



Behaviour & Information Technology

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/tbit20>

Exploring perceptions of web accessibility: a survey approach

Yeliz Yesilada^a, Giorgio Brajnik^b, Markel Vigo^c & Simon Harper^c

^a Middle East Technical University Northern Cyprus Campus, Kalkanlı, Güzelyurt, Mersin 10, Turkey

^b Dip. di Matematica e Informatica, Università di Udine, Udine, Italy

^c School of Computer Science, University of Manchester, Manchester, UK

Accepted author version posted online: 25 Oct 2013. Published online: 13 Dec 2013.



CrossMark

[Click for updates](#)

To cite this article: Yeliz Yesilada, Giorgio Brajnik, Markel Vigo & Simon Harper (2015) Exploring perceptions of web accessibility: a survey approach, Behaviour & Information Technology, 34:2, 119-134, DOI: [10.1080/0144929X.2013.848238](https://doi.org/10.1080/0144929X.2013.848238)

To link to this article: <http://dx.doi.org/10.1080/0144929X.2013.848238>

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden. Terms & Conditions of access and use can be found at <http://www.tandfonline.com/page/terms-and-conditions>

Exploring perceptions of web accessibility: a survey approach

Yeliz Yesilada^{a*}, Giorgio Brajnik^b, Markel Vigo^c and Simon Harper^c

^aMiddle East Technical University Northern Cyprus Campus, Kalkanlı, Güzelyurt, Mersin 10, Turkey; ^bDip. di Matematica e Informatica, Università di Udine, Udine, Italy; ^cSchool of Computer Science, University of Manchester, Manchester, UK

(Received 28 January 2013; accepted 20 September 2013)

The equality of access—accessibility—is difficult to quantify, define, or agree upon. Our previous work analysed the responses of web accessibility specialists in regard to a number of pre-defined definitions of accessibility. While uncovering much, this analysis did not allow us to quantify the communities' understanding of the relationship accessibility has with other domains and assess how the community scopes accessibility. In this case, we asked over 300 people, with an interest in accessibility, to answer 33 questions surrounding the relationship between accessibility, user experience (UX), and usability; inclusion and exclusion; and evaluation, in an attempt to harmonise our understanding of web accessibility. We found that respondents think that accessibility and usability are highly related and also think that accessibility is applicable to everyone and not just people with disabilities. Respondents strongly agree that accessibility must be grounded on user-centred practices and that accessibility evaluation is more than just inspecting source code; however, they are divided as to whether training in 'Web Content Accessibility Guidelines' is necessary or not to assess accessibility. These perceptions are important for usability and UX professionals, developers of automated evaluation tools, and those practitioners running website evaluations.

Keywords: web accessibility; usability; definition; user experience

1. Introduction

In a constantly evolving field, understanding each others view of 'accessibility' can be tricky (see Section 2). This makes it difficult for the web accessibility community to interact, reach agreement, or share understanding. What is more, it makes it very difficult for those outside the community to understand, plan, budget, enact policy, or conform to accessibility requirements and legislation when the community itself has so many conflicting ideas about what this really means.

In this case, we asked over 300 people, with an interest in accessibility, to answer 33 questions surrounding the relationship between accessibility, user experience, and usability; disability, inclusion, and exclusion, in an attempt to harmonise our understanding and support the expectations of users outside the community (see Section 3). We have previously published a partial analysis on the communities' agreement regarding the definition of accessibility (Yesilada *et al.* 2012). However, our previous paper did not discuss where accessibility fits — or at least our communities perception of fit — into the overall 'Human Computer Interaction' (HCI) landscape. Here we address this deficit by asking questions such as 'Are web accessibility and usability problems related?', 'Do web accessibility problems only affect disabled people?', and 'Is web accessibility necessary for good user experience?' (see Section 3.2).

We found that respondents think that accessibility and usability are highly related, further thinking that accessibility has a greater impact on both usability and UX than vice versa (see Sections 3.2.1 and 3.2.7). They also think that accessibility is applicable to everyone and not just people with disabilities (see Section 3.2.2). Respondents strongly agree that accessibility must be grounded on user-centred practices and that accessibility evaluation is more than just inspecting source code (see Section 3.2.4); however, they are divided as to whether training in 'Web Content Accessibility Guidelines' (WCAG) is necessary or not to assess accessibility (see Section 3.2.4).

Overall (see Section 4) we found that it is the general belief that developing accessible and usable sites benefit both people with and without disabilities, and that web accessibility and usability are conceived as interrelated qualities. Further, web accessibility is also understood to be a subset of UX; indeed, respondents believe that web accessibility paves the way towards a good UX.

