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Accessibility Evaluation of Arabic E-Commerce Web Sites Using Automated Tools

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Abstract

Disabled people encounter many barriers while attempting to access the services on the web. Nevertheless, many tools, which could help them to access the web, are available. E-commerce websites have been also intensively and widely used. The e-commerce market in Saudi Arabia will hit $13.3 billion by 2015. This huge investment requires e-commerce websites to be accessible by different types of users. This paper explores the tools that usually used by disabled users while using the web. It also discusses a number of available tools that help designers, developers and testers to assess web accessibility. It also evaluates the accessibility of 3 popular Arab e-commerce websites using 5 accessibility testing tools; namely Achecker, TAW, Eval Access, MAUVE and FAE. This research has found that Most accessibility guidelines are covered by Achecker tool. Navigation, readability, input assistance and timing are the common found accessibility problems while assessing the accessibility of the targeted websites. It has been also revealed that HTML can influence accessibility evaluation as HTML errors are considered as accessibility problems. It has been clearly observed that improvements are needed for better web accessibility, although some tools did report a small number of accessibility problems for some websites.

Keywords

Web Accessibility, E-Commerce, Automated Tools

1. Introduction

Nowadays human interaction with computers is becoming popular and spread wide; technology made it easy to interact with people via devices. Also, the web eases the way to find information, to communicate, to read a book or the news, to find a job or even to start a new business. Accessing the web is not a hard thing to do, but when it comes

to individuals with disabilities, it is.

Understanding user's demands and preferences is one of the most powerful requirements in increasing customer satisfaction, and attracting users including disabled people by providing them helpful and useful techniques. These techniques must dynamically scale itself to the abilities, skills, and requirements of the users. Web accessibility aims to help disabled people to use the web equally as anybody else. It is very compulsory for any organisation to adapt such techniques in order to rise up with its community.

Many tools to evaluate the web page accessibility have been designed. These tools generate evaluation reports that are designed to help locate errors and give warnings in order to design an accessible website.

The Internet has become essential to be used for users regardless their ability. Therefore tools have been proposed to help those people with special needs to utilise the web. All type of internet websites are expected to be accessible and they will be considered accessible as long as they meet web accessibility standards and requirements. This section discusses the tools used by disabled users in order to use the Internet. It also explores the tools usually used to examine to which extent the web is accessible. It also explores a number of recent studies which discuss web accessibility including its results and findings.

2. Accessibility Tools Used to Help Disabled Users

Although a significant number of barriers face the disabled people whilst surfing the internet, there are many ways in which their access to the web could be more efficient. For example, browsers which do not support enlarging the text or providing images without an alternative text are amongst the sorts of difficulties most commonly thwarting access to the web [1]. Furthermore, colours have been used to attract surfers, but this is a negative aspect for the colourblind users as they are part of disable users because using the text with a coloured background can adversely affect those who have difficulty in perceiving colours [2].

Assistive technologies and adaptive strategies are the two main approaches for interacting with the web. The former refers to any hardware or software can improve disable users while interacting with the web. It includes screen readers, magnifiers and voice recognition. The latter includes the techniques which disabled users use while surfing the internet. These techniques are meant to help and improve the interaction of disabled users and the web such as mouse speed control, increasing text size or turning on captions [3].

Of the methods that have been used by the visually disabled to access the web efficiently, one of the common is converting all the data that is needed on a particular page to black text on a white background, something similar that the user prefers [4]. In fact, style sheets offer a useful service to the colourblind by substituting their own style sheets for the original style sheets, and this does not take a great deal of time. Additionally, a number of websites use high or low contrast to ease access [5].

A wide range of Adaptive Technologies which have been utilised by the visually disabled, e.g. a large monitor which helps them to enlarge the text. Screen enlarging software, and browsers like Internet Explorer, contains commands to display fonts. In addition to these technologies, some operating systems, e.g. windows, offer the opportunity to increase text sizes. Furthermore, there is a technology called screen magnification, this software has been developed to magnify the web so that people who have difficulty focusing clearly can read more easily [1]. Even the new technologies such as mobile phones or tablets have accessibility options to help people with special needs to use the mobile itself or the Internet.

