

**DETERMINING USER REQUIREMENTS OF SOCIAL MEDIA ACCESS
FOR BLIND AND VISUALLY IMPAIRED**

A.USLU

BAU 2022

ARDA USLU

EYLÜL 2022

**DETERMINING USER REQUIREMENTS OF SOCIAL MEDIA
ACCESS FOR BLIND AND VISUALLY IMPAIRED**

**BAHÇEŞEHİR ÜNİVERSİTESİ
LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ
YÜKSEK LİSANS TEZİ**

ARDA USLU

**BİLGİSAYAR MÜHENDİSLİĞİ DALINDA
YÜKSEK LİSANS DERESESİ İÇİN GEREKLİ ÇALIŞMALAR
YERİNE GETİRİLMİŞTİR**

EYLÜL 2022

BAHÇEŞEHİR ÜNİVERSİTESİ
LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ

...../...../.....

YÜKSEK LİSANS TEZ ONAY FORMU

Program Adı:	BİLGİSAYAR MÜHENDİSLİĞİ YÜKSEK LİSANS
Öğrencinin Adı Soyadı:	ARDA USLU
Tezin Adı:	DETERMINING USER REQUIREMENTS OF SOCIAL MEDIA ACCESS FOR BLIND AND VISUALLY IMPAIRED
Tez Savunma Tarihi:	21.09.2022

Bu tezin Yüksek Lisans tezi olarak gerekli şartları yerine getirmiş olduğu Lisansüstü Eğitim Enstitüsü tarafından onaylanmıştır.

Prof. Dr. Ahmet ÖNCÜ
Enstitü Müdürü

Bu Tez tarafımızca okunmuş, nitelik ve içerik açısından bir Yüksek Lisans tezi olarak yeterli görülmüş ve kabul edilmiştir.

	Ünvanı, Adı Soyadı	İmza
Tez Danışmanı:	Doç. Dr. Pınar Sarısaray Bölük	
2. Üye :	Dr. Öğr. Üyesi Tarkan Aydın	
3. Üye :	Dr. Öğr. Üyesi Eyüp Gedikli	



Bu tezdeki tüm bilgilerin akademik kurallara ve etik ilkelere uygun olarak elde edildiğini ve sunulduğunu; ayrıca bu kuralların ve ilkelerin gerektirdiği şekilde, bu çalışmadan kaynaklanmayan bütün atıfları yaptığımı beyan ederim.

Ad, Soyad : ARDA USLU

İmza :

ÖZET

GÖRME ENGELLİLERİN SOSYAL MEDYA ERİŞİMİ İÇİN KULLANICI GEREKSİNİMLERİNİN BELİRLENMESİ

Uslu, Arda

Bilgisayar Mühendisliği Yüksek Lisans Programı

Tez Danışmanı: Doç. Dr. Pınar Sarısaray Bölük

Eylül 2022, 50 sayfa

Sosyal medya hayatımızda önemli rol oynamaktadır. Görme engellilerin de aynı şekilde bundan faydalanması önem arz etmektedir. Bu çalışmada, kullanılabilirlik testleri yapılarak görme engellilerin sosyal medyada yaşadıkları kullanım ve erişim zorluklarının tespit edilmesi amaçlanmıştır. Bunun için Türkiye Görme Engelliler Derneğinde 12 adet değişik seviyelerde görme engeli olan kişiyle sosyal medyayı kullanım şekilleri hakkında anket çalışması ve bu çalışmayla bağlantılı görüşmeler yapılmıştır. Ayrıca zorlandıkları yerleri görmek adına uygulama çalışmaları gerçekleştirilmiştir. Sosyal medya araçlarının zayıf ve kuvvetli yönleri belirlenip, irdelenmiştir. Ağırlıklı olarak Facebook üzerinde çalışılan bu tezde ara ara diğer sosyal medya araçları hakkında da değerlendirmeler yapılmıştır. Bahçeşehir Üniversitesi içerisinde, Engelli biriminin desteğiyle bir görme engelli ile yapılan çalışmada önceden hazırlanmış bir senaryo üzerinde uygulamalar yapılmıştır. Bu senaryo üzerinde görevlere bağlı olarak uygulanacak adımlar önceden belirlenmiş olup, her adımı geçen denek o adıma bağlı belirtilmiş puanı kazanacak şekilde yönlendirilmiştir. Daha sonra her adım süresince geçen süre kaydedilmiştir ve son 3. değişken olarak kişinin bu adımları bilip, bilmediği de dikkate alınmıştır. En son bölümde deneyin sonuçları hakkında tartışma, öneri ve sonuçlara varılmıştır.

Anahtar Kelimeler: Kullanıcı tecrübesi, Erişilebilirlik, Kullanılabilirlik, Görme engelli.

ABSTRACT

Determining User Requirements of Social Media Access for Blind and Visually Impaired

Uslu, Arda

Master's Program in Computer Engineering

Supervisor: Assoc.Prof. Dr. Pınar Sarısaray Bölük

September 2022, 50 pages

The consumption of social media plays an important role in our lives. It is crucial that blind and visually can likewise take part in various social media platforms. In this study, the usability practices of Blind or Partially Sighted people and the difficulties they face are aimed to be detected by making usability tests. Those difficulties experienced by visually impaired and blind people can be categorized as accessibility and usability issues. For this purpose, 12 surveys that led to semi-structured interviews are conducted at the Blind and Visually Impaired Association Headquarters. We interviewed 12 people with different levels of vision about how they use social media and where they had difficulties. We also examine the strong and weak parts of social media platforms. At Bahçeşehir University with the help of the Disability Unit, we tried to discover the problems and interactions faced by blind or partially sighted on Facebook with the help of tasks that are prepared beforehand. We as researchers, helped the participant to pass the steps required to complete these predetermined tasks if the participant encountered a problem. According to the first factor, the results are displayed in terms of points attributed to the steps. Secondly, the time required to complete the task is checked. The third factor is if the participant had already known it before or not. As a result, findings in terms of usability and accessibility are discussed. Hence, we tried to find out what can be done to address these issues.

Keywords: User experience, Accessibility, Usability, Visually impaired.

ACKNOWLEDGMENTS

I would like to thank the workers of the Disability Unit of Bahçeşehir Unity and Visually Impaired Association Headquarters for their kind assistance and for welcoming me to their place.

I also would like to thank my mother A.Didem Uslu for proofreading and for supporting me when I was fatigued and demoralized.

Besides I would like to express my deepest appreciation to my master thesis supervisor, Pınar Sarısaray-Bölük who offered me this rewarding subject, for her support and encouragement during my master thesis at Bahçeşehir University.

İSTANBUL
21th of September 2022

ARDA USLU

TABLE OF CONTENTS

İNTİHAL.....	iii
ÖZET.....	iv
ABSTRACT.....	v
ACKNOWLEDGMENT.....	vi
TABLE OF CONTENTS.....	vii
TABLE LIST.....	viii
FIGURE LIST.....	ix
LIST OF ABBREVIATIONS.....	x
Chapter 1: Introduction.....	1
1.1 Problem Statement.....	4
1.2 Research Questions.....	5
1.3 Assumptions of Study.....	5
1.4 Motivation of Study.....	5
1.5 Contributions of Study.....	6
1.6 Organization of the Thesis.....	6
Chapter 2: Related Works.....	8
2.1 General Usage of Screen Readers in Android Platforms.....	8
2.2 Usability Testing of Blind and Visually Impaired on Predetermined Tasks of Social Media Features.....	12
2.3 General Usage of Social Media, Technology by Blind and Visually Impaired ..	
Chapter 3: Methodology.....	17
3.1 Preliminary Observations.....	33
3.2 Data Collection.....	35
3.3 Considerations and Limitations of this Study.....	41
Chapter 4: Results and Discussion.....	44
Chapter 5: Conclusion.....	46
REFERENCES.....	47

TABLE LIST

TABLES

Table 1.....	8
Table 2.....	45



FIGURE LIST

FIGURES

Figure 1: Social Media Usage of Certain Sites According to The Number of Participants.....	35
Figure 2. Average Years of Usage Depending on The Social Media Platform	36
Figure 3. Number of Participants for The Corresponding Screen Reader	37
Figure 4. The Platform where The Facebook Access Happens	38
Figure 5. While the Participant of the Experiment was Trying to Perform the Duties According to the Scenario.....	38



LIST OF ABBREVIATIONS

AAT	Automatic Alt-Text
AI	Artificial Intelligence
AT	Assistive Technologies
BPS	Blind or Partially Sighted
BVI	Blind or Visually Impaired
BVIAH	Blind and Visually Impaired Association Headquarters
CAPTCHA	Completely Automated Public Turing Test to tell the Computers and Humans Apart
HIT	Human Intelligence Task
ICT	Information and Communications Technology
IE	Internet Explorer
IHCI	Interfaces and Human-Computer Interaction
IT	Information Technology
JAWS	Job Access With Speech
LP	Weather Polyester Laser
MSN	Microsoft Network
NVDA	Non-Visual Desktop Access
OS	Operating System
PC	Personal Computer
Q & A	Question and Answer
RIA	Rich Internet Applications
SAFA	Screen Access For All
SATG	System Access To Go
SM	Screen Magnifier
SNS	Social Networking Sites
SR	Screen Reader
TB	Talkback
UI	User Interface
VA	Voice Assistant
VI	Visually Impaired or Visual Imparity
VO	VoiceOver
WAI-ARIA	Web Accessibility Initiative-Accessible Rich Internet Applications
WCAG	Web Content Accessibility Guidelines

Chapter 1

Introduction

Social Network Sites (SNS) are a few of the most visited websites in the world. As of October 2018, the social networks by the number of monthly active users are; Facebook (2.234 billion), YouTube (1.9 billion), WhatsApp (1.500 billion), Facebook Messenger (1.300 billion), Instagram (1 billion) (Global social media ranking 2019. (n.d.)). These numbers are expected to grow even further, especially with the robust growth of the population in developing countries. Faster internet access and a boost in mobile phone sales with economic development will inevitably consolidate this trend. Naturally, these numbers also include users with special needs. In today's modern world it is an obligation to integrate them from all perspectives. In an increasingly equal and just society, blind or visually impaired (BVI) people deserve to be treated as equally as possible in comparison to people who do not have those special needs. Accessibility of disabled users began to be a major issue in the last decade. To overcome these challenges, Facebook (FB) founded its Accessibility Team in July 2011.

We have conducted research to determine the user requirements of BVI. We worked with 12 people in the Blind and Visually Impaired Association Headquarters (BVIAH) in Kadıköy and 1 student from the Disability Unit of Bahcesehir University. The participants' vision starts from 0% and continues up to 50%. We tried to make an equal number of females and males because they have different life experiences and different attitudes. Each session was recorded in Turkish. Sessions change between 16 minutes to 3 hours depending on the users' avidness to talk. After the recording, it was written in a notebook. Then it is translated into English from Turkish

All subjects in this thesis, that are presented in this research gave consent to take part in this study. Before they started we had read all of them the ethical conditions that are determined by the university.

- i. This is a volunteer research project, they knew they would not receive any kind of compensation for it.
- ii. They knew they could leave if they want to at any time in their study session.
- iii. They were aware at the beginning that they had the right to deny it.
- iv. They might be excluded from the study if their participation is not considered useful to the research or because of another reason.

These 4 conditions written above are based on the text provided by Bahcesehir University Ethical Committee website. They all signed and also gave consent on audio tapes. One person rejected to participate and we excluded that person from the study.