There is some contradiction in that individuals agree that accessibility is about inclusion but still do not believe that it is about low income. For WCAG views are more mixed, on the one hand, experts, those with a technical background, individuals dealing with users, people who belong to the public sector, and those who are 'in the trenches', show a favourable opinion about WCAG training to be necessary to assess accessibility; on the other hand, non-experts,

*Corresponding author. Email: yyeliz@metu.edu.tr

those without a technical background, those who belong to the private sector, NGO and academia, and people who do not deal with end users or are not practitioners, have the opposite yet somewhat ambivalent view. There is also a general disagreement that testing source code is a good way of ensuring accessibility; practitioners disagree even stronger about this. Their stronger position on WCAG training and reluctance to solely rely on source code analysis suggests that those who have a practical role find guidelines relatively useful, which highlights the practical aspect of guidelines as one of their strengths.

These perceptions are important because they affect how the accessibility community interacts. Without a shared understanding (see Section 5), clarity of purpose can never be accomplished.

2. Related work

There are many definitions of web accessibility in the literature which differ substantially (see a review in Yesilada *et al.* 2012). Standardisation bodies tend to focus on defining web accessibility as something that can be empirically tested, while designers focus on design elements involved in web accessibility. Regarding the scope, some definitions specifically refer to disabled people, some also include older users, and some definitions focus on all users, regardless of their abilities. Some definitions treat accessibility as equivalent to usability, some consider accessibility as part of usability, and some conceive web accessibility as a part of user-centred design. These different views have been discussed in the literature; yet there is no scientific work on exploring the general perceptions of web accessibility. Typically webmasters (Lazar *et al.* 2004) and web developers (Freire *et al.* 2008) have been the focus of such analyses. Considering the amount of stakeholders with different backgrounds and responsibilities involved, we focus on how these differences influence on their perception of accessibility.

Compared to web accessibility, usability has a much longer history and it is quite established (Shackel 1991). Even though some people think usability is a fuzzy concept (Frandsen Thorlacius *et al.* 2009, Hertzum and Clemmensen 2012), it has been well researched (Nielsen 2000). As discussed in Petrie and Kheir (2007), the relationship between web accessibility and usability can be seen in different ways:

- (1) accessibility and usability problems are two distinct, non-intersecting sets of problems, meaning people with disabilities and people without disabilities experience different problems (Petrie and Kheir 2007);
- (2) accessibility problems might be the subset of usability problems (Thatcher *et al.* 2002);
- (3) both usability and accessibility problems are encompassed by ‘universal usability’, meaning that

the traditional scope of usability can be expanded to also address problems experienced by disabled people (Shneiderman 2000).

Even though some insights into the relationship have been provided (Petrie and Kheir 2007), we still have no clear understanding of this relationship. Similarly, with the recent developments on UX research, we also do not know how web accessibility relates to UX on the Web. In fact, there is no agreement to define UX, and recently a survey has been conducted to better understand the scope and nature of UX (Law *et al.* 2009). This survey provides a fundamental ground for understanding, scoping, and defining the concept of UX although the relationship between UX and web accessibility is not investigated.

Traditionally, web accessibility has been described as the field investigating the difficulties that disabled people experience when they access the Web (WAI 2005). However, recently, it has been found that able-bodied individuals using mobile devices (Harper *et al.* 2011, Yesilada *et al.* 2011) and older people (Currana *et al.* 2007, Arch 2009) experience similar difficulties to those encountered by people with disabilities. This situation is described as the ‘situational impairments paradigm, which is defined as the ‘difficulty accessing computers due to the context or situation one is in, as opposed to a physical impairment’ (Sears *et al.* 2003). Considering situational impairments, some research suggests that it is appropriate to extend accessibility from a strict view, where it is bound to people with disabilities only, to a more general one encompassing problems created by technology, situation, and the context of use (Yesilada *et al.* 2008). Some even suggest extending accessibility to address problems experienced by people in developing countries (Kelly *et al.* 2010) or by illiterate people (Capra *et al.* 2011). Some radical positions indicate that web accessibility is about accessing information on the Web regardless of abilities, languages, and country (Hendler 2012). Conversely, some think that these concepts are all part of universal access and web accessibility needs to only focus on the needs of disabled people (Henry 2004). Even though these concepts all show differences in the perceptions of web accessibility, there is no work in literature that investigates how in reality people perceive web accessibility.

3. The study

Providing a better understanding of web accessibility will help us to (1) guide and help in better teaching web accessibility by solidifying ideas, concepts, and language into a more solid bedrock of understanding; (2) better communicate the meaning of the concept to people who are not in the field, and thereby making communication with the wider community, companies, and governments more harmonious and insightful; (3) advance web accessibility as a research field by providing a shared understanding,

grammar, and lexicons; and (4) improve penetration of web accessibility into commercial and industrial settings by harmonising the language and therefore the expectations of companies with regard to planning, budgeting, enacting policy, or conforming to accessibility requirements and legislation. We conducted a survey – inspired by following a similar methodology to that conducting UX (Law *et al.* 2009) – in which we asked over 300 people, with an interest in accessibility, to discuss their views and definitions in an attempt to harmonise our understanding and support the expectations of users outside the community. Our previous paper (Yesilada *et al.* 2012) published on this survey only investigates the definitions and did not address the issues surrounding the relationship between accessibility, user experience, and usability; disability, inclusion, and exclusion; and evaluation, leaving open questions related to these. It is these questions we now intend to address here.