To demonstrate some of the methods that have been used by the disabled when accessing the web, some of the more commonly employed technologies are briefly discussed here. Screen reader interprets the site through speech synthesis. This has some particular advantage; once it meets an image in the site, it reads an alternative text if one can be found. Many people who have impaired vision or blindness have utilized it. Moreover, voice browsers, screen enhancement software and text browsers like Lynx, are popular ways of accessing the web [1]. A screen reader can be used in two ways to provide information either using speech or Braille. A screen reader utilizes a Text-To-Speech (TTS) engine to translate on-screen information into speech, which can be heard through speakers. A TTS may be a software application that comes packaged with the screen reader, or it may be a hardware device that plugs into the computer. In addition to speech feedback, screen readers are also capable of providing information in Braille. An external hardware device, known as a refreshable Braille display is needed for this. A refreshable Braille display contains one or more rows of cells. Every cell can be framed into the state of a Braille character, a series of dots that are similar to domino dots in their layout. As the data on the PC screen changes, so does the Braille characters on the presentation change, giving refreshable data specifically from the PC. There are many screen readers available, including JAWS from Freedom Scientific, Window Eyes from GW Micro, or Thunder from Screenreader.net [6]. A number of applications and tools are not free to use such as JAWS. However, screen readers tool is already built-in the operating systems of the mobiles. The only difference between the desktop and mobile accessibility testing is the navigation of screen reader. Keyboard shortcuts are required for the desktop to navigate where mobile screen readers can be connected through a Bluetooth keyboard or even specific finger gestures [7]. Another technique which is special browser that should be able to discriminate the structure of your page, to the extent that the page has a structure, and pass the information on to the user in a meaningful way [8].

The last technique which is screen magnification, the screen magnification system enlarges text and graphics on a computer screen. It is loaded into the computer's memory and functions similarly to a magnifying glass moving over a page, following the cursor, and magnifying the area around it. Utilizing a mouse or console orders, a client positions the cursor on the screen's segment to be amplified or has the cursor move naturally crosswise over and down a magnified page at a preset speed, screen magnifi-

cation can work in conjunction with screen readers [9]. MAGic is a screen magnification and screen reading solution for low vision and visually impaired computer users. MAGic can help users work more efficiently with business applications, documents, email, navigating the Internet, and engaging in social networking [10]. There are other implements that support the disabled in accessing the web and one of the more common marks is the asterix (*) which is always placed next to the required fields in case the person is colour-blind. Thus, the visually disabled have many ways of accessing the Internet efficiently [2].

Nevertheless, proper web accessibility design guidelines were not presented to Retinitis Pigmentosa (RP) patients. Therefore, it can be concluded that visually impaired users are less beneficial from the web than the normal users [11]. It can be seen that although different tools have been developed, some of the disabled users may not be able to utilise it due to their inability.

3. Tools Used for Web Accessibility Evaluation

Generally, a significant number of tools are available for evaluating web pages. In more detail, there are automatic tools like Bobby and W3C HTML validation tool. There are also, manual evaluations methods, based on comparing the web with accessibility guidelines [2]. However, the automatic tools have some disadvantageous aspects as these tools are not always able to identify all the difficulties that the disabled users might encounter, Although the manual evaluation are subjective and error-prone [2] [12]. This section will discuss the importance of Utilising accessibility tools and explore a number of accessibility evaluation tools.

There are a number of accessibility guidelines, such as Web Content Accessibility Guidelines (WCAG), that can help to guide designers in building an accessible web page. In fact, all the guides have checkpoints which assist the designers in which specific area an aid should be applied [13]. Evaluation tools also provide reports that show the result of any evaluation, and some of them give a mark to the website. W3C divided these tools into three types: general, focused, and services [14]. Some tools can also check whether or not pictures have ALT text, and make sure HTML and links are valid. There are many types of software available helping to decide whether or not a web page is accessible, and W3C has recommended some of them.

