Towards Characteristics of Accessibility and Usability Issues for Older People - A Brazilian Case Study

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Abstract. The constant evolution of the Web is a worldwide phenomenon that needs to deal quickly with the various segments of current society. Thus, Web content should be accessible to the different user profiles. In this century, the aging population has presented a high rate of demographic growth. Older people (aged 60+) have some of their capacities limited and may face barriers to interact with services and content available on the Web. Despite of legislation and recommendations concerning how to make Web content more accessible and usable, there are still many problems related to accessibility and usability to be solved, especially those related to recent technological advances of current Web resources. The purpose of this study was to investigate the main accessibility and usability issues on websites. The study involved a sample of 20 Brazilian older people. Results showed the most common issues found and participants manifested their main difficulties.

Keywords: Web accessibility · Web usability · Website · Older people

1 Introduction

The Web has undergone substantial technological innovations, and its adoption in various segments of current society has proved to be irreversible, especially in segments such as e-government, online banking, entertainment and others. Although novel Web browsing facilities have arisen, there is still a great challenge related to Web accessibility and usability. It is very important that different user profiles must be considered at the system's design, in order for information to be accessible in the broadest possible way [20]. In addition, an accessible Web has the potential to help people with disabilities and older people to participate more actively in society [14].

According to the ISO 9241-171 standard, accessibility is "the usability of a product, service, environment or facility by people with the widest range of capabilities" [5]. In particular, Web accessibility enables people with disabilities to

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perceive, understand, navigate and interact with the Web, and thus to contribute with it [4]. These requirements are also relevant to older people, which may have their abilities affected by aging, with possible influences in their physical, mental and learning capacities [18].

In this context, older people are identified as a profile to be included in accessibility and usability issues. As people become older, their sensory, physical and cognitive abilities are affected in general, gradually. The aging process naturally brings to them difficulties when interacting with resources of computer systems [17].

Population aging is a worldwide phenomenon. The United Nations (UN) [2] and the World Health Organization (WHO) [8] showed that the world population is in a unique and irreversible transitional demographic process which will result in older populations everywhere. While fertility rates decline, the proportion of people aged 60 or older will double by 2025 and will reach virtually two billion by 2050. According to the National Census data from 2010, conducted by the Brazilian Institute of Geography and Statistics (IBGE) [6], population aging has been occurred at an accelerated way due to factors such as increased life expectancy. Furthermore, according to the population projections, based the on Census, the Brazilian population of people aged 65 or older will be four times greater by 2060. By this time, this number will reach the percentage of 26.8 % of the population, while in 2013 it was only 7.4 %.

Despite the existence of accessibility and usability guidelines such as the Web Content Accessibility Guidelines (WCAG) [9], The National Institute of Aging's (NIA) guidelines [7] and the Brazilian Electronic Government Accessibility Model (e-MAG) [1], further studies are needed in order to reach a better understanding of the needs of older people as users of computer systems. Additionally, the barriers that those users face to interact with websites should be better characterized [10]. Often, websites are not designed aiming at older people. The percentage of these users has been increasing in significant proportions, boosting mechanisms to Web adaptation for taking into account this user profile.

In this context, the purpose of the present study was to investigate the main accessibility and usability issues on websites encountered by Brazilian older people. We first conducted an initial survey to investigate which websites older people access more frequently, which was answered by 87 participants aged 60–90.

Then we selected four websites to the next phase of this study: evaluating their usability and accessibility with the participation of older users. A total of 20 older people agreed to participate in this phase. Their ages ranged from 61 to 84 years, with a mean age of 67.5 years. They were all residents of the city of São Carlos, state of São Paulo, Brazil. We asked each participant to attempt to perform three tasks for each one of the four websites.

All participants had many difficulties during interacting with the websites. After the test sessions, every participant was dissatisfied with the evaluated sites, and almost all have failed to successfully complete the required tasks. We used the guidelines proposed in the literature, by [15,16,19] to define our set of

issues for guiding the process of identifying usability and accessibility issues that occurred during the tests. The proposed issues were grouped in sets according to the similar topics, and their overlap was removed. In addition, the issues that refer to the barriers and difficulties that older people face when interacting with the Web were identified.