3.1. Methodology

Our questionnaire survey was designed into three parts: (1) *Demographics*: for collecting demographics information about our respondents. (2) *Definitions*: Respondents were asked to rank five definitions which can be found in Yesilada *et al.* (2012), specify what they liked and did not like about each definition, and provide their own definition if they did not like any of the provided ones. (3) *Statements*: Thirty-three statements were included to investigate perceptions of web accessibility which are mainly discussed in the related work section. The statements were presented in random order and the main categories were not included in the survey. Therefore, our respondents did not know the categories of these statements.

This survey was implemented using SurveyGizmo.¹ The survey was conducted for a month between August to

September 2011. The call for participation was distributed in a number of web accessibility-related mailing lists which include W3C Web Accessibility Initiative Interest Group (WAI IG),² Mozilla web accessibility, CHI announcements, SIGACCESS announcements, WEBAIM mailing lists, and also sent to personal contacts and groups working on web accessibility. One thousand one hundred and eighty-six people accessed the survey and 379 of them completed it; of these 75 (about 20%) lacked demographic information and were removed; another 4 lacked responses on definitions and accessibility statements ranking, and so were also removed. Of the 300 valid responses that were retained and analysed, 119 (40%) came from females; 8 (3%) from individuals aged between 18 and 24, 96 (32%) from the 25–34 age group, 143 (48%) from the 35–54 group, and 53 (18%) from people aged 55 or more. Table 1 shows the distribution of country, work sector, education, and specialisation areas of respondents. A complete analysis of the demographics information including that related to the amount of accessibility work performed, the respondents expertise, their technical background and interests, their role in the organisation; and the employment sector are also available (Yesilada *et al.* 2012).

3.2. Statements

Our previous work (Yesilada *et al.* 2012) on the survey found that misunderstanding accessibility definitions, language, and terms might cause tension between different groups; that social, and not economic, aspects drive our perspectives of accessibility, and that definitions used by standards and regulatory bodies are most accepted – not those of individual experts. Forcing accessibility adoption does not encourage the acceptance of an accessibility ethos, but providing empirical evidence that accessibility

Table 1. Country, work, education, and specialisation data.

Country			Work		
USA	146	49%	Industry	120	40%
Canada	23	8%	Academia	100	33%
Europe	96	32%	Consultants	82	27%
Australia	16	5%	Practitioners	81	27%
Others:	18	6%	Researchers	79	26%
(Algeria, Antigua,			Gov. agencies	38	13%
Argentina, Brazil,			NGOs	32	11%
China, Ecuador, India, Israel, Mexico, New Zealand, and South Korea)			Managers	30	10%
Education			Specialisation		
Computer science	115	38%	Web accessibility	93	31%
Social sciences	62	21%	HCI	70	23%
Other sciences and eng.	55	18%	Software engineering	32	11%
Psychology	14	5%	Design	28	9%
Design	13	4%	Computer science	22	7%
			Business	12	4%
			UX	10	3%

Table 2. Statements that deal with the relationships between accessibility and usability.

	Statement	<i>N</i>	Rate	Mdn	IQR	<i>M</i>	<i>sd</i>	Low	High
s1	Web accessibility and usability problems are not related. Usability problems only affect non-disabled people	210	0.70	1.00	1.00	1.35	0.74	1.25	1.45
s2	Web accessibility problems are a subset of usability problems	210	0.70	4.00	1.00	3.52	1.10	3.37	3.67
s3	Accessible sites are more usable for all	210	0.70	4.00	1.00	4.28	0.87	4.16	4.40
s4	Usable sites are more accessible for all	206	0.69	4.00	2.00	3.74	1.13	3.58	3.89
s31	Accessible sites are more usable for disabled people	209	0.70	4.00	1.00	4.19	0.93	4.06	4.32
s33	Usable sites are more accessible for disabled people	207	0.69	4.00	1.00	3.44	1.06	3.30	3.59

Notes: *N* is the number of actual respondents (out of the 300 that we considered), Rate is the response rate, Mdn and IQR are the median and the inter-quartile range, *M* and *sd* are the mean and standard deviation, and Low and High give the 95% confidence interval of the mean of the scores.

benefits all does. Finally, realistic and concise language was preferred when attempting to communicate or define accessibility.

