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# **A study about web accessibility in Portuguese museums: How to overcome the main difficulties**

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## **Abstract**

Museums and their websites are an important component in the promotion of accessible tourism. However, some problems related to web accessibility may raise great barriers to the practice of tourism by people with disabilities. This study evaluates the level of website accessibility of museums located in Portugal, as it illustrates the importance of information being presented in an accessible way. A sample of 575 websites was analysed based on Web Content Accessibility Guidelines (WCAG) 2.0, using an automatic web diagnostic tool (AccessMonitor). This analysis was performed considering the A, AA, and AAA conformance levels of WCAG. Currently the state of web accessibility levels is medium, and there are still constraints that make information gathering difficult for visitors with disabilities. After the barriers are identified, proposals to design more accessible websites are presented. These proposals contribute to making museums' online information accessible to all people, independently of their needs and functional limitations.

**Keywords:** c.

## **1. INTRODUCTION**

The Internet and diverse web platforms have become the main means of disseminating information (Abascal, Arrue, Fajardo, Garay, & Tomás, 2004). This is particularly relevant in the case of tourism, as many visitors with disabilities rely on this type of platforms to plan their trips. Accessible information online is crucial in order to transmit more security and confidence to people with disabilities (PwD) during the decision-making process (Evcil, 2018). Pre-planning stages are heavily influenced by the accessibility of web platforms, and it is crucial to ensure that special needs are met (Dimitrios Buhalis & Darcy, 2011: 56). These platforms should not only provide information about the museums' accessibility, but this information should also be provided in an accessible way. However, there are still many informational barriers, which result in difficulties in using websites for PwD (Schmutz, Sonderegger, & Sauer, 2016).

Barriers to information have a high impact on accessibility in the field of museology, as website constraints prevent the delivery of content to PwD, for whom web platforms are a very significant source of information (Handa, Dairoku, & Toriyama, 2010; Langa et al., 2012; Mangani & Bassi,

2019). It is also important to point out that the process of planning a trip is done in much more detail in the case of PwD, since the greater the accessibility requirements, the greater the requirements for detailed information (Buhalis, Eichhorn, Michopoulou, & Miller, 2005). There is a need for recommendations and legislation to provide guidelines for website developers. However, in order for this to come about, major failures need to be identified and corrected.

In the case of Portugal, the government has recognized and remarked the importance of this matter (AMA, 2019), even creating much-needed legislation for public web platforms (Decree-Law 83/2018, 2018).

This study aims to analyse the website accessibility of museums located across diverse regions of Portugal. The selected websites were analysed using the Web Content Accessibility Guidelines (WCAG) 2.0 (W3C, 2018a), regarding all three conformance levels (A/AA/AAA). The evaluating tool used was AccessMonitor, an automatic tool developed in Portugal and available online. The main goal of this study is to perform an evaluation on web accessibility levels in Portuguese museums, identifying the main web accessibility problems and make proposals to overcome these obstacles, contributing thus to making tourism accessible to everyone.

The paper is organized into six sections. The first section introduces the study, and the second discusses the importance of museum web platforms having accessible design. Afterward, the methodology applied in the empirical study is explained and the results of the web accessibility evaluation, using AccessMonitor, are illustrated. In the results and discussion section, the main problems related to the websites affecting disabled users will be presented. Taking into consideration the main issues identified, some recommendations to improve the web accessibility level of museums, will be proposed. In the closing section, the main findings and implications are presented.

## **2. LITERATURE REVIEW**

### ***2.1. Accessible tourism and museums websites***

Visitors with disabilities still face significant barriers that negatively influence their tourism experiences and prevent PwD from travelling and having new experiences (Buhalis & Michopoulou, 2011). Therefore, it is of utmost importance that all tourism supply agents, especially public entities like museums, aim to create accessibility conditions. In this context, one of the main problems preventing people with different types of disabilities from travelling is largely related to the shortage of information (Stumbo & Pegg, 2005; Zajadacz, 2014). If there is a lack of information, it is impossible for disabled tourists to be sure that all their requirements will be fulfilled.

In the specific case of museology, PwD not only demand an appropriate provision of information while at the museum, but also before their arrival, in the process of planning the visit (Langa et al., 2012). Studies about accessibility conditions in museums reveal that PwD must have useful

information on the website, that can be consulted before the visit, with details about physical obstacles that may be encountered (Handa et al., 2010; Poria, Reichel, & Brandt, 2009). The correct dissemination of information on museum web platforms is crucial, so that visitors with disabilities can be aware of critical aspects that may prevent tourism activities. This is in line with research on PwD undertaken in the field of tourism (Daniels, Drogin Rodgers, & Wiggins, 2005; Devile & Kastenholz, 2018; McKercher, Packer, Yau, & Lam, 2003), since due to the constraints PwD face, they have greater needs concerning information for planning the trip, and feel highly constrained when this information either does not exist or is difficult to perceive. Not having information on the accessibility of the museum provided in an accessible way through the museum's website may potentially prevent some PwD from visiting museums (Mangani & Bassi, 2019). As museum websites are considered a major information source for PwD, it is important that they are designed in a way that everyone can access.

