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Social Networks Website Accessibility for People with Visual Disability: An Experi- mental Study

إمكانية وصول الأشخاص ذوي الإعاقات البصرية للشبكات الاجتماعية: دراسة تجريبية

Abstract

Social networks' accessibility is vital for full participation in the society; especially for people with disability. Accordingly, the purpose of this study is to investigate how is Facebook accessible to people with visual disability and the impact of enhancing Facebook accessibility on their usage. In order to understand the research problem, an experimental method was utilised, where fifty pretest questionnaires were distributed over visually impaired respondents to select suitable candidates for the experiment. Fifteen respondents were found to be experts in using computers, Internet, social networks, and assistive technologies, and have completed the experiment on Facebook to identify accessibility problems. After that, a post-test questionnaire was conducted to investigate the impact of enhancing Facebook accessibility on the usage of people with visual disability.

The research results show that some features of the Facebook website are inaccessible for people with visual disability, while other features are semiaccessible. The research concludes that people with visual disability have received insignificant attention regarding these problems. Finally, the research suggests a list of recommendations for Facebook in order to be more accessible. To sum up, this paper is one of few studies that brings the topic of web accessibility by disabled people into the era where social networks is the way out of the digital divide. This makes it a thorough investigation that helps social networks make better informed decisions. Hence, the originality of this article lies in its focus on accessible social networks.

Keywords Web Accessibility, Visual disability, Social Networks, Facebook, Assistive Technologies.

Paper type Research paper.

ملخص البحث

إمكانية الوصول إلى الشبكات الاجتماعية أمر حيوي للمشاركة الكاملة في المجتمع؛ وخاصة بالنسبة للأشخاص ذوي الإعاقات. وبالتالي، فإن الغرض من هذه الدراسة هو التحقيق في كيفية إتاحة وصول الأشخاص ذوي الإعاقات البصرية لموقع الفيسبوك وأثر تعزيز إمكانية الوصول للفيسبوك على استخدام ذوي الإعاقات البصرية للموقع. من أجل فهم مشكلة البحث، تم استخدام طريقة تجريبية، حيث تم توزيع خمسين استبانة على المستجيبين ذوي الإعاقات البصرية قبل الاختبار لاختيار المرشحين المناسبين للتجربة. وقد وجد أن خمسة عشر مشاركا هم خبراء في استخدام الحواسيب والإنترنت والشبكات الاجتماعية والتكنولوجيات المساعدة، وأنجزوا التجربة في الفيسبوك للتعرف على مشاكل إمكانية الوصول. وبعد ذلك، أجري استبيان ما بعد الاختبار للتحقيق في أثر تعزيز إمكانية الوصول إلى موقع فاسيبوك على استخدام الأشخاص ذوي الإعاقات البصرية. أظهرت نتائج البحث أن بعض ميزات موقع فيسبوك لا يمكن الوصول إليها للأشخاص ذوي الإعاقات البصرية، في حين أن الميزات الأخرى شبه قابلة للوصول. وقد أثبت البحث أن الأشخاص ذوي الإعاقات البصرية لم يحظوا باهتمام كبير فيما يتعلق بهذه المشاكل. وأخيرا، يشير البحث إلى قائمة من التوصيات للفيسبوك من أجل أن تكون أكثر سهولة. هذه الورقة هي واحدة من عدد قليل من الدراسات التي تتطرق إلى موضوع إمكانية الوصول إلى الإنترنت من قبل المعوقين في العصر الذي تعتبر فيه الشبكات الاجتماعية هي السبيل للخروج من الفجوة الرقمية. وهذا ما يجعل البحث تحقيقا شاملا يساعد الشبكات الاجتماعية على اتخاذ قرارات مستنيرة. وبالتالي، فإن أصالة هذه المادة تكمن في تركيزها على الشبكات الاجتماعية التي يمكن الوصول إليها.

1. Introduction

The ability to access and use the Internet is becoming increasingly important for full participation in the society (Lorca et al, 2016); especially for people with disabilities. The term “digital divide” is used to describe the gap between those who do and do not have access to information and communications technology. Social networks websites play an important role in many people's lives; as they use these social networks to communicate with each other, and to share and exchange information. There is a variety of popular social networks; some of which are: Facebook, Twitter and YouTube. The role of social networks in the Arab countries is not only limited in socializing and entertainment, but rather extends to include a wide variety of uses that range from national engagement and political participation to business entrepreneurial efforts and social change (Arab Social Media, 2017).

According to Internet Live Stats (2016), there are over three billion and four hundred million Internet users. Egypt is an important country in the region, due to its strategic location, and notably high population, reaching over 87 million (according to the Egyptian Central Agency for Public Mobilization and Statistics) on August 2015. In March, 2017, Facebook reported that it has around 1.94 billion monthly active users, with 156 million users in Arab countries, 23% of which are in Egypt. Twitter on the other hand, has around 313 million monthly active users, with 11.1 million users in Arab countries, and 1.7 million active users in Egypt (Arab Social Media, 2017).

There are many Internet attempts to maintain equality and improved independence. However, a great number of websites still mainly target the majority of users, with little concern about those with a visual disability (Wild, 2016), and Egyptian people with visual disability in particular have received negligible attention regarding this matter. This creates a desperate need to address this issue in Egypt. Therefore, the main aim of the research is to identify Facebook accessibility barriers that face Egyptian people with visual disability while surfing the website, and examine the impact of enhancing Facebook accessibility on the usage of people with visual disability in the Egyptian context. The overall aim of this study can be achieved by answering the research questions: How is Facebook accessible to Egyptian people with visual disability? And what is the impact of enhancing Facebook accessibility on the usage of Egyptian people with visual disability?

Accordingly, the following sections explore literature review on visual disability in general and web accessibility for people with visual ability in particular. After that, previous work related to worldwide accessibility guide lines, assistive technologies, and social networks applications is illustrated. Then, the research methodology used in the current study will be demonstrated with elaboration on population and sampling, questionnaire design, research framework, accessibility testing with experiment design, procedures and participants. The questionnaire results are then shown, followed by the research discussion, conclusion, recommendation and future work consecutively.

2. Literature Review

The World Health Organization (WHO) has classified disability into three key definitions that are often used interchangeably but have different meanings: Impairment, Disability and Handicap. 'Impairment' refers to an abnormality in the anatomy, anatomical, physiological, or psychological function. On the other hand, 'Disability' refers to any limitation of an individual's ability to perform an activity in a normal manner. Finally, 'Handicap' refers to a shortcoming for a person due to an impairment or a disability that hinders him/her from fulfilling of a normal role on an equal level with a peer group due to physical and social barriers (Wood, 1980; DPI, 1982; Lang, 2007).

2.1 Visual Disability

Disabilities are divided into Mobility Impairment, Cognitive, Hearing, Speech, and Visual Impairment. Visual impairment refers to an impairment in vision that, even with correction, affects the educational performance. It ranges from low vision impairment to total blindness (Zitkus, et al., 2016). The International Classification of Diseases classifies four levels of visual functions which are: normal vision, moderate visual impairment, severe visual impairment, and blindness. People with moderate and severe visual impairment are classified as low vision people. The last classification is blindness, which is the focus of this research together with the perception of people with visual disability towards Facebook accessibility.

