JB: "What did you like most about the features used in this scenario?"

P2: "They were very easily laid out. Simple features to get used to the layout of... the web page."

JB: "What did you like least about the features used in this scenario?"

P2: "Just repetitive."

JB: "What would you like to have added or changed about the features used in this scenario?"

P2: "I can't think of anything at this time."

2.1.2 Scenario 2 -Social Search

JB: "What did you like most about the features used in this scenario?"

P2: "Nothing really stood out to me."

JB: "What did you like least about the features used in this scenario?"

P2: "The internal server errors of Facebook."

JB: “What would you like to have added or changed about the features used in this scenario?”

P2: “Just the errors fixed.”

2.1.3 Scenario 3 - Information Sharing

JB: “What did you like most about the features used in this scenario?”

P2: “Nothing really stands out.”

JB: “What did you like least about the features used in this scenario?”

P2: “Again. Nothing really stands out.”

JB: “What would you like to have added or changed about the features used in this scenario?”

P2: “Nothing.”

2.1.4 Scenario 4 - Privacy and account visibility

JB: “What did you like most about the features used in this scenario?”

P2: “Nothing.”

JB: “What did you like least about the features used in this scenario?”

P2: “Nothing. Nothing stood out.”

JB: “What would you like to have added or changed about the features used in this scenario?”

P2: “Nothing I can think of.”

2.1.5 System Usability Scale Questionnaire

JB: "I think that I would like to use this website frequently."

P2: "Agree...Five"

JB: "I found this website unnecessarily complex."

P2: "One."

JB: "I thought this website was easy to use."

P2: "Five"

JB: "I think that I would need the support of a technical person to use this website."

P2: "One."

JB: "I found the various functions in this website were well integrated."

P2: "Five."

JB: "I thought there was too much inconsistency in this website."

P2: "One."

JB: "I would imagine that most people would learn to use this website very quickly."

P2: "Five."

JB: "I found this website very cumbersome/awkward to use."

P2: "One."

JB: "I felt very confident using this website."

P2: "Five."

JB: "I needed to learn a lot of things before I could get going with this website."

P2: "One."

2.1.6 Post Scenario Interview

JB: "What do you like most about Facebook.com?"

P2: "[Long pause] I like the connection with multiple people at the same time. I like the ability to see the way it's organized and how the posts are organized. I'm just a fan of the general principle of it..."

JB: "I'm sorry?"

P2: "I said I'm just a fan of the general principle of Facebook."

JB: "What do you like least about Facebook.com?"

P2: "I really can't think of anything at this time. Now if you were doing this study for the iPhone now that would be different."

JB: "Are there problems that you have identified for the iPhone?"

P2: "Oh yea with the Facebook app with the integration and the response time with the Facebook app towards the iPhone with the iOS7. Like I said It's pretty much flawless with Windows but when you try to do...with the iPhone, it tends to become an issue."

JB: "What existing features would you like to change about Facebook.com?"

P2: "I really can't think of anything I want to change. It has everything I want to do."

JB: “What features would you like to add to Facebook.com?”

P2: “The ability to put music on your pages...the whole MySpace idea”

JB: “Is there anything else that you would like to add or mention?”

P2: “No.”

2.2 Participant 8

2.2.1 Scenario 1 - Profile Creation

JB: “What did you like most about the features used in this scenario?”

P8: “Hmmm. What did I like most? Well as far as, I mean, using the JAWS keystrokes, I mean, I was able to find some of it but I’m just not use to doing these tasks is my problem...these particular tasks.”

JB: “Anything else?”

P8: “No.”

JB: “What did you like least about the features used in this scenario?”

P8: “The editing didn’t seem to be working very well. It was hard to know exactly where I really was. [Laughs] And I would think I was one place and really didn’t ever feel confident that I was at the right place. “

JB: “What would you like to have added or changed about the features used in this scenario?”

P8: “I really don’t have any opinion on that. [Laughs] Is that an answer? [Laughs]”

JB: "Yes, any answer you give."

2.2.2 Scenario 2 -Social Search

JB: "What did you like most about the features used in this scenario?"

P8: "[Long Pause] Well basically....I mean when they work they're better than having to arrow down to everything using the different keystrokes."

JB: "You mean when the search works? Like the search box?"

P8: "Yea or..."

JB: "What did you like least about the features used in this scenario?"

P8: "That they didn't work [Laughs]"

JB: "What would you like to have added or changed about the features used in this scenario?"

P8: "I really don't have an answer for that."

2.2.3 Scenario 3 - Information Sharing

JB: "What did you like most about the features used in this scenario?"

P8: "[Long pause] Well I like using the shortcut keys rather than having to arrow all the time."

JB: "Anything else?"

P8: "No."

JB: "What did you like least about the features used in this scenario?"

P8: "They didn't always work."

JB: "What would you like to have added or changed about the features used in this scenario?"

P8: "I really don't have any ideas on that."

JB: "And is it more because you don't know what the options would be?"

P8: "Right I don't know what the...yea options would be."

JB: "What could be done basically?"

P8: "Right."

KE: "When you said you like using the hot keys does that mean you like navigating like in between headings and then so that you don't have to look at every single one?"

P8: "Yes, right uh huh. And using the JAWS to find links."

KE: "And when you're on Facebook and using those headings you've found that whenever you go to a heading the things you're expecting to be there aren't there?"

P8: "They're not exactly."

KE: "They're not exactly where you think they're gonna be so you have to search around?"

P8: "Uh huh."

2.2.4 Scenario 4 - Privacy and account visibility

JB: “What did you like most about the features used in this scenario?”

P8: “Well again being able to use shortcut keys instead of arrowing all the time although I did a lot of arrowing. [Laughs] ‘Cause I’m just not familiar with this, these pages.”

JB: “What did you like least about the features used in this scenario?”

P8: “Well it’s hard when you don’t know what’s on a page and I mean and when you’ve not been to these pages before it’s hard and so you end up having to do more arrowing around to find out what is there.”

KE: “Comparatively to like other websites that you use would you consider this one to be like better laid out or worse laid out?”

P8: “Well I would think worse.”

JB: “What would you like to have added or changed about the features used in this scenario?”

P8: “For them to keep, to get it like it’s supposed to be and not change it.[Laughs]”

JB: “What, when you say like it...”

P8: “I mean, well I mean...well if you just know what to expect on each page.”

JB: “And when you say ‘know what to expect’ if it was something like if you click a button and you know what the expected response is supposed to be or...”

P8: "Well if you just know what...I don't know how to say it I guess. Plain when you just don't know what you're looking for. It seems that Facebook keeps changing is I guess what I'm trying to say"

JB: "And that makes it more difficult for you to use?"