Achecker is an online and a semi-automated tool. It evaluates HTML pages according to the BITV 1.0. It cannot evaluate all the guidelines automatically. It produces three types of errors; known, likely and potential. It uses WCGA1.0 and WCGA2.0 of international accessibility guidelines [15] [16]. WAVE is a set of tools which are expected to apply web accessibility evaluation by providing a visual representation of accessibility issues within the targeted page. It offers coloured results. Yellow colour refers to errors. It does not provide repairing results neither shows the implemented guidelines [15] [16]. TAW is a free tool where it has two versions; English and Spanish. It tests the proposed website against WCAG guidelines. It produces three types of outcomes; problems, warnings and not reviewed [15] [16]. Cynthia Says software is one of

tools that is freely available and brings up the specific web page to meet the W3C's standards. This provides an opportunity to decide on the level of accessibility for the visually disabled. Human judgment is also required because some accessibility guidelines can't be determined by just automatic tools [17].

Multiguideline Accessibility Usability Validation Environment (MAUVE) is an environment for accessibility testing. It aims to examine both HTML and CSS and, through some browsers' plugins, it can validate dynamic pages as well [16]. Moreover, EvalAccess is an accessibility evaluation tool that allows to automatically evaluate the accessibility of web pages using the WCAG 1.0 from the W3C [18]. Functional Accessibility Evaluation (FAE) assesses website for WCAG 2.0 Level A and AA requirements. It also offers a detailed report of the testing [16]. FireEyes is also a tool which a Firefox plugin that integrates with Firebug and allows developers and QA engineers to evaluate web sites for Section 508 and WCAG 2.0 accessibility issues [19].

4. Related Work of Web Accessibility Evaluation

Most of the studies state that the websites are keeping the minimum standard as per the WCAG 2.0 recommendations. However, some of the studies reveal that the people with disabilities in a certain region still face obstacles in being included in society alongside people without disabilities [4]. There are a number of studies have explored web accessibility in different ways. [20] used various tools for the web accessibility evaluation. The accessibility guidelines are tabulated and used for the evaluation. This study was mainly focussed on the evaluation of e-government websites. The website progress had been examined in Saudi Arabia and Oman. The united nation e-government stages model was used as one of the evaluation tools. 8 of Saudi ministries did not have an online presence on the study time. It found only 13 Saudi ministries' have an online presence [20]. They carried an evaluation over five stages. In each stage, the selected websites were assessed and the results did not meet accessibility guidelines and standards. The authors also used one of the well-known commercial online tools, that is, Bobby to test the websites. The evaluation process of these government websites, (13 from Saudi Arabia and 14 ministries' sites from Oman), showed that none of these websites conform to all priority1 checkpoints, which means that one or more groups will find it difficult to access information on these websites [20].

The accessibility of Saudi Arabia government websites was examined by [21]. Although automated tools were not used, the results were interesting. The achieved results clearly indicate that many accessibility issues were found in the Saudi government websites. A set of recommendations and suggestions have been reported in order to improve the accessibility of Saudi government websites [21]. However, accessibility automated tools were utilised by [21] for Saudi universities websites. A multi-method analysis has been carried out. The main goal of their research is to examine to which extent the Saudi universities consider web accessibility. Similarly to [21] results, 80% of Saudi universities did not achieve the minimum standard of web accessibility. They also claimed that web developers in Saudi Arabia are not aware of website accessibility

standards and requirements [21]. However, this study did not take into consideration the new universities and did not employ the manual accessibility testing. [22] have conducted an evaluation of usability and accessibility for LMS "Blackboard" at King Saud University [22]. Although only a questionnaire has been used, improvements on accessibility have been highly recommended to have the system more accessible to students and teachers [22].

In [23], the authors conducted a study to assess the accessibility of banks websites in Pakistan. Two accessibility tools had been used to conduct this study. The achieved results showed that standard accessibility rules had not been taken seriously by developers. They did not consider them while building banks' websites [23]. Another study is also examined web accessibility for the public sector in Pakistan. It resulted into a set of recommendations and suggestions to improve the web accessibility as it had been revealed they are not accessible for the disabled people [24]. In Jordan, [25] found that the majority of the selected websites did not consider web accessibility guidelines and they had a number of web accessibility issues. They examined Jordanian e-governments websites using two accessibility tools.