There are around 285 million people having a visual impairment worldwide; they can be divided into 39 million blind and 246 low vision people, with

around 90% living in low-income settings (WHO, 2016). They can be divided into: inability to see images clearly and distinctly, loss of visual field, inability to detect small changes in brightness, color blindness, and sensitivity to light (Ahmed, et al., 2017).

Due to the negligible attention paid to people with visual disability, there is no accurate or updated statistics of the number of people with visual disability in Egypt. According "Al-Ahram" newspaper (2013), the number of people with disabilities in Egypt is around 20 million. This can be divided into 6 million with mobility impairment, 6 million with intellectual disability, 4 million with hearing impairment and 4 million with visual disability. In Egypt there is lack of awareness about the visually disabled people and how to deal with them. Many parents of visually disabled people might deal with a low vision person as a blind person due to lack of awareness. Not to mention the lack of computer and internet related courses in schools that are especially tailored for people with visual disability (Marshall, et al. 2009).

2.2 Web Accessibility for People with Visual Disability

ISO 9241-171 defines accessibility as the usability of a product, service, environment or facility by people with the widest range of capabilities. According to W3C, web accessibility refers to disabled people's ability to perceive, interpret, browse, and interact, and contribute to the web (Freire, 2012). It does not only benefit people with disabilities, but rather all people including old ones and those who interact

with digital information via different devices (Petrie and Bevan, 2009). Web accessibility evaluation is an assessment of how well the web can be used by people with disabilities. There are different techniques that are used to evaluate the website accessibility. Methods aim to explore accessibility problems; such as guideline violations, failure modes, defects, or user performance and include: standards review, user testing, subjective assessments and screening techniques (Yesilada et al., 2015).

User testing is considered the most effective method that can be used to evaluate the web accessibility, but it requires access to a number of people with disabilities to represent different disability types (Dell et al, 2012). It also represents the different levels of experience in using browsers and assistive technologies (Aizpurua, 2016). After selecting the sample that will represent people with disability, they are required to perform given tasks while being observed and being asked to think aloud. The evaluator records the test and takes notes during the test based on the user comments (Pereira et al, 2015). Finally, these audio, video recordings and user comments are analyzed by the evaluator and the list of problems that the user faces during the test is generated. Many studies suggest using this method to make sure that the website is fully accessible (DRC, 2004; Vigo et al, 2013). Despite the drawbacks of this method such as its high cost, the availability and mobility of people with disability, and the need to predefine test scenarios need to be well predefined, yet it is considered very beneficial for its ability to accurately identify accessibility problems that are usually experienced by real users (Dell et al, 2012),

which is the main reason why this method was used in the underlying study.

2.3 Worldwide Accessibility Guidelines

Web accessibility is an umbrella term for the study of the adequacy of web technologies to users with special needs. This adequacy can be viewed from two perspectives; first, a strict perspective, where accessibility means the ability to access, and people with visual disability cannot understand the information in images. The second is a broader perspective, where the term represents how easily this type of users can interact with a web page. This perspective has been the main direction taken by the Web Accessibility Initiative (WAI).

In response to the rapid change of the web and due to the new technologies, W3C developed WCAG 2.0 as the second version of the W3C Web Content Accessibility Guidelines (Schmutz, 2016). It has four general principles of accessibility, 12 guidelines, 61 success criteria and still has the three priority levels that was implemented in WCAG 1.0. A summary of WCAG 2.0 guidelines are shown below in table 1 (Caldwell et al, 2008; Rømen and Svanæs, 2012). One of the major goals of WCAG 2.0 was to describe the requirements for Web content accessibility in a technology neutral language, so that it could be applicable to any W3C or non-W3C technology, such as CSS, SMIL, SVG, XML, PDF or Flash in addition to HTML and XHTML (Rømen and Svanæs, 2012). Another goal of developing these guidelines is to make its requirements accurately testable, to in-

sure the website conformance to the WCAG 2.0. So All WCAG 2.0 success criteria are testable. While some can be tested by computer programs, others

must be tested by qualified human testers. Sometimes, a combination of computer programs and qualified human testers may be used.

Table 1. Principles and Guidelines

Principle	Guidelines
1. Perceivable - Information and user interface components must be presentable to users in ways they can perceive	1.1 Text Alternatives: Provide text alternatives for any non-text content so that it can be changed into other forms people need, such as large print, braille, speech, symbols or simpler language.
	1.2 Time-based Media: Provide alternatives for time-based media
	1.3 Adaptable: Create content that can be presented in different ways (for example simpler layout) without losing information or
	1.4 Distinguishable: Make it easier for users to see and hear content including separating foreground from background
2. Operable - User interface components and navigation must be operable	2.1 Keyboard Accessible: Make all functionality available from a keyboard
	2.2 Enough Time: Provide users enough time to read and use content
	2.3 Seizures: Do not design content in a way that is known to cause seizures
	2.4 Navigable: Provide ways to help users navigate, find content and determine where they
3. Understandable - Information and the operation of user interface must be understandable	3.1 Readable: Make text content readable and understandable
	3.2 Predictable: Make Web pages appear and operate in predictable ways
	3.3 Input Assistance: Help users avoid and correct mistakes
4.:Robust - Content must be robust enough that it can be interpreted reliably by a wide variety of user agents, including assistive technologies	4.1 Compatible: Maximize compatibility with current and future user agents, including assistive technologies.

2.4 Assistive Technologies

People with visual disability are in need for a special hardware or software, assistive technologies, (Suwannawut, 2013; Goldrick et al 2014) that support people with disabilities to carry out daily activities including using computers and the web that they would otherwise find impossible or difficult to do. Examples of these technologies for people with visual disability include:

- A screen reader is a piece of software which interrogates the contents of the screen on a computer and turns the contents into a non-visual form. This can be presented in synthetic speech using speakers, or braille using braille displays devices, or both (Edwards and Launikonis, 2008).
- Refreshable braille displays are used to provide users with refreshable Braille output of what is shown on the screen (Chen et al., 2014). They consist of cells which each produce a touchable Braille symbol by using a piezoelectric drive to raise a number of small pins. Displays consist of lines of twenty, forty, or eighty cells; Modern Braille cells have eight dots and can therefore be used for computer as well as literary Braille (Vatavu, 2017).
- Optical characters recognition software (OCR) converts any scanned paper using desktop scanner into electronic document, and this converted file can be printed in Braille form (Vella et al, 2014). Unfortunately, most OCR software do not support recognition of the Arabic papers, except one software produced by Sakhr Company, which support the Arabic language but unfortunately its recognition accuracy is

very low. Examples of OCR software are Kurzweil 1000 and Read Iris (Popescu et al 2014).