P8: "Cause I don't understand what it means and I've heard my sighted friends even complain about that so."

JB: "Ok."

2.2.5 System Usability Scale Questionnaire

JB: "I think that I would like to use this website frequently."

P8: "Somewhat agree."

JB: "I found this website unnecessarily complex."

P8: "I would agree with that statement [Laughs]. 5"

JB: "I thought this website was easy to use."

P8: "Well I guess that would be disagree. Ahh, would that be a 1? Well to me it shouldn't have been I mean and I feel like as I have said I have not been to these pages and somehow this is just not something that I have been doin' so I feel like I'm not giving ahh...I'm not giving you... know what you have done today a fair try. Cause I felt very.... It's just stuff I don't do. "

P8: "Well I guess I would have to say somewhat. It's just knowing where to go. The links are there [laughs] and stuff. I don't know how to explain it anymore. [Laughs]"

JB: "I think that I would need the support of a technical person to use this website."

P8: "Yea I think so. Strongly agree. "

JB: "I found the various functions in this website were well integrated."

P8: "I'll disagree. I'll say strongly disagree."

JB: "I thought there was too much inconsistency in this website."

P8: "Strongly. Well let's see I agree. Strongly agree."

JB: "I would imagine that most people would learn to use this website very quickly."

P8: "Maybe somewhat agree. I guess."

JB: "I found this website very cumbersome/awkward to use."

P8: "Strongly agree [Laughs]."

JB: "I felt very confident using this website."

P8: "Strongly disagree [laughs]."

JB: "I needed to learn a lot of things before I could get going with this website."

P8: "Yea I did. I guess strongly agree. [laughs]"

2.2.6 Post Scenario Interview

JB: "What do you like most about Facebook.com?"

P8: "Hmm [long pause] well being able to talk with friends that don't live nearby."

Friends that are in other states. And I guess that's what I'd have to say. Being able to

communicate with friends in other areas. And sending them, and sending friends a happy birthday wish... and stuff like that.”

JB: “What do you like least about Facebook.com?”

P8: “Hmm...what do I like least? Well hmm. Well I guess as a visually impaired user it’s not easy to navigate.”

KE: “Could you expand on that a little bit, like just you know say like using the headings.

P8: “Yea.”

KE: “So you just sometimes get in places you’re not expecting maybe?”

P8: “Can’t find what I’m looking for.”

KE: “Can’t find what you’re looking for. Ok.”

JB: “And would you say that’s because things don’t seem to be labeled appropriately or they’re put in odd places or they’re not labeled at all?”

P8: “Well I think you’ve probably hit it. It’s not labeled appropriately and maybe not labeled at all.”

JB: “What existing features would you like to change about Facebook.com?”

P8: “Well I mean I would like to be able to edit a profile without having to...I mean it needs to be clearly labeled so you can make sure that you’re entering information in the right place and that’s it’s not gonna go to somebody else’s name.[Laughs]”

JB: "So confidence, like your confidence in knowing that what you're doing is exactly what you wanna do is that the big thing?"

P8: "Right. Yea."

JB: "Ok. Did that seem to be a big thing overall with the website? Just not necessarily feeling like it was giving you the type of responses so you could be confident in knowing what you were doing?"

P8: "Right and especially like when to edit things and where I was editing. If I'd arrow up then it'd seem to go somewhere else then where I thought I was."

KE: "So I noticed whenever um you were going to edit say your current city you were probably expecting like a ping from your um JAWS or something like that. That's the indication that you're in an edit screen...."

P8: "Right. Right."

KE: "And you didn't get that so maybe have that right next to the edit? Or somehow related to it because that's what you were expecting to see?"

P8: "Right. Yea yea."

KE: "Ok."

P8: "It makes a little 'bing' like you say noise. And it let's you know that that you're in the edit field. And even hittin' 'E' which is supposed to get you to the edit field that didn't all the time work either."

KE: "And when you hit 'E' it brings you to the nearest edit field right?"

P8: "Well you would think"

KE: "Yea...right. Ok."

JB: "Is it shift 'E' or control 'E' or?"

P8: "It's just an 'E'"

JB: "What features would you like to add to Facebook.com?"

P8: "Hmm I don't know it's got enough. [Laughs]"

JB: "So do you think it may be helpful if they actually streamlined the features or maybe removed some in a certain version of Facebook to make it more usable? Or..."

P8: "I mean all this information about you, you know is not necessary to me... I mean. What you did and all your hobbies and all that I just don't think all that is necessary. Of course I know you don't have to put it but it's just a lot of stuff on there. That...I don't know it's just hard to navigate."

JB: "You think if they removed some of those items that you don't necessarily want or at least had a button that would let you trim some of those items down that might be helpful?"

P8: "Right. That might be helpful."

JB: "Is there anything else that you would like to add or mention?"

P8: "Hmmm. [Laughs] Not really. I felt pretty dumb. [Laughs]"

JB: “No no no. Again it’s not a test of.. When you normally use it, do you find that your user experience is a little bit better? ”

P8: “Yea. But I’m just looking at my friends and I go under news feed and I just read about what they’re doing. And if I want to like something I hit the like button. And the comment button I...when it says to make a comment and I have found recently it seemed like used to you could tab to something like share but I found out recently If I just hit enter after I write my sentence it seems to go...go there because I can check it with ahh...what they call it refresh. JAWS key escape, update screen that what’s they call it. I’d go back and check and see if it was there. ”

JB: “How do you normally find friends? What is your normal process for finding your friends on Facebook?”

P8: “Well I usually just go to that news feed and kind of arrow down. It tells you what everybody, what most of ‘em are doin’. And If I want to go to find friends I usually do the insert F 7 and hit an F and it’ll say find friends or sometimes it’ll just say friends. ”

JB: “And that’s how you’d send a friend request to somebody? Like if you were wanting to add...let’s say you met a new person...”

P8: “Oh under find friends yea if it... if it it’ll give you a list, people you may know and it’ll have an add friend button. Now sometimes I can’t decide now is this this person or this person below. You know I have gotten that confused and added somebody I didn’t want to add. [Laughs]”

JB: “And how do you normally make a determination do you just maybe pick one or maybe look at their profile?”

P8: “Well I try to start at the top and see where...what starts first. You know if it's their name or add friend first and then a name. I'm trying...the order of how they have it with all the list of people. And uh, sometimes I think I figured it out but I 'm not sure. Because sometime I have added somebody that I didn't even know.”

JB: “Do you have anything?”

