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Accessibility and Usability on the Internet for People with intellectual disabilities

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Abstract – As the internet becomes the most significant source for seeking information and acquiring services, the problems raised by the lack of usability and accessibility on websites lead to problems of e-exclusion, which phenomena may potentially have a great impact on one's life. Although some groups of individuals with special needs, namely the visual disabled people, have received the help of researchers to overcome the problem of accessing the information, there are other groups, particularly intellectually disabled people, that received little attention, indicating that their ability to access information is still limited.

In this paper we present a study that investigates how people with the mentioned intellectual disabilities interact with web pages, which difficulties do they have while accessing the information and we propose guidelines for the studied group. While conducting this study we have also analyzed how the guidelines (1.0 and 2.0) suggested by W3C are applied to this particular group.

Keywords: Accessibility, Usability, Internet, People with Intellectual Disabilities.

I. INTRODUCTION

The World Wide Web provides a wealth of information to a large global audience, being also important for ensuring the access to all people and, therefore, improving significantly the life quality of every single one in society. To guarantee everyone this digital accessibility it is needed an overall comprehension of how different people access to the information available on the internet. In fact, many pages in the Internet are made without taking in concern the level of accessibility or usability, limiting to a great extent many people´s access to these pages, such aspect is considered to be a basic necessity in order to overcome the digital exclusion and discrimination and turning it into outdated concepts.

As a result, the study presented in this paper focus precisely on intellectually disabled people and is particularly motivated by the almost absence of scientific data on how to make the Web content accessible to this particular group, proving that BOHMAN´s words, "we still know very little, and we still do much less" [3], are still very veritable.

Having knowledge of the outcomes/results of several studies stating that the implication of the W3C guidelines on accessibility is insufficient to ensure access for people with intellectual disabilities [7], [9], this document shows great will in raising awareness among developers of Web contents concerning the difficulties felt by this group when accessing the Web. It shall be referred that although this is not intended to solve all the problems of accessibility it intends to arrive to a set of identifiable items in order to make a critical analysis of links presentation in navigation menus, taking into account the target audience.

In a particular degree, this study intends to contribute to overcome the problem of identifying a link or button as a clickable or non clickable content allowing the recognition if whether there is a hyperlink on the navigation menu of a web page or not, and how to make easier its corresponding acknowledgment. Such difficulty as felt by intellectual disabled people while accessing web pages was justly identified by several studies [6], [8], [9].

II. BACKGROUND

The identified theme-related studies, apart from a few that do not contain enough information to justify any evidence, are uneven in quality, scope and applicability [4]. In several studies it is even questioned the possibility of finding a guiding principle when planning Web sites for people with intellectual disabilities [6], due to difficulties resulting from the wide range of disabilities among such group of people.

The studies included in this analysis must fulfill each of the following parameters:

• The target audience must be constituted of people with intellectual disabilities, acquired or developed without specifying any of these;

• Highlight the improvements attained regarding the internet access, with special focus on Web content or the creation of an "accessible" design. However, browsers enhancement related aspects, including assistive technologies, were not object of particular analysis.

A. Previous case studies

The first two relevant case studies focused on the theme “Internet design for people with intellectual limitations ", i.e. How people with intellectual disabilities navigate the Internet? ” [6]. The very aim of the research lies in understanding how the internet is used by people with intellectual disabilities and establishing an appropriate strategic method, effective to the extent of increasing accessibility in the web environment. Accordingly, these studies show three stages of research whose contents are described as follows:

The first step consists in building the "cognitive support" in the design of a website and generating guidelines based on the user testing. Secondly, users with cognitive disabilities interact with the Internet Explorer browser. And, finally, the last step aims to test a method of accessing the Web using an input device, that is, a Pen, that enter in automatically web addresses and other website texts, bypassing the need for the user to enter this information by hand [6].

Rather than textual means, images were used as a preferred alternative not only because they are easier to keep in mind and recall but also require little effort when navigating to a favorite website.

Therefore, the authors [6] presented the following results as the most significant ones: the entry of text is problematic and the multi-options were referred as difficult to use.