- Talking internet browsers are technologies designed to speak web pages to people with visual disability or those who have difficulties in fast writing. Moreover, it can be used to give audio instructions to the computer. Example of this software is: Dragon NaturallySpeaking software (Hersh and Johnson, 2008; Vatavu, 2017).

3. Social Network Applications

People use social networks to support their existing offline connections with people that they already know, or create new online connections. Social networks provide a wonderful way to gather pictures and thoughts and then share them with people, either privately or publicly. Every social network website has its own features depending on the purpose of it (Mislove, 2009; Kelsey, 2010). In 2000 social media received a great boost with the witnessing of many social networking sites springing up. Those that were launched included Lunar Storm, six degrees, cyworld, ryze, and Wikipedia. In 2001, fotolog, sky blog and Friendster were launched, and in 2003, Myspace, LinkedIn, lastFM, tribe.net, Hi5, etc. In 2004, popular names like Facebook Harvard, Dogster and Mixi evolved. During 2005, big names like Yahoo! 360, YouTube, Cyword, and Black planet all emerged (Junco et al, 2011).

There are many social network applications. However, only the main and most popular social networks are Twitter, MySpace, YouTube, LinkedIn, So-

undCloud, and Facebook. Twitter was launched in 2006 as a mobile service; because its tweets must be not bigger than hundred and forty characters. According to the statistics shown on Twitter's website, it has 288 million monthly active users, and 500 million Tweets are sent daily with more than 33 languages (Twitter, 2015). On the other hand, Myspace found in 2003. To show artists and their work, the site gives people access to 53 million tracks and videos. In 2006, Myspace became the most popular social networking website in the United States, but was overtaken in 2008 by its competitor Facebook that internationally became the most popular social networking site worldwide (Hamdi and Abd El Aziz, 2016). Approximately 43.2 million users visit Myspace on a monthly basis. Myspace also has a special profile for musical artists where they can download their entire music into mp3 songs (Natta, 2010; Myspace, 2016).

YouTube was found in November 2005, is considered the world's most popular online video community. In November 2006, the website was acquired by Google. In 2015, it was recorded to have more than one billion users. Also 300 hours of video are uploaded to YouTube every minute. Moreover, YouTube is localized in 75 countries and available in 61 languages. Half of YouTube views are on mobile devices. Over 6 billion hours of video are watched monthly on YouTube (YouTube, 2016). LinkedIn is the world's largest professional network that was found in 2003. According to Alexa rankings, it occupies the sixth rank in the United States with more than 347 million registered members from around the globe and their number is con-

stantly growing (Alexa, 2015). LinkedIn has more than 6,800 full-time employees with offices in 30 cities around the world. All of the Fortune 500 businesses are members at LinkedIn.com. The site is available in 200 countries in 24 languages, and has around 48 million monthly visits globally (LinkedIn, 2016). Furthermore, SoundCloud is a social sound platform that was launched in 2008 allowing users to audio connect with each other and share their sounds to Twitter, Tumblr, Facebook and Four-square. SoundCloud can be accessed anywhere using the official iPhone and Android apps. By January 2012, SoundCloud.com reached 10 million registered users with an increase of over seven million users since January 2011 (SoundCloud, 2016).

Facebook is a social networking website launched in February 2004. According to the website statistics, it has 1.28 billion daily active users on average for March 2017, and 1.94 billion monthly active users as of March, 2017. Furthermore, it has 1.03 billion mobile daily active users on average for July 2016, and 1.13 billion mobile monthly active users as of July, 2016. These statistics show that approximately 83.5% of daily active users are outside the US and Canada (Facebook, 2017). Facebook is used to connect friends through exchanging of messages, sharing links and videos, uploading and tagging of photos and sharing statuses updates. The basic features of Facebook is the user's homepage; where he can monitor the "news feed" of his friends or his liked "pages" and "gro-ups", and the user's profile page; where he has his own "Timeline", can post his status updates and actions and where he can also interact with his friends through

public messages. Facebook is considered the second top ranked website after the Google website. And it is also the first ranked website in Egypt, according to the Alexa traffic rankings (Alexa, 2017).

The total number of Facebook users in the Arab world at the beginning of March 2017 was 156 million. Also by March 2017 the country average for Facebook penetration in the Arab region was over 39% (Arab Social Media Report, 2017). Internet users in Egypt have reached 29 million users at the beginning of March 2017. Egypt continues to constitute about a quarter of all Facebook users in the Arab region (23%) and has gained the highest number of new Facebook users since January 2014, with an increase of over 2.6 million users in that time period. According to a report by the Digital Marketing Academy, Egypt is the second Arab country in terms of activity on social networks (Egyptian Ministry of Communications and Information Technology, 2017).

4. Research Methodology

The survey research is concerned with sampling, questionnaire design, and data analysis (Abd El Aziz, 2012). The purpose of an experiment is to study causal links; whether a change in one independent variable produces a change in another dependent variable (Creswell, 2012, Saunders et al, 2009). This research seeks to investigate the accessibility problems that face people with visual disabilities when using the "Facebook". In the first stage it uses the survey strategy to collect information about the participants. In the second stage an experiment is conducted to

detect the accessibility problems of the "Facebook" and participants' perception towards these problems.

Questionnaires are relatively quick and easy to create, code and interpret, and it allows reaching a wide range of respondents quickly, easily and effectively. It is also easy to standardize. Think aloud (verbal) protocol, is used to get access to what is going on in participants' heads while performing assigned test tasks (Cotton and Gresty, 2006). This method can be used during or after the test. During the test, participants reveal important hints about how they think about the system (Rubin and Chisnell, 2008). It enables understanding why a problem exists and how someone tries to work around it. Another think aloud method is done after the test session ends by replaying the recorded test session and ask respondents to explain their problems

Therefore, before undertaking the test, the evaluator asked participants to say anything that crosses their mind during the test session, and explain any problem that they face when performing a specific task. The test evaluator can pause the test session and discuss this problem with the participant to avoid calculating the time spent in the discussion as part of the task completion time. After that, the evaluator takes notes of this comments and problems for each task to analyze it. In an experiment the investigator measures the effects of an experiment which he conducts intentionally.

Several studies stated that experiments in web accessibility testing are the most successful methods to detect accessibility problems, but they argue

that they are expensive and time consuming (Brajnik, et al., 2010; Brajnik and Giachin, 2014; Pereira et al, 2015). The user testing employs techniques to collect data while observing representative end users and giving them realistic tasks to do (Rubin and Chisnell, 2008). Accordingly, in the underlying study, questionnaires were used to collect data about the participants, followed by another one to evaluate the accessibility of the “Facebook” website. Finally, in this research the think aloud method was also used to let users state what they would like to say about the test tasks and the “Facebook” website, where the observer recorded these comments and analysed them.

4.1 Population and Sampling

The researcher must select the appropriate sampling technique. In many experiments, only a convenience sample is possible because the researcher must use naturally formed groups (e.g., a classroom, an organization) or volunteers (Sekaran, 2010). Thus, the most suitable technique for the current study is the convenience sampling, which involves selecting individuals or groups that happen to be available and are willing to participate at the time.