In [19], the authors have attempted to evaluate Arabic website accessibility using automated WCAG 2.0. in fact, WCAG 2.0 tools are available although the main concern is still whether they can evaluate Arabic websites with insightful suggestions [19]. Their main goal was to evaluate WCGA 2.0 tools while assessing Arabic websites. 5 tools have been used to evaluate the accessibility of a number of Arabic websites. It has been found that these tools (TAW, Achecker, Fire EYES World Space, Deque World Space and Web Accessibility Assessment Tool) are biased to Latin-based websites [19]. It has been also found that significant differences among these tool results although the same website has been assessed [19]. This can clearly justify the need for more comprehensive accessibility tool.

In [26], the authors conducted research which explores the accessibility issues of e-commerce website in Sri Lanka. Hotel websites have been selected for their research. A survey has been used to collect the data. Lack of adherence to W3C accessibility guidelines was found. ALT-text facility, navigation and readability were main accessibility issues [26]. Lack of clarity and fonts were also noticed by users. The results were reported by participants, however, Utilising one or more accessibility tools can offer more interesting results to this study. Poor E-commerce accessibility may lead to business issues as users heavily rely on the Web to do many transaction. Its crucial to improve web accessibility for e-commerce websites. In [27], the authors conducted a study to compare the accessibility of different e-government websites in some Arab countries. Different accessibility tools were used, namely; Achecker, TAW, WAVE and Sortsite. It has been found that Egyptian websites were more accessible than others. However, the authors state that users involvements and feedback are needed for better results [27]. Accessibility is considered as one of the success factors for E-business with other factors such as content, navigation and speed. It has been a critical success factor for virtual market requirements [28]. In addition, it has been reported with other key factors for developing successful e-commerce websites [29].

It can be seen from the recent literature that assessing the accessibility of Arabic e-commerce has not been discussed neither investigated, although e-commerce is growing fast. For example, It has been reported that in 2015, the e-commerce market in Saudi Arabia will hit $13.3 billion [30]. in addition, a number of automated tools should be used to offer more reliable results while assessing the accessibility of e-commerce websites. Therefore this study utilised a number of popular accessibility automated accessibility tools.

5. Research Methodology

A number of methodologies can be utilised for websites accessibility evaluation such as questionnaires, behavioural observation tools and web accessibility evaluation automated tools. These include structural and content evaluation. This study utilised a number of free accessibility evaluation tools to assess how accessible e-commerce websites are in Arab world. The utilised tools are AChecker, TAW, EvalAcess, Multiguideline accessibility and usability validation environment (MAUVE) and Functional Assessment Evaluation 2.0 (FAE). This number of tools is to offer more valid results and reveal more accessibility issues. Each tool examines the targeted website based on a set of criteria. Table 1 shows a comparison of these tools in terms of the submission methods and the accessibility guidelines referenced.

Homepages of the Arabic e-commerce websites have been tested. These websites have been recognised as popular Arabic e-commerce websites; namely SOUQ, HARAJ and NAMSHI. A number of steps have been applied before the testing was carried. These websites have been visited to ensure functionality, size and to ensure similarity. There are other Arabic e-commerce websites have been excluded due to the limit of this study or there may some parts under contractions or has a limited size.

6. Results and Analysis

A number of problems, warnings and errors have been revealed while testing the accessibility of the targeted websites in each tool. Table 2 shows the achieved results. "AChecker" represents the number of "known problems" that have been detected while the automated testing. Such accessibility known problems are expected to be fixed. "Likely Problems" and "Potential Errors" have been revealed. Further investigations have been also carried out to identify which types of accessibility problems are exist in

Table 1. A comparison of used accessibility tools in this study.

Tool	The submission method	WCGA 1.0	WCGA 2.0
Achecker	URL	YES	YES
TAW	URL	YES	YES
EvalAccess	URL	YES	NO
MAUVE	URL	YES	YES
FAE	URL	YES	I*

I*: ITAA Web Accessibility Standards. They are based on the WCAG 1.0 and Section 508 guidelines.