Meanwhile, Small et al. [9] examined the issue "Internet accessibility for people with Intellectual Disabilities" presenting the following thesis: Are the W3C guidelines for Internet accessibility effective or ineffective for this type of population? The study focuses on issues of navigation within the site, which success depends from four elements, namely, situational awareness, spatial awareness, the switching between tasks (task-set) and early response system. The outcomes of this study point to difficulties in multiple aspects such as the recognition of links (especially when the text was not underlined or was not perceived as "clickable"), the activation of links (recognition of the arrival to a correct page), the typing (they are not used to the backspace key), the need for scrolling, returning to the home page of a website (some participants clicked on the browser’s home button), the reading of instructions and understanding that they are in a Web environment. Many users to successfully complete the task required several direct interventions by the researcher [9]. From the study its authors conclude that there are various factors limiting the accessibility of websites and W3C guidelines for accessibility are clearly insufficient to ensure intellectual disabled people their expected access.

In his doctoral dissertation entitled “Designing accessible Web-based instruction for all learners: Perspectives of students with disabilities and Web-based instructional personnel in higher education”, Roh [8] analyzed and investigated how students with intellectual disabilities and Web-based Instruction (WBI) perceive web accessibility, identifying some of the problems we want to tackle, thus resulting crucial to our research. Therefore, the most interesting result was obtained with the observation and testing of a student possessing several difficulties, namely, learning difficulties, dyslexia (difficulties in the reading, writing and spelling comprehension areas) and dysgraphia (difficulty in understanding the written language), from whom the following difficulties were justly identified:

• Confusion when there is a need to insert large amount of text in small text boxes, requiring scrolling;

• Technical problems (some interpreted as a lack of technical knowledge by the student);

• Navigation in complex websites;

• Distinguishing between clickable and non-clickable images (due to inconsistent functionality of the pages);

• Remembering the instructions given by the researcher when the links lead to the image content of additional courses;

• Read text when the contrast between the text and background is low;

• Access to specific content in browsers and computers that were not always available to her.

As a result, this study provides some recommendations in order to overcome the difficulties that were experienced [8]:

• Provide notes ahead of time;

• To ensure that Web content works in multiple browsers and operating systems;

• Provide a brief summary at the end of each lesson;

• Provide clear and precise instructions, to maintain the structure (layout) simple and clear;

• Minimize the number of windows to open;

• Minimize the file size and provide content in various file formats;

• Provide appropriate pages and securities;

• Avoid graphical as possible;

• Ensure sufficient contrast between text and background color;

• Do not provide unnecessary information.

The student's lack of both patience and technology expertise partly because of her disability, leads to further frustration and exaggerations. Thus, there is still doubt whether these issues may be or not only psychological and emotional in nature or are due to her disability.

B. Web Content Accessibility Guidelines (WCAG) 2.0

How to classify a web page as accessible or non accessible? So far, are used the recommendations developed by the World Wide Web Consortium (W3C). The goal of W3C consists in enabling people with special needs to access websites, regardless of their disability [1]. These recommendations are of much interest to this study because these guidelines help Web designers and developers concerned with accessibility issues. In the case studies described in the previous section these recommendations were also object of discussion raising the question whether they are actually sufficient for this specific audience or not.

There are two versions of these guidelines. The recent second version of the guidelines was approved on the 11st of December 2008.

The second version is divided into four global principals thought of to make content visible, operable, understandable and robust. Such principles are based on 12 guidelines that provide the basic goals that web designers and developers should work on to make web content more accessible to users with disabilities. Furthermore, **testable criteria success is provided** for each guideline to allow WCAG 2.0 to be used to test, for instance, design specification, purchasing, regulation, and contractual agreements. There are three levels of conformance: A (lowest), AA, and AAA (highest). These levels were defined to meet the needs of the different groups and situations. It is also documented a wide variety of techniques for each guidelines and success criteria. The techniques are divided in two categories: *those that are **sufficient** for meeting the success criteria and those that are **advisory*** [1].

All of these principles, guidelines, success criteria, as well as sufficient and advisory techniques collaborate together to grant guidance on how to create content more accessible [2].