Since it is very difficult to obtain a large representative user sample in accessibility researches (Jay et al, 2008), when evaluating website accessibility by people with visual disability, a small sample size can be used to represent the entire population because they have common strategies, needs and expectations (Petrie and Bevan, 2009), and this sample can be generalized to subgroup of the population. Accordingly, and due to the limitations and availability of

people with visual disability, a small pretest questionnaire is distributed to 50 people with visual disability electronically or as a hard copy. The questionnaire questions ask respondents to rate their experience and usage of computers, screen readers, internet and “Facebook” website. After this questionnaire results were statistically analysed, 15 candidates were selected to undertake the experiment according to their experience and usage of the previously stated technologies.

4.2 Questionnaire Design

In the underlying study a **Pre-test questionnaire** form is designed to evaluate the user experience and select them before undertaking the accessibility test, this questionnaire consist of 2 sections, the first section consists of 4 questions that request the user to rate his experience and usage towards the computers, screen readers, Internet and “Facebook”, in order to identify the user’s experience to select the appropriate participants who undertake the test. The second section consists of 4 questions to know the demographic information of the user which are: (gender, age, education and occupation). Another small **Post-test questionnaire** was distributed to the participants who took the test to check their satisfaction with the test. It also inquires on the Facebook usage, and whether it has become more accessible and they would use it straight away, within a year, after getting a positive feedback, or not use it at all. It also inquires on the their level of understanding of the experiment tasks, in addition to the demographic information Gender, Age, Education, Occupation)

Experimental Variables

The test conducted on this study contains a set of tasks that are considered as a basic tasks that every basic user can do it every day smoothly, the test consist of 15 tasks according to the user preference he can choose between 3 options to read these tasks:

1. Using printed braille paper
2. Through word document file
3. Make the evaluator read the tasks one by one to the user

In this research seven variables are selected to measure the accessibility of the "Facebook", five of them are adopted from the web content accessibility guidelines. Additionally Effectiveness and Efficiency variables are adopted to test their effect on website accessibility.

These variables are shown below as follows:

1. **Image text alternatives ("alt text") (task 6):** Convey the purpose of an image, including pictures, illustrations, charts, etc to people who cannot see the image. (The text should be functional and provide an equivalent user experience, not necessarily describe the image. (For example, appropriate text alternative for a search button  would be "search", not "magnifying glass").
2. **Headings (task 9, 15):** Web pages often have sections of information separated by visual headings, for example, heading text is bigger and bold (like "Headings" right above this sentence :-). To make this work for everyone, the headings need to be marked up. That way people can navigate to the headings—including people who cannot use a mouse and use only the keyboard, and people who use a screen reader.
3. **Keyboard Access and Visual Focus (all tasks):** Many people cannot use a mouse and rely on the keyboard or assistive technologies to interact with the web. Keyboard focus should be visible and should follow a logical order through the page elements. Visible keyboard focus could be a border or highlight, as shown below, that moves as you tab through the web page.
4. **Forms, labels, and errors (task: 1, 2, 5, and 9):** Labels, keyboard access, clear instructions, and effective error handling are important for forms accessibility .Form fields and other form controls usually have visible labels, such as "E-mail Address:" as the label for a text field. When these labels are marked up correctly, people can interact with them using only the keyboard, using voice input, and using screen readers. Also, the label itself becomes clickable, which enables a person who has difficulty clicking on small radio buttons or checkboxes to click anywhere on the label text.
5. **Multimedia (video, audio) alternatives (task 12):** Follow the steps above for keyboard access to ensure that the media player controls are labeled and keyboard accessible.
6. **Effectiveness:** It is defined as the accuracy and completeness with which users achieve specified goals, this variable is measured through checking if the user completed the task or not and if he complete it from the first trial or making more than one trial to complete it.

7. **Efficiency:** It is defined as the resources expended in relation to the accuracy and completeness with which users achieve those goals, this variable is measured through calculating the time that user spend to

complete each task, this time is calculated from he was given the task until he complete it or saying that he cannot complete the task.

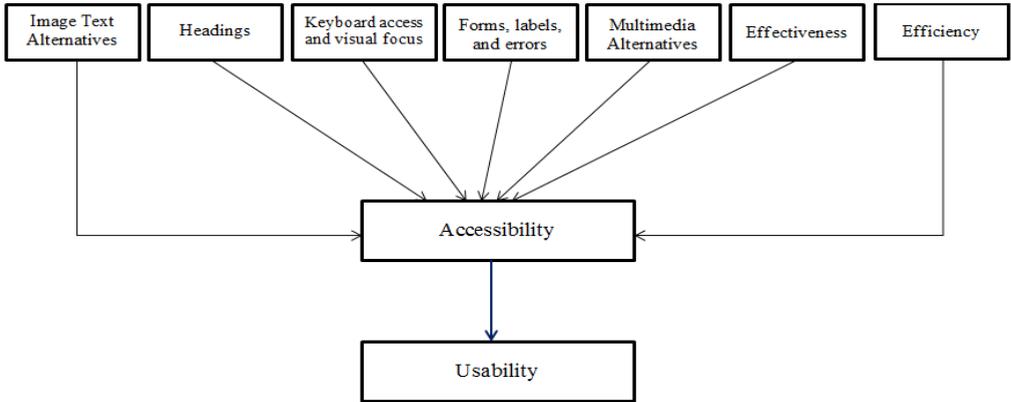


Figure 1. Research Framework

4.3 Research Framework

The above proposed theoretical framework shown in Figure 1 is mainly based on the web accessibility initiative that introduces the Easy Checks attempt. The framework adopts 5 variables of the Easy Checks list that affect the website accessibility. Literature review also shows that Effectiveness and Efficiency are two main variables that affect website accessibility, and are accordingly adopted in the research framework. The framework also shows that website accessibility affects website usability as reviewed in literature.

4.4 Accessibility Testing

There are different methods for evaluating the accessibility, which can be divided into 2 categories based on who

would evaluate the accessibility. **These categories are:**

- a. Automatic Evaluation: such as Achecker, WAVE2, bobby, SortSite and Total Validator tools could be used to automatically evaluate the accessibility of any web page and its conformance to selected guidelines such as “WCAG 1.0”, “WCAG 2.0” and “section 508”; (Abascal et al, 2004; Fernandes et al, 2013; Vigo et al, 2013).
- b. Manual Inspection: this require a human to evaluate the page accessibility. This method uses different techniques such as: (conformance reviews, screening techniques, subjective assessments, barrier walkthrough and user testing) (Raufi et al, 2015).