KE: “Just to expand on his question, but do you ever like look at the profile and see well hey they did work at Walmart. Or hey they are friends with my friend Dan and Dan knows him so that's how I know him. ”

P8: “Well here's what they'll say. It'll say so many mutual friends. And I don't friend that many I mean if I don't really have much to say to them I don't. [Background Laughter]”

P8: “Not that I have a...If I really don't know them they may be a good friend of one of my friends but that doesn't mean that, you know, I have a dialogue you know any kind of...any thing in common with them. You know.”

KE: “Well the edit thing was, was one of the things I kept noticing and I think we got that resolved on the paper so I think I'm all good too.”

JB: “Well thank you very much. You've been a great help.”

2.3 Participant 17

2.3.1 Scenario 1 - Profile Creation

JB: “What did you like most about the features used in this scenario?”

P17: “Is that a fill in the blank question?”

JB: “Yes.”

P17: “[Laughs] What did I like about them? I like the fact that there is a way for me to go onto Facebook and change my information even if it does take a little longer. And some things obviously you cannot find for example the education for my school. Umm...but at least I can build my own profile.”

JB: “What did you like least about the features used in this scenario?”

P17: “Umm...the time that it took and it really wasn't straightforward, you had to click on different pages to bring it up instead of it just being in a whole list, type your school I can understand because it had to search for it. But really it should all have been on the same page to me. And then you can see if you can just pull it up later and probably hit enter on your school.”

JB: “What would you like to have added or changed about the features used in this scenario?”

P17: “Umm...probably just the layout if I change anything just the layout.”

KE: “Anything specific with the layout maybe?”

P17: “Ahh...lets see like it's easy for me to hit 'H' and go down to it.”

KE: “Say like using the headings”

P17: “Headings work very good. Sometimes there aren’t headings. Facebook for example does have them on the mobile site. On the regular site I don’t think it does too well. But other than that there was a lot of spaces in between which I guess is good. But there was a lot of... I don’t know It just seems spread out to me. Like you would have ‘the.....cancel and submit’ and then something would be there that’s like maybe graphic; It wasn’t English. And then underneath that it would have the lead. If you’re working on something I want it to be like on its own page. ”

KE: “Everything to be related on the same page?”

P17: “Instead of having everything around it and having to heading down to where you need to be.”

2.3.2 Scenario 2 -Social Search

JB: “What did you like most about the features used in this scenario?”

P17: “I like the fact that you gave me so much information to find them. Because usually when I search for friends on Facebook I mean sometimes I will go through friends and look at their friends but if I’m using the search feature as we did today I usually just type their name and that brings up a whole bunch of people. So for example John Smith or James Smith it would bring up all the James Smiths and I would hit enter on all of them until hopefully I would find them. Usually I don’t. So...”

JB: “How long does that normally take you? Like how much time do you normally spend on it?”

P17: "I usually give up. [Laughs]"

JB: "How long before you normally give up? 30 minutes, 20 minutes..."

P17: "30 minutes yes. And then I end up calling the person and ask for their email address."

JB: "What did you like least about the features used in this scenario?"

P17: "There wasn't anything that I really didn't like in that scenario."

JB: "What would you like to have added or changed about the features used in this scenario?"

P17: "Umm...I'm not technically sure I would change anything. It was very nice because you can write everything you want in the search box but for you know the ease in finding people, umm...you know just with other websites there could be a name button or city button or you know a place for you to type their high school or some place that they work at. You know give you different boxes for information. "

KE: "Sort of separate searches?"

P17: "Separate the searches and have you pick what you want to put in. So you can put his name also for example his hometown or his school or you know."

KE: "In your experience do you ever use information you know about someone to find them we told you 'John so and so was from Speed' or do you usually just use the friends of friends method?"

P17: “Actually I usually just use the ‘friends of friends’ method. I have done the school because half the time the people I’m looking for have gone to my school so I’ll type their name and then I’ll type for example Westford high school or what is it? Guilford high school. And If it pops up it pops up but half the time it doesn’t. But I went to a big school. So usually there’s more than one person. So....”

2.3.3 Scenario 3 - Information Sharing

JB: “What did you like most about the features used in this scenario?”

P17: “To be honest umm...the tag feature is new because usually we can’t tag people. But I know like the little commands and just going along the pages and stuff and that way I was able to find it. But if you had of asked me a month ago that tag feature was not there and I always asked my friends how to tag people. And I would put the @ sign and try to type their name which used to work a long time ago but doesn’t work anymore so...”

KE: “Was using the @ symbol easier?”

P17: “Umm...It was a way to do it. It wasn’t really easy because I would have to go look to see how their name was exactly spelled. That used to work and it doesn’t work anymore.”

KE: “So this way brings up a list that way you can compare names?”

P17: “Uh huh.”

JB: “What did you like least about the features used in this scenario?”

P17: “Umm...where it has more options. For example since we did that last the messages and stuff were pretty simple and straight forward. For example the more options. Because I know you can change your mood and tag friends. I didn't like how it was on a separate page and that I had to type in it three different times because every time I would tag a post it would clear out the message. So that was pretty much the only thing I really didn't like about it.”

JB: “What would you like to have added or changed about the features used in this scenario?”

P17: “Umm...On the first page, on the home page underneath it says public and then it has the more options. I wish that they could just make that a combo box. Because I know there is a way that you can change your mood statuses and stuff. So I don't know that should just all be combo boxes. Where you can tag friends and then have, I know it's a lot, but you can hit like ‘your name is Julian and your name is something’.... tab over and hit ‘J’ or something and have it bring up the different names in ‘J’. Like in a combo box say the first combo box like after your post is an edit box and then ‘share’ is underneath that. Now if there was a combo box underneath the share button that had tag friends or umm... mood status or whatever you want to put in there. Like if you hit a ‘2’ in the combo box. And you tag again depending upon what you pick, because I know that can be done. It will bring up a list of your friends, even though you probably don't have many or the different moods and have ‘submit’. That would be like really plain and simple. ”

KE: “And all on the same page.”

P17: “Like right underneath each other...like you know drop down lists.”

2.3.4 Scenario 4 - Privacy and account visibility

JB: “What did you like most about the features used in this scenario?”

P17: “It shows me that I can actually go in... the public can't see my stuff pretty much. I can limit who sees my information, my profile I just know that the whole world can't look at my name and see everything that's on my Facebook page.”

JB: “Were you not aware of those settings before?”

P17: “I was but I was not aware how to get to them.”

JB: “What did you like least about the features used in this scenario?”