## **2.2. Universal design**

Universal design is an approach to design thinking which can have a big impact in assuring the correct dissemination of information, with particular relevance in accessible tourism. When designing different products and services in the area of accessible tourism, it is important to ensure that they are user-friendly and contain no obstacles. Careful planning and design of the different touristic products, services and activities are beneficial to eliminate some accessibility constraints for disabled people (Dimitrios Buhalis & Darcy, 2011). In the UN agreement, universal design means “the design of products, environments, programs, and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design” (United Nations, 2006). Universal design is a concept of designing products and environments for the needs of people, despite their age, ability or status in life (Persson, Åhman, Yngling, & Gulliksen, 2015).

When universal design principles are applied, products and services meet the needs of potential users with a wide variety of characteristics (Burgstahler, 2001). One of the most frequently cited issues of universal design is the seven principles elaborated at the Center for Universal Design, at North Carolina State University (Connell et al., 1997). These seven principles are: (i) equitable use; (ii) flexibility in use; (iii) simple and intuitive use; (iv) perceptible information; (v) tolerance for error; (vi) low physical effort; and (vii) size and space for approach and use. In fact, technological solutions with universal design are more likely to serve all needs, including the needs in accessible tourism, particularly those of PwD, since they also make tourism more approachable for a broader range of the population (Pühretmair, 2004). Accessible technology ensures that correct information is displayed to visitors, helping to eliminate all other obstacles. It is therefore essential that concepts of universal design and accessibility features are given proper thought during the conceptualization phase of tourism web platforms.

### 2.3. *The importance of web accessibility evaluation*

Web accessibility can be understood as the level of access to its content which a website provides to the largest spectrum of users, including PwD (Akgül & Vatansever, 2016). In the field of accessible tourism, making information accessible is only possible if websites are capable of supplying the right information at the right time to the right visitor, since the information presented on a website only has value if individuals have access to it (Wang, Law, Guillet, Hung, & Fong, 2015). Consequently, the concept of website accessibility while using web services is a major factor for PwD. However, while web accessibility is not easy to evaluate, there are some tools capable of guaranteeing some accessibility parameters according to certain guidelines (W3C, 2019), such as Web Content Accessibility Guidelines (WCAG) (W3C, 2018b). As websites experienced major improvement, these guidelines have also been undergoing adjustments over the years, starting with WCAG 1.0, then WCAG 2.0, and most recently WCAG 2.1.

As WCAG 2.0 became a standard for evaluating tourism-related websites (Akgül & Vatansever, 2016; Domínguez Vila, Alén González, & Darcy, 2018) it is important to understand the components involved within this evaluation criteria. WCAG 2.0 is divided into four general principles (Perceivable, Operable, Understandable, and Robust) (W3C, 2018a). Every principle has guidelines, which can be evaluated using success criteria based on three available conformance levels: A – basic accessibility representing the minimum level; AA – intermediate accessibility, when the website meets all criteria under levels A and AA; and AAA – high accessibility, when a set of requirements are added to level AA.

These principles and guidelines, especially WCAG 2.0, were used in the development of studies about web accessibility on websites of services offered by the hospitality industry (e.g. Domínguez Vila et al., 2018; Kuzma, Yen, & Oestreicher, 2009; Mills, Han, & Clay, 2008; Teixeira, Eusébio, & Silveiro, 2019). In museums, some studies were found that evaluate the level of web accessibility (Argyropoulos & Kanari, 2015; Langa et al., 2012; Luccio & Beltrame, 2018; Mangani & Bassi, 2019). Argyropoulos and Kanari (2015) were able to understand that web accessibility was one of the most critical factors in museums' overall accessibility. The lack of web accessibility led to the creation of a WIX website by Luccio and Betrame (2008). Both Mangani and Bassi (2019) and Langa et al. (2012) studied the accessibility of online information for PwD in Italian and American museums, respectively. Both authors concluded that only a restricted group of the museums analysed took the information needs of visitors with disabilities into consideration. Finally, it should be noted that none of the studies utilized evaluation tools using the WCAG 2.0 guidelines. In Portugal there are no known studies conducted in this area to assess web accessibility of museums.

### 3. METHODOLOGY

#### 3.1. Data collection and sample characterization

An online search was made, more specifically on the website of museums in Portugal<sup>1</sup> and on the website of the Directorate General for Cultural Heritage<sup>2</sup>, to identify Portuguese museums' websites. This search was complemented with an intensive search on the Google search engine using the name of the museum to collect the website link when it was not possible to obtain the link on the mentioned platforms.