The remainder of the paper is structured as follows: in Sect. 2, we examine the previous works related to this paper. In Sect. 3, we describe the usability test of the websites, in Sect. 4 we present the results and discussion. The main conclusions and future work are described in Sect. 5.

2 Related Work

Several studies have discussed the main barriers and difficulties that older people encounter while they interact with the Web. Such studies employed methods such as interviews and usability tests, conducted in field studies or in controlled environments. These barriers show that many websites are not designed keeping in mind the profile of older users, making Web access, sometimes, impossible.

Some research studies have investigated the usability and accessibility of websites by older people. Arfaa and Wang [11] performed a study with 22 elderly users aged 65 or older, with none to advanced computer experience, utilizing social networking sites. The results showed that their previous computer experience and the design of the sites affected the usability and accessibility for those users. Furthermore, they identified that social networking sites are difficult for elders to use because of computer illiteracy, lack of knowledge of Web 2.0 concepts, navigation and other usability issues.

Similarly, in another research study which also involved social networking sites, Braun [13] aimed to understand the factors that influence to the use social networks, such as Facebook. In that study, 124 older adults (aged 60–90) who used the Internet were surveyed. The survey focused specifically on factors related to technology adoption and measured attitudes about perceived ease of use and perceived usefulness of social networking websites, as well as other factors related to technology acceptance. The analyses carried out showed that the use of social networks was associated with trust in their abilities and the Internet use frequency. Unlike what was expected, factors like ease of use and social pressures were not significant predictors.

Bergstrom et al. [12] conducted five independent website usability studies that included younger and older participants and examined age-related differences in them using noninvasive eye tracking. The studies highlighted the potential for age-related differences in performance while navigating websites, such as differences in eye movement and performance during use of some of the sites. The older participants had lower accuracy in one study and took longer to complete tasks in two studies compared to younger participants. In addition, the research inferred that when a website has distracting visual elements, older people pay attention at those areas more than to the rest of the screen.

According to Finn and Johnson [16], many web designers still ignore usability and accessibility design guidelines. The authors of that study conducted a

usability study in three travel websites with 9 elderly users aged 55–80 and encountered some problems like: text too small and not easily enlargeable, difficulty returning to Home page, confusing terminology, hard-to-operate menus, poor marking of links, among others. That study showed that companies which target older adults may be failing to follow such guidelines.

In the present paper we investigated the main accessibility and usability issues on sites frequently visited by Brazilian older people in the town of São Carlos. In contrast to research conducted by [16], we have carried out an initial survey that showed that the travel websites were not very accessible for elderly Brazilians. In addition, participants in our study had 60 years or more, because Article 1 of the Brazilian Statute of the Elderly (Law 10.741) considers old people as those who are aged more than 60 years [3].

3 Methodology

In order to investigate the accessibility and usability issues on websites for Brazilian older people, we followed the methodological procedures as described in next subsections, detailing the data collected and the usability tests performed.

3.1 The Evaluated Websites

We first conducted an initial survey to investigate which websites older people accessed most frequently. The survey was conducted by means of interviews with 7 open-ended questions: the first 6 questions asked for the main websites the participant accessed in each of the following categories - search engines, social network sites, video sites, email services, news sites and blogs. The last question asked for any other website not previously categorized in the interview, such as shopping sites, Wikipedia, health sites, food sites, banking sites and others.

The survey was answered by 87 participants, aged 60–90, of the educational program of the University of the Third Age in the São Carlos Educational Foundation (UATI - FESC), in the town of São Carlos, in the state of São Paulo, Brazil.

From the initial survey results, we applied a criterion for selecting websites for inclusion in this study. We chose the most accessed websites and government websites, both at national and regional area.

The 4 selected websites for the study, were:

- UOL - Universo Online - http://www.uol.com.br;
- São Carlos Agora - http://www.saocarlosagora.com.br;
- Previdência Social (Social Security services for Brazilian people) - http://www.previdencia.gov.br;
- FESC - http://www.fesc.com.br.

The websites were downloaded with HTTrack Website Copier Tool[1] version 3.48-21, on 6th May 2015 and hosted on the server of our research group for use in the usability test sessions.

[1] Available online at https://www.httrack.com/.

