Web Accessibility: an Introduction

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Abstract

While the Internet has been a great boon to society, much of the Web is still inaccessible to those with disabilities. Even the government and public websites of various EU countries fail to comply with industry-standard guidelines, and private websites are often worse. These industry-standard guidelines are created by third-party organizations, the most prominent of which is the World Wide Web Consortium. Their current standards, the Web Content Accessibility Guidelines 2.0, are referenced by the International Organization for Standardization, the European Commission, and the United States government. The WCAG 2.0 has several components, the first level of which consists of four principles that describe accessibility: *perceivable, operable, understandable,* and *robust*. Categorized under these principles are twelve guidelines, as they specify the requirements that would pertain to those traits. To measure successful compliance, websites must meet the respective requirements to be classified at a certain level. The lowest level is A, and the higher levels, AA and AAA, are attained when further requirements are met on top of the lower level ones. One of the biggest challenges in implementing accessibility is evaluating a website for its compliance. WCAG 2.0 provides tools termed *techniques* and *failures*. Techniques are recommended implementations or improvements, images, headers, and hyperlinks have standards they must adhere to. For content like this, designers can use simple third- party tools to evaluate them manually. For professional productions, however, a more involved and automated process is necessary. An example of such a process would be developers evaluating OCW websites, where they used a modified WCAG-EM 1.0 for the purposes of streamlining both the automated and manual testing.

1 Introduction

Tim Berners-Lee, creator of the World Wide Web, said "the power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect" (Henry, 2005). As long as someone has a connection, there is a wealth of information available in the form of videos, podcasts, blogs, or even pictures. The Internet has freed people from numerous physical limitations, enabling them to create entertainment, online storefronts, and digital services as a result. Furthermore, these many resources are much easier for people to access, especially for people with disabilities. Now more than ever, people with disabilities have the potential to create communities, participate in the workplace, and make use public services and resources (Ferri and Favalli, 2018). The caveat to any of this progress is that accessibility must be accounted for when designing websites. To properly address accessibility in web design, more people need to be aware of the issues in creating more accessible websites, both non-technical and technical stakeholders alike. In order to bolster understanding of web accessibility issues, stakeholders must first understand what the current state of web accessibility is, what accessibility means to those implementing it, and how developers check whether they have implemented accessibility.

1.1 Current Web Accessibility

For the millions of people with disabilities, accessibility issues are not trivial. 93% of respondents to the 2012 Flash Eurobarometer survey said "barriers to accessibility make it more difficult for people with a disability to attend schools, to have a job, to vote and/or to freely move around and go on holiday" ("Flash Eurobarometer 345: Accessibility," 2012). While many of these barriers do not directly relate to the web, studies do show that disabilities affect Internet access. For example, "[t]he Eurobarometer report on discrimination in the EU, released in 2012, indicates that there is gap in Internet access of more than 20 percentage points between people with disabilities and non-disabled people" (Ferri and Favalli, 2018) A major reason why these barriers exist is that most able-bodied users will never encounter problems with accessibility, and this includes designers. Web pages have more enhanced interactivity and visual elements than ever, but these create barriers for users with disabilities who use different controls to browse the web (Ferri and Favalli, 2018). Furthermore, "while accessibility has increased, the majority of e-government websites among several [EU] Member States remain inaccessible to people with disabilities" (Ferri and Favalli, 2018). Implementation of accessibility measures has been so slow that the European Union's websites were not considered fully accessible, and in various member countries "public service websites do not comply with the WCAG 2.0 AA requirements" (Ferri and Favalli, 2018). An example is Italy's public health websites whose accessibility is "extremely modest" (Ferri and Favalli, 2018).

The accessibility of private websites is often poor as well. While this decreases the quality of life for people with disabilities, these businesses also stand to lose as a result. Ferri and Favalli (2018) say that "73% of participants with access needs experienced

barriers on more than a quarter of websites they visit for the first time" and that "71% of disabled customers with access needs will leave websites that they find difficult to use." To contrast, Ferri and Favalli (2018) cite a 2016 study conducted in Spain which found that the size of a bank is inversely correlated to how likely they are to implement accessibility measures. They specifically quote that Spanish study when they say "web accessibility is 'becoming a source of competitive advantage for businesses'" so "small banks with limited resources are more inclined to implement it" (Ferri and Favalli, 2018).

