

Applying an Approach to Develop Web Applications Considering Accessibility Practices Using Design Rationale

Thiago Jabur Bittar^{1,2}, Leandro Agostini do Amaral², Luanna Lopes Lobato¹,
and Renata Pontin de Mattos Fortes²

¹Universidade Federal de Goiás – UFG, Brazil
{thiago.bittar, lll}@catalao.ufg.br

²Universidade de São Paulo – USP, Brazil
{jabur, ordnael, renata}@icmc.usp.br

Abstract. Regardless of the techniques and methods that have been developed to improve web applications, there are still gaps that need to be solved in order to reduce the accessibility barriers. Aiming to contribute to this area, this study presents an controlled experiment to validate an approach which uses Design Rationale. The participants attended an initial training and, after being classified according to their experience and divided into different groups, they were asked to develop a web application. Such process gave rise to useful concerns that were shared among the work teams. This paper reports this experiment and presents relevant contributions to approach accessibility issues.

Keywords: Web, Accessibility, Design Rationale.

1 Introduction

The lack of accessibility has become a prevalent issue that challenges developers of web applications. Through the implementation of good accessibility practices it is possible to remove the barriers that prevent certain groups of people from accessing information.

Accessibility is very important to software applications and several studies have been dedicated to it. In spite of this, the current scenario presents a mismatch between the requirements imposed to apply accessibility during system development and what is really performed and presented to the market. Thus, there is a gap related to accessibility in web applications development due to the lack of guidelines and recommendations which, once adopted, would provide access for many users.

For this reason, our study is focused on the use of good accessibility practices, since there is an increased awareness about the topic and a growing demand for applications that take into consideration the needs of all potential users.

To ensure the development of accessible web applications, it is important to train developers. In view of this, this study proposes and presents an approach to guide developers during system's development. In this way, they will learn what must be done in several cases to ensure accessibility to web content.

In order to test the proposed approach, a controlled experiment was undertaken in an academic environment, involving undergraduate students from the Computer Science Department of Federal University of Goiás - Brazil. First of all, the students were trained and after they were divided in groups to perform a task. A questionnaire had been previously applied to identify the participants' profiles so that they could be distributed in similar groups. The groups were asked to develop a web application for scheduling scientific evaluation committees. The experiment resulted in several considerations and useful findings that contributed to improve the approach. Such results were shared among the development teams.

As a result of this study we identified an increasing awareness of the participants relating to accessibility issues. This is relevant since the academy and the industry can take profit of the insights presented in this study and incorporate the lessons learned to new web projects.

The remainder of this paper is organized as follows: Section 2 presents the concepts of accessibility which may be used as guidelines to achieve it. Section 3 addresses the Design Rationale concept. Section 4 presents the methodology used in this study and the findings. Section 5 presents final remarks and envisages future work.

2 Web Accessibility: Concepts, Tool Support and Guidelines

Accessibility can be interpreted as the possibility of using a resource universally, without barriers or through alternative access means. In the web context, the resource to be accessed is constituted by the pages content. The idea of this concept is that the users, using every agent, can understand and interact with the offered content [10].

In web projects, it is a common practice to consider accessibility only at the advanced stages of development or when the applications are entirely coded. At this point, making applications accessible is a real challenge that involves redesign and reprogramming. Moreover, developers almost always do not know details about accessibility practices or, if know, they do not use such knowledge during the application development. Thus, most programmers have no essential knowledge or experience to ensure that their code meet accessibility requirements.

A solution for this problem is the use of lessons learned from other projects, since the same mistakes may be avoided and the accessibility practices already tried with success may be reused. This solution reduces costs related to the process of choosing the practices that should be applied during the application's development. For this reason, in general, the use of patterns and templates is recommended.

According to Bigham et al. [1] very few developers have been explicitly trained for accessible pages creation. Evaluating pages using assistive technology may reveal problems related to the complexity of defining systems.

Aiming to explain how to produce accessible web contents, World Wide Web Consortium (W3C), through its Web Accessibility Initiative (WAI), released a collection of accessibility guidelines in a document named Web Content Accessibility Guidelines (WCAG). These guidelines present recommendations to produce web

content (texts, images, forms, sounds) accessible for people with disabilities including blindness and low vision, deafness and poor hearing, learning difficulties, dyslexia, cognitive limitations, movement limitations, speaking inability, photosensitivity and combinations of them.