We included a last section in our survey which focuses on investigating these issues in the belief that addressing the following questions will advance our knowledge on web accessibility and how web accessibility can be scoped. (1) What do people think about the relationship between accessibility and usability? (2) What do people think about the relationship between web accessibility and user experience? (3) Do people think web accessibility is only specific to disabled people or to all? (4) What do people think about the relationship between inclusion and exclusion? (5) What do people think about web accessibility evaluation? (6) What are the effects of expertise on the view of web accessibility vs. usability, web accessibility vs. user experience? Respondents were asked to rank their agreement with certain statements through a Likert scale (1 = Strongly disagree, 5 = Strongly agree, NA if one did not want to respond).

3.2.1. Usability vs. accessibility

A first group of statements concerns relationships between accessibility and usability (Table 2).

Figure 1 shows that the majority of respondents definitely disagree that accessibility and usability are not related (i.e. they think they are related; statement s1). They also agree with the remaining statements (moderately for s2, s4, and s33; strongly for s3 and s31); and they think that accessibility has a greater impact on usability than vice versa (i.e. scores for s3 are higher than those for s4).

3.2.2. Disability vs. all

The second group of statements deals with whether accessibility should be mostly concerned with people with disabilities or it should cater to a wider audience (Table 3). Respondents strongly disagree with s5, which states that

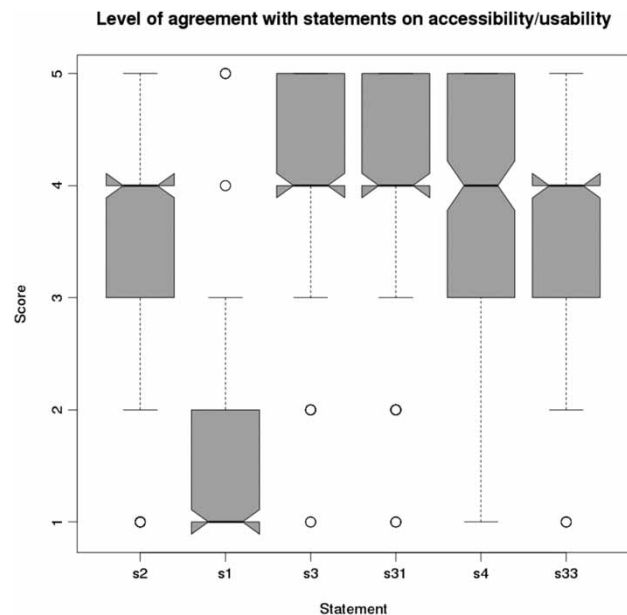


Figure 1. Distributions of scores for agreement on the usability vs. accessibility statements (see Table 2). Notches in the boxplots show the position of the median.

accessibility is only related to people with disabilities (Figure 2). This is consistent with the strong agreement with statement s6 ('all types of people'), with s8 ('older users') and s12 ('inclusion'). Disagreement with s7 and s13 is weaker and with a wider span; the larger span could be explained by the ambiguity of the statement: blind people are those that benefit the most from accessibility (as currently the Web is a eminently visual medium), even though they might not be the only ones who benefit from it. The large distribution for s13 may be due to the inclusion of very different categories, and specifically of illiterate people side by side to people with low income or from developing countries.

Table 3. Statements that deal with the people who benefit from accessibility.

	Statement	<i>N</i>	Rate	Mdn	IQR	<i>M</i>	<i>sd</i>	Low	High
s5	Web accessibility problems only affect disabled people	208	0.69	1.00	1.00	1.66	0.97	1.53	1.79
s6	Web accessibility problems affect all types of people regardless of their situational or physical limitations	209	0.70	4.00	1.00	4.05	1.10	3.90	4.20
s7	Web accessibility benefits mainly blind users	211	0.70	2.00	2.00	2.15	1.13	1.99	2.30
s8	Web accessibility benefits older users	209	0.70	4.00	1.00	4.37	0.76	4.27	4.48
s12	Web accessibility is about inclusion	206	0.69	4.00	1.00	4.32	0.77	4.21	4.43
s13	Web accessibility is about people with low income from developing regions and illiterate people	201	0.67	2.00	2.00	2.10	1.27	1.93	2.28