1.2 Standards of Accessibility

In order to be effectively implemented, accessibility needs agreed-upon standards. These standards are generally set by "standardization organizations" which are "private bodies, which include various stakeholders, and which develop, issue and revise standards," the most influential of which is the World Wide Web Consortium (W3C) (Ferri and Favalli, 2018). The W3C contributors include different related organizations, research centers, stakeholders, and even large private companies such as Google and Adobe (Ferri and Favalli, 2018). Importantly, while the standards set forth by the organizations that the W3C oversees are officially voluntary, Ferri and Favalli also state that the Web Content Accessibility Guidelines (WCAG) "have been widely incorporated or adopted into policy and legislative frameworks" (Ferri and Favalli, 2018). For example, in 2014 the European Standardization organizations created a new standard whose accessibility requirements refer to the WCAG 2.0. This is because the "WCAG 2.0 are currently considered the most advanced standard" (Ferri and Favalli, 2018). WCAG 2.0 is also endorsed by the International Organization for Standardization (ISO) (Lazarte, 2012). Even the United States updated their laws with references to the WCAG as part of the ICT Refresh, which seeks to make US guidelines closer to guidelines other countries use ("About the ICT Refresh").

One of the foremost purposes of standardization organizations is to define accessibility in a clear and applicable manner. On the *Introduction to Web Accessibility* page under the section *What is Web Accessibility*, W3's Web Accessibility Initiative (WAI) website defines accessibility as when "websites, tools, and technologies are designed and developed so that people with disabilities can use them" (Henry, 2005). In their study of online course websites, Rodríguez et. al (2017) say that the most commonly used definition of accessibility is from the ISO. The ISO definition of accessibility can be summarized as the "use of a product, service, framework or resource in an efficient, effective, and satisfying way by people with different abilities" (Rodríguez et. al, 2017). Usability is a closely related concept in this context because of how it builds off of accessibility. Rodríguez and his colleagues draw the connection between these two concepts by saying "accessible websites are more usable and vice versa" (Rodríguez et. al, 2017). The related concept of usability as defined by the ISO is summarized as how much a given user can achieve "specific goals with effectiveness, efficiency and satisfaction in a specific use context" (Rodríguez et. al, 2017).

2 WCAG Overview

Given how much the definition of accessibility can encompass, most accessibility guidelines will provide further clarification. In terms of the WCAG 2.0, there are the four top-level foundational principles to follow when making accessible web content: perceivable, operable, understandable, and robust (Caldwell et. al, 2008). Perceivable means the user interface and other information must be presented the user in a perceivable manner. Operable means that the interface must be operable by the user. Understandable means the information and site operation are understandable to the user. Lastly, robust means that it can handle a lot of different inputs reliably, including assistive technologies (Caldwell et. al, 2008).

Underneath these principles are a total of 12 guidelines that, while not testable, represent goals that help with understanding what successfully implemented accessibility should look like. Caldwell et. al (2008) describe each of the guidelines in order of the principles they are placed under. Perceivability has four guidelines: providing text alternatives for non-text content, providing alternatives for "time-based media," making content that can be presented differently without loss of information, and making content that is easier to distinguish from the other content. Operability also has four guidelines: making all functionality keyboard accessible, giving the user enough time to consume content, avoiding the use of seizure-inducing content, and providing ways for the user to "navigate, find content, and determine where they are" (Caldwell et. al, 2008). The third principle, understandability, has three guidelines: making text readable, making web pages predictable, and helping users avoid and correct input mistakes. Robustness only has one guideline, and that is to ensure the software is compatible with current and future technology (including those that are assistive).

2.1 Measuring Conformance

In order to measure the success of a website in upholding WCAG standards, there are three different conformance levels that can be fulfilled (Caldwell et. al, 2008). The minimum level is A, with the higher levels expanding on the requirements from lower levels, and the maximum level is AAA. These standards can also be upheld if a website has an alternate version that does meet the conformance requirements. Caldwell et. al (2008) also state that not all content can be compensated for to a AAA level degree. These standards also require that the full web page must be accounted for, and the admittance of partial support, or at least ensuring the inaccessible content does not block the way to accessible content (Caldwell et. al, 2008). Furthermore, pages in a series must also meet the same level of conformance or better to be considered conforming, giving the example an online store that "has a series of pages that are used to select and purchase products" (Caldwell et. al, 2008).