Each museum was checked to ascertain whether it had a website and, based on the information obtained from these sites, a database was created, which was then complemented with a search on the websites of the city councils. All these data were inserted in an Excel database, which contains information about the museums, namely: name of the museum, its website, the municipality and also the NUTS II region where the museum is located, whether the website belongs to the museum itself or another entity. The database included 575 museum websites. As it can be observed in Figure 1, the biggest share of museums is located in the Central Region of Portugal (29.9% of the total) and in the Metropolitan area of Lisbon (23.1%). Conversely, a much smaller number of museums were registered in the autonomous regions of Madeira and Azores.

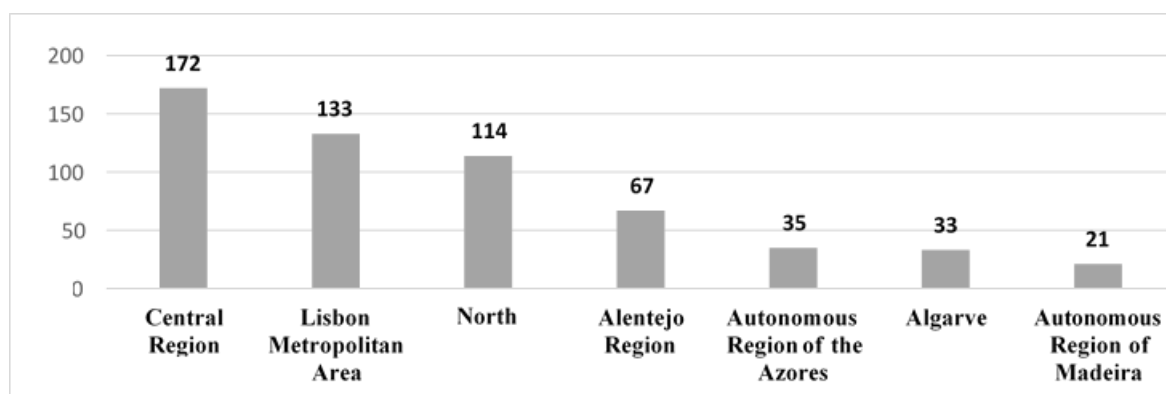
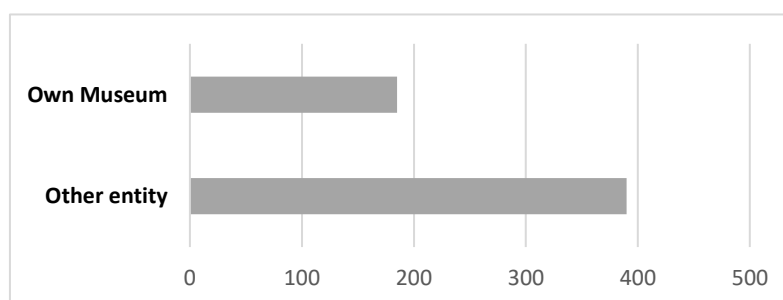


Figure 1 – Location of the museums

It is also relevant to analyse the entity that owns the website. It turns out that only 32% of the websites are owned by the own museum entity and 67.8% of the museums' websites are owned or developed by another entity, mainly Municipal Councils, as shown in figure 2.



<sup>1</sup> <http://museusportugal.org/>

<sup>2</sup> <http://www.patrimoniocultural.gov.pt/pt/museums-and-monuments/portuguese-networ/>

Figure 2 – Entity that owns the website

### 3.2. Data Analysis Method

To analyse the website accessibility of museums located in Portugal, first, it was imperative to select adequate tools for the study. According to the literature, there are different possible tools (Domínguez Vila et al., 2018; Mohd Isa, 2011; W3C, 2019) that can be used to examine the accessibility level of a website. To carry out this study, an online tool (AccessMonitor), capable of identifying web accessibility problems, was selected. The correct provision of the failures is essential for understanding how to overcome the main difficulties in order to make the information which is disseminated by the museums through their websites accessible for all.

AccessMonitor<sup>3</sup> was selected to analyse the web accessibility of museum websites, given that this is a free, online, automatic evaluation tool, which has been widely used in Portugal to examine website accessibility (e.g. Borges, Costa, Sousa Pinto, & Abreu, 2020; Macedo & Sousa, 2019; Teixeira et al., 2019). This software tool was developed by the Foundation for Science and Technology, and analyses websites regarding WCAG 2.0. AccessMonitor analyses the web page of the address inserted and provides an accessibility index, which indicates the average level of web accessibility. This index ranges, in a scale, from 1 (very poor web accessibility practice) to 10 (excellent web accessibility practice). This tool also indicates the errors on HTML components found on the website by degree of compliance (A, AA, and AAA).

## 4. FINDINGS: MUSEUM WEBSITES ACCESSIBILITY LEVELS

According to the results of the global AccessMonitor index of the museum websites analysed, presented in Table 1, it can be seen that, on average, museum websites have a regular (medium) accessibility practice, with a mean of 5.8 and a standard deviation (SD) of 1.81, on a scale between 1 (very poor web accessibility practice) and 10 (excellent web accessibility practice). 60.3% of the museum websites in the regions have an accessibility index above the average (5.80).