One of the locations of the study BVIAH where some part of this research is conducted in Kadıköy is a place BVI people come together, receive necessary educational support, and socialize. It has a football club and a library. They have a support program for university entrance exams. There were lots of people from all walks of life. Some elderly people come and depart. It was difficult to find different people. We visited BVIAH lots of times and acquired a considerable amount of information. However, the information that is acquired was very difficult to process and categorize. That's the part where we prepared questions and had semi-structured interviews with them. If they were avid to talk, longer conversations were held. We had some understanding of their access to social media website behavior. Some of them utilize apps like KamApp Messenger that we've never heard of.

After the interview part, a testing part was planned. The testing part was a total disaster. Some of them were not that proficient in social media, and some of them were but we could not catch them again after the interview part. Some of them were using a screen reader (SR) which we have no previous preparation for. It makes things too complicated since there are lots of different screen readers with various features. At the beginning of my research, no distinction between mobile or desktop social media access was made. During the literature review in the first phase of this research, we explored lots of research about VoiceOver (VO) screen reader which is the screen reader of Apple. However, in Turkey, lots of people use Talkback (TB) which is the

popular one for Android phones. Apart from those two that are predominantly used in mobile devices, some people use JAWS (Job Access with Speech), and NVDA (Non-Visual Data Access). JAWS is considered to be the best one by many but also the most expensive so it does not have that many users. Most of those people who used it said that they saw it at one of their friends' house because even the trial version is very expensive. Other ones are called Window-Eyes, Supernova, System Access To Go (SATG), and Screen Access For All (SAFA). NVDA and SATG are the only free ones. These are not used by many people and they do not have a significant presence in the papers that are examined during the literature review.

Because of these challenges, it is decided not to include most of the research that was made in BVIAH. Just some references were made in certain parts. After these failures, we decided to make a very simple testing with challenging functions. Luckily, we could have learned from the Disability Unit that none of the BVI students in their department uses SR. That was a huge advantage. Unfortunately, I could find only one person.

In this study, research is carried out with the help of a BVI person on FB. Prior research shows that visually impaired people have difficulty accessing it (Leporini, B., Buzzi, M. C., & Buzzi, M. 2012; Ramayah, B., Jaafar, A., & Yatim, N. F. M. 2013; Smaradottir, B., Håland, J., & Martinez, S. 2017; Brian M. Celusnak, 2016; Bennett, C. L., E, J., Mott, M. E., Cutrell, E., & Morris, M. R. 2018; MacLeod, H., Bennett, C. L., Morris, M. R., & Cutrell, E. 2017; Rakesh Babu & Rahul Singh, 2013; Rakesh Babu, 2014; Ramayah, B., Jaafar, A., & Yatim, N. M. 2012).

There is a lot of research regarding this phenomenon. Wu and Adamic (2014) had a comprehensive study about FB usage that benefits from a huge chunk of FB data. They utilize big data techniques to gain information about BVI behaviors on FB. However, it's only on iOS devices. Most of the research about visually challenged people's use of social media is on iOS devices (Leporini, B., Buzzi, M. C., & Buzzi, M. 2012; Smaradottir, B., Håland, J., & Martinez, S. 2017; Brian M. Celusnak, 2016; Bennett, C. L., E, J., Mott, M. E., Cutrell, E., & Morris, M. R. 2018; MacLeod, H., Bennett, C. L., Morris, M. R., & Cutrell, E. 2017; Joao Guerreiro & Daniel Gonçalves,

2013; Wu, S., Wieland, J., Farivar, O., & Schiller, J. 2017; Shaomei Wu & Lada A. Adamic., 2014; Qiu, S., Hu, J., & Rauterberg, M. 2015; Voykinska, V., Azenkot, S., Wu, S., & Leshed, G. 2016. Android devices are so rare (Vashistha, A., Cutrell, E., Dell, N., & Anderson, R. 2015; Rodrigues, A., Montague, K., Nicolau, H., & Guerreiro, T. 2015; Bennett, C. L., E, J., Mott, M. E., Cutrell, E., & Morris, M. R. 2018).

From those papers written above, Vashistha, A., Cutrell, E., Dell, N., & Anderson, R. (2015) made a detailed study about the usage of social media in rural and peri-rural parts of India. In it, the only thing about Android is just the brief mention of the Talkback screen reader. Rodrigues, A., Montague, K., Nicolau, H., & Guerreiro, T. (2015) mentioned the smartphone adoption process and general functions of smartphones with no comment on social media practices (Rodrigues, A., Montague, K., Nicolau, H., & Guerreiro, T. (2015). Bennett, C. L., E, J., Mott, M. E., Cutrell, E., & Morris, M. R. (2018)) made a research about the photo-taking habits of BVI by using audio and video recordings just like our study. Roughly half of the participants in that study are Android users. There is a lack of research on Android devices although they are widely used throughout the world as well. We are trying to fill in this gap. In this study, with the help of a VI person, we aim to test the usability of FB functions. There are 6 specific tasks (Change Language, Change Profile, Edit Username, Ignore Message, Unignore Message, Activate Status) given to test the participant on FB Messenger.

1.1 Problem Statement

Social media users face a lot of problems that are originated either from their actions or from external factors. BVI people might be the most substantial group within the group with special needs when they utilize social media platforms. Several predicaments of BVI are stated in the literature review, the discussion, and the result sections. The more studies about this subject are made, the more the usability and accessibility of BVI can be improved. This study is made to find the requirements for the social media access of BVI people. The usability studies that are performed in the form of semi-structured interviews and observations that are made during the

implementation of certain predetermined tasks also helped to discover the accessibility issues of BVI.

1.2 Research Questions

This study is not commenced with an evident research question. The main ones are asserted below.

- i. What are the difficulties that are faced by BVI users when they access social media platforms?
- ii. What are the accessibility issues that are faced by BVI users when they access social media platforms?
- iii. What are the usability issues that are faced by BVI users when they access social media platforms?
- iv. How can those issues be defined?
- v. What can be done to address these issues?

1.3 Assumptions of the Study

Initially, this study was not based on a certain, specific hypothesis. This subject intends to find the requirements for a more usable and accessible interface. In the course of the research, assumptions began to appear gradually.

1.4 Motivation of the Study

- a. To study among real human beings is quite rewarding. Taking into account the subjects that can be selected in computer science and engineering, this is one of the few ones that require a substantial amount of human interaction rather than sitting at a chair and writing codes.
- b. This study is a worthwhile endeavor for society. It benefits the visually impaired by improving their social media access and usage. This is a gratifying experience for the researcher.
- c. Accessibility and usability of BVI in social media is still not a broadly studied

subject and it inevitably requires further studies.

- d. More research about this subject will raise awareness for society in general. While developers, user interface designers, user experience researchers,...etc work on their projects, they will attribute more importance to Web Content Accessibility Guidelines (WCAG). Thereby, learning and using it in their products.

1.5 Contributions of the Study

This study was presented virtually at the *14th International Conference of Interfaces and Human-Computer Interaction (IHCI) 2020* and published as a proceeding. It aims to fill in the research gap related to the lack of Android devices in the usability and accessibility studies related to the BVI. As it is mentioned in certain parts of this thesis, the BVI people in developing countries tend to use Android devices because of economic factors. This hypothesis is also confirmed by this study during the semi-structured interviews as well. iOS devices are considered to be more accessible by the studies and by the participants who used both types of devices. Unfortunately, most of the research is conducted in richer countries with Apple devices.

Another research gap that is observed in the literature is that the usability studies that are made with BVI people with predetermined tasks have very simple features like friend search, chatting,...etc. However, this study has more advanced FB features like ignore/unignore messages, activate status,...etc.

1.6 Organization of the Thesis

This thesis consists of 5 parts:

- i. The first part begins with general information about social media and the visually impaired and is followed by a problem statement, research questions, assumptions, motivations, and contributions.
- ii. In the second part, we aimed to present the research that has already been carried out. These include the behavior of BVI during their social media access.
- iii. In the third part, our research is stated with our findings whether that would be graphs with data obtained from questionnaires or implementation of tasks.
- iv. In the fourth part, the discussion about the subject is made clear. The results are discussed.
- v. In the fifth part, the results and conclusions are presented briefly.

Chapter 2

Related Works

2.1 General Usage of Screen Readers in Android Platforms

Some people might have confused about Voice Assistant (VA) and Talkback (TB). They are different types of screen readers. VA (that has the previous name Galaxy Talkback) is developed by Samsung and TB is developed by Google. TB is available on all Android phones and that's the more popular one.

Table 1

Voice Assistant	Talkback
Monitor your actions	Monitor your actions
Retrieve Window Content	Retrieve Window Content
Turn on Explore by Touch	Turn on Explore by Touch
Turn on Your Enhanced Accessibility	Observe the text you type
Observe Text Type	Control display magnification

When it is tried to activate the Voice Assistant (VA) SR that is available on the mobile phone (Samsung S6 Edge with the Android Version of 7.0 (called Nougat)) We got the message that the currently installed voice assistant does not support the currently chosen language which is Turkish. So it would be adjusted as English (USA). It is said that this might have unexpected consequences. The operating system version is intentionally mentioned because we realized newer and more developed ones that have better SR capabilities. This error might be specific to that version and it requires detailed examination with different mobile phones to confirm that expectation or trend.

It is observed that VA screen reader reads everything in English, even though they are in Turkish (there is no change in the system language so it is much easier to make it English for someone who can understand it in English) thereby making it much more difficult to understand. On the other hand, lots of BVI people learn to understand it even though they are not fluent in English (encountered only 1 person in my study who is fluent in English) after they listen to it over and over again.

To activate the VA screen reader;

You need to press Settings on your Home screen. it is assumed, that it would be on BVI's Home screen because that's more accessible that way. Then on your Settings tab;

Accessibility -> Vision (under categories, there are also other types of disabilities there that are out of the scope of this research) -> Voice Assistant

On that screen (i.e. Voice Assistant Page) it is required to turn on the slider button to activate it. It asks for permissions like monitoring your actions (lets voice assistant know the app you are using), retrieving window content (to gain detailed information about the window the user connects by), turning on explore by touch (lets users navigate the screen with gestures when the pressed items are read aloud), turn on your enhanced web accessibility (lets app content be more accessible by installing scripts), observe text type (this also includes sensitive personal information. There are privacy issues involved).

It directs the user to the tutorial for the screen reader after VA is activated. The tutorial (called Voice Assistant Help on the phone screen) consists of four parts. Any kind of touch gesture is blocked when the tutorial information is being read aloud by the screen reader but the next and previous buttons can be used. It reads repeatedly in certain intervals. It never stops talking, unless the VA is deactivated. During the interviews, it is realized that even some BVI sometimes have difficulty tolerating it.

- i. Exploring The Screen: The screen reader reads a brief description of the screen.
- ii. Navigating Through Pages: Scrolling up or down with two fingers in a vertical list of items.
- iii. Navigating Single Screens: It has a scenario that lets the user practice swiping from the top right corner to the left bottom. It has items put in the form of a 4*5 table. (4 rows, 5 columns).
- iv. Changing Granularity: It lets the user change how the screen reader reads the words, lines, paragraphs, and characters.

Character granularity: It reads character by character.

Word granularity: It reads character by character.

Line granularity: Reading line by line (1 line each time).

Paragraph granularity: Reading paragraph by paragraph. (1 paragraph each time). It tells to move 3 fingers from top to bottom or vice versa. Unfortunately, we could not do this one. It seems to be not working. Vibrations are felt and only “paragraph granularity” was seen and heard. It was outside of the frame. “You got out of the text area” was read by SR. That’s a useful warning by VA.