P17: “Umm...It's not really that I didn't like anything about it. It's just it feels kind of hidden. Like that setting, the privacy settings for example at least for your...I don't know. I guess it was in a good location but it just feels like it was hidden. Privacy is always at the bottom of the page Instead of in your profile where you can just click and have it adjust like you adjust your pictures and stuff. Instead of being there it was all the way down at privacy. Anyway...It just feels hidden. I don't know.”

JB: “What would you like to have added or changed about the features used in this scenario?”

P17: “I really wouldn't change anything. It was pretty simple you click on one link and it takes you to another. It wasn't all together so you're questioning what you're changing.”

2.3.5 System Usability Scale Questionnaire

JB: "I think that I would like to use this website frequently."

P17: "Five."

JB: "I found this website unnecessarily complex."

P17: "One."

JB: "I thought this website was easy to use."

P17: "Five."

JB: "I think that I would need the support of a technical person to use this website."

P17: "One."

JB: "I found the various functions in this website were well integrated."

P17: "Four."

JB: "I thought there was too much inconsistency in this website."

P17: "Two."

JB: "I would imagine that most people would learn to use this website very quickly."

P17: "Three."

JB: "I found this website very cumbersome/awkward to use."

P17: "Three."

JB: "I felt very confident using this website."

P17: “Four.”

JB: “I needed to learn a lot of things before I could get going with this website.”

P17: “One.”

2.3.6 Post Scenario Interview

JB: What do you like most about Facebook.com?”

P17: “It’s a way for me to stay connected with friends and family.”

JB: “What do you like least about Facebook.com?”

P17: “I haven’t really thought about it. It’s nothing I really don’t like about it.”

JB: “What existing features would you like to change about Facebook.com?”

P17: “Umm...nothing except for the post options.”

JB: “More variety or easier to use or...”

P17: “It’s easy to post a status but it’s not easy to add what other people can add like the mood statuses or your friends.”

JB: “What features would you like to add to Facebook.com?”

P17: “I wouldn’t say technically any features. I don’t know... more...[long pause] can I pass? [Laughs]”

KE: “If you don’t mind me asking whenever there’s a new features like using the @ symbol to tag people how do you discover that usually? Is there something like ‘new feature try this’? Or does a friend tell you about it?”

P17: “With the@ symbol what I used to try to do when I tag people is umm... you arrow down and it says ‘link’ when there’s an @. That’s how I did it before. And at the beginning of their name JAWS reads the @ symbol so that’s exactly what I started to do and that just doesn’t work anymore.”

JB: “Is there anything else that you would like to add or mention?”

P17: “Umm...no. Your system that you did here how you had me do different scenarios for like you know example looking up people and stuff like that. I don’t know if it could be created just like kind of a small tutorial. That you know because on Google for example has ‘for screen readers click here’. You know if you had a small tutorial that you could add to Facebook if it were at all possible that says click here and it routes you to a whole new thing where you can just run through the exercises.”

JB: “So like a Facebook tutorial maybe that shows you how to do different things like common features?”

KE: “With screen readers?”

P17: “With screen readers yes.”

KE: “Because I don’t think the mobile site has...they don’t ever make that available.”

P17: “There is a tutorial?”

KE: “I don’t think so, no. There might be one with the main site but I don’t think there’s one...”

JB: “I think there’s one on the main site but I don’t think there’s one on the mobile.”

2.4 Participant 36

2.4.1 Scenario 1 - Profile Creation

JB: “What did you like most about the features used in this scenario?”

P36: “I like that the features were there. That the features we were looking for were findable...umm. That’s about it.”

JB: “What did you like least about the features used in this scenario?”

P36: “That I could not edit those fields. I don’t understand the Inability to be able to edit those fields with the usual JAWS command. “

JB: “And is that primarily what made it very unlikely that you would use those features that you couldn’t edit them?”

P36: “Exactly.”

JB: “What would you like to have added or changed about the features used in this scenario?”

P36: “Everything really is pretty straightforward and what I am kind of used to when I use it. But I have never tried to edit fields before that it didn’t work and I don’t understand why that’s not working. I can see why people want to quit.”

2.4.2 Scenario 2 -Social Search

JB: “What did you like most about the features used in this scenario?”

P36: “That at least I could put in the search and it would go there and it was pretty much [self] explanatory. Of what I was looking for.”

JB: "So because it was a single, you know, edit field, single text box?"

P36: "Yes, yes."

JB: "What did you like least about the features used in this scenario?"

P36: "That I never found either one of them. I have to say, I guess you don't have a place to put it, but if there were friends that I was looking for I probably could have found them if they were friends that I really knew."

JB: "How would you go about doing that normally?"

P36: "If I really knew them?"

JB: "Uh huh."

P36: "I would do the same things that we just did but most people um have a little bit more information like a high school or...there's just more on there to be able to locate them usually. Friends I've always searched for before had something that connected with what I knew about them."

JB: "So as long as their profile is somewhat filled out it makes it easier for you to find"

P36: "Yea it does...much so. Yes."

JB: "What would you like to have added or changed about the features used in this scenario?"

P36: "Umm...That you could put more information into the search box. I'm not sure all the information that I put in would work with the actual person's name. I'm not sure about that."

JB: "So something to where, maybe you could...instead of just putting in their first and their last name or their email address maybe you could put in 'find a friend' named 'Bob Smith' from Washington, DC who works at Walmart? Maybe just put all that information in one text box? Something like that?"

P36: "Something like that. Or even just put in, um to narrow it down, if I knew what year they graduated from high school you could just put in the name and, or just put in high school graduates from that year."

JB: "Ok. Or find 'Bob Smith' who's friend of another friend of yours maybe?"

P36: "Yea, yea."

JB: "So, basically to able to put information that you know that person may have listed or you know will identify them."

KE: "Do you...Sorry I was just going to ask a really quick follow up question. Um so when you were looking through there and you found all the 'Amy Wilson's' or whatever could you think of any features that would make it easier to tell where you were on the list maybe? Because you know you saw that big long list of 'Amy Williams'..."

P36:"Yea, yea! [enthusiastically]"

KE: "Could you think of any features that maybe you've seen or maybe you could think of that would make it a little bit easier?"

P36: "I don't know I think that...I don't know if there was a space between them, you know? Cause if it was just one after another after another, maybe if there was a space that would help. Although I'm not really sure because when there is just one name after another it is very hard to think did it go back to the very name I left off."

KE: "Do you think 'first Amy Williams', 'second Amy Williams', 'third Amy Williams' that would make it easier?"

P36: "Yea, yea. It would yea. [enthusiastically]"

KE: "Ok."

2.4.3 Scenario 3 - Information Sharing

JB: "What did you like most about the features used in this scenario?"

P36: "That I am familiar with the commands of what to do. I know they are doable. [Long pause] That's about it."