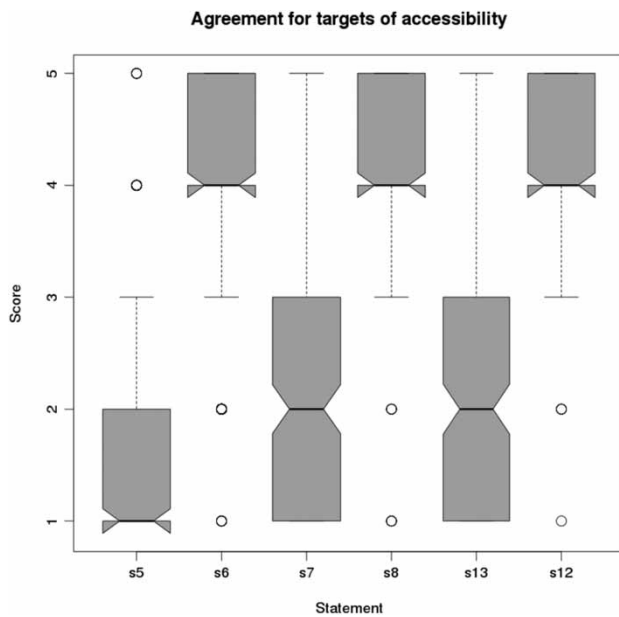


Figure 2. Distributions of scores for agreement on the disability vs. all statements (Table 3).

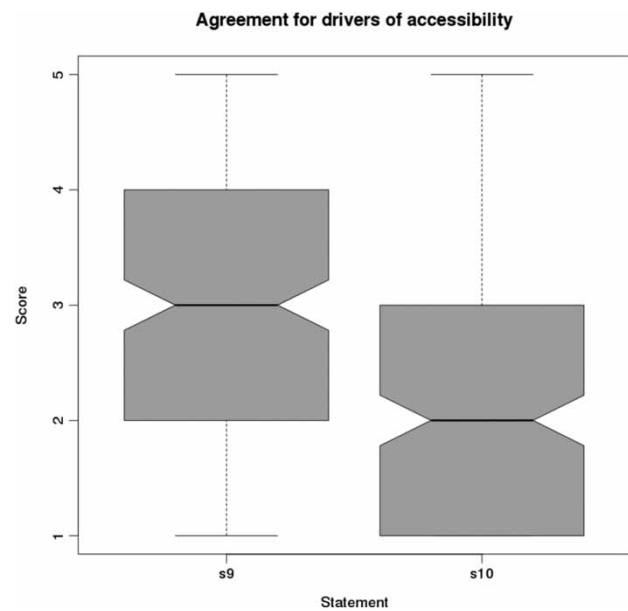


Figure 3. Distributions of scores for agreement on legislation vs. revenues statements (Table 4).

3.2.3. Driven by legislation vs. revenue

The third group of statements deals with whether accessibility is motivated by regulations or by business opportunities (Table 4). Respondents appear undecided regarding s9 ('law') and to weakly disagree with s10 ('business revenues') (Figure 3). Even if the mean value (3.08 – median value (3.00)) suggests neutrality about the role of legislation as a driver, the distribution of values shows that respondents are evenly divided between those that lean

towards recognising the role of legislation and those that do not. These two results are consistent with outcomes we presented concerning definitions.

3.2.4. Evaluating accessibility

The fourth group of statements deals with how accessibility can be assessed (Table 5). Respondents strongly agree that accessibility must be grounded on user-centred practices (s11); they also strongly disagree that accessibility can be

Table 4. Statements that deal with accessibility drivers.

	Statement	<i>N</i>	Rate	Mdn	IQR	<i>M</i>	<i>sd</i>	Low	High
s9	Legislation is the main motivation for ensuring web accessibility	209	0.70	3.00	2.00	3.08	1.21	2.92	3.25
s10	Web accessibility is best viewed in terms of business revenue	208	0.69	2.00	2.00	2.13	0.99	1.99	2.26

Table 5. Statements that deal with how accessibility can be tackled.

	Statement	<i>N</i>	Rate	Mdn	IQR	<i>M</i>	<i>sd</i>	Low	High
s11	Designing for web accessibility must be grounded in user-centred design	211	0.70	4.00	1.00	4.18	0.87	4.06	4.29
s14	Web accessibility can only be assessed by running user tests	210	0.70	2.00	1.00	2.55	1.11	2.40	2.70
s15	Compared to other methods web accessibility can be assessed more reliably and validly by running user tests	208	0.69	3.00	1.00	3.37	1.07	3.22	3.51
s16	Web accessibility can be quantified and thus compared across similar pages	208	0.69	3.00	1.00	3.37	1.07	3.22	3.51
s17	Accessibility is personal experience and accessibility evaluation should take this into account	211	0.70	4.00	1.00	3.46	1.01	3.32	3.60
s18	Web accessibility can be assessed by only inspecting the underlying source code of a page	210	0.70	2.00	1.00	1.83	0.92	1.70	1.95
s19	Web accessibility of a page can be well assessed in less than five minutes	204	0.68	2.00	1.25	2.33	1.08	2.18	2.48
s20	Opinions of people with disabilities are sufficient to assess web accessibility	209	0.70	2.00	0.00	2.10	0.87	1.98	2.22
s21	To assess accessibility of a web page you need to be trained in WCAG	212	0.71	3.00	2.00	3.32	1.13	3.16	3.47
s22	To assess accessibility you can rely on only WCAG	211	0.70	2.00	1.00	2.21	1.03	2.07	2.35

