

Persona Based Accessibility Testing

Towards User-Centered Accessibility Evaluation

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Abstract. Web authors have a hard time understanding and applying accessibility guidelines. The guidelines are considered too technical, without providing sufficient support for problem solving. This results in bad usability of Web applications for people who rely on accessibility. In the field of designing Web applications and interfaces, the concept of personas, as a representation of the target audience, is well established. Personas are typically used to describe the user on a personal level, with their needs, preferences and habits. In this poster, we illustrate a new workflow approach for accessibility evaluations. We propose persona-based representations of accessibility guidelines for acceptance tests of Web applications, for web authors to gain understanding on the needs of people with disabilities and thus improve the accessibility of Web applications.

Keywords: human computer interaction, accessibility, personas, acceptance test, web accessibility guidelines, automatic testing, user-centered accessibility evaluation.

1 Introduction

For a large number of software developers, it is unclear how persons with disabilities interact with web applications. Several studies found that developers have issues to understand and classify accessibility guidelines [1][2].

Therefore, when checking the accessibility of a Web application, it is important to take the perspective of the end user, i.e. that reflects how an end user would interact with the system [3]. This involves testing the application as rendered in the browser, with dynamic code (e.g., JavaScript) being executed, and the user interacting with the application. This is essential for modern Rich Internet Applications (RIAs) in particular which render their user interface dynamically at runtime.

Many studies (see below) suggest that accessibility is strongly user-centered. Barriers occur when there is a mismatch between a user and a website in terms of interaction characteristics.

Brajnik [4] characterizes accessibility in a user-centered context: “[Accessibility is when a] specific users with specific disabilities can use it [the software] to achieve specific goals with the same effectiveness, safety and security as non-disabled people.” According to this understanding, a barrier is a condition, which prevents a

specific user, who has specific traits and is using specific assistive technologies, from achieving his specific goals. A barrier is not just an defect on a web application, but an attribute of the interaction between the user and the system [4][5][6][7]. The occurrence of a barrier is user-dependent and defined by:

- The user and his specific traits
- The type of assistive technology being used
- The goal of the user
- The properties (defects) of the web application which prevent the accomplishment of the goals

Therefore, conformance tests cannot be used to fully clarify the accessibility of a web application, as discussed in [8] and [9]. The conformance to accessibility guidelines is a technical property of the website and doesn't take the specific traits of the user, his devices and assistive technologies into account.

Personas can be a way for a more user-centered accessibility evaluation. They are an established concept for focusing on the goals and needs of the users during the development of a product [10][11].

Personas use scenarios to describe the goals of the target audience. They are depicted as a description of a hypothetical user. This includes a name, a description of the daily routine and of devices and technologies that the hypothetical user uses to access a specific software product. Several studies showed the benefit of using the concept of personas for accessibility evaluations.

Schulz and Skeide Fuglerud [12] shared their experience of using personas, to convey the needs and preferences of people with disabilities. They claimed that using personas, including descriptions of their assistive technology and specific interaction patterns, helps web authors to focus on the user.

Baily and Pearson [13] introduced a tool for teaching web accessibility to undergraduate students. They used personas to describe information about assistive technology usage and specific interaction patterns by people with disabilities. Using personas for accessibility evaluation raises the awareness for the specific interaction between people with disabilities and web applications, which results in more accessible applications.

Vigo et. al [14] described the usage of context-aware guidelines. Those guidelines are based on the W3C Web Content Accessibility Guidelines (WCAG) and filtered by a certain context, which is defined by the traits of a specific user and his assistive technology. Conformance evaluation focuses on the success criteria relevant for the context only.

Brajnik [5] presented the concept of a *barrier walkthrough*, which is derived from the usability inspection technique *cognitive walkthrough*. In a mental process, the evaluator imagines the usage of the software (or any product) through to eyes of a dedicated user, by answering questions like: "Is that information perceivable for the user?" or "Would the user know what to do at this point?". This enables developers to find more severe accessibility problems than with pure conformance tests.

In the scenario-based design the *cognitive walkthrough* technique is used as a way to evaluate software with personas [10].

Our proposed system addresses the needs of Web application authors. It can run automated acceptance tests, similar to unit tests. Rather than walking a list of technical problems that has been generated by a conformance-testing tool, the developer works with *personas* and *user scenarios*. We define a *user scenario* as an instance of a *use case*, but with concrete usage data. Each user scenario has an actor, represented by a persona. These personas and user scenarios provide the input for the acceptance tests.

Personas are used as illustration of the impact of accessibility guidelines and serve as actors in the scenario. They tell the test system how to test and which interaction patterns to use, e.g., "check only for specific success criteria (in WCAG 2.0) that are relevant for visually impaired people, and consider navigation by keyboard and via screenreader". These tests are executed in the Web browser of the client, in the same way as end users interact with them. A similar concept is introduced in [15].

