Methodology for Heuristic Evaluation of Web Accessibility Oriented to Types of Disabilities

Anyela Orozco(✉), Valentina Tabares, and Néstor Duque

Universidad Nacional de Colombia Sede Manizales, Manizales, Colombia
{alorozcom,ndduqueme,vtabaresm}@unal.edu.co

Abstract. In order to ensure that a Website available is easily accessible to as many people as possible, evaluation processes are carried out on Web accessibility, allowing the identification of issues in the construction of such sites and barriers that may limit access to information. However, making these evaluations can become a time consuming task and produce incomplete results; besides, they are based on general guidelines that do not take into account the particularities of each type of disability. This paper proposes a methodology for heuristic evaluation of web accessibility oriented to types of disabilities, consisting of five stages that allow establishing the level of accessibility and specific problems of a website.

Keywords: Web accessibility · Web accessibility evaluation · Disabilities

1 Introduction

The accessibility of websites is aimed at providing equitable access to information, breaking barriers in some sites in order to provide every human being with this fundamental right. Web Content Accessibility Guidelines (WCAG) 2.0 - W3C/WAI set the accessibility requirements for people with disabilities and are the basis of many automated tools and accessibility evaluation manuals [1].

The evaluation of Web accessibility is a fundamental stage in the process of evolution of accessibility, as it identifies the issues in the processes of construction of websites and the barriers that limit access to information to people with disabilities [2].

Currently, there are different tools for evaluating accessibility, some automatic and others manual, but generally this evaluation process becomes time consuming and produces incomplete results [3]. In some cases, it seeks to establish -from the review of compliance with criteria such as the WCAG - the level of accessibility of a site; however, this process is based on general guidelines that do not take into account the particularities of each type of disability [1].

Since web applications are also dynamic, some initiatives aimed at this situation have developed frameworks for the analysis of the characteristics of these types of sites [4].

Based on the above, this paper proposes a methodology for heuristic evaluation of web accessibility oriented to types of disabilities which consists of five stages that allow

M. Antona and C. Stephanidis (Eds.): UAHCI 2016, Part I, LNCS 9737, pp. 91–97, 2016.
DOI: 10.1007/978-3-319-40250-5_9

establishing the level of accessibility and specific problems of a given website in order to implement improvement strategies.

Section 2 presents some basic concepts related to evaluation of accessibility and Sect. 3 presents related work. The proposed methodology is detailed in Sect. 4, and in the next section is presented an experimental work implementing the proposal. Finally, Sect. 6 presents conclusions and future work.

2 Theoretical Framework

The Web is critical for the society of today, as it has become an essential part in education, work and daily life. For this reason, one should think of a Web that guarantees all members of society access to the services offered [5].

Web accessibility is defined as the possibility that a product, environment or service available through the Internet can be used in equality, safety and comfort by all people, and especially for those with disabilities [6]. Several initiatives have been aimed at achieving a Universal Web that the user can access regardless of the type of hardware, software, network infrastructure, language, culture, geographical location and capabilities [7, 8].

The goal with the Web Accessibility Evaluation is to determine whether the evaluated sites comply with the guidelines and minimum standards that allow access to people with disabilities, identifying possible barriers that may be faced and alternative solutions [9].

Some principles have been defined internationally to guide Web accessibility and that are critical to the evaluation process. The Web Content Accessibility Guidelines (WCAG), proposed by the W3C, are to be highlighted; their main objective is to guide the design of Web pages, reducing information barriers and increasing accessibility [8].

In total, 14 guidelines grouped into 4 principles are presented [10]:

Perceptible: The components of user interface and information must be arranged so that users can perceive them.

Operable: Forms, controls, navigation and other interface elements must allow interaction.

Comprehensible: Content and interface must be easily understood and be semantically rich.

Robust: The content must be consistent and reliable enough to allow use, with a wide variety of user agents, technical aids and prepared for future technologies.