The researcher can use the automatic tools or involve humans on the accessibility evaluation process or make a mix between both; which is called semi-automatic evaluation. Some of these methods are adapted from the usability evaluation methods while others are specifically used to evaluate accessibility (Brajnik et al., 2010). To evaluate any website for accessibility, different methods could be used to do so but most evaluators use the automatic testing methods; due to time constraints and in order to achieve reliable results. People with visual disabilities have difficulties to move to the testing place in addition to the lack of the availability of visually disabled people to test the website, but user testing method is more efficient and reliable for detecting the accessibility barriers on a website because in this method the user try to explore the hole website and detect the barriers that they might face while using it (Pereira et al, 2015). For this reason the research at hand uses the user testing method to check the accessibility problems that face people with visual disability while using the “Facebook” website. An experiment is conducted with people with visual disability to detect the accessibility problems using the user testing method.

4.4.1 Experiment Design

The nature of the experiment is designed based on a set of basic tasks that every participant can do frequently. These tasks measure the accessibility of “Facebook” and its conformance to the “WCAG 2.0” guidelines. The experiment is executed through observing participants at any place they choose taking into consideration conducting the experiment in a suitable environment to

let them concentrate on the given tasks. The evaluator conducts the experiment by observing one participant at a time, then repeating the same experiment with the rest of participants and discuss any problems that participants face when performing the tasks using the think aloud verbal method.

This type of connection is preferred to people with visual disability to let them be willing to and comfortable with carrying out the experiment. The participants are allowed to do the task in an opened time and to pause the experiment and resume at any time. Before they start the experiment, participants are asked to customize the screen reader settings according to their preference, and to use the web browser they prefer.

Hardware and software used in the experiment: the test is executed using laptop PC running Microsoft windows 8 professional operating system. The laptop specifications are Intel core I5, processor at 2.5 gigahertz speed with 4 gigabyte ram. An external keyboard was connected to avoid the difference in the order of keys on some laptop brands. It was also equipped with headphones to allow users to listen to the screen reader clearly and to avoid any disturbance.

Installed software: Microsoft internet explorer version 10.00.9200-.16384. Firefox version 28.0 and Google chrome version 25.0; Internet browsers to allow users choose their preferred browser and also to compare the accessibility problems that occurs on each browser. “Jaws for windows version 16.0” screen reader. Finally, a screen recording application called “BB FlashBack Pro Recorder version 4” was

installed to record the speech of the screen reader in addition to recording what is displayed on the screen.

4.5 Experiment Procedures

Every participant from the selected 15 participants is invited to do the test according to his preferred time and place the researcher tried as soon as possible to make the place comfortable to the participant and tried to make it as a controlled laboratory environment. Before starting the test the evaluator tells the user about the reason for this test also he inform the user that no personal information are collected during this test in addition to the places of the devices that are around him and he will use to let him feel independent and comfortable, these devices are the (laptop, external keyboard, braille paper that contains the tasks list and headphones). The test consists of 15 tasks given to users in an organized form, with tasks done in the same pages ordered to let the participant do them smoothly, as shown below:

1. Sign up for a new “Facebook” account by visiting the website to fill the sign up form and log-out from this account. Participants can fill the form by using the screen reader shortcut to go quickly to the beginning of the form, search for a heading titled “sign up” or scan the whole page to find the beginning of the form.
2. Log-in again by entering the credentials of the account he just created using the login form.
3. Add 2 friends to participant’s account by going to the search box. He can go to the search box by browse the edit boxes on the page using the shortcut provided by screen reader “e” or the shortcut provided by “Facebook” to go directly to the search box “alt+”. After reaching the search box, the participant type the e-mail address then browse the results using up or down arrow keys, then select the required result by pressing “enter” key and add them.
4. Press on the “messages” button menu or the link called “messages” on the site navigation par to open inbox then open a received message and post it to his wall either by copying it or search for button that share it directly.
5. Use his Facebook account to send external e-mail to “msn” e-mail account by pressing on “compose a new message” button in the same “messages” page and fill the form and press on the “send” button to send the e-mail.
6. Create a new album and add specified picture either by opening the photos page or press on “add photo/video” button that is available in the home page and select “create new album”.
7. Change the privacy of the uploaded photo by pressing on the “privacy” button menu that is located beside the photo to select the required privacy settings.
8. Search for a specified “Facebook page” by going to the “search” edit box that is available in the site navigation as described in task number 3, then write the name in the search box and browse the results then when he found it he like it by pressing on “like” button.
9. Create a “Facebook” group by going to home page and browse for a heading called “groups” then navigate down until he finds a link called “create group”. He is then required to

- click it or retrieve a list of all page links using the shortcut provided by screen reader “insert + f7” and fill the form to create the group, and finally click on “create” button to apply creating the group.
10. Invite friends to the created group via the create group dialogue box or from the group page.
 11. Go to the timeline of his friend “Ahmed Hassan” either by searching using the search box or by browsing his friend list and choose him and click enter on the link. Then, browse for edit box called “write something” using the screen reader function that list all edit boxes on the page or press the shortcut “e” to browse all edit boxes then write the post and navigate using the “tab” key until reaching the “post or share” button.
 12. In the same page, browse the posts of this friend using the “h” key to navigate through headings then he found the link to a video to play it, he press on it then scan the page for button called “pause” or “play” using the “b” key, this is a screen reader shortcut, and use the shortcuts provided by flash player to control the video.
 13. Press on the “like” button located below the link of the video then navigate down using the “down arrow” key to find the “write a comment” edit box to write the requested comment and publish it.
 14. Chat with his friend “Ahmed Hassan” by browse the page for a button called “chat” and press on it then navigate using the arrow keys to find the required friend name and press enter then the focus of the screen reader cursor changed to the edit box that the user can type the message and then press “enter” to send.
 15. Go to the Facebook homepage either by using the Facebook shortcut “alt + 1” or browse the headings using screen reader shortcut “h” to find the :home” heading and press on it then search for “what’s on your mind” edit box using the previously described methods then type the required text as a new status and post it after posting it he required to go to the heading contains his post then navigate using “up arrow” key to find “option for this story” button menu to press on it and choose “delete this post” option then press on the confirmation button to delete the post.

Finally the evaluator saves the recorded file and thanks the user for his collaboration and effort. After completing all the required tests the evaluator start to enter the quantitated data into the excel sheets to export it to the statistical software in order to generate results.

4.5.1 The Participants

In this study, 50 pretest questionnaires were distributed to evaluate the users experience and their level of knowledge of using computers, the internet and specially “Facebook” website, and the frequency at which they use these technologies. After reviewing the results, 16 visually disabled participants were selected to undertake the experiment according to their ratings in the previously stated technologies. This considerably small sample of participants were tested due to limitations such as: time consumed to conduct the

experiments, availability of the users, and the fact that most people with visual disability in Alexandria, Egypt do not actually use a desktop interface for “Facebook” website.

According to the scope of the study, participants selected were familiar with computers and assistive technologies. Also, they are familiar with “Facebook” website, its desktop interface and they use it frequently. Finally, 1 user refused to complete the test, so the total participants that are included in the analysis of this research experiment are 15 participants divided into 9 males and 6 females, their age ranges from 20 to 30 years old, 8 of which are in a post graduate studies and the remaining 7 are university graduates. Finally, all participants are employees either as a customer service representatives or teachers.