- v. Editing Text: Double tapping puts the cursor to the selected area. To choose certain parts, double fingers should be used. The related operations like select all, cut, copy, paste, more (opens all the operations including the ones mentioned before adding ones like share, clipboard, dictionary, translate, read aloud, search privately, french to English dictionary, new flashcards are also shown to realize those operations if chosen). The last two are the ones that are installed on the mobile phone. They should have changed from mobile phone to mobile phone.
- vi. It is named Other Functions on the previous screen but when it is clicked on (i.e. double tap as long as the VA is on) it writes a voice assistant test pad on top of the screen. It opens with the comment “Tap with one finger” (on the line above) and “Device will read aloud item under your finger.” (on the line below.) When it is tapped with one finger, it stays on the same screen and it does not change. On the contrary, when it is a double tap on that screen, the screen with the “Double-tap with one finger” on the line above and “Device will perform action relevant to the selected item or turn Edit mode”. When it is double-tapped, it goes to the previous screen. On both pages, the exit button is found at the bottom of the screen. That finishes the tutorial. Under more sections, there are lots of controls starting with mostly alt controls and continuing with ctrl, and shift. They look quite complicated, it would probably take time to master by a BVI.

It has the dark screen mode in the vision:

Apps -> Settings -> Accessibility -> Vision -> Dark screen

VA screen reader has different controls from the way the sighted users use their mobile phones.

The main controls to mention are;

- 1- tap => to read aloud
- 2- tap (double click) => to perform whatever the pressed control requires it to do.
That's how it works for sighted users or BVI that does not use screen readers
- 3- Scroll with 1 finger => It lets the user navigate on the current mobile phone menu.
It is useful for BVI because it helps to learn every item on the menu although it takes time to do it.
- 4- Scroll with 2 fingers => It lets the user scroll on a bigger page [(i.e. bigger than a mobile phone screen) from top to down, left to right,...etc.]. This is equal to scrolling with 1 finger to the sighted or BVI users without the VA screen reader.

TB SR has a more clear voice compared to Samsung's VA. It is much easier to understand. They are both robotic sounds but TB sounds better. It does not talk as much as a voice assistant and most importantly it is quieter. After some time, it completely stops talking. There were lots of times when VA could not detect the pressed button but TB does not have a problem like that.

2.2 Usability Testing of Blind and Visually Impaired on Predetermined Tasks of Social Media Features

Babu, R. (2014) had a study that examines the three most common SNS functions (search for people, communicate with people, and plan social events) that are analyzed using verbal protocol analysis with 6 participants to find the difficulties experienced by these users.

The difficulties with these 3 functions are;

- i. About Search Function: Participants had difficulty in finding the correct search fields since there are two. One of them is for web search and the other one is for SNS search. The web search does not have a descriptive caption. Therefore, they could not realize that operation. There is uncertainty about what to search for as well. Can that be a name, an e-mail, or anything else? These complications are attributed to the lack of clarity about appropriate search terms, inconvenient labeling of the search field, and lack of guidance.
- ii. About Communication Function: Participants could not find the “Timeline” part that enables them to send messages. A descriptive label is crucial under a different section that facilitates the messaging operation. On this issue, adding instructions about how to access timeline input can be beneficial.
- iii. About Planning Social Events: When the participants navigate to “Create Event”. There is a default “Today” value that causes frustrations when it is attempted to delete with a Backspace. That movement triggers backward navigation. Entering the desired date is also not possible. It had to be editable from the keyboard then the BVI can achieve the task without using the mouse.

The research paper from Nobre, C. N., Meireles, M. R. G., Silva, D. B. F. D., Farla, A. H., & Vieira, N. (2018), written by Brazilian researchers has a significant number of references in Brazilian Portuguese, introduces the work of local Brazilian scientists to a much broader audience in English. The structure of this paper differentiates from the other works with its theoretical background section which is mostly seen in social sciences and not much in natural sciences or formal sciences. In

this theoretical framework, psychological concepts like emotional design, emotions, feelings, and positive-negative affect schedules with the aid of a social science literature review are explained. Moreover, it briefly discusses theories of emotion whether would base on cognition or somatic factors, followed by the PANAS (Positive and Negative Affect Schedule) which is a kind of self-report questionnaire invented by three psychologists in 1988 (Mulder, 2018).). The experiment in this study comprise both sighted and VI participants. It uses PANAS defined with 10 certain adjectives that define emotions (satisfied, surprised, excited, interested, determined, irritated, useless, frustrated, sad, confused) which are categorized as positive affect (PA) and negative affect (NA) that can be on a Likert scale from 1 to 5. This questionnaire is implemented for blind, low-vision (as defined in the paper), and sighted users to determine the difference between these three categories of users by using statistical tests in 4 different FB features like friends search, dissemination of the text, video, photo, likes, comments and sharing of items chatting feature by using FB Messenger

Two other FB features namely creation and participation of groups and creation and participation in events are excluded from the study because none of the BVI are using it.

Friends search was the worst option because there is a very small amount of information to actualize in that feature. Even for sighted users finding friends by looking at the photos is a burdensome process because it is mostly required to deal with lots of people with the same name and surname. As an alternative way, it is possible to use this feature via a mobile phone number or e-mail address. However, privacy settings that are set by the concerning FB member can prevent them from being accessible in that manner. Inevitably, this is a situation that exacerbates the accessibility of this function

Dissemination of Text, Videos, or Photos, Blind users experienced PA more frequently than the others (low vision or sighted). Determined, satisfied, and interested are the most pronounced emotions in this FB feature.

Likes, Comments, and sharing of Items feature were considered to be confusing for the BVI because they couldn't comprehend if they do it for the correct item. The names of the options are always the same. They couldn't differentiate these options for distinct posts because SR cannot provide the correct context for the users. FB has lots of unlisted images with no use and it is hard to use from the keyboard alone.

Chat is the best option for the BVI probably because it is mainly a textual tool. They said they were not distracted by useless information like advertisements, images with no descriptions,...etc.

There is a direct relationship between the negative feelings that the participants experienced and the accessibility problems of BVI. This is a slightly different way of studying the subject despite having more or less the same goal. Mainly, it tries to find new ways to empathize with the BVI people and to receive more detailed, original, precise information like the other papers stated in this literature review.

The research paper by Wentz, B., & Lazar, J. (2011) intends to make up for this deficiency with a study realized with 15 blind users who access FB on the desktop version as well as another phase with 15 blind users who use the mobile version making it a total of 30 users.

Most of the BVI in this study use SR like JAWS, System Access, or Windows Eyes. However, the majority do not use them for FB. The accessibility problems of FB include the visual use of CAPTCHA, lack of skip links, or alternative texts that explain and improve screen reader usage. Also, there is no alternative to the Javascript features. Browser keyboard shortcuts would be introduced as well as audio CAPTCHA to improve accessibility in the future. In this experiment, JAWS 10 and Internet Explorer (IE) 10 were used. Data logging software was used to record the keystrokes that are typed. Moreover, a stopwatch was used to measure the time spent on each task.

These results can be summed up as follows;

Phase One-“Facebook Desktop”: Navigation can be difficult with a lot of irrelevant

content and links.

- i. Task One (open and log into a FB account): Labelling is considered to be confusing. The username edit field seemed to be occasionally missed, descriptive label can't be read. 93% of participants completed this task.
- ii. Task Two (read one of the new posts on a FB account): 2 users had difficulty in locating the current posts by the "Friends", 93% of participants completed this task.
- iii. Task Three (add a status posting to the FB account): 5 users had difficulty updating the status and 2 users were distracted by the web browser menu. 27% of participants completed this task.
- iv. Task Four (send an email to a specific external email address): No user could complete this task. 10 users could not find the link to compose a message. The pop-up box was considered inaccessible. 4 users could not send the email because of visual CAPTCHA after randomly tabbing through the surface. They thought the message was sent. 0% of participants completed this task. That is, it is not completed by any participant.
- v. Task Five (upload a Picture to a FB account): 3 out of 15 could complete this task. They had difficulty in navigating the upload photo interface. 5 out of 15 could not access the "update pop-up" that is required to update the photo. 20% of participants completed this task.

Phase Two-"Facebook Mobile": Feature of sending emails to friends that are not on FB. IE 8 with an external keyboard is used.

- i. Task One (open and log into a FB account): All users completed the task. However, there was a labeling problem with the text field. The "Email or Phone" part is read as "Edit. Type in Text" 100% of participants completed this task.
- ii. Task Two (read one of the new posts on a FB account): Improvement in time

was observed. 100% of participants completed this task.

- iii. Task Three (add a status posting to the FB account): In the mobile version updated status does not show up on the screen until the page is refreshed but the “Your status has been updated” message is displayed. 100% of participants completed this task.
- iv. Task Four (send an e-mail to a specific external email address):- (this feature does not exist in the mobile version of FB)
- v. Task Five (upload a picture to a FB account): Significantly higher for those who had experience with FB Mobile before. There was difficulty in locating the photo because it was not a choice on the top menu some users who are experienced with the Desktop version tried to upload the photo by selecting the link to edit the profile. It became an added option later. On FB Mobile there are instructions for emailing Pictures to a FB profile as an alternative method. This was not evaluated during the study. 47% of participants completed this task.

The Accessibility and Usability Issues for the mobile version are;

- i. the absence of a “skip navigation” link
- ii. the need for more headings for better identification of the interface enabling more efficient navigation
- iii. difficulty in understanding the focus page
- iv. when the user navigates back the system is logged out of the system. (That's a common behavior for many BVI users.)

Unlike the desktop version, the performance of users fluctuated from time to time throughout the weeks in the mobile version. The updates for the desktop version were more frequent and more publicized. Generally, mobile interfaces are considered to be more accessible because they have a simpler layout. E.g. Amazon has already announced its mobile version as the more accessible one.

Important factors that can be mentioned in the study for improved accessibility are as follows:

- i. If a mobile interface is advised as an “accessible” interface then it should be consistent and up-to-date with the other versions of the application.
- ii. All text fields should have logical labels that guide the users.
- iii. Interfaces that are considered “accessible” should have all expected application features available to all users.
- iv. All web-based interfaces should consider universal usability as a top priority.



2.3 General Usage of Social Media, Technology by Blind and Visually Impaired

Wu, S., & Adamic, L. A. (2014) had very comprehensive research and it's the first large-scale empirical study about how BVI people use social media. A group of FB employees conducted this study with the help of data that they have access to. This study differs from most of the others by the quantitative methodology it uses. The data analysis was done on the servers. Trend detection algorithms are used to capture the necessary data that can be formed to get the information. Distinctive patterns about the usage of FB could be captured with the information gained from the people who use screen readers. Not all BVI use screen readers but that's a majority. If the test subjects used it just once or twice, they are excluded from the study. That's made to avoid the people who might have pressed the screen reader accidentally or maybe someone just curious to test it. However, the sample is quite big and consists of 2 groups one of which contains 50000 BVI users and the other one has 160000 randomly sampled users that are active for at least 3 days during the same predetermined 1-month period. For both groups, feedbacks (i.e comments and likes), photo uploads, and their status updates data are collected. Demographic information like age, country, and gender are compared. The user activity is divided into 3 categories such as content produced, feedback sent and feedback received. It is confirmed that BVI people mostly use VO (i.e Apple screen reader). (That's the case especially for developed countries considering the price of the iPhone. For instance, that's not the case in Turkey. Participants in our study also confirmed that they use Android due to financial reasons).