The WCAG also provide techniques for evaluating the success of the website's accessibility conformance. In the article *Understanding WCAG 2.0*, there is a section named *Understanding Techniques for WCAG Success Criteria*. There, two categories are

defined; the techniques that are “reliable ways to meet the success criteria” are termed sufficient, and those that “suggest ways to improve accessibility” are termed advisory (Cooper et. al, 2016). Defined there also are failures. These are “things that cause accessibility barriers and fail specific success criteria” and their use is recommended over even the techniques because they demonstrate an actual shortcoming (Cooper et. al, 2016). Using these techniques does not guarantee passing WCAG, and inversely the WCAG does not require using these techniques for success (Cooper et. al, 2016). Instead, techniques are merely helpful options that come with tests and can make a site likelier to pass (Cooper et. al, 2016).

3 Applying WCAG Standards

Consider the accessibility of even simple pieces of content on a web page. When putting an image on a page, accessibility measures require that there is an appropriate description for its contents. This is termed the `alt` text, and is used when the image hasn’t loaded or for screen reading software. Ng (2017) outlines the process for what should go into the alt text by using three simple questions. The first question is “what role does the image play?” (Ng, 2017). If the image is just decorative then the alt text can be left blank, otherwise there should be a descriptive id, or a short label. If it is informational, then the type of info the image represents must be taken into account. The image as a link means the alt text can be a label for the link, while an image with a small amount of information can have an alt text with a short description or a short label and a separate text description. If there is a lot of information, then the alt text should contain a concise label and a location for the separate text alternative. These actions would uphold the WCAG principle of perceivability under its first guideline of providing a text alternative to non-text content.

Another example Ng gives is to make links and header elements descriptive. Headers are used for visual organization, but they also help organize the content and are easy to change. Ng (2017) helpfully explains that “[m]any reading tools and assistive technologies allow users to read the headings first like a table of contents” or “to skip content by heading” as well as being used by search engines to estimate that page’s contents. Organizing information with headers of different sizes (6 are available in total) could be compared to using bullet points that have different tab levels. Meanwhile, users who move using the different hyperlinks on a page instead will need descriptions that give context as to where those links lead (Ng, 2017). If a hyperlink only has the text “click here” to describe its purpose, that purpose could be anything from linking to a different website to playing an audio file (Ng, 2017). If that same hyperlink had the text “information about hyperlinks from W3C,” the purpose of that hyperlink would be to lead the user to further information on hyperlinks. Ng (2017) explains that users navigating a page through links would “only see or hear ‘click here,’ making it difficult to distinguish from other links that have the same text”.

3.1 Evaluating Content

One of the most difficult tasks for developers and creators to perform in regards to web accessibility is to actually audit their content. Ng (2017) gives a simple overview of tools that help designers determine if their websites fulfill accessibility guidelines. For documents hosted online, “most popular commercial document creation software, such as Microsoft Office and Adobe Acrobat, have built-in accessibility checking tools” (Ng, 2017). Ng (2017) also lists three different simulators that take web page contents and present it in a different manner. The WAVE Toolbar “can display a web page in different ways, such as an outline of headings, and a text-only version” (Ng, 2017), and is available as an extension on Chrome and Firefox. To see how a page would look to different colorblind users, designers can use Toptal’s Colorblind Web Page Filter to see a side by side comparison of the original website and an adjusted copy. For Firefox users, the plugin Fangs can provide what would be read by a screen reader in a text format. Ng (2017) also lists two automated code checkers, HTML Codesniffer and the Firefox plugin WCAG Contrast Checker. The first tool, available on Squiz’s GitHub, is a pastebox which checks if the code inside “conforms to either Section 508 of the Americans with Disabilities Act or Web Content Accessibility Guidelines” (Ng 2017). WCAG Contrast Checker also uses the designers code by testing the colors defined by the website’s style sheets (Ng 2017). Ng (2017) does qualify the recommendation of the tools listed previously by saying they have the same problem a spellcheck might, where they flag all errors regardless of intent, including only potential issues.

Additionally, these compliance tools are meant to be used by content creators making relatively simple content. For an example of an enterprise application, Rodríguez and his colleagues (2017) set out to create a methodology and framework for evaluating and improving open source learning resources named Open Course Ware (OCW) using the materials provided by W3C. Aside from referencing the WCAG, they also describe other resources provided by WAI for evaluation that they use. The first such resource is the WCAG-EM or WCAG Evaluation Methodology, which “describes a procedure to evaluate websites providing considerations in order to guide reviewers and to promote good practices” (Rodríguez et. al, 2017). The WCAG-EM assists with examining websites that already exist (Rodríguez et. al, 2017). The second resource consists of the “easy checks - first review” on the W3C site, which as its name suggests, helps a designer perform simple checks on a web page’s accessibility (Rodríguez et. al, 2017). The third item Rodríguez et. al list consists of two particular tools from the 69 provided by W3C, these being TAW and Checker. TAW is a tool that helps designers examine web pages for accessibility in both WCAG 1.0 and 2.0 (Rodríguez et. al, 2017). Checker is a tool that evaluates the accessibility of a site, and can use many different guidelines, including WCAG 1.0 and 2.0 (Rodríguez et. al, 2017).

