

Supporting developers in developing accessible digital artefacts – Challenges in implementing a sustainable workflow in developers’ work practices

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Abstract: Digital accessibility is an important lever for the equal participation of people with disabilities in society. This article examines the question of how IT developers can be supported in their work practice with holistic measures to make the development of accessible IT products the norm. There are already rather isolated approaches for development practice. However, these are inadequate. There is a lack of a holistic view of sustainable measures that address the socio-technical infrastructures. On the basis of two qualitative-empirical studies, the authors work out that isolated approaches without embedding them in the work structures – technical, individual and organizational – have not yet been able to produce a practical reference architecture for the implementation of the topic of accessibility in companies and that these aspects must be taken into account in further research.

Keywords: accessibility, accessible development, socio-technical infrastructuring, socio-informatics, WCAG

1. Introduction

Accessible software and websites are important prerequisites for the equal participation of people with disabilities in society. In particular, the use of accessible software in the workplace opens up new perspectives for many people for meaningful participation in working life (Branham and Kane 2015).

However, the development of accessible software and websites still poses particular challenges for many companies and the groups of people involved in development, especially developers (Patel et al. 2020). There is currently no reference architecture for the implementation of accessibility at all levels in companies (Paiva, Freire and de Mattos Fortes 2021), but there are isolated approaches and (technical) possibilities for the group of developers to support accessible programming (Zimmermann & Vanderheiden 2008; Fuglerud 2014; Persson et al. 2015).

Going beyond isolated support artifacts, this article examines the question: How can developers be sustainably supported in their work practice?

Chapter 2 provides a brief overview of isolated support artifacts and knowledge relevant to the assessment of accessibility. Chapter 3 describes the implementation and analysis of two qualitative empirical studies and Chapter 4 presents the results. The discussion of the results in chapter 5 concludes the work.

2. Related work

Previous work has specifically addressed the groups of people directly involved in the development process, often the developers themselves. This concerns tools to support the implementation and testing of software and websites (2.1) as well as development models for accessibility in design and development processes (2.2). Various areas of knowledge that contribute to accessibility are also described (2.3).

2.1 *Support tools for accessible development*

A number of programs and applications are aimed at supporting developers, e.g. test frameworks/guidelines, browser plugins, integrated development environment (IDE) integrations and simulation products (Stray et al. 2019; Alsaeedi 2020; Eusébio et al. 2020; Caria et al. 2021). However, only about half of the WCAG test steps can be checked automatically (Tollefsen & Ausland 2017), the rest require independent thinking and implementation. Even if some such tools, such as simulation products, also contribute to users awareness (Stray et al. 2019), no uniform model has yet been established for the selection and sequence of application of such tools, as can be seen from the large number of different approaches.

2.2 *Development models for accessible design*

In addition to support tools, different approaches for implementing accessibility in development processes can be found in the literature. Concepts such as universal design, inclusive design, accessible design or design for all (Fuglerud 2014; Persson et al. 2015) emphasize the consideration of accessibility, in various forms, in all phases of development processes (Ordoñez et al. 2022).

The various models localize the implementation of accessibility in companies not only in the development department, but across organizational units (Aumann et al. 2021). However, practical process models or a reference architecture are still lacking (Paiva et al. 2021).

2.3 *Knowledge about (the benefits of) accessibility*

Power et al. (2009) point to arguments within the design and development communities that there are not enough users with disabilities to economically justify the standard implementation of accessible IT design. However, the authors refute this assumption by pointing to the number of several million affected potential users with disabilities in the UK. More recent work confirms the refutation and emphasizes that people with disabilities represent an underestimated proportion of the population of around 1 billion people (Aumann et al. 2021).

Recent studies have since shown that accessibility is not only useful for specific target groups, but is also beneficial for all users due to its proximity to usability (Schmutz et al. 2017; Stray et al. 2019; Bi et al. 2022) and for the image of companies (Bühler 2017). However, knowledge of technical implementation, testing and support tools (see 2.1) is not very widespread among those who need to apply this knowledge to understand and implement accessibility requirements (Silva et al. 2019; Lorgat et al. 2022; Ordoñez et al. 2022; Bittenbinder & Müller 2023).

Patel et al. (2020) cite inadequate (formal) training in the field of accessibility as a reason for this, but also the fact that companies often do not give the issue of accessibility enough space due to time and cost pressures.

3. Methodology

For this article, qualitative data was re-analyzed from two contexts: a study on the implementation of the topic of accessibility in a company (Bittenbinder & Müller 2023) and an interview and observation study to evaluate an accessibility checklist. The data was analyzed with regard to the research question addressed here and relevant topics were identified.

The 9 participants from the first-mentioned study (hereinafter referred to as "S 1") resulted from the compilation by the company, which named the persons responsible for the topic of accessibility (as conceived to date) and brought them together in a joint meeting. Data material was generated from field notes from this group discussion (Nentwig-Gesemann 2010) as well as telephone and email communication.

The sample of the second study (hereinafter referred to as "S 2") comprises four developers and one product manager who evaluated a checklist that contains an aggregated form of official guideline catalogs (WCAG and BITV) with 9 test steps and was created within the iDESkmu project with representatives of developers and experts. These participants were recruited via convenience sampling from companies already active as cooperation partners in the aforementioned project, via social media and personal contact in the HCI degree program at the University of Siegen. The data was generated from five semi-structured interviews and two observations in conjunction with the Thinking-Aloud method, in which the participants applied the aggregated accessibility checklist to a website, focusing on their understanding of the test steps and the practical application of these.