The WCAG guidelines are in their 2.0 version since December 2008 [10]. Their objective is to support developers and to be a reference for tests undertaken by automated tools and by humans.

3 Design Rationale

Design Rationale (DR) can be defined as a reference for the reasoning that justifies a project as well as for discussions that justify the choice of structure on other alternatives [5][8][9]. MacLean, Young & Moran [8] and Lee [7] consider that DR not only includes a description of the potential artifact, but also defines reasons for decisions, experiences, alternatives and arguments that lead to the decisions that best fit to the system development.

The interest in DR has grown, since the approach presents relevant tools that consider not only the reasons behind a design decision but also the justification for it. DR presents, as well, other alternatives, as the tradeoffs evaluated and the argumentation that led to the decision.

The DR concept was selected to assist the use and register of decisions and techniques concerning web accessibility, since we aim to build a useful basis for knowledge management and reuse by the work team. This approach is based on previous studies with intensive domain research [2][3].

According to Lee [7] as the use of DR's systems increases, new tools have been developed to capture and to make DR easily accessible. Such tools improve dependency management, collaboration, reuse, maintenance, learning, and documentation.

However, storing DR can take a significant time and be expensive, since the most current DR system can fail to consider practical concerns, such as cost-effective use and smooth integration. In order to solve these problems, it is possible to automate the capture process and associate it with the work object, i.e. the development itself.

4 Methodology and Results

This section presents a controlled experiment performed with the aim of assessing the benefits and drawbacks of the reported approach. The experiment was carefully designed and validated by two main researchers: i) a Ph.D. expert in empirical Software Engineering, who helped to define the processes to be followed; and ii) a Ph.D. student that has worked with web development and accessibility in the last five years, who is the main author of this paper and who proposed the approach.

In this study we developed an academic experiment since experiments in a real scenario demand several external interventions, take more time to be performed and require additional investments. Moreover, it is difficult, sometimes, to find companies that agree to undertake academic experiments in their development process.

The methodology used in this study consists in executing a sequence of stages, like the general planning, the analysis of developers experience and their division into groups aiming to have a technical balance on each team. To define the stages and to set other methodological details, we used the recommendations, concepts and techniques for experiments described in [6].

In order to perform a systematic experiment, we followed the recommendations defined in Wohlin *et al.* [11], which describe the plan, or protocol, used to perform the experiment and also to analyze its results.

To verify the quality of the insights from each group we performed a quantitative evaluation. This evaluation was based on the criteria defined in this research. A value 1 was assigned for each fulfilled criterion and a value 0 was assigned when the development was not in accordance with the criterion. These scores are presented in the Figure 1.

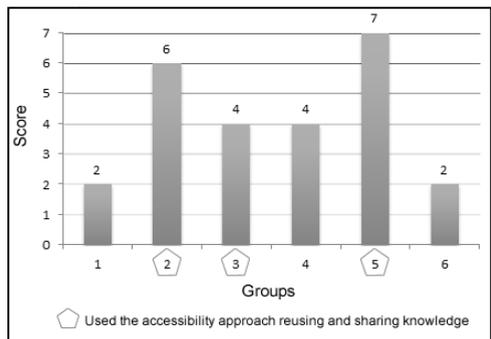


Fig. 1. Graph showing the score obtained by each group in the assessment

Figure 1 demonstrates that groups using the approach presented higher scores than those not using the approach. However, Groups 3 and 4 obtained the same score in spite of the first one having used the approach and the second having not used it. This is justified because using the approach constitutes an aid and not a guarantee. In other words, not using the approach does not imply necessarily a bad development.

Additionally, the Figure 2 displays the corresponding box-plot graph for the data distribution of the obtained results.

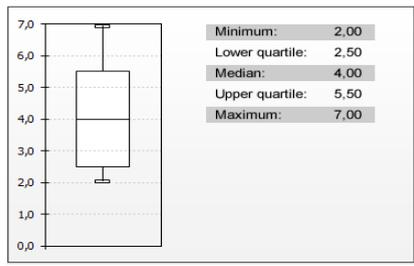


Fig. 2. Data distribution in a box-plot graph

As observed in Figure 2, none of the groups obtained a zero score, indicating the importance of the initial training, regardless the approach used.

5 Conclusions

As a result of this study we identified an increasing awareness of the participants relating to accessibility issues. This is relevant since the academy and the industry can take profit of the insights presented in this study and incorporate the lessons learned to new web projects.

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