Table 2. Accessibility tools and accessibility issues for each website.

Tool	Criteria	SOUQ	HARAJ	NAMSHI
Achecker	Known Problems	23	119	54
	Likely Problems	0	1	0
	Potential Problems	17	963	738
TAW	Problems	1013	172	75
	Warning	1802	129	454
	Not Reviewed	17	16	16
EvalAccess 2.0	Errors	10	7	6
	Warnings	703	249	203
	General Warnings	5	5	9
MAUVE	Errors	18	9	1
	Warnings	516	2246	1266
	Violations	8	6	12
FAE	Warnings	6	16	2
	Manual checks	29	33	31
	Passed	19	9	15

the three websites. Navigation, readability and input assistance have been also automatically identified by Achecker. Navigation has been reported by [31] as a popular accessibility issue as it appears to be difficult. Clear indication is not always presented to the users [31]. In addition, lack of appropriate labels and instructions on data entry forms and difficulty navigating when presented with unfamiliar or inconsistent terminologies are examples of known or Potential accessibility problems. Achecker has been reported as one of the best accessibility tools based on a study was conducted by [27]. Most accessibility guidelines are covered by Achecker tool was the given justification for their claim [27]. Although expert review did not take place, the achieved results are valuable from "Achecker" in this study. TAW tool has discovered a number of accessibility problems and warnings. TAW recommends the problems to be corrected, warnings to be reviewed and not reviewed to be human reviewed. Perceivable, operable and understandable are main accessibility criteria should be either corrected or reviewed based on TAW results for all the three websites. An example is if the web page heading is not structured correctly then the screen readers cannot correctly identify and read these headings. Another example, in some parts of the targeted websites the evaluation failed as the images did not have ALT text. In contrast, the some parts passed the evaluation tests as they recognized every link in the web clearly. Furthermore, the evaluation test examined the pages to check whether it is usable when scripts or applets are not supported or turned off, and this page passed. EvalAccess also offers interesting and valuable results where the targeted websites scored almost the same in terms of the found problems and warnings. More appropriate labels and instructions on data entry

forms can be seen as warnings for the targeted websites. It is also important that the focus has sufficient contrast and can be easily discerned in case of users who are visually impaired. However, as mentioned earlier EvalAccess is only assess the targeted websites based on WCGA 1.0. from W3C.MAUVE found many warnings and a number of errors. The findings are mainly for visually impaired such as better contrast can be done between text and background colours. Lacking of useful alternative text for images and along with colour contrast and alt text issues, a common accessibility issue for carousels and slideshows is a lack of controls. FAE also revealed similar results among the three targeted websites. It scored better in timing although [12] reported that loading time should be considered as it appeared an issue while testing governments websites. The purpose of the website may be the justification for this difference as e-commerce websites seriously consider the loading time. It has been also reported that "almost complete" for navigation and audio and videos. Style and content are classified as "need human review". The three websites were not able to provide proper frame titles in some pages as this can confuse disable users while navigation. This has been clearly reported by [21] while testing the accessibility of Saudi Arabia universities websites as almost 25% of the Saudi universities had " absent frame titles" [21]. It has been clearly observed that improvements are needed for better web accessibility, although some tools did report a small number of accessibility problems for some websites. This finding is in line with [12] findings where accessibility should be more considered.

Below is Table 2 that shows the found accessibility problems by each tool. It can be clearly noticed that there are some differences among tools performance. The justification may refer to that AChecker considers HTML markup errors as accessibility problems. Therefore, HTML can influence accessibility evaluation. This also has been reported by [12] as she clearly stated that more accessibility problems do not mean good evaluation was done [12].

All the selected tools check WCAG 1.0 which specifies a total of 14 guidelines for accessibility design [21]. Each of these guidelines is associated with a number of checkpoints. It results of 65 checkpoints [21]. Three categories are the results of the 65 checkpoints. Each category specifies more accessibility. Describing a website is an accessible is based on to which extent it satisfies all the categories. In the meanwhile, WCAG 2.0 has several enhancements over WCAG 1.0. The checkpoints are the basis for determining conformance to the WCAG 1.0 where WCAG 2.0 is the success criteria. It's based on four web accessibility design principles. Each principle has guidelines, and each guideline has testable success criteria at level A, AA, or AAA [21].