3.2 A Framework for Evaluating Websites

Due to the more technical nature of their undertaking, Rodríguez and the other researchers have to define a methodology, or a formally defined process, to evaluate their

websites. To define their methodology, Rodríguez et. al (2017) take the WCAG-EM 1.0 and add elements to adapt it specifically for OCW. Hence, they describe the steps they follow alongside their extra adjustments. The first step in the WCAG-EM they describe is to determine the "scope of evaluation" which essentially means determining what pages and parts of pages are to be evaluated (Rodríguez et. al, 2017). Second, the evaluator needs to get a handle on the website by learning how it works and what kinds of pages are common on the website (Rodríguez et. al, 2017). Third, the evaluator will choose "a representative sample of the web pages" from the website that would "conform to the evaluation objectives" as defined in step one (Rodríguez et. al, 2017). Evaluating the entire website would just be too redundant, so pages that are chosen can depend on "type, size, age, complexity, consistency and the website development process" (Rodríguez et. al, 2017). The sample being tested should reflect the nature of the website to a reasonable degree (Rodríguez et. al, 2017). Next, an evaluator must evaluate the sample from step the previous step, using both automatic and manual assessments to obtain a quantitative value (Rodríguez et. al, 2017). In addition, the assessments should also provide a plan or a solution to the identified problems based on the framework being used (Rodríguez et. al, 2017). Using different types of assessment and multiple data sources is important as it will give a more accurate assessment (Rodríguez et. al, 2017). Finally, the results of each step must be documented so that future developers and evaluators understand the reasons for the decisions and changes made (Rodríguez et. al, 2017).

In order to test the effectiveness of this methodology, Rodríguez et. al (2017) apply it to the OCW site Universidad Técnica Particular de Loja (UTPL), which is an Ecuadorian education institution with a focus on distance learning. They essentially get a bunch of UTPL students in the computer science programs with variable OCW knowledge to test the website (Rodríguez et. al, 2017). For the scope of evaluation, the goal is to determine the level of accessibility and usability of this website as well as testing the framework itself (Rodríguez et. al, 2017). The website itself has "three types of pages: (i) home page (ii) degree page or category associated with the OCW, and (iii) the homepage of the course" (Rodríguez et. al, 2017). Rodríguez et. al then describe the functionality and structure of the OCW. The primary functionality is as a Content Management System (CMS), in this case implemented on Educommons. Including the main page, there are around 150 pages on the UTPL OCW site. For the 13 courses available, there are 8 internal pages including ones for things like assessments, content plan, and course information (Rodríguez et. al 2017). Rodríguez et. al (2017) list the five categories these courses could belong to as: economy, continuing education, civil engineering, institute of pedagogy, and systems software and computing. For the evaluation stage of the process, Rodríguez et. al (2017) perform automatic evaluation using the TAW and A-Checker which both use the standards from the WCAG 2.0 to determine accessibility. Manual evaluation uses a sample of users with different levels of experience with the UTPL's OCW site answering questions on the features (Rodríguez et. al 2017). Through this methodology, Rodríguez and his colleagues were able to not only find flaws, but also potential solutions for the accessibility issues on the UTPL website.

4 Conclusion

Web accessibility, while being an important and necessary part of the Internet, is too often a neglected aspect of web design. Due to so many websites failing to provide proper accessibility, people with disabilities have a significantly harder time than non-disabled people with using the web, despite legislation requiring it. The most referenced web accessibility standards, the W3C's WCAG, are used in the EU as a unified reference. WCAG consists of principles which each have a set of specific guidelines that dictate what makes content accessible. These give developers a clearer idea of what their websites should look like. Under WCAG even simple content like images and hyperlinks require content creators to make certain considerations. However, the primary challenge for creators implementing accessibility is being able to assess if their content is actually accessible or not. For more casual developers, this paper lists several simple tools that can help check whether or not content is accessible. For more professional levels of development, there needs to be a formal method for evaluating websites. The example explained in this paper uses the WCAG-EM, adjusting it as necessary for a specific purpose, and otherwise following its steps. Hopefully, novice web developers now understand the importance of accessibility and the considerations required to implement it properly.

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