Important aspects of their (i.e BVI users') behaviors according to this study are as follows:

- i. BVI users post significantly more status updates
- ii. BVI users upload slightly fewer (such a small percentage) photos
- iii. Generally, BVI users produce more comments in general, except the comments about photos. They make fewer comments and likes for pictures posted by others.
- iv. They receive more likes and comments for their status updates excluding photos.
- v. The numbers are almost identical when it comes to the question-asking habits between BVI and the randomly sampled control group (probably most of whom are sighted, users)

- vi. The most common words are about their disabilities
- vii. The most common photo captions are about the radio stations that are used by BVI users.
- viii. Network size tends to catch up with the size of the sighted users. This refutes the theory that BVI users have smaller networks as it is mentioned in the paper.
- ix. BVI users mostly become friends with each other

The study by Wu, S., Wieland, J., Farivar, O., & Schiller, J. (2017, February) might be the first paper published about the usage of the automatic alt-text generator of FB considering that the first news (<https://www.theverge.com/2016/4/5/11364914/facebook-automatic-alt-tags-blind-visually-impaired>) about it is around April 2016. Later in 2018, it was introduced on Instagram as well. This research which is also conducted by FB employees like the one before, mentions iterative prototypes and in-lab user studies used to design the system. The major challenges of the system that are required to consider are the selection of tags, the integration of machine-generated content, and the structure of information.

This FB feature [Automatic Alternative Text, which is mostly used in the form of Automatic Alt-Text (AAT)] uses computer vision technology to identify objects, faces, and other themes that might be conducive to the understanding of the image by the BVI users. When the screen reader is used and it comes to the image part, SR starts reading the AAT generated by FB. It generates statements like “this image may contain two people standing and one person is sitting”.

It is stated that we need to limit the concepts to receive the genuine alt-text like the ones given below;

- i. Concepts related to the personal identity
- ii. Adjectives (that is, attributes of objects)
- iii. Concepts that would be challenging for an algorithm to work (e.g. About landmarks. Let’s say we have Eiffel Tower in the photo. The AAT should be able to perceive that the photo is taken in Paris)

The photos with AATs receive more likes and comments from BVI users. However, they still demand more detailed descriptions of the identities and emotions of the people in the pictures. The algorithm can miss some people if their faces are too small (i.e taken from afar) or if their faces turn into one side. Better performance is achieved with bigger objects. Blind users appreciate it more when they can see a full sentence rather than an unorganized list of tags. Because artificial intelligence (AI) still lacks in forming good sentences, advancement is not foreseen there. AAT may also generate wrong content.

There is a human-powered alternative system as an alternative to this technology. Nevertheless, it takes time to receive a person that will describe the picture. Naturally, the number of pictures that can be put into the process this way is constrained by the number of volunteers.

In recent years, the observed tendency in BVI accessibility in social media tends to move towards social media content authoring (BVI as a producer of content) and AAT generators after its introduction by FB in 2016. It is supposed to be since BVI accessibility as a receiver of content is studied more in the past.

Pereira, L. S., Coelho, J., Rodrigues, A., Guerreiro, J., Guerreiro, T., & Duarte, C. (2021) had one of those with social media content authoring. The sighted users are not aware of the fact that accessibility improving practices might be beneficial to society. Twitter is the first choice for the disabled followed by FB. Twitter's alt-text edit feature for the authors is considered to be an effective idea although it is so hard to find by both the sighted and BVI users. There is a lack of control mechanisms for the quality of alt-text. Some BVI complains that they do not have the chance to rank or criticize the quality of alt-text. Some argue that the edited text should be mandatory acting as a tool that reminds society about the needs of BVI. According to the paper, the idea of BVI sharing and producing content should be promoted in society.

Duarte, C., Pereira, L. S., Santos, A., Vicente, J., Rodrigues, A., Guerreiro, J., & Guerreiro, T. (2021, June) have prototyped a Google Chrome extension and

an Android application that can find if a user is authoring content with images and suggests an alt-text and where to put it. These suggestions come from human-powered systems, automatically generated from an image analysis or a text recognized in an image. AI-powered systems can be good at listing things in an image still but they are far from understanding the true intention and meaning of an image. As a result of this, it is considered to be of lower quality.

Stangl, A., Morris, M. R., & Gurari, D. (2020, April) tries to find nuanced image description preferences to enhance the quality of image descriptions. The image descriptions are considered to be very broad. Some participants need to know about the race or gender of a person for a better understanding. One of the participants said that he had wanted more details when he was younger. However, now he doesn't want lots of details. It is not possible to continue with a one size fits all approach. There should be an increasing number of choices for people with different views, ages, where the writing is published... etc.

Mathur, R., & Brady, E. (2018, October) examines the collaboration between sighted and BVI social media users for alternative text. Most sighted users are not aware that they can write alt-text for the BVI despite the demand by them as it is found in the Pereira, L. S., Coelho, J., Rodrigues, A., Guerreiro, J., Guerreiro, T., & Duarte, C. (2021) study. The ones who know are the friends or relatives of BVI people. The majority of BVI people are still collaborating with sighted users while uploading photos. Writing alt-text is considered to be time-consuming and it is not known if this would please the BVI community.

Duarte, C., Duarte, C. M., & Carriço, L. (2019, May) presents an updated version of an algorithm that checks the alternative text in terms of accessibility aspect. Alt-text can be detectable but its quality is hard to understand without the help of a human expert. Image descriptor, image's domain descriptors, and image metadata are compared with the image description. The results are given scores from 1 to 4, 1 being a very bad description and 4 being a very good description. It is also noted that sometimes alt-texts are not required. Null alternative texts should be provided for the decorative images that do not add new information. Those images may be found

confusing when they are read by SR. If functional images receive a description of the image, then this may also be problematic for the BVI since its main purpose is its action.

Kim, L. H., Boadi-Agyemang, A., Siu, A. F., & Tang, J. (2020, October) aims to detect when it makes the most sense to add human narration to social media. It is concluded that the first-person narration is useful to form a connection between the viewer and the content creator. On the other hand, third-person images are convenient when it is required to have an impartial mental image. The degree of familiarity with the voice may also reinforce the social connection.

Vashistha, A., Cutrell, E., Dell, N., & Anderson, R. (2015, October) aims to uncover the use of social media use of low-income people in rural parts of India by using semi-structured interviews, phone surveys, and observations with total of 18 participants. A specific type of phone-based social media is also presented making up for the deficiency of internet connection in the rural parts.

Qiu, S., Hu, J., & Rauterberg, M. (2015, February) studies usability problems for people with different kinds and levels of visual deficiency for the sake of finding out how the BVI utilizes social media on mobile devices. All 5 subjects of this study have iPhones. Likewise, they think iPhone has the best auditory accessibility equipment (e.g. VO for iPhone)

There were 3 types of participants in this experiment. These were:

GROUP A: Blind group (congenital blindness and mostly no sense of color or weak sense of color)

GROUP B: Moderate visual impairment (one participant is in this group and she needs assistance while using VO)

GROUP C: Severe visual impairment (congenital blindness and sense of color)

As a result of the initial observation, it is found that people in GROUP A swipe their fingers over from left to right on the mobile phone screen and double tap to select the choice that is gotten according to the VO auditory feedback which is too fast and too weak (most blind people use it that way as we learned from interviews) for the

interviewer. However, it can be caught by the participant of the experiment. In GROUP B, VO is still required since the participant cannot press all the tabs correctly. In GROUP C, she chose to use a physical magnifier rather than the scaling property of the iPhone (i.e. Apple's magnifier which is called Zoom)

The most common thing observed by the researchers is these people use social media to receive information rather than posting it. They attribute this behavior to their lack of security sense. They read posts from others. They mostly do not post themselves. However, they may sometimes respond to the posts. One of them said to use "Like" for the messages. The SR cannot read the symbols (mostly emojis that cause the problem). When it comes on them, it says blank. BVI users wish they could have known the color, location, and information of the object. Another participant said he is afraid of uploading photos yet he cannot recognize the content and VO only reads the sequence number of photos. They never friend someone whom they do not know and they are most afraid of doing so.

To act as a remedy to BVI users' desire to learn about color and other information. A preliminary design concept called Voice Photo is also proposed in this paper. It is planned to;

- i. record synchronous voice while taking a photo
- ii. recognize and speak out the text information embedded in the photo
- iii. automatically detect the object's color and speak it out.

Della Líbera, B., & Jurberg, C. (2017) had a study on BVI teenagers. To receive information from focus groups, semi-structured interviews and observations when the participants were using their mobile devices were made. Sessions are recorded in MP3 and analyzed later. It is observed that their preference is smartphones yet they are easier to carry and their SR works better according to them. Desktop computers have lots of shortcuts, and keys that are not used thereby making them much harder to understand. SR has the same issues that are found in Qiu, S., Hu, J., & Rauterberg, M. (2015, February) study such as an image with no command on it cannot be read.

Fuglerud, K. S., Tjøstheim, I., Gunnarsson, B. R., & Tollefsen, M. (2011) states that the frequent interface changes for example caused by the use of AJAX technology, already complex interfaces, the use of Captcha [(Completely Automated Public Turing Test to Tell Computers and Humans Apart) it does not exist anymore in FB but it is mentioned in our research mostly for banking mobile apps in Turkey in 2018, it still existed in that year] and the use of special characters such as emoticons [(also observed in Della Líbera, B., & Jurberg, C. (2017) and Qiu, S., Hu, J., & Rauterberg, M. (2015, February) As it is observed, now VO can read emoji, but it is still not very conducive] makes it challenging for BVI to comprehend social media pages.

Fuglerud, K.S., Tjostheim, I., Gunnarsson, B.R., Tollefsen M. (2012, July) repeats the finding that the use of CAPTCHA is a significant problem for the VI. Most sites require users to enter values on a form that are seen on a bitmapped image. However, even if the sites offer the choice of audio CAPTCHA, the voice can be so robotic and difficult to hear. The use of AJAX in dynamic sites also contributes to the inaccessibility problems. BVI may see the desktop version as difficult because mouse navigation is the only alternative and the participant may not know where to click.

Two surveys are made to discover the accessibility problems. , the survey participants are either blind, severely visually impaired (VI), or moderately VI and they are between 15 and 75 years of age. The number of people is divided into four (15-24, 25-39, 40-59, 60-75) because VI increases with age. Each group has about %30 in each group for a better representation. The survey aims to find out what the challenges are for people with BVI while using social media and why they use it. Also, another web-based questionnaire is developed and published through FB and email lists.

The results of the telephone survey showed that %99 of BVI have mobile phones. Fewer have access to a PC. The most commonly used assistive technologies (AT) are text-to-speech, magnification, or Braille. Blind people do not use a magnifier and they mostly rely on Braille. Moderately VI and severely VI mostly rely on the magnifier. For severely VI, text-to-speech is used slightly less than a magnifier. Of all the participants, the magnifier is the most commonly used AT. The young people (15-

24) use FB significantly in the form of text messages showing that they use AT with mobile. Most of the respondents were not relevant to the question for the perceived level of difficulty regarding social media and for the ones who were, the slim majority that finds it easier rather than difficult. Friends and Peers are the most important factors that led to the use of social media.

The web survey shows that just like the other papers the CAPTCHAs are seen as a major accessibility problem. Most of the pages on FB are not navigable and the pages contain icons and buttons with images rather than texts. Unfortunately, these icons and buttons do not have alternative texts most of the time and therefore, it is not possible to know what they are. Emoticons can also cause problems. They are recognized by SR in chat applications, but not for the web interfaces. User-generated content like pictures or videos can be a problem too because they lack text that explains their content. AJAX structure that causes certain parts of the page to reload is an important issue. In addition to these, most BVI users say the FB page changes so frequently that they have difficulty learning every single time.

Tjosthelm, I., Solheim, I., and Fuglerud, K. S., (2011, June) aim to discover a more accurate picture of the usage of BVI and try to find out if it improves the way of life. Telephone interviews are chosen instead of web-based surveys because they are considered to be more accessible. Information like age, if he or she is a user of Braille or big print, and degree of vision was obtained.