The remainder of this paper is structured as follows: Section 2 introduces the general concept. Section 3 specifies the envisioned benefits of our proposed approach and section 4 provides an outlook on our next steps.

2 General Concepts of Our Approach

The underlying principle of our approach is to use personas as representation and illustration of accessibility guidelines (e.g., WCAG) for the developer. Each success criterion of the guideline is represented as a set of personas affected (possibly in varying degrees) by the success criterion. This requires an ontology, which maps accessibility guidelines to personas [16].

A persona also contains information about how they would interact with a Web application, together with a description of assistive technologies that the persona would possibly use. This information is essential for determining assertions for testing Web applications. It tells the test system which specific success criterion of a guideline to follow, and how to interact with the application, e.g., "use only tab navigation and test if the application is accessible with a screenreader". However, interaction between people with disabilities and software is usually more complex than in this brief example.

Using personas in this manner has several benefits:

A) Personas serve as representation of the accessible guidelines for the developer. From their origin, personas are designed to work as a representation of the target audience. According to [10], personas work because they tell stories, stories of real people and their traits, activities and problems. Rather than working with textual requirements, a persona consists of stories to illustrate the success criteria of accessible guidelines. Therefore, development teams can empathize with their target audience and use techniques like the barrier walkthrough to question features and functions. *Alan Cooper* expresses this concept as follows: "*We are designing for Rosemary, not for somebody!*" [11] ("Rosemary" is the name of a persona.).

B) Personas provide a machine-readable representation of the accessibility relations between success criteria, personas for whom the success criteria are relevant, and interaction patterns such as keyboard-only navigation, magnification, or the use of a screenreader. Along with the knowledge of the structure of the Web application to be tested, personas enable the test system to run extensive automated tests and thus support the development of accessible Web applications.

For each use case of a Web application, a user scenario with concrete usage data can be derived, by capturing the use case interaction with a real person (e.g., the developer). We call this a *user scenario blueprint*. This blueprint consists of real usage data and an interaction pattern. If combined with the information specified by a persona, it tells the test system what and how to test. The basic principle of the system is to follow the navigation pattern, according to the user scenario blueprint, but with the constraints given by the persona. Thus, the test system can automatically perform end-user acceptance tests, as introduced in a similar approach [17], by using techniques of Web crawler and JavaScript to execute interaction [3]. The user scenario and the persona (actor) can be modeled by using the interaction flow modeling language (IFML), the new standard for modeling the user interaction flow for software, based on UML [18].

If the system finds any problem, it can pinpoint to the affected persona, the corresponding success criterion, the location in the source code and highlight the relevant area in the browser. Besides a detailed explanation of the problems found, the test system should provide solid guidance for their solutions, warnings and errors [19]. The test can be repeated for all use cases and all personas. Figure 1 illustrates these concepts.

The term "responsive design" has been recently used to describe the adaption of Web applications on various target devices, platforms and browsers [20]. By expanding the test system to test across devices, platforms and browsers [20]. By expanding the test system to test across devices, acceptance tests can be executed, taking multiple target devices into account. The goal is to test each combination of scenario, persona and device (since *Rosemary* can either use her desktop computer or her smartphone).

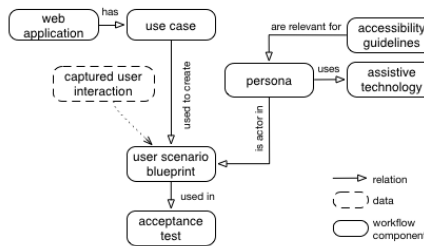


Fig. 1. Overview of the core concepts

3 Envisioned Benefits

In a nutshell, we envision the following benefits of this approach:

- Developers will gain a better understanding of accessibility, as compared to reading the plain guidelines.

- Testing the "real" accessibility of a RIA (based on its interaction flow) rather than its conformance to accessibility guidelines.
- Checking the accessibility of a RIA for a dedicated target audience, e.g., people with color blindness, by using as actors only personas linked to success criteria for that specific group.
- Cross-device tests can be conducted for Web applications that follow the "responsive design" approach.
- The accessibility of a web application can be sustained, following the continuous integration approach of modern software development. This implies running the acceptance tests again after changes to the application have been applied.

4 Current Status and Next Steps

This project is work in progress. So far, we have developed an HTML-based interactive high-fidelity prototype of an Integrated Development Environment (IDE), to simulate the later usage of our evaluation-workflow approach (as described in section 2). With the prototype we simulate the evaluation workflow for a single use-case of an application, create the scenario blueprint based on the selection of a persona, and conduct the accessibility evaluation.

As a next step, we will use this prototype to conduct user tests, with web authors and students from the field of computer science, to validate the workflow and the concept for its usability among web authors. A similar study showed the potential of such an integrated approach [21]. Besides the prototype, we are starting to implement a runnable version of our approach, to conduct further tests, so we can analyze the effectiveness of our approach in comparison with other accessibility evaluation methods.

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