JB: "What did you like least about the features used in this scenario?"

P36: "That I would have to... learn... go around... features... to get done the tasks that I wanted to do. It wasn't made totally, precisely... simple."

JB: "So it was too complicated somewhat?"

P36: "Yea. [Laughs] I'll stop trying to be fancy."

JB: "Do you use status updates and things like that normally?"

P36: "All the time. And I don't understand why it's not on this Facebook page because it is on my...when I go to my mobile page from my desktop it is there a place just for status."

JB: "So you're saying it seems different than what use on your version of..."

P36: "It is. Most of it is the same but not all of it and that status thing is a biggie."

JB: "What would you like to have added or changed about the features used in this scenario?"

P36: "Umm...just that it be made more simple...that there definitely be a status line."

JB: "So if 'status' was more prominent or it was easier for you to find?"

P36: "Yea and more things were clearly labeled. It looks like from looking at it that they are clearly labeled yet they aren't once you go to the link it doesn't always do what it says. Doesn't give you the options, more options...more clear options."

2.4.4 Scenario 4 - Privacy and account visibility

JB: "What did you like most about the features used in this scenario?"

P36: "That I was more familiar with them. That's not a good thing. That it's a little easier to follow."

JB: "What did you like least about the features used in this scenario?"

P36: "That it's still not simple enough."

JB: "So a little bit too complex and not straightforward?"

P36: "Uh huh...not straightforward."

JB: "Is it difficult for you to know where you are?"

P36: "Somewhat. Yes."

JB: "What would you like to have added or changed about the features used in this scenario?"

P36: "Just simplified in their verbage...."

JB: "So if they were clearer to specify what you need to do and when?"

P36: "Yea, some of them it's like....the first part of the sentence it says something else and the end of them is different so that's a little confusing"

2.4.5 System Usability Scale Questionnaire

JB: "I think that I would like to use this website frequently."

P36: "Somewhat agree."

JB: "I found this website unnecessarily complex."

P36: "Strongly agree."

JB: "I thought this website was easy to use."

P36: "Strongly disagree."

JB: "I think that I would need the support of a technical person to use this website."

P36: "Strongly agree."

JB: "I found the various functions in this website were well integrated."

P36: "Somewhat disagree."

JB: "I thought there was too much inconsistency in this website."

P36: "Strongly agree."

JB: "I would imagine that most people would learn to use this website very quickly."

P36: "Strongly disagree."

JB: "I found this website very cumbersome/awkward to use."

P36: "Strongly agree."

JB: "I felt very confident using this website."

P36: "Strongly disagree."

JB: "I needed to learn a lot of things before I could get going with this website."

P36: "Strongly agree."

2.4.6 Post Scenario Interview

JB: "What do you like most about Facebook.com?"

P36: "Umm..that it is after all somewhat accessible. "

JB: "But not as accessible as you would like?"

P36: "Correct."

JB: "What do you like least about Facebook.com?"

P36: "That it is not as accessible as I would like. [Laughs]"

JB: "What existing features would you like to change about Facebook.com?"

P36: "I don't know how to say this and it come out right. I was just telling him... on my iPhone everything has a button, everything is labeled, everything is clearly labeled and that's the one I always use. Because, its, its...everything is very, very clearly labeled. [Laughs]"

JB: "And you normally use your iPhone?"

P36: "I always use my iPhone"

JB: "Is it for that reason would it be more comfortable for you to use a laptop or do you primarily use the iPhone ..."

P36: "No, no I use my iPhone..I can do everything that we did on my iPhone."

JB: "Ok. So that's the biggest reason why you probably use the iPhone is because you can actually do what you want to do with it?"

P36: "Yea"

JB: "And that's because everything is labeled or are you able to actually speak to it or it speaks back to you."

P36: "Both"

P36: "But everything is labeled I can add pictures, I can tag, I can do everything that we just did on my iPhone with much less difficulty. I can talk to it. I can check in places. I

can do everything that's done on the regular Facebook site, not even the mobile site, it's just so much easier. However, the privacy settings...you still have to pretty much do...you can do them on Facebook on the iPhone but I just like doing them on the computer, like double check. I didn't mean to get into all that I'm sorry."

JB: "No, no by all means please give me as much information as possible."

JB: "What features would you like to add to Facebook.com?"

P36: "Oh, gosh I don't know, there's so much added already that I can't think of anything else that needs to be added. [Laughs] I really can't."

JB: "Well, let me ask the question in reverse. Are there some features that you think could be removed like maybe if there was a button that would streamline...maybe have a profile , if there are features that you don't use at all that may actually simplify the user interface so it would be a little bit easier for you?"

P36: "There are some I don't use at all but they don't get in my way because um, it runs, like on the iPhone, it runs off of a menu I don't know what you call them exactly but the whole menu runs down the side of the page. They don't bother me but if they were on my computer they would really aggravate me because Facebook has all this stuff like apps and games and stuff like that on it and I don't need that."

JB: "But because when you use it on your phone that doesn't really get in your way because they're labeled and its easier for you to use..."

P36: "Right, I can just avoid them it's not a problem."

JB: “Now when you’re using it on your phone are you primarily talking to it or are you actually touching the links? How are you normally...”

P36: “You know it talks to you just like JAWS does. You know. I usually, most of the time, I am just looking to see what my granddaughter are up to so I am just looking at statuses and so forth. But I do put pictures up there quite often and I do check in quite often to where I am and I do change my statuses so...”

JB: “Ok. You normally do that by talking to it?”

P36: “I do it by talking. I have done it...I will listen to what...I dictate it and then I listen to it. Sometimes I have to go back and correct it because SIRI didn’t get it right. I can use the on screen keyboard.”

JB: “Would it be helpful to have that on the desktop version? If you could just basically talk to it? If you could just dictate what it is you want?”

P36: “Nah.”

JB: “You don’t think so?”

P36: “Nah, not unless I could just tell it what I want to do and get it to do it. Like Dragon Speak...”

JB: “Yea that’s what I mean. Let’s say that was built into Facebook.”

P36: “Dragon speak might be a better solution.”

JB: “Ok. So you don’t know if you would necessarily like it if it was built into Facebook that you could tell it what you wanted to do and it would do it?”

P36: "Oh yea that would be great. Yea. [Long pause] It might even work with Dragon Speak. You know?"

JB: "What about maybe a user interface that basically had a single text box that would let you put in your posts or retrieve your messages instead of having multiple edit fields you just have one that maybe understands what it is you want a little bit better? So you could just basically type in exactly what it is you want in once space and it returns that information? Do you think that would be something that would work for you maybe?"