According to the results obtained from the experiment, the impression for the social media usage statistics in different time frames is as follows:

Facebook > YouTube > Windows Messenger(MSN) > Twitter

Motives or factors related to social media are categorized. In the research model, these 5 conditions (i.e. emotions, feedback, friends, real-time, peers) are used. 2 statements are determined for each of these 5 thereby making the number 10 in total. These statements are given points by the participants. As a result, younger people perceive social media more favorably than the old, and the two factors, friends and peers

contribute to a better life for BVI. Unsurprisingly, usage of information and technology (ICT) is more efficient in young BVI people compared to older ones because they have better information technology (IT) skills. Just like the research results in the other papers, many BVI uses mobile apps rather than the desktop version. They suggest m.facebook (mobile internet site of FB as the accessible version. Some even use it on their personal computer (PC).

Giraud, S., Colombi, T., Russo, A., and Therouanne, P. (2011, September) had some essential findings for the ideal layout that can be optimal for BVI. Rich Internet Applications (RIA) are found to be very difficult to navigate with an SR since they are filled with rich interactive and dynamic elements. SR serializes the content of the web page while using the source code of the page. On the other hand, the pages are browsed in a parallel style (mostly organized in columns while SR reads by rows) with dynamic structures like drag and drop, tables,...etc. If the web page is well structured with the use of headings or links such as "skip to main content" that eliminates the unnecessary links if chosen, then blind users can use it much easier. Another problem for the SR, it also does not consider the context of the page. Instead, it just turns visual information into auditory information. Each BVI user used his or her computer with the SR "JAWS" with internet Explorer (IE). Handycam HDD was installed to record actions and Morae software to calculate the execution time of tasks. Before this experiment, each participant filled out a questionnaire to determine their habits related to the usage of the interfaces. After the experiment, there was another questionnaire that measures the satisfaction of the interface.

As a result of the experiment, they find that the SR reads unnecessary things like empty spaces or characters which makes it harder to understand. Most of the pages do not have adaptable and full content for the disabled. When a page is opened for the first time, the user should get a general idea about the page before getting into details. If not, then it is time-consuming, difficult, and much harder to understand.

Dale, O., Drivenes, T., Tollefsen, M. & Reinertsen, A. (2012, July) had a Project on the development of two social media sites. The first one is a web application a Braillebook that provides FB functionality in an alternative user interface. It is

designed for blind screen readers and suitable for WCAG 2 level AA (Average level of requirement. 2nd Level. Includes all the requirements from the A Level) There is also another one called My Education which gives information about general education in Norway. These two are tested for user accessibility in a test with 21 users from 16 to 63 years of age with different BVI and motor function mobilities they use SR, SM, roller mouse, spelling, writing software, adaptations to the operating system (OS), LP (weather polyester laser) keyboard stickers. Braille book is well received by the participants and that even asked if they can use it as their FB UI (user interface). Two demonstrators reported incomplete labeling of control buttons and pressing too many spaces may result in unnecessary navigational key presses on some pages. The context for the text input box was not good which caused them to search a lot around the pages for BVI users.

There were some usability issues like;

- i. Using different names for the same actions in both actions caused difficulty in finding the correct controls.
- ii. The My Education website requires too many steps for the registration process. On the other hand, for the Braillebook website sending a direct message requires too many unnecessary steps.
- iii. Both sites used different UI on different pages which create complexity thereby making it more difficult to use by VI.
- iv. They weren't easy enough to find feedback for problems.

Issues about the users are categorized as accessibility issues, usability issues, and issues related to the user (the expertise of the user in using ICT, AT) for a better understanding of the participants.

Guerreiro, J., & Gonçalves, D. (2013) had a study that consists of two exploratory case studies. Their paper aims to find out the accessibility problems of two blind people who use social media applications through a mobile device (iPhone) and PC. Besides, it is aimed at comparing and contrasting the findings in these two case studies. The findings are categorized into two categories. They are related to writing

and reading explained in the following paragraph and the ones related to the personalization of FB are explained in the paragraph just after that.

For mobile, it is tough to utilize touch screens while entering texts. Comprehension of images is quite hard due to the screen size. Moreover, it takes longer to load due to CPU (computer processing unit) power. Both participants stated that it had taken a lot of time to find the necessary information for them even though they developed faster browsing techniques throughout the time. The existence of wide-ranging lists of information parts like posts and tweets on social media exacerbates the situation. Most posts are quite small to be seen and summarized properly.

FB personalizes its news feed according to the actions of the user. SR may collect feedback according to wherever the users look at. This aids them to analyze the users' interests and behaviors. As a consequence of these personalizations, BVI mobile device user BVI said she can move to the next post by just listening to the beginning of the post.

Brady, E., Zhong, Y., Morris, M. R., and Bigham, J. P. (2013, February) aim to find out how efficient blind people are in asking questions related to images on social networks. There are 191 blinds in the study. It tries to find out if the BVI users see SNS as a suitable place for Q & A (Question and Answer). There are log analysis questions asked using VizWiz Social, an iPhone app that can be read by screen readers. However, people can be hesitant to answer questions if they think the question they ask might be considered too easy. A reluctance is observed for FB users who do not want to spam their friend's news feeds.

According to this research, social media usage for BVI is as follows;

92% of blind users use SNS, 85% use FB or Twitter, 80% use FB, 52% use Twitter, 40% use LinkedIn, 15% use Google Plus, 4% use MySpace, 3% use Yammer, 3% use Inclusive Planet and 1% use Orkut.

Those with FB accounts said 72% of their friends are friends and family, and 24% of their friends are colleagues. Those with Twitter accounts said 27% of their friends are friends and family, and 42% of their friends are colleagues. Twitter users are observed to be more likely to meet their contacts online. Only 55% think questioning on an SNS is an efficient way to get answers. 12% of users of FB compared to 26% of users of Twitter ask questions at least once per week. Only 34% received an answer on FB whereas 33% receive answers on Twitter. For them, it is considered to be annoying to ask a lot of questions when none of them are answered. FB works slower when used with an SR. The ability to interact asynchronously in SNS at a relaxed pace can be appealing for the blind avoiding the rush. Twitter is considered to be more accessible possibly since it is text-based without the rich multimedia features of FB.

The techniques to explain the pictures used in this study are;

- i. Crowdsourcing: Mechanical Turk (5 cents for each HIT (human intelligence task) answered) on-demand workforce. The sighted participants are paid to describe the pictures.
- ii. IO (input-output) Engines: human-backed image recognition if the algorithm fails to describe the pictures.

Types of randomly sampled questions with their given percentage were categorized as follows;

- i. Identification (%44): Questions that identify an object by a user.
- ii. Description (26%): Questions that describe a visual or physical property of an object
- iii. Reading (23%): Questions that demand a question to be read.
- iv. Unanswerable (7%): Question e.g when a photo did not generate information even if it is required to do so.

No correlation between types of questions and types of crowdsourcing or friend sourcing could be found. Crowdsourcing is more popular because there is no expected

element of judgment. Speed of response, quality, and accuracy of response, photo taking feedback are considered advantages of it. Web-workers are anonymous and they know nothing about the disability. BVI people are observed to have smaller network sizes.

Hollier, S. (2012) had a broad study that includes SNS like FB, LinkedIn, Youtube, Twitter, Skype, and Blogging Tools (Google's BlogSpot and Wordpress.com), and one part of it is based on responses via e-mail or Twitter from people with different disabilities, ages or different patterns of usage that aims to bring light to disabled people's behavior on social media. Heuristic methods under Web Content Accessibility Guidelines (WACG) 2.0 (<https://www.w3.org/TR/WCAG20/>) are used. Other tests are conducted.

As a result,

- i. Usage of mobile site m.facebook.com is common for BVI. AT perform better in those sites. You can also sign up for a mobile site through an HTML interface only. It is more accessible than the desktop version but it only provides basic profile editing, messaging, Wall posts, and friend searching options. It sounds like an interesting additional keyboard shortcut to facilitate jumping from section to section. It is important to find out if they have different unique tactics.
- ii. Additional keyboard shortcuts are required to facilitate jumping from one section to another.
- iii. WAI-ARIA (Web Accessibility Initiative-Accessible Rich Internet Applications) navigation landmarks: a screen reader is more likely to read more and provide additional help in navigating between FB functions.

Problems that are detected in this study can be summed up as follows;

- i. User Competence: There should be training for BVI social media users and it is difficult to learn things by doing. The adjusted settings for JAWS are difficult to control.
- ii. Problems Related to Change: FB constantly changes. When one finally learns

to navigate through the page, another update comes. The mobile page does not change as often as the desktop version then it is preferred by people with BVI. Participants realized font size is reduced so now 4 times magnification is required.

- iii. Lack of Standards: Graphical links without alternative links, missing or inadequate structuring, fields without label tag, poor contrast between interface sections, font size is not changeable. FB is detected not to follow WCAG 2.0. There are too many animations, advertisements, and pop-up messages.
- iv. Technical Issues: FB crashes when ZoomText with standard pages is used. FB support group deactivated Captcha when they learned the user is BVI. Another person said often Captcha does not work.
- v. Chat: It is difficult to use with Braille display. It is completely impossible to see who is online. Cannot add links in either status or messages.

Murphy, E., Kuber, R., McAllister, G., Stain, P., Yu W. (2008) is based on a study about 30 BPS users. How sites are navigated, how page layouts are perceived, and interactions with the assistive devices (SR, text-to-speech synthesizers, and Braille output devices) are examined. Assistive devices cannot handle graphics, moving images, or similar multimedia information. Complex pages and inaccurate labeling or even lack of labeling cause difficulty for blind users. Analysis shows that SR shows navigational constraints and provides very little about the web page layout. Using non-visual interfaces with the help of multi-modal technologies may give spatial and navigational cues to the user.

Some designers use accessibility guidelines validators like WebXact, LIFT, CynthiaSaysPortal, or the W3 mark-up validator to check if their pages conform to these guidelines. However, these guidelines are not perfect. According to some research, they only cover 55% of accessibility barriers. They chiefly check the technical performance standards and do not validate how usable the sites are. Even for the existing guidelines, it is difficult to enable the program to check all the guidelines. Human supervision is still necessary.

A survey was realized with 30 users to determine the requirements related to

the perceptual and navigational deficiencies of AT. SR cannot extract information like changes in font size, text size, and formatting. Using the mouse has a visual approach so many blind users choose to use tab and arrow keys as well as the ST shortcuts. SR outputs in a linear way instead of the way it is understood by the brain as the sighted users do. It fails to portray the natural ordering elements. By default, they move from top-left to bottom-right which can be time-consuming and boring for the user. Moving backward, forwards, or getting lost on the page is a problem. So some users were found to close the browser and then re-launch again. A standalone application called pwWebSpeak provides a speech-based representation of page content so the page can navigate through the page based on its contents: links, headings, and paragraphs instead of scrolling through the page. The IBM Home Page reader has provided access to structural information like tables, frames, and form elements. To facilitate the understanding of the page the application uses different voices to distinguish between text and links. Another web tool lets users select from a list of headings, hyperlinks, and headers.

El-Gayyar, M., ElYamany, H. F., Gaber, T., Hassanien, A. E. (2013, November) propose a system between blind and deaf people within Arabic sign language conversions. Mobile devices (gets the objects), Cloud services (help to analyze the photo and the related data), and social networks are used to realize this communication. When a face is detected thereby telling the identity of the person and according to the mimics of the face the emotions of the person are determined. Moreover, when it detects a sign language then it converts it into Arabic. FB is not known to contain any features to attract blind/deaf people to participate in life more actively. There is an application called VizWiz that is found on Android and iOS. It helps to take pictures and then identify them through different methods like Computer Vision techniques or asking other people. However, it does not have a mechanism that captures the photo automatically. In that way, it might be quite difficult for a VI person to take it with good clarity

Chapter 3

Methodology

In this study, the usability practices of Blind or Partially Sighted (BPS) people and the difficulties they face are aimed to be detected by making usability tests. We aimed to detect the difficulties experienced by visually impaired and blind people. For this purpose, 12 surveys were conducted in the BVIAH. We tried to discover the problems and interactions faced by BVI on Facebook (FB) with the help of tasks that are prepared beforehand. We as researchers, helped the participant to pass the steps required to complete these predetermined tasks if the participant encountered a problem. According to the first factor, the results are displayed in terms of points attributed to the steps. Secondly, the time required to complete the task is checked. The third factor is if the participant had already known it before or not.