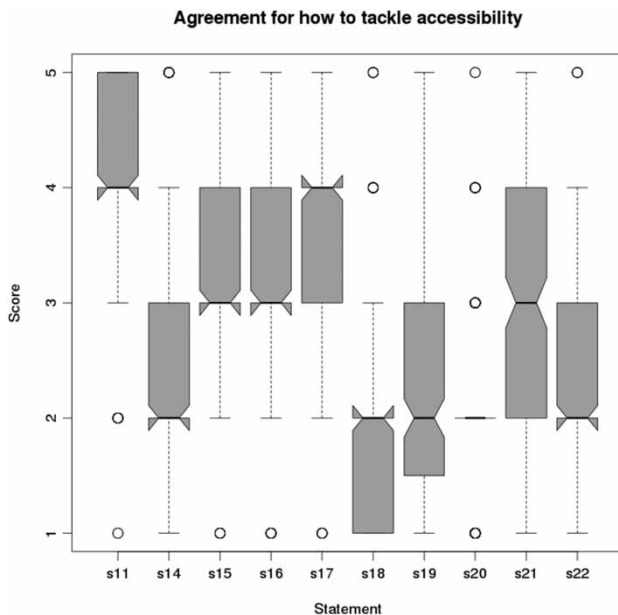


Figure 4. Distributions of scores for agreement on evaluating accessibility statements (Table 5).

assessed by only inspecting source code (s18) (Figure 4). They moderately agree with the fact that accessibility is a personal experience (s17).

The agreement pattern with statements s11, s17, and s18 suggests that respondents see the benefits of user involvement in the evaluation, rather than just looking at the source code of pages.

They moderately disagree with s14, that user tests are the only means to assess accessibility; with s19,

that accessibility can be quickly assessed; with s20, that opinions of people with disabilities are sufficient; and with s22, that relying on WCAG is sufficient. They are evenly divided, although without taking an extreme position, on whether training on WCAG is necessary to assess accessibility (s21).

They moderately agree that user tests are more valid and reliable than other methods (s15). However, we believe this statement is ambiguous (which other methods?), and thus less useful than others in this survey.

3.2.5. Dynamic and contextual

The fifth group of statements deals with how accessibility is affected by pages that change and the context in which a page is experienced (Table 6 and Figure 5).

Respondents agree with s24 ('contextuality') and s25 ('familiarity'); note that agreement is moderate if we look at the medians. They are evenly divided on s23 ('dynamic'). The fact that most respondents feel that context of use and familiarity of a page play a role in accessibility suggests that these two aspects are considered key accessibility aspects.

3.2.6. Standard definition

There is a single statement that deals with whether there is a need for a standard definition of accessibility (Table 7 and Figure 6). Respondents moderately agree that standardisation is needed.

3.2.7. Accessibility vs. user experience

This group of statements deals with the relationships between accessibility and user experience (Table 8 and

Table 6. Statements that deal with whether accessibility is affected by dynamic pages and contextual experience.

	Statement	<i>N</i>	Rate	Mdn	IQR	<i>M</i>	<i>sd</i>	Low	High
s23	Web accessibility is highly dynamic: it changes constantly while interacting with a page	205	0.68	3.00	2.00	3.22	1.04	3.08	3.36
s24	Web accessibility occurs in and is dependent on the context in which the web page is experienced	208	0.69	4.00	1.00	3.53	1.06	3.38	3.67
s25	Prior exposure to a web page shapes subsequent web accessibility	196	0.65	4.00	1.00	3.47	0.96	3.34	3.61

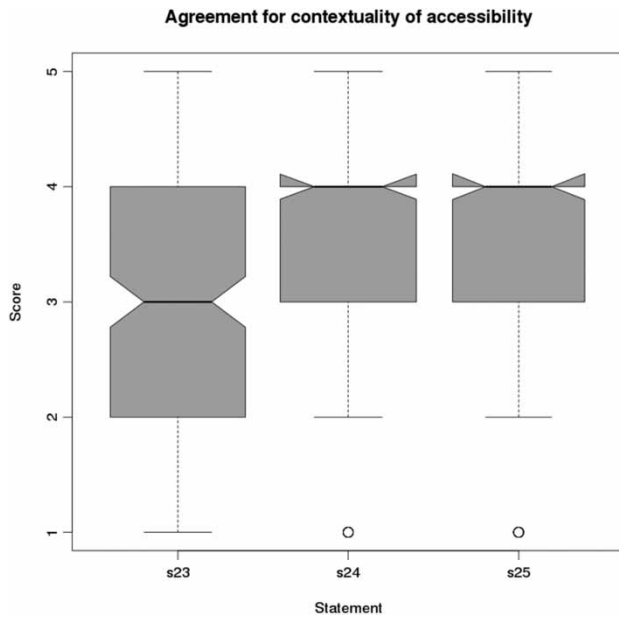


Figure 5. Distributions of scores for agreement of dynamic and contextual statements (Table 6).