3.2 Participants

Twenty participants aged 60 or older participated in the study, out of 53 invited from senior activity centers, as UATI - FESC and the University of Sao Paulo (USP). They were 5 men and 15 women, with ages ranging from 61 to 84 years, with a mean age of 67.5 years. They all lived in the town of São Carlos, in the state of São Paulo. On average, participants had used the web for 5–10 years. Participants reported average daily web use of one to three times per day.

All the 4 websites were evaluated by 17 participants, and three participants evaluated only two websites each. Due to equipment failure, the data of two of the older participants were lost and one participant gave up to do it. According to the responses of the pre-test questionnaire, the participants were divided into 2 groups:

- Group of experts (**GE**): those who use the Internet for over 10 years - 9 seniors
- Group of novices (**GN**): those who use the Internet for less than 10 years - 11 seniors

The distribution of the participants in each group with respect to gender, age and education level is shown in Table 1.

Table 1. Number of participants in each group, according to their characteristics

Distribution of the participants in groups		GE	GN
Gender	Female	6	9
	Male	3	2
Age	60–69	8	8
	70–79	1	1
	80–89	0	2
Education Level	Elementary school	1	1
	High School	2	2
	Graduate	6	9

3.3 Tasks Undertaken

Each participant was asked to perform three tasks in each website, the tasks were different for each website.

The set of tasks devised for each website was related to typical and common tasks that older people could perform on each website. The tasks were organized in a scenario to find specific news for news sites and search for important information by the elderly in government sites.

The websites were evaluated in different cycles, and the order was reshuffled at each cycle to avoid any ordering or fatigue effects.

3.4 Equipment and Software

The evaluations were performed using a HP Pavilion laptop with Microsoft Windows 7 Operating System with processor AMD Dual-Core 2.30 GHz, 4 GB RAM, equipped with speakers, keyboard, a 14 in LCD screen, a webcam and a 2-button mouse.

Participants accessed their assigned website using the Web browser with which they were most familiar. In this study, all participants used Firefox 40.0.3. The computer also ran a screen capture program, Morae 3.2.1[2], that recorded the screen and voice of participant and researcher. Morae was set to record keystrokes and mouse events.

3.5 Procedure

The usability test sessions were conducted in the laboratories of the senior activity centers: the UATI - FESC and USP, where the older people take Internet courses (University of the Third Age). Each session lasted around 46 min, depending on the number of sites each participant chose to evaluate.

Participants were first briefed about the purpose of the study, the process of the evaluation and were asked to read and sign an informed consent form. Next, they completed a brief questionnaire about their age, educational competencies, profession, how long they use the web and the frequency of use of the Internet per day.

After all the settings on the computer have been made, the researcher opened the browser with the link that downloaded sites were hosted in the research group of the server and began the recording session with Morae. For each site, the researcher read the description of the task to the participant and gently asked participants to think aloud protocol, indicating the usability problems they encountered. While the participants performed the tasks, the researcher noted all comments, questions and reactions from the participants during each session.

After usability test sessions were finished, the researcher asked participants to report what tasks had greater difficulty, which sites have suggestions for improvements and summarize the important aspects for them on the evaluated sites.

4 Results and Discussion

The results from the usability tests showed that all participants had many difficulties to interact with the sites. After the test sessions, participants showed dissatisfaction with the evaluated sites, and many failed to successfully complete the requested tasks. Following, the accessibility and usability issues observed during the evaluation of four websites are discussed.

To define our set of issues, we based the analyses on the guidelines proposed by Dias et al. [15], Finn et al. [16] and Lara et al. [19]. The following 7 sets

[2] Available online at https://www.techsmith.com/morae.html.

of issues were proposed, regarding to the issues that refer to the barriers and difficulties that older people faced when interacting with the Web. In addition, the identification of accessibility and usability issues was conducted by means of observations by the researcher and manifestation of users during the tests.

Issue 1 - Location of the Requested Information. All participants (both GE and GN) had many difficulties to find the requested information. The sites of FESC and São Carlos Agora had drop-down menus very close, which caused confusion to participants. In addition, important information for the population, such as the opening hours of FESC and program of courses were not easy to find, which made users to give up searching the site. They said they preferred to go or call FESC to obtain this information. The same happened to the site of Previdência Social, which did not present the information in an easy-to-find manner, making users go to another website (The National Social Security Institute - INSS) seeking information that was not clear on the site.