4.6 Questionnaire Results

The user questionnaires are divided into two parts; the first part was distributed before the experiment to ask the participants about their knowledge on computers, assistive technologies,

their usage of the Internet and their usage of “Facebook” social network in order to help the researcher select the appropriate participants before they undergo the experiment. The second part is distributed to participants who undertook the experiment to know their demographic information, their perception towards “Facebook” social network if it became more accessible, and their satisfaction toward the experiment.

Table 2 below shows the percentages of participants’ usage of computers, screen readers, internet and “Facebook”. Four participants were excluded because they never used computers. According to the analysis 10% of respondents rated their internet usage as good, and 18% rated their “Facebook” usage as good. This shows that some respondents use the internet for opening “Facebook” website only. 8% and 10% of participants never used computers and screen readers respectively, revealing that 2% of respondents use an assistive technology to use computers such as screen magnifier.

Table 2 Pre-test Questionnaire Results

Statement	Never Done	Fair	Average	Good	Expert
Using Computers	8% (4 users)	10% (5 users)	12% (6 users)	30% (15users)	40% (20 users)
Using screen readers	10% (5 users)	16% (8 users)	16% (8 users)	20% (10 users)	38% (19users)
Browsing the Internet	14% (7 users)	24% (12 users)	20% (10 users)	10% (5 users)	32% (16users)
Accessing a social network	16% (8 users)	22% (11 users)	12% (6 users)	18% (9 users)	32% (16 users)

Demographic results:

Gender: 58% (29 users) are females and 42% (21 users) are males. **Age:** 70% (35 users) ranges from 20 to 30 years old, 20% (10 users) ranges from 30 to 40, 8% (4 users) ranges from 40 to 50 years old and 2% (1 user) ranges from 50 to 60, 0% (0 users) for both below 20 and above 60. **Education:** 74% (37 users) are college graduates, 26% (13 users) are enrolled in post graduate studies and 0% (0 users) for both no qualification and undergraduate.

According to the main goal of this questionnaire; which is selecting an expert user of computers, screen readers, Internet and “Facebook”, 32% of the participants’ (16 users) were rated as experts towards the previously stated 4 technologies. These participants were selected to undertake the research experiment, but 1 participant was excluded from the analysis as she refused to continue the experiment after performing the first 2 tasks, she declared she was no longer willing to continue the experiment and cannot perform tasks.

4.6.1 Analysis of the Experiment

After all the tests were conducted, the evaluator started to analyze every test first by playing the recorded video, and then extracting its related data to Microsoft excel sheet using coding system to quantify the test results. The excel sheet was then exported to a statistical software (IBM SPSS Statistics version 22.0) for analysis. The evaluator also recorded the time taken by each user to perform every task. The time

was then converted into numbers as the software did not understand the time form. The coding system used for the accessibility level of tasks is divided into 3 levels:

1. The task is accessible if the participant completes it from the first trial
2. The task is semi-accessible if the participant completes it after doing more than 1 trial
3. The task is inaccessible if the participant cannot complete the task or complete it in a wrong way

Participants’ comments during the test were documented and statistically analyzed. So a mixed method approach is used to analyze the tasks, where some variables are quantitative (such as: task completion time, number of participants who completed the task, and number of trials that user took to complete the task), and others are qualitative (such as: participants’ comments and website content). The experiment tasks measure the accessibility of the website and its conformance with “WCAG 2.0” easy checks. These 3 levels of accessibility measure the effectiveness of tasks; as shown in the results:

- The most accessible task in the test is task number 13 with 100% completion from the first trial so the most easy and accessible task for people with visual disability was to like and comment on any post,
- 86.6% of the participants have also completed tasks number 2, 11 and 14, which means that visually disabled users can login to Facebook, write posts and chat with their friends with few problems.
- The chatting task was reported to cause problems when the feature

was used in a page that always updated with new news feeds.

- On the other hand, the most inaccessible tasks were task number 5 and number 12 with a result of 100% either not completed or wrong completion, which means that the send an e-mail to an external e-mail address feature and controlling any video on the Facebook are not accessible to people with visual disability as it cannot be controlled through the keyboard
- A percentage of 93.3% of the participants could not complete task number 15 which means that deleting any published post on “Facebook” isn’t accessible through keyboard either.
- Moreover, task number 6 was considered as the most semi-accessible task with a percentage of 93.3% completion after performing more than 1 trial, which means that the task can be performed but is associated with many accessibility problems the users face in order to complete it such as the

default uploader of the photos which is not accessible.

- Task number 3 was also considered as semi-accessible with 53.3% percentage of completion after performing more than 1 trial and 6.7% not completed, this means that the users have some difficulties when searching for a friend to add to their friend lists,
- This problem also appeared when searching for a “Facebook page” on task number 8 with 60% completion after more than 1 trial and 20% not completed the* task.

Table 3 describes the number of tasks that was completed per each of the 15 participants after reviewing the efficiency of each task. The table shows that 0 participants could perform all the test tasks correctly, only a maximum of 12 out of 15 tasks (80%) were correctly performed by participants which means that the website is not fully accessible to any of the participants.

Table 3. Number of Completed Tasks by every user

User	Number of completed tasks
1	10/15
2	9/15
3	11/15
4	10/15
5	10/15
6	10/15
7	12/15
8	11/15
9	9/15
10	10/15
11	11/15
12	12/15
13	11/15
14	11/15
15	10/15

Table 4 describes the task completion rate for the experiment. The average time of an experiment is 0 hours, 45 minutes and 18 seconds, the maximum time that an experiment took is 1 hour 36 minutes and 35 seconds, while the minimum time was 0 hours, 30 minutes and 9 seconds.

Table 4. Task Completion rate

	N		Mean	Median	Mode	Std. Deviation	Skewness	Std. Error of Skewness	Minimum	Maximum	Percentiles		
	Valid	Missing									25	50	75
task 1 time	15	0	13.9167	13.2500	16.75	7.43794	1.167	.580	5.41	32.20	7.8600	13.2500	16.7500
task 2 time	15	0	.9547	.9300	.93	.21738	.825	.580	.65	1.41	.7900	.9300	1.0500
task 3 time	15	0	4.4287	3.8800	1.85 ^a	2.32347	.737	.580	1.85	9.10	2.4000	3.8800	5.7500
task 4 time	15	0	2.9720	2.7500	3.35	1.39313	.892	.580	1.57	6.00	1.7000	2.7500	3.7500
task 5 time	15	0	2.3160	2.0000	.50 ^a	1.52456	1.125	.580	.50	5.75	1.2000	2.0000	3.2000
task 6 time	15	0	5.9913	5.5700	1.35 ^a	3.94043	.910	.580	1.35	14.80	2.7000	5.5700	7.6000
task 7 time	15	0	2.1187	2.0600	2.03 ^a	1.11124	.821	.580	.56	4.75	1.2000	2.0600	3.1200
task 8 time	15	0	3.0920	1.8500	1.20 ^a	3.39491	2.205	.580	.80	11.30	1.2300	1.8500	3.0300
task 9 time	15	0	2.4613	2.2000	1.03 ^a	1.38442	1.289	.580	1.03	5.58	1.3500	2.2000	2.6800
task 10 time	15	0	1.8867	1.6800	1.00 ^a	1.06980	.568	.580	.75	4.03	.8700	1.6800	2.7100
task 11 time	15	0	1.4460	1.1000	1.00	.76154	1.524	.580	.85	3.25	.9600	1.1000	1.7500
task 12 time	15	0	1.5380	1.2000	3.06	.77973	.999	.580	.58	3.06	1.0200	1.2000	1.8600
task 13 time	15	0	.7560	.7800	.50 ^a	.19372	.506	.580	.50	1.21	.5300	.7800	.8600
task 14 time	15	0	.8667	.8300	.35 ^a	.36703	.845	.580	.35	1.75	.6800	.8300	1.0500
task 15 time	15	0	2.0607	1.9100	1.86	.73370	.043	.580	.86	3.25	1.6800	1.9100	2.6800