Figure 7). Respondents strongly disagree with s29, that accessibility and user experience are not related (i.e. they think they are quite related). There is strong agreement with s32, that user experience for people with disabilities is enhanced by accessibility. Finally, there is moderate agreement with s27 (accessibility is necessary for user experience), with s28 (that accessibility problems are UX problems), and with s30 (that accessibility enhances UX for all).

3.3. Statements and expertise

Two questions in the survey were included concerning the amount of accessibility work people do ('what percentage of your work hours you dedicate to web accessibility?' and

Agreement for standard definition

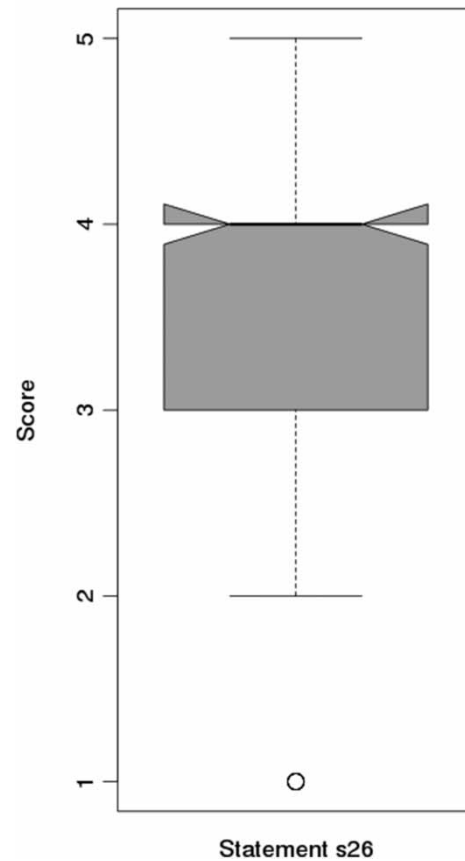


Figure 6. Distributions of scores for agreement on the statement related to the need of a standard definition (Table 7).

'how many years have you been working in web accessibility?'); they are useful to characterise the level of expertise that participants have on web accessibility. Figure 8 shows that half of the respondents devote to web accessibility at least 20% of their week-hours, and that they worked at least

Table 7. The statement that deals with the need of standard definitions.

	Statement	<i>N</i>	Rate	Mdn	IQR	<i>M</i>	<i>sd</i>	Low	High
s26	There is a definite need for a standardised definition of the term 'web accessibility'	211	0.70	4.00	1.00	3.57	1.05	3.43	3.72

Table 8. Statements that deal with relationships between accessibility and user experience.

	Statement	N	Rate	Mdn	IQR	M	sd	Low	High
s27	Web accessibility is necessary for good user experience	212	0.71	4.00	1.25	3.94	1.04	3.80	4.08
s28	Web accessibility problems are a subset of user experience problems	209	0.70	4.00	1.00	3.69	1.04	3.55	3.84
s29	Web accessibility and user experience are not related: user experience only affects non-disabled people	207	0.69	1.00	0.00	1.26	0.61	1.18	1.34
s30	Accessible sites enhance user experience for all	211	0.70	4.00	1.00	4.21	0.96	4.08	4.34
s32	Accessible sites enhance user experience for disabled people	211	0.70	5.00	1.00	4.47	0.71	4.37	4.57

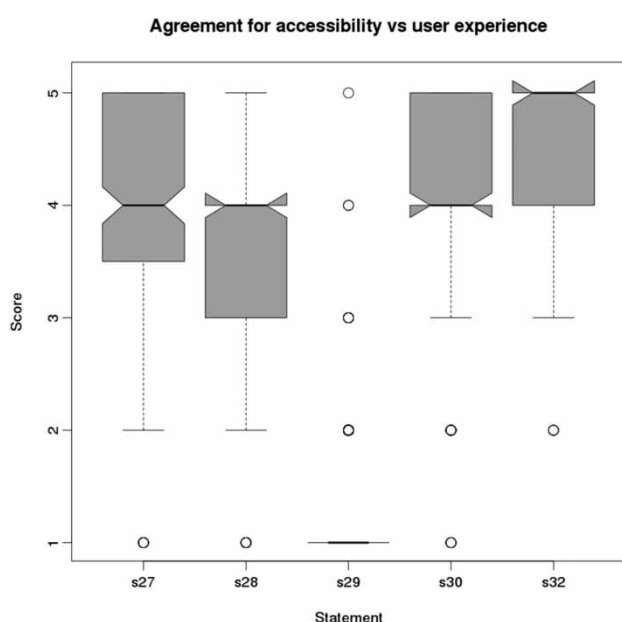


Figure 7. Distributions of scores for agreement on statements dealing with the relationships between accessibility and user experience (Table 8).

for 7 years in the web accessibility field; it also shows that half of the respondents spend between 5% and 70% of their week-hours working on accessibility, and that they worked on accessibility between 3 and 10 years. Some of them are not working on accessibility, while others spend their entire time in accessibility and have been working on accessibility for 35 years.

