Creating Accessible Digital Content and Applications

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Abstract. Access to digital content and to web pages is a fundamental right for all citizens and is crucial for people with disabilities to participate fully in society and the workforce. Unfortunately, imposing accessibility by law is insufficient, considering many websites still present relevant accessibility issues. Moreover, there is a lack of culture about accessibility, even among designers and developers. This tutorial teaches some basic concepts to create accessible digital content like web pages, papers, and presentations. It also introduces some innovative solutions for the accessibility of mathematical function graphs. Finally, an initial comparison of support for accessibility of mobile applications by frameworks for cross-platform mobile development will be discussed.

Keywords: Web Accessibility · Digital Content.

1 Introduction

Are modern websites and technologies inclusive? Unfortunately, the answer is often no, and many devices and services represent a significant digital barrier for users with disabilities. The same question holds for science: many research papers are not accessible to people with visual impairments, as are other materials used during research work. Many presentations are not accessible by design due to issues with the slides or how the speaker conducts the talk.

According to the last report on the top one million pages by WebAIM [1], the number of pages that failed during *Web Content Accessibility Guidelines (WCAG)* [2] tests stood at 96.8%, an enormous number, even if it is a little better than the previous year. In this context, one of the main problems is the lack of knowledge about accessibility among web designers and developers: they are often not aware of either international guidelines about accessibility or national regulations. Thus, they cannot consider accessibility during the development and compile a complete list of tests the website must pass. Moreover, a tool that automatically tests all accessibility issues does not exist [8], and developers often do not know how to test each feature. Even the use of Large Language Models (LLMs) does not completely solve the problem [9].

Many websites use CAPTCHAs, Completely Automated Public Turing-test-to-tell Computers and Humans Apart, i.e., tests developed to prevent robotic access to websites and services for thwarting spam and automated extraction of data. They have always been a problem from the point of view of accessibility [7], because they often base their tests on the use of sight, since the ability to see an image or a text and recognize or understand its content is a way to make out a human being from a bot. But visually impaired users are unable to see; nevertheless, they are human beings, and CAPTCHAs are a barrier for them. The result is that CAPTCHAs are often better at preventing access to users with visual impairment than to bots.

Creating accessible content, i.e., web pages, web applications, papers, books, didactic materials, etc., is a critical issue in providing access to all users to education, services, research, knowledge, etc. Although the European laws impose accessibility for new products and the definition of an updated version of WCAG by W3C, this goal is often not reached due, not only to technological limitations, but also to the lack of knowledge among developers and researchers.

2 Tutorial Overview

This tutorial allows researchers and PhD students to experience the difficulties encountered by people with disabilities when using a digital device through a set of exercises and describes how to create accessible content and presentations. It will start with a set of experiences to guide users who can see in the world of users who cannot see.

Moreover, this tutorial can interest many researchers since it will present the state of the art of research in areas of web accessibility and some development results.

2.1 Intended Audience

This tutorial is intended for PhD students, researchers, and practitioners. Creating accessible content is an important topic to remove barriers from research. Besides websites, many papers and didactic materials are not accessible to blind people, and the same holds for other materials used during research work. This means that culture, education, and research are often off limits for people with disabilities. Many presentations are not accessible, either for issues in the slides or in the way the speaker conducts the talk. This tutorial aims to contribute to fill this gap.

This tutorial provides basic knowledge about creating accessible digital content and how to conduct an accessible talk. Some knowledge about HTML could help, but it is not strictly required. During the tutorial, a laptop is needed.

2.2 Tutorial Structure

The tutorial will start with an exercise that allows attendees to experience digital barriers encountered by people with visual impairments. Then, the tutorial will

show digital barriers for other kinds of impairment (e.g., cognitive impairments) and an overview of both American and European laws and regulations.

The tutorial will provide a set of instructions to create digital content, including papers and presentations. Moreover, it will describe some hints to deliver an accessible speech and show some useful tools to check the accessibility of web pages and presentations.

Some useful tools will be presented to simulate the navigation of people with impairment. An example is Silktyde, an extension for the Chrome browser that helps you test web pages for common accessibility failures, e.g., color contrast, alternative text for images, keyboard navigation, simulation of different impairments, etc.

The second part of the tutorial discusses the state of the art in web accessibility and a tool to help people with visual impairments learn mathematical functions through the extensive use of sounds and touch [4], [6]. STEM subjects like mathematics are difficult for this kind of user, since concepts like lines or curves heavily depend on visual content to convey essential information. Grafici-Accessibili[4] is a mobile app that allows users to draw lines and parabolas in the Cartesian plane incorporating sound and haptic feedback to make them perceivable by all users. Mathematical functions are sonified, enabling users to discern the position of their points on the quarters of the Cartesian plane through sound cues. Furthermore, the application assists users in exploring the Cartesian plane through touch, giving haptic feedback for curves and axes. In this way, the user can mentally visualize the graphical representation of the function.

Finally, we will discuss the impact of frameworks for cross-platform mobile development on the accessibility of mobile applications [3], presenting an initial analysis of *Flutter* by Google and *React Native* by Meta.

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