Unlike, the works (Brian Wentz & Jonathan Lazar, (2011); Qiu, S., Hu, J., & Rauterberg, M., (2015)) that have more basic operations such as read and post, check-in, create an account, log in to an account we tested operations like ignore/unignore message, change the language settings,...etc. Think aloud observation method in Rakesh Babu & Rahul Singh, (2013) was not chosen for this method. It was thought to lengthen the natural time the participant would otherwise spend using that method. The online survey used by Morris, M. R., Zolyomi, A., Yao, C., Bahram, S., Bigham, J. P., & Kane, S. K. (2016) on Twitter was not an option because of the lack of suitable participants.

This work is examined and confirmed by the Ethical Committee of the Bahcesehir University for ethical standards. This is realized for any kind of experiment that requires human interaction in any discipline. The questionnaires and the detailed explanation of the project have been added to the authorization form. All the participants accepted to be part of the project. They accepted that they will not take any kind of benefits as a result of this study. They also have the right to give up whenever they want. We read the conditions each time before we started our interviews and we started as soon as they accepted them. Their acceptance speeches are kept in my voice recorder device (Sony IC Recorder ICD-P110) with the other parts of the

interviews. Sometimes we took a video to see which buttons they pressed. Few of them asked questions to clarify the things they wanted to know. We did not disclose their identity and we signed a paper that conditions us to obey the rules determined by the University Ethical Committee. We searched lots of candidates in a (VIAH) Visually Impaired Association Headquarters. However, it was not possible to find long-term FB users. Some of them were not using it for a long time. Their stay was also not permanent. That's why another participant from the disabled unit of the university is found.

3.1 Preliminary Observations

The mode (i.e. dark screen mode) can be found using the directions that is also stated in the related works part like Apps-> Settings-> Accessibility-> Vision -> Dark Screen. It keeps the screen dark at all times. Some assume it is just for privacy but that's not the only reason. BVI cannot see as good as sighted users some even can't see anything and the screen is a useless feature for them. In addition to that, mobile phone utilizes more energy when the screen is turned on. Screen reader uses lots of energy when they read aloud and they do it a lot even if the user does nothing because it repeats the same warnings over and over again. According to one BVI that is interviewed, he thinks TB consumes battery as much as listening to music. Considering the frequent use of TB and the repetitions it makes, it looks like a reasonable estimation. This loss can be offset by the use of dark screen mode. The screen reader is the most widely used BVI device that is encountered during the interviews. Some use screen magnification (SM), Braille keyboards, ...etc. There was a machine that was on the internet that turns the web page into the Braille alphabet. Two of them (a couple) say they saw it in a fair about BVI but could not afford it. One of the other ones also agreed it is pricey. During the time of the interviews, it was around 2000TL in 2018 (as of 08.05.2018 at 15:30 1USD=4.2871TL) There weren't any people who uses it. However, most people also knew it was an expensive device.

3.2 Data Collection

The graphical information that is extracted from the data acquired during the visits to VIAH is as follows;

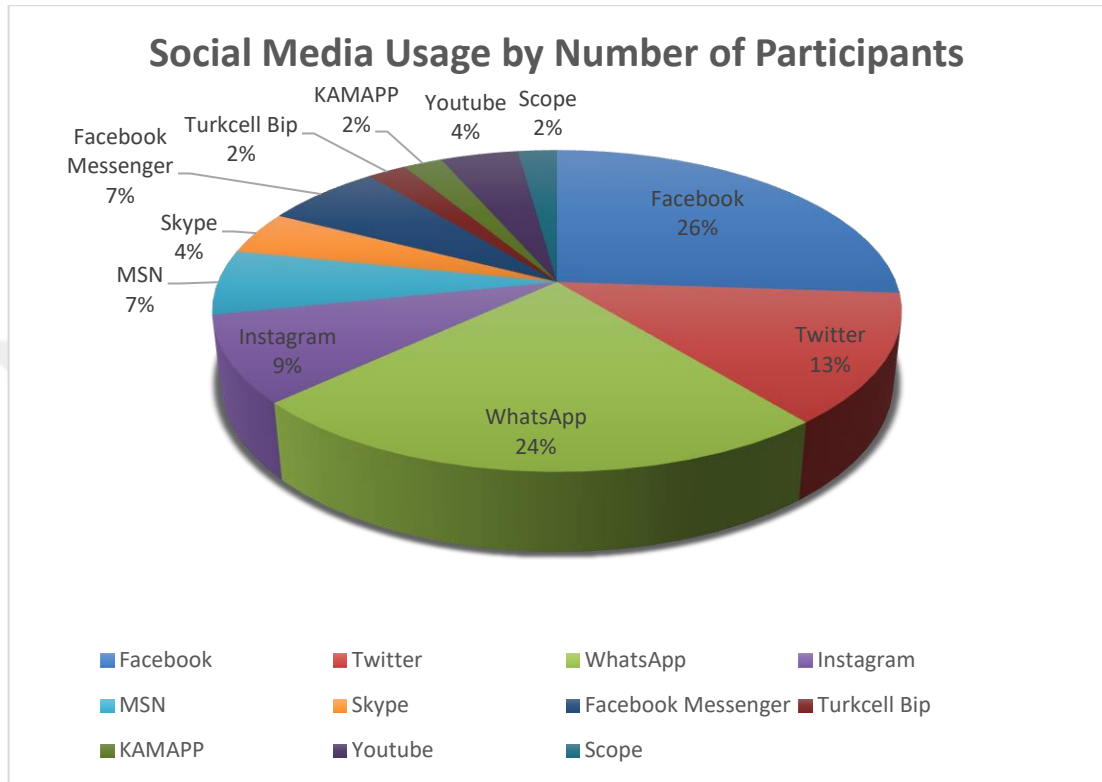


Figure 1: Social Media Usage of Certain Sites According to The Number of Participants

On the graph above, we can see the number of users by the social media platforms they use. These numbers are obtained in the year 2018. One participant can choose more than 1 social media platform if they wish. FB is the one with the highest users. All 12 participants use FB. This is followed by 11 participants with WhatsApp which is found both accessible and usable by participants. The remaining ones in descending orders for participants are as follows;

Twitter with 6 users, Instagram with 4 users, MSN and FB Messenger with 3 users, Youtube and Skype with 2 users, Turkcell Bip, Scope, and KamApp all three have 1 user.

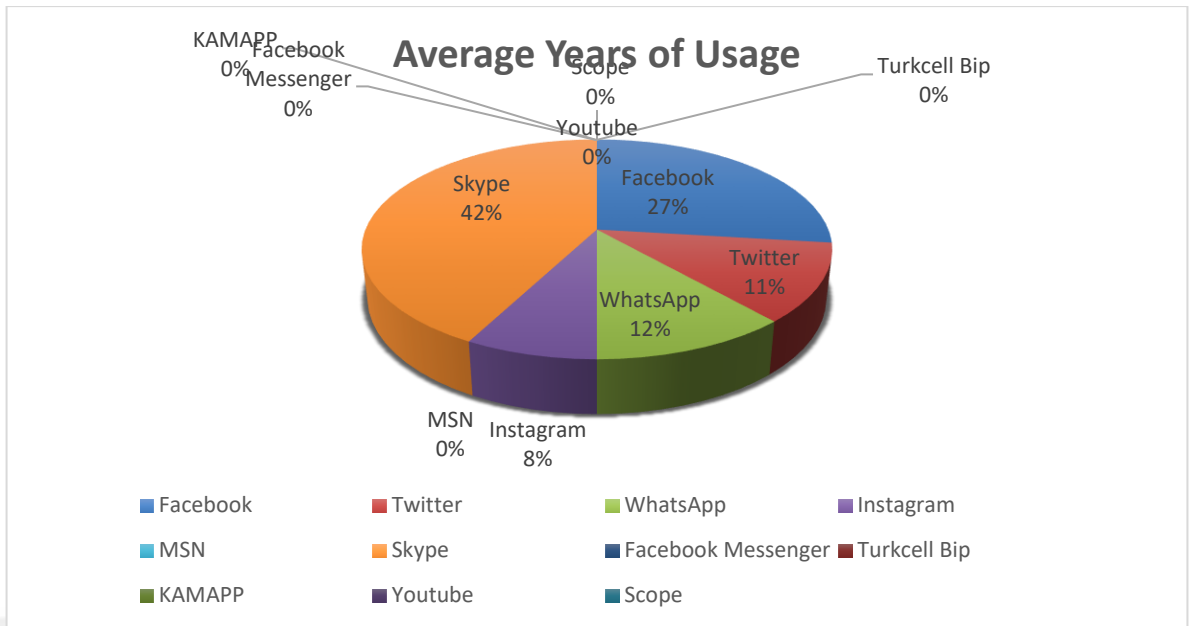


Figure 2. Average Years of Usage Depending on The Social Media Platform

The average years of usage according to the social media platforms are shown on the graph above. These are also given for the year 2018. Skype which is quite an old social media platform has the highest average years of usage with 11 years. It is followed by FB desktop with 7 years which is founded in 2004. Average years of usage are the same for WhatsApp and Twitter with 3 years. Instagram has 2 years and it was new and gaining popularity at that time. MSN (it is old-fashioned for many), Turkcell Bip, KAMAPP (one tech-savvy participant used it a couple of times but could not find anyone to send messages to), Youtube (1 participant had an account and used it a couple of times), Scope (1 participant tried it for a couple of times) is shown as 0 in the graphs. However, it is also used to depict the usage of less than 1 year.

- If the participants do not remember how long they used that social media platform in Fig. 2, it is not used in the calculation.

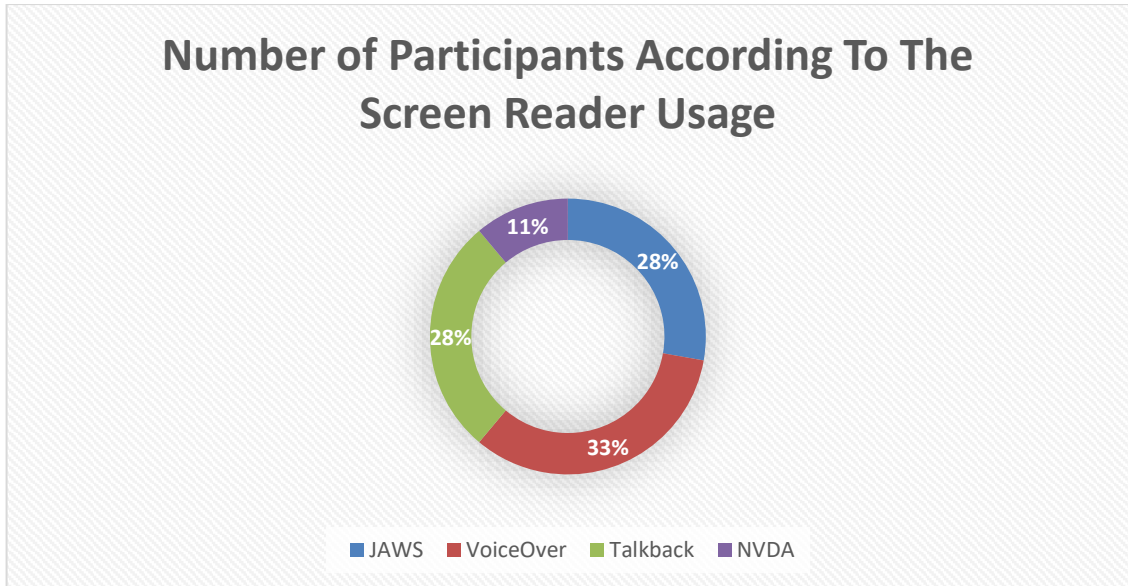


Figure 3. Number of Participants for The Corresponding Screen Reader

NVDA is the least used SR despite it being free with only 2 users. JAWS is found to be very expensive, especially for Turkish standards but is also very useful. It is the second most used one with 5 users. As a disadvantage, it has to be bought again if the operating system changes. The VO is the most commonly used one with 6 users. That can be explained by the general perception of the BVI community that Apple products are more accessible despite having a big price tag. Most of the studies that are implemented in richer, developed countries that are mentioned in the literature review consist almost predominantly of Apple users. The high number of TB usage with 5 users can be explained by economic factors.