In this study, all the selected websites have been assessed against WCAG 1.0 and 2.0. it considered priority one for both of them. This can ensure the website achieved the baseline of web accessibility guidelines. The result of this study while analysing the targeted websites against WCAG 1.0 and 2.0 are interesting. All the three websites achieved a number of basic standards for web accessibility. All the websites achieved clearly the priority 1 No.4 which "Clearly identify changes in the natural language of a document's text and any text equivalents". The selected websites did not fail in the text

equivalent for images. This means either the websites meets all the guidelines or they only have a minimum of failures.

7. General Remarks, Recommendations and Limitations

To have an accessible web, designers should consult widely and consider the many factors that would guide them to build truly accessible web pages. In spite of the many difficulties are expected to be experienced by the disable users while using the targeted websites, designers should be able to present web pages to all users without experiencing any difficulties. In this regard, the flexibility concept is the most important aspect of building an accessible website. Factors that should be considered seriously by designers include designing for various types of browsers [32]. Flash and acrobat which are less accessible than HTML so the latter is recommended to be used [31]. In particular, following the web standards is the best way to build an accessible web; although there are a wide variety of disabilities that influence web accessibility [32]. According to the official accessibility guidelines, there are rules that make the pages accessible for the visually disabled, and these include depending on text and not only on colours, "providing equivalent alternatives to auditory and visual content" [33], using markup and style sheets, and designing for device-independence. This has been highly recommended for web accessibility [34]. Applying all the official rules should make web sites much more easily accessible [33]. Other steps that should be considered in order to improve accessibility, include avoiding small text and having an alternative text to any image in the web site as this has been found while testing the targeted websites. These would promote active participation, and should not pose severe difficulties to designers as developments in this area are moving apace. Moreover, using and organizing lists, and tables is an important part of facilitating the access to web sites. Auto-refreshing is not recommended due to visual disabled who can't usually read as fast as fully sighted. Furthermore, the level of the language should be understandable and the web's navigation ought to be easy to move between pages [1]. Navigation has been found as one of the main accessibility issues in this study and also in other research such as [23]. Keeping websites simple is a basic standard to have a good design [35]. Actually, amongst the most vital aspects that designers should take into account are headings, colours and links. Making the headings more noticeable can significantly improve matters for visually disabled. Fully naming all links is better than just indicating "click here" because this latter is a barrier to the visually disabled [7]. Although the primary role of colours is to enhance web pages, it has a negative effect on the colour-blind.

This study has a number of limitations, Firstly, it involves only automated tools, although 5 tools have been used. Accessibility issues cannot be always detected automatically. Expert involvement is recommended for a compensative evaluation. Secondly. The achieved results cannot be generalised as there are many Arab e-commerce websites. This study attempt has attempted to examine three famous ones. A number of this study findings can lead to further investigations. Different results from different accessibility tools for the same website can be worth investigations to justify these differenc-

es. The impact of the accessibility issues of e-commences' websites on users decisions could reveal more valuable findings.

8. Conclusion

A number of tools that assist disabled users have been discussed with brief explorations for the tools which usually used to assess the accessibility of the Web. Then, this study goals were examined as to assess the accessibility of selected Arab e-commerce websites. Five different accessibility tools have been employed in this study. The results show that there are a number of accessibility issues exist in the targeted websites. This study also has revealed that most accessibility guidelines are covered by Achecker tool. In addition, navigation, readability, input assistance and timing are the common found accessibility problems while assessing the accessibility of the targeted websites. The disabled users are expected to encounter those issues. A set of recommendations based on this study findings have been also reported in this paper. For further research, expert involvement is recommended for a compensative evaluation. In addition, the achieved results cannot be generalised as there are many Arabic e-commerce websites and this study is only limited to 3 websites. Different results from different accessibility tools for the same website can be worth investigations to justify these differences.

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