	<b>GLOBAL INDEX VALUE</b>	<b>CONFORMANCE LEVEL A (ERRORS)</b>	<b>CONFORMANCE LEVEL AA (ERRORS)</b>	<b>CONFORMANCE LEVEL AAA (ERRORS)</b>	<b>NUMBER TOTAL OF A+AA+AAA (ERRORS)</b>
<b>MINIMUM</b>	2.60	0.00	0.00	0.00	0.00
<b>MAXIMUM</b>	10.00	16.00	7.00	3.00	22.00
<b>MEAN</b>	5.80	4.98	0.97	1.56	7.51
<b>STANDARD DEVIATION</b>	1.81	3.46	0.93	0.78	4.19

<sup>3</sup> <http://accessmonitor.acessibilidade.gov.pt/amp/>

Table 1 – Global indicators of the museums' websites' accessibility levels

A deeper analysis of the global AccessMonitor index obtained (Table 2), revealed that almost half of the museums' websites analysed (47%) have regular practices. However, although there is no museum categorized as very bad practice, 13% of the websites analysed have bad practices. In contrast, 9% of the museums have excellent practices. In this group, it is interesting to note that there are 14 museums (2.43% of the total) that have the highest accessibility index (10), which is considered very positive and demonstrates the concern existing with this type of cultural attractions for certain democratization of access to culture.

WEB ACCESSIBILITY PRACTICES	GLOBAL INDEX VALUE	N	%
Very bad practices	[0-2[	0	0
Bad practices	[2-4[	75	13
Regular practices	[4-6[	270	47
Good practices	[6-8[	150	26
Very good practices	[8-9[	29	5
Excellent practices	[9-10]	51	9

Table 2 – AccessMonitor Global Index of the museums' websites

An analysis of the different types of errors identified on the museum websites analysed according to the three conformance levels (A, AA and AAA) shows several fragilities of the websites (Table 2). The low conformance level (A) stands out, presenting the highest average number of errors per website (mean = 4.98, SD = 3.46). In contrast, the medium level of conformance (AA) has the lowest average number of errors by website analysed (mean = 0.97, SD = 0.93). Taking the three levels of conformance (A, AA, AAA) into account, an average of 7.51 errors were obtained on each website examined. However, there is great heterogeneity in the web accessibility of museums in Portugal, with some museums' websites showing no errors in the three conformance levels (A, AA, AAA) and others a maximum of 22 errors.

A more detailed analysis of the different types of errors present in HTML components according to the three conformance levels (A, AA, AAA), allows the identification, not only of the segments of the accessible tourism market who will have more difficulty in obtaining information from the museums' websites, but also some lines of action to carry out so that people with functional limitations can have access to the information available on the museums' websites.

Tables 3, 4, and 5 report the errors detected by AccessMonitor on HTML components at all three levels of conformance (A, AA, AAA). It can be seen (Table 2) that all possible failures in conformance level A have been detected on Portuguese museum websites. It is imperative to fully understand the errors pointed out by AccessMonitor in detail in order to perceive the challenges for



museums' web accessibility. With the help of descriptions on evaluated HTML components (AMA, 2019), the main failures can be inferred.

Table 3 illustrates failures in conformance level A. The types of errors with the highest levels are: (i) "links to bypass blocks of information"; (ii) "forms markup"; (iii) "links, menus, and link-text-markup"; (iv) "alternative text in images" and (v) "standard W3C (HTML + CSS)".

<b>ERRORS TYPE A</b>	<b>N</b>	<b>MIN</b>	<b>MAX</b>	<b>MEAN</b>	<b>STANDARD DEVIATION</b>
Alternative text in images	575	0	2	0.48	0.56
Multimedia insertion	575	0	3	0.30	0.60
JavaScript use	575	0	2	0.21	0.53
Image maps markup	575	0	1	0.01	0.07
Button graphic markup	575	0	1	0.06	0.24
Frames and respective alternative equivalentents markup	575	0	2	0.02	0.14
Headers markup	575	0	1	0.18	0.39
Links, menus, and link-text markup	575	0	3	0.59	0.60
Link to bypass blocks of information	575	0	2	1.18	0.89
Data tables	573	0	2	0.06	0.25
Forms markup	575	0	4	0.69	0.85
Standards W3C (HTML + CSS)	575	0	2	0.47	0.60
Obsolete presentation elements and attributes	575	0	2	0.31	0.54
Metadata	575	0	1	0.07	0.23
Main page language markup	575	0	1	0.33	0.47

Table 3 – Type A errors in HTML components of museum websites

The flaws in "links to bypass blocks of information" disrupt the mechanism, which allows blocks of material to be circumvented that are repeated on multiple web pages, passing to the main content. The first interactive item on the web page should be a link that takes the user to the beginning of the main content. When failures occur, PwD may have difficulty accessing the main content of a web page quickly and easily. Inaccuracies in "forms markup" prevent the correct provision of a mechanism that allows users to make an explicit request for a change of context.