The checkpoints upon which the WCAG are based are assigned to a level of priority that, when evaluating web accessibility, allow the identification of which site is in better conditions. In total, there are three different levels of priority, where Priority 1 corresponds to the points that a web developer must meet because, otherwise, certain groups of users could not access the information on the website. In the case of Priority level 2,

points that should be met for certain user groups to easily access the Web are taken into account; and finally, Priority 3 makes reference to the characteristics that enable some users to experience easy access to an inclusive web and with more possibilities [10, 11].

3 Related Work

Here are some works related to the topic of evaluation of web accessibility:

In [1], models are proposed to facilitate automated evaluation of web accessibility for large sites with sophisticated features, where Semantic Web technologies are used structuring results in a standardized way in order to achieve better performance and reuse.

The works presented in [2] describe a measuring process of the level of web accessibility for educational sites, where unfavorable results are obtained for the institutions that own the sites, limiting access to information and services offered to certain people with some specific needs.

The authors of [12] propose a conceptual framework for automatic evaluation of accessibility of Rich Internet Applications (RIAs), including web robot, RIA events controller, WAI-ARIA accessibility specifications, evaluator, and results handler.

In [13], it is proposed a guideline to Evaluate Web page accessibility based on several structural-based accessibility models where an innovative Accessibility-Popularity (A-P) analysis is deployed to measure and, thereby, to modify a Web structure.

An heuristic checklist for an accessible smartphone interface design is proposed in [14]. User requirements are reorganized in statements in six general categories: mechanical controls, display, speech and general operation controls, audio feedback controls, touch-operated controls, and others.

4 Proposed Methodology

From the literature reviewed, it was possible to identify that in most cases the results of accessibility evaluation using tools to perform the process automatically are incomplete, and manual evaluation presents a high degree of subjectivity.

It was also identified that a fully automated evaluation of WCAG is infeasible, since it requires human validation in cases where diffuse, ambiguous and subjective terms are presented. Additionally, automated accessibility evaluation tools are unable to identify problems for a specific type of user [3].

This leads to the need of proposals to integrate the two approaches for better results, but it is also required an approach to accessibility evaluation where special needs are taken into account, since barriers on a website depend to a large extent on the specific conditions of each user.

Below is proposed a methodology for heuristic evaluation for web accessibility, which aimed at guiding the process of accessibility evaluation with a focus on specific disabilities and barriers that could be faced by this group of people. It is sought to respond to the particular conditions of users with respective disabilities and provide a comprehensive evaluation based on a set of heuristics.

This work is based on the methodology proposed in [15] and used in [16], where a series of steps are defined to establish heuristics that support the usability evaluation process. The authors argue that the heuristic evaluation is an inspection method widely used, as it is easy to apply and does not require high costs; however, to avoid overlooking some errors, it requires appropriate heuristics to specific situations.

The defined methodology consists of five stages described below:

Stage 1 - Analysis and Characterization of the Population. This stage reintegrates steps 1 and 2 of the methodology presented in [15], which consist of performing exploration on what is to be assessed and describing the most important features.

For the particular case of the accessibility evaluation process, it is necessary to perform an analysis of the characteristics of the disabled population to which the evaluation will be oriented. Groupings are established according to the needs and barriers that could be faced by these people in order to have an initial idea of how the accessibility evaluation process would be carried out and which elements would be taken into account. This analysis is done considering the literature reviewed where such characteristics are described; it is also recommended an initial approach to the population subject of the definition of the heuristics and subsequent evaluation.

Stage 2 - Definition of Indicators for Evaluation. This step corresponds to step 3, proposed in [15], where the characteristics to be taken into account for the definition of the heuristics are identified.

Once identified and selected the group on which the evaluation will be focused, an analysis of the barriers that these people could face when trying to access the contents of a website is done.

For the definition of indicators to assess whether or not the accessibility criteria are met, WCAG 2.0 and other proposals for manual evaluation of accessibility are used, identifying which elements can be taken into account for the particular case of the group subject of the evaluation.