P36: "That sounds more confusing to me."

JB: "You think so?"

JB: "Is there anything else that you would like to add or mention?"

P36: "Yea, if all the edit fields work like they're supposed to its fine like it is. As far as like you know mine usually has a line for status and I just edit it and it says share and then I go on my way. Same with messages and the same with all, most of the other features. I don't know why those edit fields didn't open up and let me type on them like they're supposed to. But if they edit like they're supposed I don't...they're fine like they are. "

JB: "Ok. So that was a big...that was one of your bigger issues with it."

P36: "That was huge, yea. It was because it just didn't let me edit"

JB: "And then the lack of the 'bing' noise I guess you would say when you're actually in an edit field?"

P36: “Uh huh [enthusiastic] yea mine is set up to make a noise so that I know it’s actually doing it. You know.”

JB: “Did you have anything Kyle?”

KE: “Just the ambiguous edit I noticed that as we were going through. Because in JAWS it reads every sort of text field as an edit field, so when they use edit to change...so like instead of using edit they used the word change that would be a lot less confusing because it would say ‘link change’. Say you want to change hometown, next to it, it would say ‘Greenville, NC’ change hometown– link...”

P36: “Yea [enthusiastic]”

JB: “Instead of just ‘edit’?”

P36: “Because then you don’t know if it’s going to edit on top of it or...”

JB: “Gotcha. You don’t know if it’s a field or if it’s a...”

KE: “It’s unambiguous when it’s visual but it is ambiguous when it’s through JAWS.”

JB: “Very important”

2.5 Participant 112

2.5.1 Scenario 1 - Profile Creation

JB: “What did you like most about the features used in this scenario?”

P112: “Umm...Once I started understanding it I liked, once I started editing everything, that there was a search feature where you could type in what you were looking for and it would have results and you would pick one which was the right result. When I searched

for high school I wrote Guilford high school and one of the results was West Guilford so I picked it and it allowed me to edit that.”

JB: “What did you like least about the features used in this scenario?”

P112: “Well, it goes back to that search thing again because at first I didn’t know what it was for so I think I didn’t know why I was supposed to be searching for something. I would have thought the boxes should have been labeled to help go through the process of adding information.”

JB: “So it was somewhat ambiguous it wasn’t really clear what you were supposed to do?”

P112: “It wasn’t clear at first but once I got it. It’s like I like the theory but I didn’t like the execution.”

JB: “What would you like to have added or changed about the features used in this scenario?”

P112: “I think...I had trouble with the execution so I guess to have more of the edit boxes labeled so one knows which boxes to add to.”

JB: “So a little bit more clear? Better labeling of the textboxes?”

P112: “Uh huh.”

2.5.2 Scenario 2 -Social Search

JB: “What did you like most about the features used in this scenario?”

P112: “I think the way... that there is a way to search for people.”

JB: “What did you like least about the features used in this scenario?”

P112: “I didn’t like how hard it was to kind of try to match up with the information that was given. But I don’t know if it was because of Facebook or if the people were trying to keep their information private...which is understandable.”

JB: “What would you like to have added or changed about the features used in this scenario?”

P112: “Sorry I’m thinking. [Long pause] I like for it to be easier to sort of match people with their information. But at the same time I know that people may not want to be found. [Laughs] So I know that may be trouble. ”

2.5.3 Scenario 3 - Information Sharing

JB: “What did you like most about the features used in this scenario?”

P112: “Well the relative ease of tagging people and just the fact that it’s there. When I first used the Facebook mobile app I did not see any way of tagging people.”

JB: “When you say when you first used it was this a while ago”

P112: “I used it probably a few years now and they must have changed things because this ability to tag people on the Facebook mobile website was not available and if it was I didn’t know about it.”

JB: “Is this the first time you’re done it or...today or when you say it wasn’t available did you discover it a week ago a month ago?”

P112: “Earlier this year. So...”

JB: “Do you think it would be helpful if they actually sent out an email or other notification when they add functionality or change features.”

P112: “Probably. But at the same time I do try to keep up on Facebook itself.”

JB: “What did you like least about the features used in this scenario?”

P112: “Well, one thing I didn’t like when I’ve seen other people tag the people in their Facebook statuses they would be able to write to the person kind of like it was a message straight to them. So they would be able to write who they were tagging and then in the message like ‘hey Benjamin I’m starting next week’...’starting a job next week’ and then they would just be able to tag in the middle of their message to make it flow more smoothly instead of having their name tagged at the end.”

JB: “So basically being able to tag in the body of the message referencing the person you want to be tagged in the message in some way shape or form?”

P112: “I don’t...I know this is available on the regular Facebook but I’ve not been able to do that. Because I’ve tried but the way they had it setup didn’t work very well.”

JB: “What would you like to have added or changed about the features used in this scenario?”

P112: “As I said being able to reference a person in the body of the message.”

2.5.4 Scenario 4 - Privacy and account visibility

JB: “What did you like most about the features used in this scenario?”

P112: “That....how easy they were to use.”

JB: “What did you like least about the features used in this scenario?”

P112: “I don’t have anything.”

JB: “What would you like to have added or changed about the features used in this scenario?”

P112: “[Long pause] Nothing I can think of....I was going to say something before we moved on. For full disclosure I have used those before so that might be. They probably wouldn’t have been easy if that had been the first time but the fact that I’ve used them before has probably contributed to the ease with which I felt like that I went through it and that... I like how it was set up and that kind of thing. So...now we can move on.”

2.5.5 System Usability Scale Questionnaire

JB: “I think that I would like to use this website frequently.”

P112: “Strongly agree.”

JB: “I found this website unnecessarily complex.”

P112: “Agree.”

JB: “I thought this website was easy to use.”

P112: “No option.”

JB: “I think that I would need the support of a technical person to use this website.”

P112: “Disagree.”

JB: “I found the various functions in this website were well integrated.”

P112: “No option.”

JB: “I thought there was too much inconsistency in this website.”

P112: “Disagree.”

JB: “I would imagine that most people would learn to use this website very quickly.”

P112: “Agree.”

JB: “I found this website very cumbersome/awkward to use.”

P112: “Disagree.”

JB: “I felt very confident using this website.”

P112: “Agree.”

JB: “I needed to learn a lot of things before I could get going with this website.”

P112: “Disagree”

2.5.6 Post Scenario Interview

JB: What do you like most about Facebook.com?”

P112: “It’s a way to keep up with people that maybe one might not keep up with in other communication avenues in real life. And you can also sometimes meet other people. I know that’s not what they intended for it but I know a lot of people use it for that.”

JB: “So the ability to connect with other people?”