The task that took the maximum time was task 1 with 32 minutes, the minimum time was 5 minutes and an average of 13 minutes, followed by task 6 with maximum of 14 minutes and 47 seconds, minimum time of 1 minute and 32 seconds, and an average time of 6 minutes. Finally task 3 had a maximum time of 9 minutes, a minimum of 2 minutes, and an average of 4 minutes and 30 seconds.

- The most effective and easy task was task 13 with a maximum time of 1 minute and 13 seconds, minimum of 0 minutes and 30 seconds, and an average of 0 minutes and 45 seconds.

While task 2 had a maximum time of around 1 minute and 25 seconds, minimum of around 0 minutes and 40 seconds, and an average of 1 minute.

4.6.2 The Easy Checks:

The experiment tasks are analyzed through comparing the accessibility of “Facebook” website and its conformance with “WCAG 2.0”. Web accessibility initiative checks, which are also called the easy checks, are related to web accessibility to different people with different disabilities. The scope of this research used selected checks that

are related to web accessibility to people with visual disability, therefore only 5 selected checks were chosen from the easy checks.

The selected easy checks are:

1. *Image text alternatives (“alt text”)*: requires any picture on a website to have a descriptive text to describe the picture to people with visual disability. This check is measured through task 6.
2. *Headings*: requires the titles of any section on a website to be marked up with a virtual heading to allow people with visual disability who uses screen readers to navigate through these sections in a faster way. This check is measured in the experiment through tasks 9 and 15.
3. *Keyboard access and visual focus*: people with visual disability cannot use the mouse to deal with the computer so the primary device that the people with visual disability rely on for input is the keyboard. Therefore this check requires that all user actions must be accessible through the keyboard. This check is measured through the performance of all experiment tasks.
4. *Forms, labels and errors*: this check requires the forms and the labels to be accessible, which means the screen readers can read aloud the labels of any text box or radio button correctly, simultaneously informing the user when making an error on the form. This check is measured through tasks number 1, 2, 5 and 9.
5. *Multimedia (video, audio) alternatives and keyboard access*: requires

the media player buttons to be labeled correctly and accessible through the keyboard. This check is measured through task number 12.

4.6.3 Post-test Questionnaire Results

A post-test questionnaire is conducted after completing every experiment to ask if the participant intends to use Facebook website in case it becomes more accessible, examine the level of the participants’ understanding to the experiment tasks, and know their demographic information, as shown in Table 5. Based on the answers of the two questions, the results of first question reflects how people with visual disabilities are waiting for accessibility improvements to allow them use the website more efficiently, as of around 73% of the users answered by “I would use it straight away” if Facebook was more accessible. The second question results reflected that the experiment tasks was very clear to participants since the evaluator conducted the experiment one by one, so every participant was allowed to ask the evaluator for more descriptions and explanations of any task that they did not understand. The demographic results: participants are divided into 9 males and 6 females, all of which their age ranges from 20 to 30 years old, 8 are enrolled in post graduate studies and the remaining 7 are university graduates. Finally, all participants are either as teachers or customer service representatives.

Table 5. Post-test Questionnaire results

1. If Facebook was more accessible for the visually impaired		
<input type="checkbox"/>	I would use it straight away	73.33% (11 users)
<input type="checkbox"/>	I intend to use it within a year	20%(3 users)
<input type="checkbox"/>	I intend to use it but after I get a positive feedback from users	6.66% (1 user)
<input type="checkbox"/>	I will not use it at all	0% (0 users)
2. Please rate your level of understanding the experiment tasks		
<input type="checkbox"/>	Extremely clear	80% (12 users)
<input type="checkbox"/>	Quite clear	20% (3 users)
<input type="checkbox"/>	Moderately clear	0% (0 users)
<input type="checkbox"/>	Slightly clear	0% (0 users)
<input type="checkbox"/>	Not at all clear	0% (0 users)

5. Discussion

Task 1: ‘Sign up to a new Facebook account’ is related to the check for “Forms, labels, and errors”. While trying to complete the sign up process, some participants entered invalid data and did not know what went wrong. This is mainly because the only indication that the user has entered invalid data is shown by marking the invalid/missing field with a different color that the screen reader cannot detect. Another problem was that “Facebook” website does not provide a short description about the constraints for passwords such as the minimum or maximum length.

Another reported problem that the captcha; (“Completely Automated Public Turing test to tell Computers and Humans Apart”), appeared to 4 users and do not appear to the rest of the participants, the screen reader cannot read this captcha. To solve this problem users must use Firefox web browser and install an extension called (webvisum), another solution is that the user requested help from sited person to read it for him because he tried to listen to the

audio captcha but it was not clear. Analysis, this task is considered the maximum task that takes time from user to perform because it has many steps.

Task 2: ‘Log-in to Facebook account’ the problem was the labeling of the “e-mail” edit box; most users listen to the screen reader saying “password” and the cursor of the screen reader is focusing on the “e-mail or phone” edit box. Furthermore, 12 participants reported that they have problems logging out from their accounts; as the logout button which is located under the account button menu cannot be reached using keyboard. To solve this problem they open their mobile website interface of “Facebook” and visiting “http://m.facebook.com” to press the logout link.

Task 3: ‘Add friends to the Facebook account’. The problem arises when the participant search for the e-mail provided on the task, the screen reader does not read the search result popup correctly. Furthermore, the participant must have full knowledge of the friends’ e-mail not just his name in order to find the correct friend as the

visually impaired user cannot recognize either the profile picture or the cover photo. A total of 9 users faced difficulties with the search results popup as it doesn't categorize the result types such as: (people, page, group and place).

Task 4: 'Open a received message and post it on your wall' the selection of the received message often creates a problem as the screen reader announces the text and then when the user select it the cursor select another text. Different participants searched for the "share" button after the message to post it on their timeline without selection but they did not find it.

Task 5: 'Send an email to ahmed. hasan.aast@gmail.com email address (labeling, keyboard access)', A total of 6 participants did not know this function and the remaining 9 participants could not complete the task because the "buddy message" edit box is not labeled and cannot be reached using the keyboard and the "send" button was not accessible through keyboard.