Stage 3 - Definition of Heuristics. Subsequently, at the third stage, following step 4 of the methodology proposed in [15], a series of heuristics were defined based on the provisions established in the usability evaluation processes, but that fit the criteria to be taken into account specifically in evaluating accessibility.

The indicators proposed at stage 2 are used for the definition of the heuristics, but elements that allow the evaluator a greater understanding of what to evaluate and how to do it are added.

The template presented in [16] is used as a guideline, which consists of an identifier and a name for the heuristic, the detailed explanation of the indicators to be taken into account, examples of cases where the criteria are met or not, and the specific problems arising, which will be used for analysis of results.

Stage 4 - Implementation of Accessibility Evaluation. Once the heuristics to be taken into account for accessibility evaluation are defined, it is necessary to identify the websites to be evaluated, together with the people responsible for conducting the evaluation.

At this stage it is advisable to have a group of evaluators who have different levels of knowledge on the subject of web accessibility and the specific barriers that may be faced by the group of people to whom the evaluation is addressed.

One advantage of this approach is presented when making the evaluation, as the defined heuristics must be carried out in a simple language, with clear examples that facilitate the evaluation process.

Step 5 - Analysis of Results. At this stage the results obtained with the application of stage 4 are taken and analyzed. This is very important because it defines the usefulness of the evaluation process.

Unlike other accessibility evaluation strategies, the application of heuristics makes it easier to guide the process and it is possible to present the results in a clear and understandable way as it works with specific indicators.

A proper analysis of the results is fundamental for the improvement processes to be followed in the institutions whenever weaknesses on the websites evaluated may be found.

5 Experimental Work

In order to make an initial assessment of the proposed methodology, two websites of higher education institutions were selected (http://www.unal.edu.co, http://www.ucaldas.edu.co). The accessibility evaluation was performed only on the home page.

People with visual impairment were selected for the implementation of the first stage of the proposed methodology as target population. After this definition, we proceeded to perform a detailed assessment of their specific characteristics in addition to the barriers commonly faced when trying to access web content.

Taking into account the specific characteristics of the disability, images without alternative text, complex images without detailed description, multimedia elements without textual or sound description and links without significant text are identified as some of the barriers.

Having identified the barriers, the next step was the definition of the indicators that will allow performing the evaluation through the heuristics defined. These indicators were grouped into those that affect the perception of content and those that affect the operation by the user.

After defining the criteria and following the template presented at Stage 3, the heuristics to be applied were established to evaluate the selected websites according to the specific conditions of the visually impaired population. As an example, one of the heuristics designed is presented in Table 1.

The heuristics defined were applied by a group with three evaluators who identified problems in the sites from the heuristics given. Table 2 presents the total amount of problems found, both for heuristic HA01, presented in Table 1, and for heuristic HA02, which evaluates elements related with how the user can interact with the site.

The results show a number of problems taking into account heuristics used. For the first site, a greater number of issues regarding images and other multimedia resources

Table 1. Heuristic, Example

ID	HA01
Name	Multimedia Objects Perception
Explanation	Commonly, visually impaired people use tools that allow them to interact with websites, as is the case of screen readers. These tools require adequate text descriptions to allow the user to access content.
Examples	A video is presented and it has only animations and background sound. It requires a textual or sound description of what happens in the video.
Problems	- One or more images without alternative text are presented. - If the image is complex, a detailed description is presented. - Videos are presented without alternative text. - Videos are presented without alternative sound.

were found, while the second site had a higher number of difficulties with the way the site operates, taking into account elements such as links and buttons.

This evaluation is preliminary and allowed feedback to improve the heuristics defined and also the analysis of other elements that may be considered to carry out this evaluation process.

Table 2. Results of evaluation application

Heuristics	Problems found	
	http://www.unal.edu.co	http://www.ucaldas.edu.co
HA01 - Multimedia Objects Perception	10	7
HA02 - Site Operability	6	9

6 Conclusions and Future Work

A methodology is proposed to evaluate the level of accessibility of a website, following a series of heuristics that support this process and make its implementation easier.