Contrary to WCAG 1.0, the WCAG 2.0 includes three important terms, as follows:

- Web Page: it shall be noted that the expression, "Web page", in WCAG 2.0 standard, includes much more than just static HTML pages. The dynamic Web is also present, including "pages" that are able to present total virtual interactive communities.
- Programmatically Determined: i.e. the content is delivered in a way that user agents, with the help of assistive technologies, are able to extract and present this information to users in different modalities.
- Accessibility Supported: it means the use of technology that works with assistive technologies and accessibility features of operating systems, browsers, and other user agents [2].

III. PILOT CASE STUDY

The main goal of this pilot study consists in understanding how people with intellectual disabilities access the Internet and has the notion of pages content and functionality. First, we want to determine what elements motivate them to navigate in the internet (their interests) and discern what kind of menu would be more functional and comprehensible to them, meaning that they can identify it as clickable and that it has some functionality. Secondly, we need to identify a set of improvements to make navigation menus accessible and acknowledgeable.

Also, while designing this study we took into account the problems and difficulties identified in the case studies discussed in the previous section, to avoid repeating mistakes and overcome the shortcomings founded.

A. Participants

A total of 14 participants partook in the pilot study, whose ages ranged from 19 to 44 years old, and with different types of intellectual disabilities, for instance, Down syndrome, lack of attention, dyslexia and dysgraphia. These diseases are in

various degrees of severity, classified as mild to moderate disabilities. Twelve of the participants never worked with a computer, and only two have some experience on working with a computer. Similarly, they have little or no experience in use of the Internet. More precisely, thirteen of these participants had never accessed the Internet and only one had contacted with the technology. Furthermore, the group also differs in the level of literacy, seven can read and write and the others have great difficulty in these tasks, being the average rate of literacy and primary education coincident with the third grade. Moreover, the major interests of this group are playing sports and painting. Within the group, eight participants have normal vision and six have corrected to normal vision.

B. Methodology and Procedure

For two weeks (approximately thirty-five hours in total and two and a half hours per subject) the group was faced with basic and essential issues needed to use the computer and the Internet. The method used for data collection was direct observation.

Before getting into contact with the computer and the Internet, the participants were told about the importance of these technologies in society, what are their features and was further explained how to connect a computer, followed by the handling of the mouse and its use.

Also, before starting using the internet and the browser, it was given a brief explanation on how to use the buttons on the browser and their functionalities: the previous and next arrows, maximize, minimize and close windows. Also, they were shown how they might recognize a link, or when the content is clickable or not clickable, based on the transformation experienced by the mouse pointer icon (e.g. when the mouse pointer is over a link the original icon, the arrow, becomes a hand).

The first websites that the participants accessed were selected because they contain tasks that allow them to practice the mouse's use, such as building puzzles and painting. These tasks were chosen because the group showed much interest on them. The careful selection of tasks was a very important aspect as they should correspond to their interests. In fact, if this is lacking due to their condition/disability, we can lose group´s focus and motivation, making it impossible to achieve any task. Based on this information, we obtained clues about the type of websites that generate more interest for future presentation and learning.

The websites that were selected can be accessed from the searching engine "O Leme" [10] specifically in the section specialized on websites for children. In a brief analysis of this platform the issue more complex is returning to the website after accessing a page. The websites used in this stage were:

- "O Leme" [11] with the same name as the searching engine, is a website with images of living animals. The homepage contains a large text introducing the subject and is supplemented by "clickable" images of animals, which grants more opportunities to better acknowledge that specific specie.
- "A Escolinha" [12] is a website presenting several educational games meeting the preferences of the participants and causing some potential disappointment when they do not complete successfully the task. One problem of this website is that when the user double-clicks in two buttons, the audio can induce some confusion on the user due to synchronization problems.

After this initial training stage a new set of tasks were defined in order to identify what was really learned and assimilated by the group and to obtain knowledge about the improvements provided by the previous training stage. The participants started by remembering what they have learnt in the previous stage: opening the browser, in this case the Internet Explorer, go to favorites and choose the desired site, maximize and minimize windows. Then, they were asked to search websites of their choice to enhance the knowledge of what is clickable and not clickable content. This stage lasted for a week, about eighteen hours in total, an hour and a half per participant.