Task 6: 'Create a photo album and Upload the photo called "picture" from your desktop (keyboard access)', the participants created the album correctly but when trying to upload the pictures the default photo uploader of Facebook was not accessible so they clicked on "try basic uploader" link to upload the photos. The task was performed after many trials by the participants as there was no note to indicate that the default uploader was not accessible. A total of 13 participants claimed that the description of the picture was not required so many photos on Facebook are not accessible and people with visual disabilities cannot identify it.

Task 7: 'Adjust the privacy settings making your uploaded photo available only to your friends (keyboard access)', the 'privacy' button menu cannot be accessed using the keyboard when using 'Microsoft Internet Explorer' browser, whereas 3 participants completed this task correctly using 'Mozilla Firefox' browser.

Task 8: 'Search for the page called "Vodafone Egypt" and like the page', When the participants type the search keyword they listen to a result saying "Vodafone Egypt" which is the same keyword, but when they press on the result they get the Facebook application of Vodafone Egypt not the Facebook page as the screen reader could not announced the result type at the search result popup. As a result the participants had to scan the whole page to refine the results to show Facebook pages only.

Task 9: 'Create a group called "Facebook accessibility" headings (labeling and keyboard access)', a total of 5 Participants failed to reach the "create group" button smoothly as it was not marked up with a heading.

Task 10: 'Invite your friends to join the "Facebook Accessibility" group', the label of the "add members" edit box was not read by screen reader; as a result, 7 participants performed many trials to add members to the group.

Task 11: 'Write "Here I am" on the timeline of your friend "Ahmed Hassan"', the task was easily performed but with one issue that after the user entered the text and pressed the enter key to publish the post, the enter key did not publish the post instead it inserted a

new line. 9 participant's complained that they face this problem because it is always changing with the different designs of "Facebook".

Task 12: 'Playing stopping, forward and rewind the video (Multimedia (video, audio) alternatives)', All the participants could easily play the video by pressing the link and it automatically plays, yet all of the participants cannot control the video because the "play/pause, stop, forward and rewind" buttons was not labeled and not accessible through the keyboard. 3 participants commented that recently they could use this feature on the "YouTube" website but when they tried on "Facebook" they did not succeeded.

Task 13:'Like and comment on this video saying "nice video"', All participants performed this task correctly, yet 13 participants reported that when performing the task in a page with many dynamically changing news feeds, the page always refreshes with new posts, sometimes they like different post as the focus of the screen reader cursor is changed without alerting the user.

Task 14: 'Chat with Ahmed Hassan' saying "hi" to him (Headings)', The chat part is not marked up with a heading or land mark. A total of 13 participants had the same problem of the continuously updating news feeds and the focus of the screen reader always changing, Also 7 participants reported that the emoticons that they sent or received on the chats are not read by the screen reader.

Task 15: 'Write "Deleted text" on your timeline and delete it', a total of 14 participants could write a post on their

time yet they cannot delete it because the "option" button menu was not accessible through keyboard. However, the 1 participant who used 'Mozilla Firefox' browser accomplished the task.

6. Conclusion

The social network websites have become one of the most important and extensive media to provide access to news, services, entertainment, and other different kinds of information in people's daily lives. Social networks usage has been increased in the last 5 years worldwide, especially in the Arab countries; unfortunately many websites have been designed in ways that are difficult to navigate or are inaccessible to assistive technologies such as screen readers. Hence, this means that people with visual disability do not have equal access to these website as the people without any disability.

The most effective way to know the accessibility problems that face people with visual disability is to let them try using the website and generate the problems from their experiment. The results of the experiment shows that some features of the "Facebook" website are not accessible and people with visual disabilities cannot perform them independently. These features such as controlling the video content, also editing or removing any shared post could not be done using the screen reader. Also the results showed that people with visual disability faces difficulties when using some features that forces them to do it more times and take more time to do, or depend on sited person to do this task for them, because designers fail to put appropriate text tags on some graphics, links, forms, or tables to describe this content to the screen reader.

As a result of this findings, Egyptian people find Facebook as inaccessible, which highlights that they are discriminated because they do not have equal access to the website as sighted people. Also most of the studies that test the website accessibility depend on the automated testing tools, but these tools do not detect all accessibility problems in which it can be detected by humans. Moreover, they stated that there are compatibility problems of web content with screen readers. To sum up, people with visual disability face some problems that can be categorized into 2 main categories:

Category 1: User Based Problems

- The user was not trained to use new technologies such as ARIA technology.
- Users are frustrated by the continuous change in the design of “Facebook” website; as they depend on remembering the structure and order of the page elements when dealing. Therefore, when the interface design changes they make extra effort to identify the new design and deal with it.
- Users are not fully aware of all the shortcuts that smooth dealing with the website, these shortcuts either provided by the screen reader or by “Facebook” website.

Category 2: Website Problems:

- Some Website features are not accessible through keyboard.
- Some parts of the website are not marked up with a heading.
- Website design updates that can results in accessibility problems espe-

cially when using new technologies that screen readers doesn't support.

- Controlling any video on the “Facebook” is not accessible.
- Some technologies such as “JavaScript and AJAX” cause accessibility problems (Ramakrishnan et al., 2009).

If websites become accessible, people with disabilities can do daily things: children can learn adults can make a living; seniors can read about their grandchildren, and so on. Using the web, people with disabilities can do more things themselves, without having to rely on others. Therefore, accessibility for people with disabilities is more important now than ever before. As a result of these findings, Egyptian people with visual disability want to have equal access to the “Facebook” website as sighted people. Also if the website becomes more accessible, they will use it constantly. Moreover, they stated that in Egypt there is no rule that enforces website designers or governmental websites to be accessible for people with disability.

7. Recommendations and Future Work

Thus, the research at hand recommends the involvement of human users with visual disability in the testing process of any website to evaluate its accessibility, and its compatibility with assistive technologies. It also suggests the formulation of a governmental regulation that forces any Egyptian website (especially governmental websites) to be accessible to people with disabilities by applying the Web Content Accessibility Guidelines, V.2.0. Facebook” should also provide the description field

of any uploaded photo or video mandatory for the users in order to help the people with visual disability recognize the photo or video. It is also recommended to develop a solution to make the website understand the text entered in the photo description to avoid user's misuse. Finally, companies specialized in the assistive technologies should decrease the prices of these technologies (e the Arabic text to speech engines) to allow the people with visual disability in the developing countries to use it.

The limitations of the study can be divided into two main limitations. The first is related to number of users, who have undertaken the experiment; this problem happened because a large number of people with visual disability cannot use the "Facebook" website as it has accessibility problems. Also some of them had transportation problems. The second limitation is related to the tested website; this study tested some features of only one social network website, according to the given time to the study. As a result further research can be done in the future, by involving more people with visual disability or people with other disabilities to test the website, by including other features of the same website in the test, and also by testing other social networks websites to evaluate their accessibility.

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