"Alternative text in images" aims to provide text alternatives for any non-text content so that it can be changed in more appropriate ways, namely extended characters, Braille, speech and symbols. The detected errors hinder access to information, especially for people with visual disabilities. One of the techniques recommended to fulfil this criterion is to have text explaining the images so that people, mainly the blind, can understand what is in the images through words using screen reading devices. Finally, "Standard W3C" aims to eliminate ambiguities in web pages derived from code that does not comply with the specifications in force. It intends to support compatibility with current

and future users, especially with assistive technologies. Failure in this aspect can affect different disability segments since it can affect people with hearing, mobility and visual disabilities.

In the conformance level AA (Table 4), there are two types of errors that should be given special attention: (i) “use of obsolete units” and (ii) “obsolete presentation elements and attributes”. The errors in “use of absolute units” is when the letter sizes are defined in absolute units, such as dots or pixels. The failures in “obsolete presentation elements and attributes” hinder access to information and relationships being presented through visual or auditory formatting are preserved when the presentation format changes. People with hearing and visual disabilities are the segments that have more difficulties in accessing the information disseminated by museum websites when these types of errors occur. Therefore, when these web accessibility flaws make the content of the website difficult to perceive by different support tools, it becomes a barrier for different disabled users who must rely on assistive technologies.

<b>ERRORS TYPE AA</b>	<b>N</b>	<b>MIN</b>	<b>MAX</b>	<b>MEAN</b>	<b>STANDARD DEVIATION</b>
Headers markup	575	0	1	0.03	0.17
Links, menus, and link-text markup	575	0	1	0.03	0.16
Link to bypass blocks of information	575	0	1	0.00	0.04
Forms markup	575	0	1	0.00	0.04
Standards W3C (HTML + CSS)	575	0	1	0.00	0.04
Obsolete presentation elements and attributes	575	0	1	0.25	0.43
Use of absolute units	575	0	2	0.66	0.68

Table 4 – Type AA errors in HTML components of museum websites

Table 5 presents the errors at the highest conformance level (AAA). Essentially, three types of failures were detected: (i) “links, menus, and link-text markup”; (ii) “headers markup” and (iii) “text formatting (line spacing, justified text)”. Failures in “links, menus, and link-text markup” prevent the user from locating additional information and from having access to links to related pages. These failures can occur when a link is composed only of non-text content, such as an image. This must always be accompanied by a caption, otherwise the content can be ignored by the assistive technology. The flaws in “headers markup” make it difficult for the information and relationships to be presented through visual or auditory formatting and to be preserved when the presentation format changes. For example, the presentation format changes when the content is read by a screen reader. This criterion helps people who have different disabilities, allowing the users to adapt the content according to their needs, especially people with visual disabilities (and who use a screen reader) when the information transmitted through colour is also available in text (including text alternatives for images that use colour to transmit information). Lastly, errors detected in “text formatting” prevent the description of how the data is organized, resulting in constraints for PwD trying to

navigate in the websites. People, especially those with cognitive disabilities, but also people with visual disabilities, can have difficulty when the text formation makes the content incomprehensible.

<b>ERRORS TYPE AAA</b>	<b>N</b>	<b>MIN</b>	<b>MAX</b>	<b>MEAN</b>	<b>STANDARD DEVIATION</b>
Headers markup	575	0	1	0.43	0.50
Links, menus, and link-text markup	575	0	2	0.84	0.37
Link to bypass blocks of information	575	0	1	0.00	0.04
Obsolete presentation elements and attributes	575	0	1	0.00	0.04
Text formatting (line spacing, justified text)	575	0	2	0.29	0.49

Table 5 – Type AAA errors in HTML components of museum websites

The results obtained indicate that museums have medium levels in components of web accessibility, registering an index of 5.80 (on a scale of 1 to 10). The results of this study may be compared with the results of other studies in the field of tourism that used the AccessMonitor to evaluate web accessibility (Borges et al., 2020, Teixeira et al., 2019). For example, Borges et al. (2020), in a study of websites of inbound markets where Portugal is listed as a destination, obtained a global index of 6.04, with most mistakes being reported in links to surpass information blocks. In the study of Teixeira et al. (2019) on Portuguese travel agencies, the global accessibility index (on average) was much lower (4.77), giving museums a slightly better performance regarding web accessibility levels. Moreover, in a study carried out by Macedo and Sousa (2019) an attempt was made to acquire a comprehensive view of web accessibility on the websites of the five largest hotel chains in Portugal, also using AccessMonitor; a global index of 4.58 was obtained, once again lower than the index of the museums analysed. In addition, in the museum websites, the biggest failures were identified in image, headers, and main page markups. Therefore, although the Portuguese museum websites reveal a regular web accessibility level, some flaws need to be revised by web designers to make the information disseminated by this communication channel accessible to all.