A few comments from participants are transcribed as follows, and show the difficulty in finding the information requested during the tests:

"It is quite difficult to find the opening hours of the FESC Vila Prado."

"The FESC site should facilitate the way in which information is placed there, we have difficulties because of our age, we forget things."

Issue 2 - Site Map Use. Only the FESC and Previdência sites had a site map. In the GE, 44.5 % of the participants used the site map. In the GN, 9 % of the participants used the site map. The fact that GE used the site map more frequently should probably be related to their greater experience. They had more familiarity and had learned how to use this option on sites.

Issue 3 - Forgetting or Inattention. Only one participant in each group did not show any kind of forgetting or inattention. The highest incidence of forgetting episodes and lack of attention was in relation to what had to be done on the task. While performing a task, participants lost attention browsing the site and at any given time, requested help to the researcher to remind them about what should be done on the task. Another occurrence of forgetting what happened was related to what task he/she had already conducted and ended up doing it again.

Issue 4 - Presentation of Links Activation Problems. Participants (both GE and GN) reported having difficulty understanding some links that were not clear for them, for example, the link "Leia Mais" (read more) in the FESC website (Fig. 1). This link caused confusion to participants who did not understand it as a link but as part of the text to which it belonged. In addition, another problem reported was the proximity of the links on the UOL website. Some participants had trouble clicking a few links that were too close together.

Issue 5 - Information Overload and Links. The selected sites had a large amount of information and advertisements that made participants feel overwhelmed with the choices. Participants of GE and GN reported that the UOL

Fig. 1. Screen capture of option "Leia Mais" (read more) of homepage

site had a lot of advertising that appeared and flashed on their screen, numerous windows, endless scrolling, as well as information and very close links, making it difficult to navigate and distracting their attention. In addition, the São Carlos Agora site also presented lack of contrast between text and background colors, making it difficult to search for information. Another reported issue was the need to improve the content and organization of the information on the 4 sites, to make it clear and direct, especially on sites like FESC and Previdência Social, which had older people as their main target audience. A few comments from participants about this issue:

"The São Carlos Agora site is not very familiar to me, I was lost, too much information."

"The São Carlos Agora and FESC sites are very polluted!! The São Carlos Agora has too much advertising."

Issue 6 - Difficulties to Return to the Homepage of the Site. 88.8 % participants of the GE and 90.9 % participants of the GN found it difficult to return the site's home page on FESC, especially to find the schedule of the courses in one of the requested tasks. In this site, it was necessary to get the schedules of the courses offered by clicking on them, and open a new page with the PDF of times. Participants did not know how to get back to the home page. The other sites also had no clear breadcrumbs, creating difficulties for participants, especially to the inexperienced (GN) during navigation.

Issue 7 - Confusing Terminology and Understanding of Abbreviations. The FESC site presented terms that were not clear to participants (both GE and GN), such as the Institution term to indicate the different campi of FESC. Another problem was the menu with abbreviations without their definitions (Fig. 2), which caused confusion for participants who were lost with this menu and requested assistance from the researcher. A few comments about site are described as follows:

"On the website of FESC, the term institution is very formal, I can not understand that refers to differences campus FESC."

"Information needs to be clearer on the FESC site, these abbreviations are not accompanied by their definitions, it left me lost."

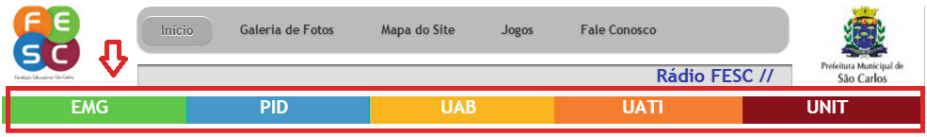

Fig. 2. Screen capture of menu with abbreviations of homepage

Failures (Unfinished Tasks). In each of the sites selected there were tasks that participants had more difficulty and abandoned or performed incorrectly. The most difficult task and most abandoned by users was the task 3 of Previdência Social, related searching for a video. This task was more difficult because the site showed the videos at the bottom, requiring participants to go throughout the entire website content to find the option that directed the videos. In addition, the site did not present the video's names, only one could see it hovering over the video. Task 2 also had a number of abandonment because the search of the FESC opening hours and the term used by the site to refer to different FESC campi was not clear. It also refers to the issue 7 already described.