This study was planned to overcome constraints, such as using the mouse and the need for the use of scrolling, bearing in mind that this type of barriers, are also present in the case studies analyzed in the previous section.

IV. RESULTS AND DISCUSSION

As the majority of the participants had never before worked with computers they naturally showed difficulties in using the mouse at first, since it was difficult for them regarding accuracy matters, to click in the icon that was intended, for example the browser icon. This was a major limitation for one of the participants and had a great impact in his performance. This individual in addition to the intellectual disability also possess some motor disabilities.

Besides the fact that they do not perceive how necessary is dealing and using the scroll functionality to see all information available on the page, they do not show any interest or motivation in using this feature. We noticed that if the test exceeds a ten minute period of time they often felt confused and present a setback in the learning process even in the most basic tasks such as using the mouse i.e. in the beginning of the test they handle the mouse without any difficulty but during the test (especially if it extends over time) the participants showed more and more difficulty in understanding what was required.

In spite of the difficulties faced by the participants in the initial training stage the level of motivation has increased in the last stage, since we were able to identify the difficulties and devise a way to overcome them. In the beginning of this stage we noticed by then some improvements when it comes to: the handling of the mouse, the use of the buttons in the browser and in the understanding of the need to scrolling to view all information on the page.

This group paid more attention to images than text and showed a great will (intuition) to click on them. The text sometimes seemed to be unnoticed, since they paid little or no attention to it. This behavior can be explained by the fact that fifty percent of the participants have great difficulties in reading and the average literacy is the third grade.

It should be noted that the difficulties faced by the participants that cannot read can be overcome if they are given audio help (menus using audio). On the other hand, for participants that can read this type of aid can divert the attention. In our study the audio revealed to be a precious help to the majority of the participants in order to complete successfully the given tasks.

The audio help must be well designed, such requirement is essential because if it is not, it will disturb and confuse the participant. As example, the audio should match the mouse's movements. E.g.: When the mouse's cursor moves away from the button, the audio should stop automatically.

There were also observed difficulties regarding the perception of what is or not clickable, namely the identification of the links. Also, it was observed that animated menus do not increase or decrease the participants' notion of what is clickable content. The best way to assume a link to the studied group was through the use of intuitive images. This was particularly evident in the case of the webpage with the animals' images that acts as links. The image must be detached and intuitive regarding to the action, meaning, to match the requested action. E.g.: ACTION – To Sing a Song; IMAGE – A girl singing.

We can assume that intuitive images allied with audio help and written subtitles are the best trilogy of help, for this group.

Finally, realizing that when the website contains many related pages people literally loose themselves in the execution of the task, resulting in a loss of motivation and interest, this study, on the contrary, presents as its main achievement the great interest and motivation shown by the group. Nevertheless, they lose interest when the web pages take more time than expected to load.

V. CONCLUSION

One major outcome of this research is the perception that this particular group of individuals with intellectual disability has a huge motivation to learn and surf on the World Wide Web. Any doubt that might exist about the fact that this group does not have any kind of interest in the Internet has been, therefore, dissipated. This reinforces the necessity to provide to these persons accessible and usable web sites. The determination to learn more and to know everything that is necessary for a good navigation in the Internet, has lead the group to overcome the obstacles and difficulties they have faced and experienced, even when dealing with Web Pages that had been created without taking in consideration accessibility issues.

The W3C guidelines for accessibility are, in fact, very valuable to anyone concerned with the elaboration of Web contents, however, these guidelines are, in our perspective, extremely global, because it embraces all the disabilities: visual, motor and audition. From the observations made, we believe that more detailed recommendations need to be defined for this particular group.

Within this study it was observed that the images were more perceptible, when intuitive, than the text and the audio revealed to be a precious help, especially to the participants with reading difficulties. As future work we plan to gather data with the help of an eye tracker to support these conclusions and evaluate the Guidelines for Accessibility and Usability provided by W3C (version 2.0) for this particular group of people.

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