## **5. HOW TO IMPROVE WEB ACCESSIBILITY IN PORTUGUESE MUSEUMS**

With the help of techniques proposed by W3C (W3C, 2016), it was possible to obtain guidance for meeting the WCAG 2.0 success criteria. W3C proposes some website development techniques to ensure their accessibility, emphasizing that the techniques suggested are not mandatory but merely proposals that can be adopted. The Portuguese government (AMA, 2019) also provides some indications on how to design accessible websites, as well as important legislation (Decree-Law 83/2018, 2018). Table 6 compiles all the measures identified that should be taken into consideration by designers when developing museums' web platforms, in view of the main problems identified in the analysis.

<b>DESIGN PROPOSALS FOR MUSEUM WEBSITES</b>
<ul style="list-style-type: none"> <li>• Provide links that allow easy navigation through the webpage</li> </ul>
<ul style="list-style-type: none"> <li>• Provide short text alternatives for non-text content               <ul style="list-style-type: none"> <li>—Provide text alternatives for images/videos/other non-text content</li> <li>—Identify the purpose of non-text content</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Make important information, structure and relationships available in text</li> </ul>
<ul style="list-style-type: none"> <li>• Resize text without assistive technology and loss of content or functionality               <ul style="list-style-type: none"> <li>—Support browser zoom</li> <li>—Using a style switcher to increase font size</li> <li>—Ensure that when the text resizes there is no loss of content</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Provide navigation sequences that do not affect meaning or operation               <ul style="list-style-type: none"> <li>—Place the interactive elements in the correct order of the sequence</li> <li>—Provide the content in a logical order</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Explain the purpose of every link               <ul style="list-style-type: none"> <li>—Provide text describing links</li> <li>—Provide text describing elements of images containing links</li> <li>—Provide button labels that describe the purpose of the button</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Initiate changes in context only by user request               <ul style="list-style-type: none"> <li>—Avoid implementing automatic updates</li> <li>—Avoid implementing automatic redirects</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Provide labels and instructions when user input is required               <ul style="list-style-type: none"> <li>—Implement auto-labelling</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Modify or delete user-controllable data in data storage systems               <ul style="list-style-type: none"> <li>—Allow recovery of deleted information</li> <li>—Provide a checkbox in addition to a submit button</li> <li>—Request confirmation to continue with a selected action</li> <li>— Before submissions of data, allow the user to review and correct answers</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Implement content using markup languages               <ul style="list-style-type: none"> <li>—Ensure that web pages are well-formed</li> <li>—Ensure that web pages can be parsed</li> </ul> </li> <li>• Introduce improvements in HTML tags to maximize compatibility with assistive devices</li> </ul>

Table 6 – Design proposals to overcome web accessibility challenges in Portuguese museums

Providing short text alternatives for non-text content and presenting the same information as non-text content resolves problems regarding the lack of alternative text in images. Furthermore, the correct provision of links and identification of their purpose can help PwD have quicker and easier access to the intended information. A meaningful order of the content while creating the website is also crucial, since it helps PwD to navigate and prevents presentation of obsolete elements and attributes. Also, the avoidance of automatic redirects can contribute to a more user-friendly content, as some users may get lost in the shuffle. A coherent explanation of the input needs by the user and input content which is easy to modify can be also important for the creation of forms and their completion by PwD. Finally, it is important to maximize compatibility with assistive devices which are usually used by PwD, and this goal can be achieved by using HTML tags according to specifications and ensuring that web pages are well-formed, and that they can be parsed.

## **6. CONCLUSION**

This study evaluated the accessibility of 575 websites of museums located in Portugal, using AccessMonitor, an automatic evaluator that provides errors in HTML components and considers WCAG 2.0. AccessMonitor allowed the identification of website components that should be improved, as the objective was to understand how to overcome web accessibility problems in Portuguese museums.

From the sample analysed, it was possible to draw three main conclusions. First, the study revealed that the web accessibility level of the museums analysed is medium, with a global accessibility index of 5.80. The main failures in the websites analysed are related to (i) alternative text in images, (ii) links to bypass blocks of information, (iii) form marking, (iv) standard W3C, (v) alternative text in images, (vi) obsolete presentation elements and attributes, (vii) use of obsolete units, (viii) headers markup, (ix) links, menus, and link-text markup and (x) text formatting. Second, all conformance levels reveal some flaws that need to be improved as the identified errors in HTML components can compromise the information gathering process for diverse visitors with disabilities. Third, the results revealed similarities with some other studies that evaluated Portuguese tourism-related web platforms. After identifying main accessibility issues, these issues were analysed and based on the techniques proposed by WCAG 2.0, government guidelines (AMA, 2019), and current legislation (Decree-Law 83/2018, 2018), requirements for the construction of more accessible websites were obtained. Of course, every single HTML component is essential, but web platforms cannot integrate all of them, because that might cause inefficiency. By focusing on the most critical errors, solutions that act to eliminate them can be identified.