* In this section, users are allowed to choose more than 1 SR and lots of users utilize more than one type.

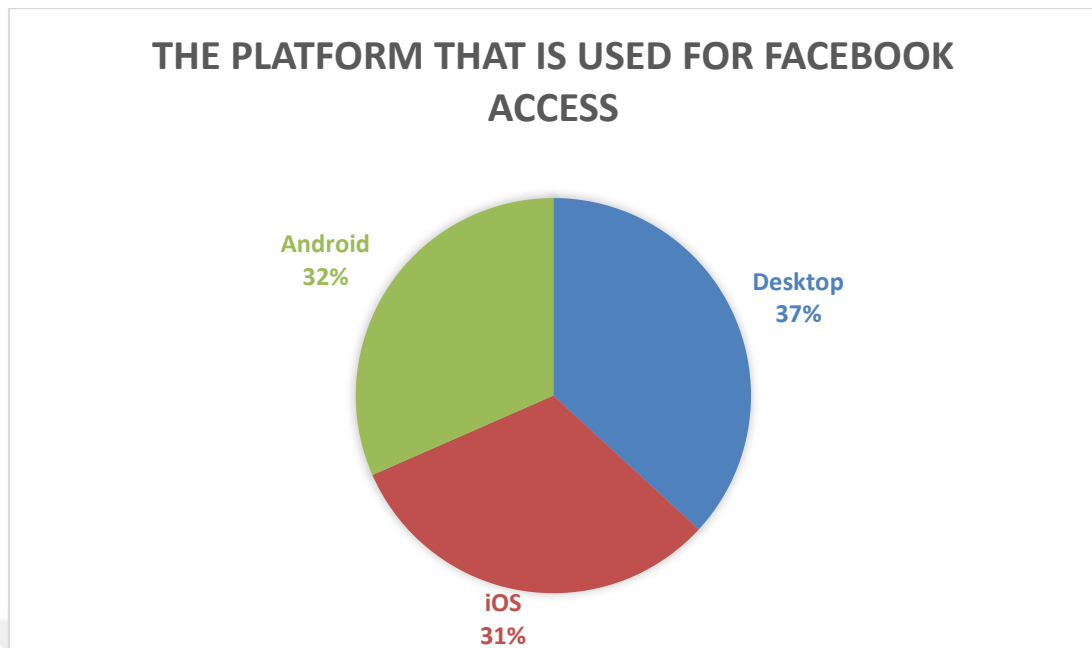


Figure 4. The Platform where The Facebook Access Happens

Figure 4 depicts how many people use which platform for their FB connection. Android is the most commonly used platform with a slim margin against iOS and Desktop. Desktop devices are increasingly considered to be heavy and bulky compared to mobile devices. The usage of Desktop is expected to decrease even further in the following years. The common usage of Android can be attributed to its low cost as it is stated before.

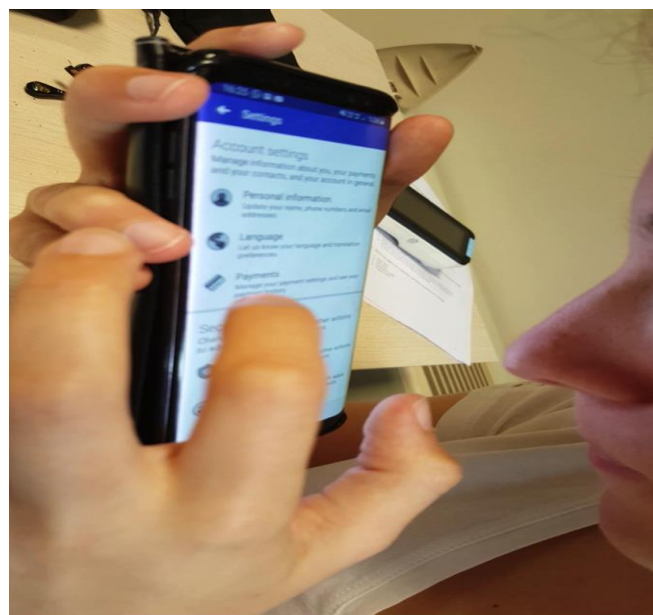


Figure 5. While the Participant of the Experiment was Trying to Perform the Duties According to the Scenario

In this part, we had a study with predetermined tasks to test our participant's capabilities as a VI person. It is done in Bahçeşehir University Disability Unit. First of all, we had an interview session to get to know her as a person and her social media practices. This information can be found below;

Our female participant is 22 years old. She studies English Language Teaching (ELT) at the university where this research was conducted. She was prematurely born at 5.5 months. That made her VI. She has a %20 vision in one eye. Her other eye was slightly worse even though she could remember the exact value. She had no difficulty in detecting light, colors, etc. She uses FB for almost 10 years in both English and Turkish. She did not recall using computer web browsers to access FB since 2016. She also uses Instagram. She never used Twitter. When she registered for FB the first time, she did not remember that she had a problem with the CAPTCHA that existed in those days. She said she could see when she opened her eyes wide. However, she needs to come near a little bit like the BVI person who takes photos (Bennett, C. L., E, J., Mott, M. E., Cutrell, E., & Morris, M. R., 2018).

To make a usability analysis of FB functions for an impaired person, we used 6 different tasks which include Change Language, Change Profile, Edit Username, Ignore Message, Unignore Message, and Activate Status. All of the tasks are firstly divided into main steps and assigned a success percentage value for each step. After identifying these steps, the participant tried to finish her tasks.

a. Change Language

Add the language if it is not on the list. (5*10=%50)

Settings -> General Management -> Language and input -> Language ->Add Language.

If it is already on the list.

i. Click Edit. (%15)

ii. Click the arrows to move it to the top of the list. (%15)

iii. Check Facebook for change. (%20)

Social->Facebook

b. Change Profile

How to change profile picture (DP) in the Facebook messenger app.

1. Click on "Add to your story" with the + icon. (%20)
2. Take a photo or go to the Gallery. (%20 for Gallery)
3. Select the picture you want to add. (%20)
4. Press the "->" icon. (Your story icon) (%20)
5. In the send to screen check the box to make it easy to share. (%20)

c. Edit Username

How to edit username in Facebook Messenger

1. In the Chats, click on my Facebook profile picture. (%25)
2. Click on Username under the Profile section. (%25)
3. Click on "Edit username". (%25)
4. In the Username section, you can rewrite the already existing username. (%25)

d. Ignore Message

How to ignore messages from someone (in messenger)

1. In the Chats screen, click on a recent conversation to reach someone's (either a friend or not) profile. (%40)
2. Click on the "i" (for info) icon at the top right. (%10)
3. Close to the bottom click on "ignore messages" (%40)
4. Press "Ignore". (%10)

e. Unignore Message

How to unignore messages from someone

1. Click on People. (%25)
2. On the People section, press the "Add Contacts" icon at the top right corner. (%25)
3. In Add controls, click on "Requests" with the icon just below Add Contacts (one of the four icons right next to each other) (%25)
4. In Message Requests, click "See all" to see filtered messages. (%25)

f. Activate Status

How to activate Status.

1. In Chats, click on your profile picture. (%25)
2. In the Me section, click on "Activate Status" under Profile. (%25)
3. In Activate Status, turn off Activate Status. (%25)
4. Click on "Turn off" in the message box. (%25)



3.3 Considerations and Limitations of this Study

The factors that must be considered for this research are;

- i. The research findings are limited by the data collection and measuring tools.
- ii. This research is constrained by the research universe and the research sample.
- iii. The research findings and the results of the discussions that are based on these findings which are obtained within the research frameworks are constricted by the research universe and the research sample.

The research that is carried out has these limitations:

- i. It is hypothesized that the research sample group formed in this study represents the research universe.
- ii. It is assumed that the participants that took part in this study with the questionnaires and semi-structured interviews gave answers which reflect their true real-life situations.
- iii. This research is done to partially fulfill the requirements of the master thesis and certainly, there is a time limit to complete the thesis and most of the things did not go as planned.
- iv. This research is limited to the participants who could be found. This study could not be done with a systemic recruitment policy. That is, participants are not invited to a certain place at a certain time. Participants are determined in each visit and not a suitable person can be found in every visit. Several recruitment constraints are encountered. These are sensitive populations that might be arduous to reach and communicate. Besides, not all the BVI people are suitable for this research. Especially older people are not as interested in social media as the younger generations and it takes significant effort and time to educate them. Even some of the younger generations have varying levels of experience and/or interest, and level of vision. Regrettably, the female participants are harder to find. This limitation prevents us from forming a sample that adequately represents the BVI population.
- v. The research is also constrained by finances. For instance, eye and/or head tracking tools, and Braille devices that convert the screen content to Braille alphabet are costly devices. Assuming that we could have afforded them, it

would have further enhanced the quality of the research that is engaged. This is true for both the participants and the researchers. None of the participants have ever used them.

- vi. There were constraints about knowledge as well. Especially, lack of practical knowledge was quite conspicuous during the experiment phase with the predetermined tasks. Before the interviews and the experiment, there was a comprehensive literature phase that aims to give more detailed information and prepare the researcher for the study. However, it was so far from reaching this goal. That was the most significant limitation of this research.
- vii. There were geographical limitations. All of the participants in this study are from Istanbul, Turkey in two different locations namely Bahçeşehir University and the Visually Impaired Association. It is hard to find people from different places considering the transportation costs and lack of contacts to communicate with people from those places. Because the university and the BVIAH both demanded documents from each other to determine if the researcher is a genuine person or if the location is a valid place, it would have been an arduous process for a single person to increase the locations further.
- viii. There were limitations of empathy since this study is entirely based on understanding BVI people, their attitudes, preferences, and habits. The researchers try to overcome this difficulty but there is an extent to the understanding of BVI by the sighted people. Mainly the papers about this subject aim to overcome this obstacle.

Chapter 4

Results and Discussion

Table 1 has given the successful performance of our participant on FB messenger in terms of total success point, and time by indicating the knowledge of the participant and, the number of steps for each function. If a participant knows how to do the task, the value is YES. As shown in Table 1, depending on the knowledge of VI, the duration time to complete tasks varied. Additionally, the successes of the tasks were dependent on the general behavior of the VI on SNS. In the Change Language task, the participant mixed the change language settings with the options for translating posts. That led her to waste considerable time. She achieved 100 points in the change language task while spending the highest amount of time. The timing can be attributed to the highest number of total steps in this experiment. In the Change Profile Picture Task, there was no problem despite the participant's reluctance. She did not want her friends to see her with a different picture. This change would easily be recognized by her friends as an update. She changed the picture back to normal as soon as she achieved it. Change Profile Picture was the second fastest after Activate Status and she received full points. Edit Username was the most problematic with 0 points and the longest time. That was mainly because no message showed the username was changed. She had already done it in 1 minute 51 seconds. However, at that time, she could not understand that she made it. That was also because of the username she chose to change.