P112: "Uh huh. And meet new people. As I said I know a lot of people do that even if Facebook may not have intended that."

JB: "What do you like least about Facebook.com?"

P112: "Well I think parts of it, while on the whole it's easy to learn I think parts of it are unnecessarily complex and could be...I would like for some of the features on the regular website if they made them to be available on the mobile version."

P112: "A lot of them...quite a few are but quite a few aren't."

JB: "Which features specifically?"

P112: "On my Facebook I like to post links of things for people to read or listen to or what have you. If I post it on the mobile website it will post a link but it won't show what the title is of that page so if I want to post that link and I want people to know what it's about I typically go to the regular Facebook to do that."

JB: "Is that difficult for you to do normally?"

P112: "Well, It was a little difficult at first but I eventually figured it out."

JB: "What existing features would you like to change about Facebook.com?"

P112: "Umm...well one I can think of in particular is the menu. On the regular Facebook they have a menu for tagging people directly in the body of a message unfortunately it just so happens that that menu is not very usable for those who are visually impaired. So...I would like for that menu to be more user friendly. Right now it's almost like it doesn't... if I try to use it its' like it doesn't function very well with the screen readers."

JB: "That feature is only available on the standard user interface?"

P112: "Uh huh, yea."

JB: "Are there any other features you can think of?"

P112: "Nope."

JB: "What features would you like to add to Facebook.com?"

P112: "[Long pause] Sorry."

JB: "That's okay take your time."

P112: "Well, that's...I'm not sure that I can...think of anything at the moment. It's kind of interesting how Facebook has changed over the years. I've been on there now they have... people have Facebook emails things like that or... I guess something that would be cool. I don't know if they'd do it but something that would be cool to allow people to kind of...I don't know... I guess more profile customization. I guess because it does seem like the profiles are, even if people hide something, the profiles are kind of done a certain way. You can tell it's a Facebook profile. So I guess that would be it."

JB: "Is there anything else that you would like to add or mention?"

P112: "Well, it was interesting to see how sometimes what I thought would be easy wasn't and what I thought might not be easy was or how certain tasks got easier once I went along."

JB: "You have anything?"

KE: "No I don't think so."

JB: "Have you tried the graph search feature yet? On the standard user interface?"

P112: "No I haven't."

JB: "Do you have any questions for me?"

P112: "I don't think so."

2.6 Participant 205

2.6.1 Scenario 1 - Profile Creation

JB: "What did you like most about the features used in this scenario?"

P205: "Consistency. I'm not sure of the question? Can I answer more than one thing?"

JB: "Yes. Oh yes...just your general impressions."

P205: "Consistency and the combo boxes were easy to use and accepted the information reliably and the buttons were labeled well. And what was that question again?"

JB: "What did you like most about the features used in this scenario?"

P205: "That completes that."

JB: "What did you like least about the features used in this scenario?"

P205: "The layout of the page in that there was a blank line in between the topic and its edit field. And then that edit field was not labeled so each edit field would just say 'edit' rather than saying 'college edit' and 'high school edit'. That's the answer."

JB: “What would you like to have added or changed about the features used in this scenario?”

P205: “I would like to see forms labeled.”

2.6.2 Scenario 2 -Social Search

JB: “What did you like most about the features used in this scenario?”

P205: “The search edit field is very easy to find and it’s on every Facebook page and it’s...just that.”

JB: “What did you like least about the features used in this scenario?”

P205: “The results...in the records I looked through it did not pull up the results I was required to retrieve. And another thing I don’t like is it is very difficult to ascertain whether a record matches. I think, I’m not sure of this, but I think a feature of Facebook is that every person’s name is associated with a picture. That can help with friend recognition but that obviously does not play in for a blind person. And then, even with the information you provided the high school and the work history and all that, it is unclear for me how to incorporate that into a search. It’s... I’m not sure how to write that out in the edit field.”

JB: “What would you like to have added or changed about the features used in this scenario?”

P205: “I would like to see some more edit fields for things like work history, city, high school college maiden name if applicable. So those I’d like confirmation of those things.”

JB: “And that would help you identify?”

P205: “That would help me sort through the records. Assuming then, this is another feature then...assuming that those features, those aspects would show up in the search records those aspects could work toward a better match.”

JB: “And how do you normally find friends on Facebook?”

P205: “Hah, by looking through the lists of other friends that I already have.”

JB: “So the ‘friends of friends’ method?”

P205: “Yes. I have never gotten a search to work. Well I say that...that’s not true. There’s a...that’s not true I was searching for a particular name and there were pages and pages and pages of that name and some of them had a little but more identifying information maybe a company or something like that but most of them it was just that name and the link. So there was no way to tell whether that was the person I wanted. I went to several pages hoping that for whatever reason I might get lucky but...I didn’t. None of those...when you get to some people’s pages because of their privacy settings there’s very little information they offer. So that complicates the situation. Everybody has a right to their privacy but I’m just saying that complicates searches. So...when I’ve gotten search to bring up some records I couldn’t tell the records apart.”

2.6.3 Scenario 3 - Information Sharing

JB: “What did you like most about the features used in this scenario?”

P205: “For the messaging there’s a shortcut key ‘alt three’ to get right to that. And then although the edit fields are not clearly labeled the button for reply or send those buttons

are clearly labeled and the layout of the relationship to the edit field and that button is clear. Umm...okay so that's it."

JB: "What did you like least about the features used in this scenario?"

P205: "The four or five instances of, I can't remember what it said, something about 'upload photo browse, upload photo browse, upload photo browse' and then below that was the link that just said mobile uploads. So the labeling of those various aspects is unclear. It...well I can think of solutions but I don't think that answers your question, so...that's it."

JB: "What kind of solutions could you think of?"

P205: "There should be a little heading that is not a link that says 'photo's to upload'. And then there should be 'upload photo one browse' and then a blank line, 'upload photo two browse' and a blank line' and so on for however many those are. And then instead of mobile uploads 'link' under all of those four or five photos 'add to album' and then when you add to the album they should get to the page that just says, umm, something like 'done...ready to post'."

JB: "What would you like to have added or changed about the features used in this scenario?"

P205: "So I just answered that."

JB: "So basically the point you just made?"

P205: "Yes."

2.6.4 Scenario 4 - Privacy and account visibility

JB: “What did you like most about the features used in this scenario?”

P205: “The links are clearly labeled so I can go into JAWS and get a list of links and search for that link by first letter navigation.”

JB: “What did you like least about the features used in this scenario?”

P205: “Well this is Facebook wide...or mobile Facebook wide. There aren't any headings, HTML headings. Headings would make it much easier to see which page you've gotten to and to get right to that region. So, you have to do too much arrow navigation, line by line navigation, to see where you are and to see which links are in current operation and to see which ones you might follow to change the operation.”