Even though the study contributed to the diagnosis of web accessibility of museum websites and identification of possible requirements, some limitations can be found. The use of AccessMonitor only allows the identification of HTML errors, and this tool does not take the experience of disabled people in real-life situations into consideration. It is essential to evaluate the perception of PwD that experience some difficulty while interacting with web platforms. This work intends to create awareness about the necessity of incorporating a more accessible design during the creation of websites for museums and other tourism supply agents.

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## REFERENCES

- Abascal, J., Arrue, M., Fajardo, I., Garay, N., & Tomás, J. (2004). The use of guidelines to automatically verify web accessibility. *Universal Access in the Information Society*, 3(1), 71–79. <https://doi.org/10.1007/s10209-003-0069-3>
- Akgül, Y., & Vatansever, K. (2016). Web Accessibility Evaluation of Government Websites for People with Disabilities in Turkey. *Journal of Advanced Management Science*, 4(3), 201–210. <https://doi.org/10.12720/joams.4.3.201-210>
- AMA. (2019). Recursos e ferramentas para melhorar a experiência de utilização de sítios públicos. Retrieved August 20, 2020, from <https://www.acessibilidade.gov.pt/>
- Argyropoulos, V. S., & Kanari, C. (2015). Re-imagining the museum through “touch”: Reflections of individuals with visual disability on their experience of museum-visiting in Greece. *Alter*, 9(2), 130–143. <https://doi.org/10.1016/j.alter.2014.12.005>
- Borges, I., Costa, E., Sousa Pinto, A., & Abreu, A. (2020). Infoaccessibility on the websites of inbound markets of Portugal destination. In Á. Rocha, A. Abreu, J. de Carvalho, D. Liberato, E. González, & P. Liberato (Eds.), *Advances in Tourism, Technology and Smart Systems. Smart Innovation, Systems and Technologies, vol 171*. (pp. 105–117). Singapore: Springer. [https://doi.org/10.1007/978-981-15-2024-2\\_10](https://doi.org/10.1007/978-981-15-2024-2_10)
- Buhalis, D., & Darcy, S. (2011). *Accessible Tourism Concepts and Issues*. UK: Channel View Publications.
- Buhalis, D., Eichhorn, V., Michopoulou, E., & Miller, G. (2005). *Accessibility Market and Stakeholder Analysis. One-Stop-Shop for Accessible Tourism in Europe (OSSATE)*. United Kingdom: University of Surrey. Retrieved from [https://www.accessibletourism.org/resources/ossate\\_market\\_analysis\\_public\\_final.pdf](https://www.accessibletourism.org/resources/ossate_market_analysis_public_final.pdf)
- Buhalis, D., & Michopoulou, E. (2011). Information-enabled tourism destination marketing: Addressing the accessibility market. *Current Issues in Tourism*, 14(2), 145–168. <https://doi.org/10.1080/13683501003653361>
- Burgstahler, S. (2001). Universal design of instruction. *Remedial and Special Education*, 24(6), 369. Retrieved from <http://www.washington.edu/doit/Brochures/Academics/instruction.html>
- Connell, B., Jones, M., Mace, R., Mueller, J., Mullick, A., Ostroff, E., Sanford, J., Steinfeld, Ed., Story, M., Vanderheiden, G. (1997). *The Center for Universal Design (1997). The Principles of Universal Design, Version 2.0*. Raleigh, NC: North Carolina State University.
- Daniels, M. J., Drogin Rodgers, E. B., & Wiggins, B. P. (2005). “Travel Tales”: An interpretive analysis of constraints and negotiations to pleasure travel as experienced by persons with physical disabilities. *Tourism Management*, 26(6), 919–930. <https://doi.org/10.1016/j.tourman.2004.06.010>
- Decree-Law 83/2018, Diário da República n.º 202/2018, Série I de 2018-10-19 (2018).
- Deville, E., & Kastenzholz, E. (2018). Accessible tourism experiences: the voice of people with visual disabilities. *Journal of Policy Research in Tourism, Leisure and Events*, 10(3), 265–285. <https://doi.org/10.1080/19407963.2018.1470183>
- Domínguez Vila, T., Alén González, E., & Darcy, S. (2018). Accessible tourism online resources: a Northern European perspective. *Scandinavian Journal of Hospitality and Tourism*, 19(2), 140–156. <https://doi.org/10.1080/15022250.2018.1478325>
- Evcil, A. N. (2018). Barriers and preferences to leisure activities for wheelchair users in historic places. *Tourism Geographies*, 20(4), 698–715. <https://doi.org/10.1080/14616688.2017.1293721>
- Handa, K., Dairoku, H., & Toriyama, Y. (2010). Investigation of priority needs in terms of museum service accessibility for visually impaired visitors. *The British Journal of Visual Impairment*, 28(3), 221–234. <https://doi.org/10.1177/0264619610374680>
- Kuzma, J., Yen, D., & Oestreicher, K. (2009). Global e-government Web Accessibility : An Empirical Examination of EU , Asian and African Sites. In *Second International Conference on Information and Communication Technology and Accessibility*. Hammamet, Tunisia. Retrieved from <http://eprints.worc.ac.uk/591/>
- Langa, L., Lazar, J., Adesina, T., Baumgart, D. M., Brockmeyer, V., Bush, H. L., ... Knauff, S. (2012). Museum web accessibility: A pilot assessment of Mid-Atlantic museums. *International Journal of the Inclusive Museum*, 4(1), 15–28. <https://doi.org/10.18848/1835-2014/CGP/v04i01/44360>
- Luccio, F. L., & Beltrame, L. (2018). Accessible tourism for users with hearing loss \*. *ACM International Conference Proceeding Series*, 243–248. <https://doi.org/10.1145/3284869.3284909>