Task Completion Rates and Time to Complete Tasks. In order to observe the behavior of groups according to the complexity of the evaluated sites for these analyzes, the four sites were divided into two groups:

1. **Simple sites (SS):** regional sites, which have less content and fewer links - FESC and São Carlos Agora
2. **Complex sites (CS):** national sites, with the greatest amount of content, different areas of information and greater amount of links - UOL and Previdência Social

An analysis considering all the sites and the completion of their tasks by the group showed that experienced participants (GE) a task completion rate of 84.4 % and novice participants (GN) had a task completion rate of 69.8 %. A Chi-Square test found a significant difference between the completion rates when comparing the two groups in all websites ($X^2 = 6.439$, $df = 1$, $p - value = 0.01$) (Table 2).

Table 2. Percentage of participants that completed or were unable to finish tasks in all sites

Groups	Completed tasks	Unfinished tasks
Experienced users (GE)	84.4 %	15.6 %
Novice users (GN)	69.8 %	30.2 %

According to Table 3, participants in GE spent more time to complete tasks and also more time give up on them. Since they were more experienced, it created

Table 3. Average time (in minutes) for performing tasks in all sites

Group	Completed tasks	Unfinished tasks
Experienced users (GE)	00:02:57	00:08:40
Novice users (GN)	00:02:40	00:05:49

an expectation that they would spend less time to perform the tasks. However, participants in GE tended to more persistent and ended up spending more time in unfinished tasks than participants in GN. More studies would be necessary to increase the number of participants and tasks in order to show this difference with statistical significance.

Task Completion in Simple and Complex Websites. A second analysis was performed splitting the data into simple and complex websites. This analysis was performed in order to verify whether the complexity of the sites in this sample had any effect on task completion rates. Table 4 shows the percentage of tasks completed and unfinished in simple sites. Table 5 shows the same information for complex websites.

Table 4. Percentage of participants that completed or were unable to finish tasks in the SS

Group	Completed tasks	Unfinished tasks
Experienced users (GE)	81.5 %	18.5 %
Novice users (GN)	66.7 %	33.3 %
Total	73.5 %	26.5 %

Table 5. Percentage of participants that completed or not the tasks in the CS

Group	Completed tasks	Unfinished tasks
Experienced users (GE)	88.1 %	11.9 %
Novice users (GN)	72.7 %	27.3 %
Total	78.7 %	21.3 %

Surprisingly, in the evaluations performed with this sample of websites, a Chi-Square test found no significant difference between task completion rates when comparing simple and complex websites ($X^2 = 0.832$, $df = 1$, $p - value = 0.36$). Considering the limited website sample size, further studies with a larger sample of websites would be necessary to analyse the influence of website complexity in task completion rates by experienced and novice older computer users.

5 Conclusions and Future Work

This study presented an evaluation of four websites that Brazilian older people frequently access and showed accessibility and usability issues regarding the design and presentation of content. The issues investigated and the statistical analysis showed that the sites need to improve the way they organize their content and information.

The analyzed Brazilian sites still have problems to present clear links and the links are very near to click, information overload and many advertisements, difficulties to return to the homepage, confusing terminology and abbreviations without their definitions. In addition, more experienced older users succeeded in navigation, suggesting that users more familiar with Internet can navigate more easily.

The results reinforced known accessibility and usability issues related to existing knowledge guidelines from previous studies. Despite the existing guidelines, there are still sites with accessibility and usability problems. Brazilian sites whose target audience are mainly older people, such as the FESC and Previdência Social were not accessible and usable to them. From the results of this research, it is possible to address the problems and redesign the sites interfaces to improve accessibility and usability for older people.

Finally, the suggestions and conclusions of this study can be used as a baseline for the development of sites considering the profile guidelines of accessibility and usability in order to provide better access to information by older people, mainly for Brazilian citizens.

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