JB: “What would you like to have added or changed about the features used in this scenario?”

P205: “I'd like to see the features in an html table...put into an html table and so the leftmost column would have the feature and to the right of that would be a column of checkboxes...or I guess it would have to be radio buttons because there could only be one operational at a time. That's it! [Excitedly]Rather than a table even...yes, it could still be a table. Have a table which lists the feature in the leftmost column and then in the right column radio buttons that apply to that. So who can see your posts that would be the name of the function that would be in the left column and the right column would have radio buttons like 'everyone, friends of friends' or that kind of thing. So then you could select the radio button.”

KE: "So you wouldn't have to just infer that everyone is not a link."

P205: "Yes. That's correct."

2.6.5 System Usability Scale Questionnaire

JB: "I think that I would like to use this website frequently."

P205: "One or sorry five, Strongly Agree."

JB: "I found this website unnecessarily complex."

P205: "Somewhat agree."

JB: "I thought this website was easy to use."

P205: "Somewhat agree."

JB: "I think that I would need the support of a technical person to use this website."

P205: "Strongly disagree."

JB: "I found the various functions in this website were well integrated."

P205: "Somewhat agree."

JB: "I thought there was too much inconsistency in this website."

P205: "Somewhat agree."

JB: "I would imagine that most people would learn to use this website very quickly."

P205: "Somewhat disagree."

JB: "I found this website very cumbersome/awkward to use."

P205: “Well again we’re talking about the mobile version...somewhat disagree.”

JB: “I felt very confident using this website.”

P205: “Somewhat agree.”

JB: “I needed to learn a lot of things before I could get going with this website.”

P205: “Strongly agree.”

2.6.6 Post Scenario Interview

JB: What do you like most about Facebook.com?”

P205: “That they do have a mobile version.”

JB: “Anything else?”

P205: “No.”

JB: “What do you like least about Facebook.com?”

P205: “The cumbersome full version and the lack of accessible HTML coding. So.... the regions don’t have names... they don’t have meaningful names. The regions don’t have meaningful names.”

KE: “Is this the full Facebook version or the mobile one?”

P205: “Yes, he said Facebook.com. The actual mobile is m.facebook.com. So the main Facebook site is just not made with accessibility in mind. Cumberstone describes it all though. Okay so that’s it.”

JB: “What existing features would you like to change about Facebook.com?”

P205: "I would like to change the searching for friends to be easier and more descript and I would like to see HTML headings implemented on the mobile version of the site. I think that's it for that one."

JB: "What features would you like to add to Facebook.com?"

P205: "Hmm...I can't think of any."

JB: "Is there anything else that you would like to add or mention?"

P205: "I would like to see the Facebook engineers do these tasks that you requested today using a screen reader. So that goes for Amazon or any of the big companies. If they had to spend the whole day using only a screen reader it would show the inaccessibility issues. So, it would be good for them to know that. Because what they're doing now is complying with a very low standard on accessibility which has little to do with using a screen reader daily. "

JB: "So you're saying generally usability...so the sites are... like Amazon and Facebook they're technically accessible but the usability is so poor ..."

P205: "Absolutely. And then you get into the thing where if you use the mobile version of the site it doesn't have the features that the full version does. So like Amazon, well I know were talking about Facebook too but...well I think you said that the searching for friend features seems to be curtailed in the mobile version versus the full. Well Amazon is like that with their mobile version too, you can't download mp3 albums on their mobile version. "

JB: "Is their mobile version more accessible than the standard ahh..."

P205: "It's more accessible but it doesn't have all the features."

JB: "So in both cases with Amazon and uhh.."

P205: "Facebook. And Walmart is the same way. They don't have the same features. They have relatively limited features on the mobile."

KE: "Like they're designing for mobile and not accessibility."

P205: "Ahhh...that's well stated. Yes."

JB: "Was there anything else you could think of?"

P205: "I'm sorry that it took so long for the friends searching thing but that's what I go through. That...arrgh! [laughs]"

APPENDIX I: Institutional Review Board Documentation



EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board Office
4N-70 Brody Medical Sciences Building· Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office 252-744-2914 · Fax 252-744-2284 · www.ecu.edu/irb

Notification of Exempt Certification

From: Social/Behavioral IRB
To: [Julian Brinkley](#)
CC: [Nasseh Tabrizi](#)
Date: 9/12/2012
Re: [UMCIRB 12-001331](#)
Web Accessibility of Visually Impaired Computer Users Age 18 to 25

I am pleased to inform you that your research submission has been certified as exempt on 9/12/2012. This study is eligible for Exempt Certification under category #2.

It is your responsibility to ensure that this research is conducted in the manner reported in your application and/or protocol, as well as being consistent with the ethical principles of the Belmont Report and your profession.

This research study does not require any additional interaction with the UMCIRB unless there are proposed changes to this study. Any change, prior to implementing that change, must be submitted to the UMCIRB for review and approval. The UMCIRB will determine if the change impacts the eligibility of the research for exempt status. If more substantive review is required, you will be notified within five business days.

The UMCIRB office will hold your exemption application for a period of five years from the date of this letter. If you wish to continue this protocol beyond this period, you will need to submit an Exemption Certification request at least 30 days before the end of the five year period.

The Chairperson (or designee) does not have a potential for conflict of interest on this study.



EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board Office
4N-70 Brody Medical Sciences Building · Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office 252-744-2914 · Fax 252-744-2284 · www.ecu.edu/irb

Notification of Initial Approval: Expedited

From: Social/Behavioral IRB
To: [Julian Brinkley](#)
CC: [Nasseh Tabrizi](#)
Date: 7/13/2013
Re: [UMCIRB 13-001325](#)
Usability of Facebook by Visually Impaired Users

I am pleased to inform you that your Expedited Application was approved. Approval of the study and any consent form(s) is for the period of 7/13/2013 to 7/12/2014. The research study is eligible for review under expedited categories #6 and #7. The Chairperson (or designee) deemed this study no more than minimal risk.

Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The Investigator must adhere to all reporting requirements for this study.

Approved consent documents with the IRB approval date stamped on the document should be used to consent participants (consent documents with the IRB approval date stamp are found under the Documents tab in the study workspace).

The approval includes the following items:

Name	Description
Informed Consent Form	Consent Forms
Post Task Questionnaire	Surveys and Questionnaires
System Usability Scale	Surveys and Questionnaires
Thesis Proposal	Study Protocol or Grant Application
Web Page Content	Recruitment Documents/Scripts

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