- Macedo, C. F., & Sousa, B. M. (2019). A acessibilidade no etourism: um estudo na ótica das pessoas portadoras de necessidades especiais. *PASOS. Revista de Turismo y Patrimonio Cultural*, 17(4), 709–723. <https://doi.org/10.25145/j.pasos.2019.17.050>
- Mangani, A., & Bassi, L. (2019). Web information, accessibility and museum ownership. *International Journal of Tourism Policy*, 9(4), 265–281. <https://doi.org/10.1504/IJTP.2019.105486>
- McKercher, B., Packer, T., Yau, M. K., & Lam, P. (2003). Travel agents as facilitators or inhibitors of travel: Perceptions of people with disabilities. *Tourism Management*, 24(4), 465–474. [https://doi.org/10.1016/S0261-5177\(02\)00107-3](https://doi.org/10.1016/S0261-5177(02)00107-3)
- Mills, J. E., Han, J. H., & Clay, M. J. (2008). Accessibility of hospitality and tourism websites: A challenge for visually impaired persons. *Cornell Hospitality Quarterly*, 49(1), 28–41. <https://doi.org/10.1177/1938965507311499>
- Mohd Isa. (2011). Assessing the Usability and Accessibility of Malaysia E-Government Website. *American Journal of Economics and Business Administration*, 3(1), 40–46. <https://doi.org/10.3844/ajebasp.2011.40.46>
- Persson, H., Åhman, H., Yngling, A. A., & Gulliksen, J. (2015). Universal design, inclusive design, accessible design, design for all: different concepts—one goal? On the concept of accessibility—historical, methodological and philosophical aspects. *Universal Access in the Information Society*, 14(4), 505–526. <https://doi.org/10.1007/s10209-014-0358-z>
- Poria, Y., Reichel, A., & Brandt, Y. (2009). People with disabilities visit art museums: An exploratory study of obstacles and difficulties. *Journal of Heritage Tourism*, 4(2), 117–129. <https://doi.org/10.1080/17438730802366508>
- Pühretmair, F. (2004). It's time to make eTourism accessible. *Computers Helping People with Special Needs*, 272–279. [https://doi.org/10.1007/978-3-540-27817-7\\_41](https://doi.org/10.1007/978-3-540-27817-7_41)
- Schmutz, S., Sonderegger, A., & Sauer, J. (2016). Implementing Recommendations from Web Accessibility Guidelines. *Human Factors*, 58(4), 611–629. <https://doi.org/10.1177/0018720816640962>
- Stumbo, N. J., & Pegg, S. (2005). Travelers and Tourists With Disabilities : a Matter of Priorities and Loyalties. *Tourism Review International*, 8(3), 195–209. <https://doi.org/10.3727/154427205774791537>
- Teixeira, L., Eusebio, C., & Silveiro, A. (2019). Website Accessibility of Portuguese Travel Agents. *14th Iberian Conference on Information Systems and Technologies (CISTI)*, (June), 1–6. IEEE. <https://doi.org/10.23919/cisti.2019.8760949>
- United Nations. (2006). *The UN convention on the rights of persons with disabilities*. <https://doi.org/10.1057/palgrave.development.1100310>
- W3C. (2016). Techniques for WCAG 2.0. Retrieved from <https://www.w3.org/TR/WCAG-TECHS/>
- W3C. (2018a). How to Meet WCAG 2.0 (Quick Reference). Retrieved August 13, 2020, from <https://www.w3.org/WAI/WCAG21/quickref/>
- W3C. (2018b). Web Content Accessibility Guidelines (WCAG) 2.1. Retrieved August 13, 2020, from <https://www.w3.org/TR/WCAG21/>
- W3C. (2019). Web Accessibility Evaluation Tools List. Retrieved August 18, 2020, from <https://www.w3.org/WAI/ER/tools/>
- Wang, L., Law, R., Guillet, B. D., Hung, K., & Fong, D. K. C. (2015). Impact of hotel website quality on online booking intentions: eTrust as a mediator. *International Journal of Hospitality Management*, 47, 108–115. <https://doi.org/10.1016/j.ijhm.2015.03.012>
- Zajadacz, A. (2014). Sources of tourist information used by Deaf people. Case study: the Polish Deaf community. *Current Issues in Tourism*, 17(5), 434–454. <https://doi.org/10.1080/13683500.2012.725713>