Performing an accessibility evaluation process focused on features and specific barriers for one type of disability, it is possible to get results that meet their needs, identifying the problems with the site, allowing for further adaptation and improvement.

As future work it is proposed the carrying of more tests, involving other types of disabilities, other websites and a greater number of evaluators. It is expected to refine the indicators and heuristics defined, besides the adjustment of the methodology according to more detailed results of validations.

Acknowledgments. The research presented in this paper was partially funded by the COLCIENCIAS project entitled: "RAIM: Implementación de un framework apoyado en tecnologías móviles y de realidad aumentada para entornos educativos ubicuos, adaptativos, accesibles e interactivos para todos (Implementation of a framework supported by mobile technologies and augmented reality for ubiquitous, adaptive, accessible and interactive learning environments for all)" of the Universidad Nacional de Colombia, with code 1119-569-34172.

References

1. Abou-Zahra, S.: A data model to facilitate the automation of web accessibility evaluations. Electron. Notes Theor. Comput. Sci. **157**, 3–9 (2006)
2. Riaño, A., Ballesteros, A.: Análisis de accesibilidad web orientado a la estrategia de gobierno en línea del estado Colombiano (2014)
3. Centeno, L., Delgado, C., Arias, F., Álvarez, L.: Web accessibility evaluation tools: a survey and some improvements. Electron. Notes Theor. Comput. Sci. **157**, 87–100 (2006)
4. Abu, D., Alkhateeb, F., Maghayreh, E.A., Mohammed, A.: The design of RIA accessibility evaluation tool. Adv. Eng. Softw. **57**, 1–7 (2013)
5. Takagi, H., Asakawa, C.: New challenges in web accessibility. Univers. Access Inf. Soc. **13**, 205–226 (2015)
6. Zubillaga del Rio, A., Alba Pastor, C.: Hacia un nuevo modelo de accesibilidad en las instituciones de educación superior. Rev. Española Pedagog. **71**(255), 245–262 (2008)
7. Martínez Usero, J.Á., Lara Navarra, P.: La Accesibilidad de los Contenidos Web, vol. 72. UOC, Barcelona (2006)
8. W3C: Web Accessibility Initiative (WAI). http://www.w3.org/WAI/
9. Pereira, L.S., Ferreira, S.B.L., Archambault, D.: Preliminary web accessibility evaluation method through the identification of critical items with the participation of visually impaired users. Procedia Comput. Sci. **67**, 77–86 (2015)
10. Cooper, M., Reid, L.G.: Web Content Accessibility Guidelines (WCAG) 2.0, pp. 1–24 (2013)
11. Sánchez-Gordón, M.L., Moreno, L.: Toward an integration of web accessibility into testing processes. Procedia Comput. Sci. **27**, 281–291 (2013)
12. Abu Doush, I., Alkhateeb, F., Maghayreh, E.A., Al-Betar, M.A.: The design of RIA accessibility evaluation tool. Adv. Eng. Softw. **57**, 1–7 (2013)
13. Yen, B.P.C.: The design and evaluation of accessibility on web navigation. Decis. Support Syst. **42**, 2219–2235 (2007)
14. Cavuoto, L.A., Benson, K., Tonya Smith-Jackson, M.A.N.: A heuristic checklist for an accessible smartphone interface design. Univers. Access Inf. Soc. **13**, 351–365 (2014)
15. Rusu, C., Roncagliolo, S., Ruso, V., Collazos, C.: A methodology to establish usability heuristics. In: ACHI 2011 Fourth International Conference on Advances in Computer-Human Interactions, pp. 59– 62 (2011)
16. Inostroza, R., Rusu, C., Roncagliolo, S., Rusu, V., Collazos, C.A.: Developing SMASH: a set of SMArtphone's uSability heuristics. Comput. Stand. Interfaces **43**, 40–52 (2016)