Table 2

Facebook Tasks' Performance in Terms of Points, Time, Knowledge, and Steps

Function to Perform	Points	Time	Know-Howto Do	Total Number of Steps
Change Language	100	3 minutes 15 seconds	Yes	9
Change Profile Picture	100	47 seconds	Yes	5
Edit Username	0	4 minutes	No	4
Ignore Message	0	1 minute 29 seconds	No	4
Unignore Message	25	2 minutes	No	4
Activate Status	100	25 seconds	Yes	4

Normally (by default), the username is in the form of **name.surname.number**. However, she chose to make it in the form of **namesurname.number**. She could not understand it because of her lack of vision and message. Even for a sighted person, it might be difficult to do for the first time. She did not know about the operation so I told her how to do it. She was not familiar with either ignore or unignore messages. I had to explain step by step. The problem about ignore was mainly because she confused it with block operation. She also could not understand why that operation is used. She received 0 points although she gave up the earliest in the ones that she had not known. For unignore operation, she correctly guessed that it is about the people menu but 4 icons on the request made her confused. Unignore message is related to the ignore message so she could obtain 25 points in 2 minutes. Activate Status was the easiest for her because that was the one she knew before. Moreover, she said that she used it regularly. Activate Status is the one with the best performance in terms of time (25 seconds) and one of the best for points (100 points).

Chapter 5

Conclusion

In this study (also published by Uslu, A., & Sarisaray-Boluk, P. A Case Study About Facebook Usage for Visually Impaired Using The Android Platforms), we make a BVI usability analysis on FB on the Android platform. Six different FB functions are used to test the usability performance of BVI on this site. Our results show that the knowledge of the BVI about the task played a positive role in the task completion time. The best times are achieved when knowledge about that specific function is concomitant with the high frequency of usage in the past. When a function includes lots of controls like unignore messages, task completion time increases even if it may not be completed by BVI. If there is a similar function the participant remembered like in Language Settings, this might also be a problem. The most visible usability problem was the lack of a message in the edit username. A message like "Your username is changed" would make it much easier to understand. It would significantly reduce the time required to complete the task. In future work, we want to find more participants. Heuristic approaches may also be added to crosscheck the efficiency of the study.

REFERENCES

- Babu, R. (2014). Can blind people use social media effectively? A qualitative field study of Facebook usability. *American Journal of Information Systems*, 2(2), 33-41.
- Babu, R., & Singh, R. (2013). Accessibility and usability of social media: Convergence between blind users and design standards.
- Bennett, C. L., E, J., Mott, M. E., Cutrell, E., & Morris, M. R. (2018, April). How teens with visual impairments take, edit, and share photos on social media. In *Proceedings of the 2018 CHI conference on human factors in computing systems* (pp. 1-12).x
- Brady, E., Zhong, Y., Morris, M. R., Bigham, J. P. (2013, February) Investigating the appropriateness of Social Network Question Asking as a Resource for Blind Users. In *Proceedings of CSCW 2013* (pp. 1225-1236)
- Celusnak, B. M. (2016). Teaching the iPhone with voiceover accessibility to people with visual impairments. *Journal of Visual Impairment & Blindness*, 110(5), 369-372.
- Dale, O., Drivenes, T., Tollefsen, M. & Reinertsen, A. (2012, July) User Testing of Social Media-Methodological Considerations. In *Proceedings of The International Conference on Computers for Handicapped Persons. ICCHP 2012: Computers Helping with Special Needs* (pp. 573-580).
- Della Líbera, B., & Jurberg, C. (2017). Teenagers with visual impairment and new media: A world without barriers. *British Journal of Visual Impairment*, 35(3), 247-256.
- Duarte, C., Duarte, C. M., & Carriço, L. (2019, May). Combining Semantic Tools for Automatic Evaluation of Alternative Texts. In *Proceedings of the 16th International Web for All Conference* (pp. 1-4).
- Duarte, C., Pereira, L. S., Santos, A., Vicente, J., Rodrigues, A., Guerreiro, J., & Guerreiro, T. (2021, June). Nipping Inaccessibility in the Bud: Opportunities and Challenges of Accessible Media Content Authoring. In *13th ACM Web Science Conference 2021* (pp. 3-9).
- El-Gayyar, M., ElYamany, H. F., Gaber, T., Hassanien, A. E. (2013, November). Social Proceedings of the 2013 Federated Conference on Computer Science and Information Systems Systems pp. 1301–1307.
- Fuglerud, K. S., Tjøstheim, I., Gunnarsson, B. R., & Tollefsen, M. (2011). Participation in Social Media by The Visually Impaired Abstract.
- Fuglerud, K.S., Tjostheim, I., Gunnarsson, B.R., Tollefsen M. (2012, July). Use of Social Media by People with Visual Impairments: Usage Levels, Attitudes and Barriers. In *Proceeding of The International Conference on Computers for Handicapped Persons. ICCHP 2012: Computers Helping People with Special Needs* (pp. 565-572).
- Giraud, S., Colombi, T., Russo, A., Therouanne, P. (2011, September). Accessibility of Rich Internet Applications for Blind People: A Study to Identify the main problems and Solutions. CHItaly: Proceedings of the 9th ACM SIGCHI Italian

- Chapter International Conference on Computer-Human Interaction: Facing Complexity. (pp. 163-166)<https://doi.org/10.1145/2037296.2037335>
- Global social media ranking 2019. (n.d.). Retrieved June 19, 2019, from <https://www.statista.com/statistics/272014/globalsocial-networks-ranked-by-number-of-users/>
- Guerreiro, J., & Gonçalves, D. (2013). Blind people interacting with mobile social applications: open challenges. In *Mobile Accessibility Workshop at CHI* (Vol. 13).
- Hollier, S. (2012, March). Sociability: Social media for people with a disability. Australian Communications Consumer Action Network. Retrieved August 29, 2017.
- Kim, L. H., Boadi-Agyemang, A., Siu, A. F., & Tang, J. (2020, October). When to Add Human Narration to Photo-Sharing Social Media. In *The 22nd International ACM SIGACCESS Conference on Computers and Accessibility* (pp. 1-3).
- Leporini, B., Buzzi, M. C., & Buzzi, M. (2012, November). Interacting with mobile devices via VoiceOver: usability and accessibility issues. In *Proceedings of the 24th Australian Computer-Human Interaction Conference* (pp. 339-348).
- MacLeod, H., Bennett, C. L., Morris, M. R., & Cutrell, E. (2017, May). Understanding blind people's experiences with computer-generated captions of social media images. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (pp. 5988-5999).
- Mathur, R., & Brady, E. (2018, October). Mixed-ability collaboration for accessible photo sharing. In *Proceedings of the 20th International ACM SIGACCESS Conference on Computers and Accessibility* (pp. 370-372).
- Morris, M. R., Zolyomi, A., Yao, C., Bahram, S., Bigham, J. P., & Kane, S. K. (2016, May). "With most of it being pictures now, I rarely use it" Understanding Twitter's Evolving Accessibility to Blind Users. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (pp. 5506-5516).
- Mulder (2018). PANAS Scale. Retrieved August 5, 2022, from <https://www.toolshero.com/psychology/panas-scale/>
- Murphy, E., Kuber, R., McAllister, G., Stain, P., Yu W., (2008) An empirical investigation into the difficulties experienced by visually impaired Internet users, *Universal Access in the Information Society* 7, 79-91 (2008). <https://doi.org/10.1007/s10209-007-0098-4>
- Newton, C. (2016, April 5). *Facebook begins using artificial intelligence to describe photos to blind users*. The Verge. <https://www.theverge.com/2016/4/5/11364914/facebook-automatic-alt-tags-blind-visually-impaired>
- Nobre, C. N., Meireles, M. R. G., Silva, D. B. F. D., Faria, A. H., & Vieira, N. (2018). Emotionally Oriented Analysis of the Experiences of Visually Impaired People on Facebook. *ACM Transactions on Accessible Computing*, 11(3), 1–21. <https://doi.org/10.1145/3230739>
- Pereira, L. S., Coelho, J., Rodrigues, A., Guerreiro, J., Guerreiro, T., & Duarte, C.

- (2021). Barriers and Opportunities to Accessible Social Media Content Authoring. *arXiv preprint arXiv:2104.10968*.
- Qiu, S., Hu, J., & Rauterberg, M. (2015, February). Mobile social media for the blind: Preliminary observations. In *International Conference on Enabling Access for Persons with Visual Impairment* (pp. 152-156).
- Ramayah, B., Jaafar, A., & Yatim, N. F. M. (2013, November). Visually impaired user's navigation experiences in Facebook. In *International Visual Informatics Conference. IVIC 2013: Advances in Visual Impairment* (pp. 788-796).
- Ramayah, B., Jaafar, A., & Yatim, N. M. (2012). Accessibility issues of social networking sites to blind users in Malaysia. In *Visual Informatics International Seminar 2012 (VIIS'12)*.
- Rodrigues, A., Montague, K., Nicolau, H., & Guerreiro, T. (2015, October). Getting smartphones to talkback: Understanding the smartphone adoption process of blind users. In *Proceedings of the 17th international ACM SIGACCESS conference on computers & accessibility* (pp. 23-32).
- Smaradottir, B., Håland, J., & Martinez, S. (2017). Accessibility of Mobile Devices for Visually Impaired Users: An Evaluation of the Screen-Reader Voice Over. *Studies in health technology and informatics*, 245, 1381-1381.
- Stangl, A., Morris, M. R., & Gurari, D. (2020, April). " Person, Shoes, Tree. Is the Person Naked?" What People with Vision Impairments Want in Image Descriptions. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (pp. 1-13).
- Tjosthalm, I., Solheim, I., Fuglerud, K. S. (2011, June). The Importance of Peers for Visually Impaired Users of Social Media. *Proceedings of the 6th IASTED International Conference on Human-Computer Interaction, HCI 2011*. 10.2316/P.2011.747-015.
- Tollefsen, M., Dale, Ø., Berg, M., & Nordby, R. (2011). Connected! A paper about the disabled and the use of social media.
- Uslu, A., & Sarisaray-Boluk, P. A. (2020, July) Case Study About Facebook Usage for Visually Impaired Using The Android Platforms. In *Proceedings of the IADIS International Conference Interfaces and Human-Computer Interaction 2020* (pp. 192-196).
- Vashistha, A., Cutrell, E., Dell, N., & Anderson, R. (2015, October). Social media platforms for low-income blind people in India. In *Proceedings of the 17th International ACM SIGACCESS conference on computers & accessibility* (pp. 259-272).
- Voykinska, V., Azenkot, S., Wu, S., & Leshed, G. (2016, February). How blind people interact with visual content on social networking services. In *Proceedings of the 19th ACM conference on computer-supported cooperative work & social computing* (pp. 1584-1595).
- Wentz, B., & Lazar, J. (2011). Are separate interfaces inherently unequal? An evaluation with blind users of the usability of two interfaces for a social networking platform. In *Proceedings of the 2011 iConference* (pp. 91-97).

- Wu, S., & Adamic, L. A. (2014, April). Visually impaired users on an online social network. In *Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 3133-3142).
- Wu, S., Wieland, J., Farivar, O., & Schiller, J. (2017, February). Automatic alt-text: Computer-generated image descriptions for blind users on a social network service. In *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing* (pp. 1180-1192).