Tabelle 1: List of study participants including role

	S 1	S 2	role	group discussion	interview	observation
CEO1	X		CEO	X		
CTO1	X		chief technical officer	X		
PO1	X		product owner	X		
CEO2	X		CEO	X		
UX1	X		Head of UX-Design	X		
HOOM1	X		Head of online & mobile	X		
DEV1	X		developer	X		
DEV2	X		developer	X		
DEV3	X		developer	X		
DEV4		X	developer		X	
DEV5		X	developer / freelancer		X	X
DEV6		X	developer		X	
DEV7		X	developer / freelancer		X	X
PM1		X	product manager		X	

4. Results

4.1 Lack of practical experience and lack of practice

The mere availability of support tools and procedures is not enough to promote the accessible development of software. The use of support tools that are useful for the accessible development of software requires not only knowledge of these tools, but also practical experience in using them. In practice, it is necessary to be able to use the tools. Two developers (DEV4, DEV5) stated that they could only use screen readers poorly because they were not native users. DEV7 had difficulties using a contrast meter. Practical knowledge is also important *"[...] to understand to what extent this [note: the test steps] can be applied to the client"* (DEV4).

4.2 Creating space and goals at different company levels

UX1 shows through great initiative that individuals at developer level have the potential to generate and share in-depth knowledge about accessibility at different hierarchical levels. However, the effectiveness strongly depends on the available space that needs to be created at higher hierarchical levels (PM1). In addition, PM1 proposes a contact person for accessibility throughout the company as a cross-cutting function in order *"to consult [him] in case of uncertainties related to accessibility testing."* (PM1) and the anchoring of user testing in the QM department, i.e. across departments. The introduction of accessibility is not only dependent on the use of tools, but also requires some process changes, as CTO1 confirms. However, in order to anchor the topic at different levels and departments, CEO1 argues that KPIs and therefore priorities need to be adjusted so that accessibility can no longer be blocked by *"[...] because we don't have enough time."* (DEV7) can no longer be justified. The change in such KPIs with regard to accessibility is also linked to the positioning of the product and company as well as the assessment of corporate social responsibility (CSR) factors, which, as CEO2 mentions in S 1, must be decided at a strategic level and implemented operationally.

4.3 Tailor-made, structured and personalized support

When evaluating the checklist (S 2), DEV4 and DEV5 rated the use of the checklist as a very structured approach: *"it gave me [...] a really good guidance instead of just testing things out separately and going into it without a tool, without a guidance"* (DEV5). Supporting and additional information in the checklist on the use of testing tools plays an important role in the creation of knowledge and differentiates this checklist from other guidelines, as PM1 emphasizes: *"This [the checklist] also describes the work of screen readers, if I run JAWS and press H, then I go through all the H elements. This is not in any WCAG."* However, the checklists should not be too detailed: *"Some of it is really useful, but some of it, if you describe a lot more, is really exhausting for users to read everything."* (DEV7).

5. Discussion

The present work shows that developers are not only dependent on purely technical support when addressing accessibility, but also on structures in the form of a functioning (working) environment that is prepared for accessibility. At the individual developer level, this work shows that too little technical-instrumental knowledge is available (DEV4, DEV5, DEV7) or, in line with Lorgat et al. (2022), is not widespread enough. In order to create space for the acquisition of knowledge, a negotiation process is required at various organizational levels within the company. At the strategic corporate level, decisions must be made about economic and social standpoints. Awareness of the size of the target group of people with disabilities (Aumann et al. 2021) and also the relevance for other user groups (Schmutz et al. 2017) as well as the assessment of a potential change in the company's image through accessible development (Bühler 2017) or the positioning of the product (CEO2) play a role here. At an operational level, we are talking here about a change in priorities, an adjustment of key figures (CEO1), roles (PM1) and processes (CTO1). The involvement of accessibility experts for acceptance, as proposed by PM1, is already described in the literature (Ordoñez et al. 2022), but not in the context of this complex process of introducing accessibility in companies. This focus on such a complex implementation process gives an idea of how difficult it is to create binding strategies across different organizational levels and explains why a reference architecture for the implementation of accessibility still exists (Paiva et al. 2021).

Furthermore, it is not enough to simply impart technical and instrumental knowledge; the relevant context in practice must also be taken into account and understood. Observing accessibility guidelines without knowing the practical implications or the practical impact on the operation of a product may help developers with programming, but not with understanding accessibility and its practical implications. Using the example of the checklist examined in S 2 with further information on how assistive technologies work and how they are used in practice, it can be seen that such assistance is very useful for understanding accessibility requirements (PM1), but should also be individually tailored (DEV7). In this way, you also pass on knowledge about the practical application and context of the use of assistive technologies, making it easier for users of the checklist to put themselves in the shoes of someone who uses these assistive technologies.

Due to these diverse interlinkages, which must first legitimize the use of support tools and then ensure their meaningful practical application, it seems that only through the holistic, socio-technical consideration of these interventions in the work context, individual, technical and organizational materials and mechanisms can be evaluated for a sustainable change in structures and ways of thinking and thus success in the direction of digital accessibility.

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