Should we consider as experts the individuals who are above the medians for both variables, then we get exactly 100 'experts' and 200 'non-experts'. Fifty-two 'experts' (52%) declared to be web accessibility experts (as specialisation); conversely, among those who declared themselves to be 'web accessibility experts', 56% are classified as 'experts' by our rule. Thus, we see that characterising expertise with respect to the time people spend or spent on accessibility does not match with their perception of being

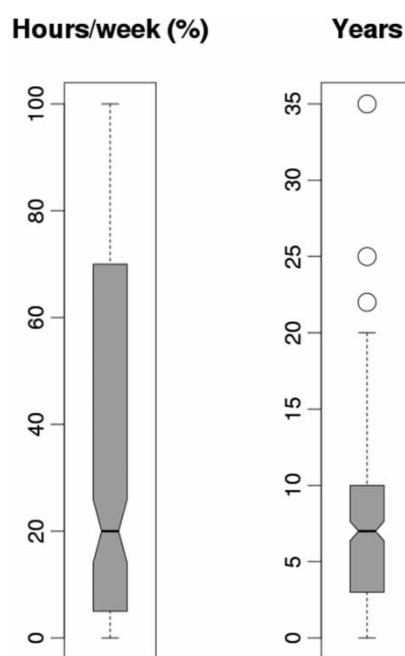


Figure 8. Boxplot of distribution of accessibility work.

Table 9. Comparison of self-declared 'web accessibility expertise' and working on accessibility above the median.

Self-declared/computed	Expert	Non-expert	
Not web accessibility expert	48 48%	159 80%	207
Web accessibility expert	52 52%	41 20%	93
	100 100%	200 100%	300

experts (as shown by Table 9); the mismatch rate is 70%. This means that should one have to analyse data on the basis of a expertise distinction, results will differ according to how expertise is going to be characterised. In the following, we will use the expertise notion based on the median values.³

Effect of expertise on usability vs. accessibility: The effect of expertise levels is not significant on statements in

Table 10. Effects of expertise on scores of statements: means (M) compared by two-tailed unpaired t -test and medians (Mdn) compared by the Wilcoxon rank sum unpaired test with continuity correction.

Statement	Experts (M)	Non-experts (M)	p (t -test)	Experts (Mdn)	Non-experts (Mdn)	p (Wilcoxon)
s8	4.53	4.28	0.01* [0.05, 0.45]	5.00	4.00	0.02*
s10	2.29	2.04	0.07 [-0.02, 0.54]	2.00	2.00	0.04*
s11	4.33	4.09	0.04* [0.01, 0.47]	4.50	4.00	0.07
s21	3.57	3.17	0.01* [0.09, 0.72]	4.00	3.00	0.01*
s22	2.42	2.09	0.03* [0.04, 0.62]	2.00	2.00	0.02*
s27	4.16	3.82	0.02* [0.06, 0.62]	4.00	4.00	0.02*

*highlights the p values smaller than 0.05.

Table 2: a two-tailed unpaired t -test on the mean scores shows no significant difference due to expertise levels for any statement and similarly, Wilcoxon unpaired, non-parametric test on medians on the scores also shows no significant difference due to expertise levels for any statement. This is compatible with expertise not affecting the perception of the relationship between accessibility and usability.

Effect of expertise on 'disability vs. all': Regarding whether accessibility is concerned with people with disabilities or with a wider audience (Table 3), expertise has an effect on statement s8 ('Web accessibility benefits older users'). Experts agree more with that statement than non-experts (Table 10).

Effect of expertise on 'law vs. money': With statements contrasting whether the accessibility drivers should be seen as legislation or business opportunities (Table 4), expertise plays a role only for statement s10 ('Web accessibility is best viewed in terms of business revenue'). While parametric tests indicate that the difference is marginally significant (Table 10), non-parametric ones suggest that non-experts do actually disagree more with that statement than experts.

Effect of expertise on 'evaluating accessibility': Regarding how accessibility should be assessed (Table 5), expertise affects only agreements with statements s11 ('Grounded on user-centred development'), s21 ('To assess accessibility of a web page you need to be trained in WCAG'), and s22 ('To assess accessibility you can rely on only WCAG'). It is important to note that according to the Wilcoxon test on medians, the difference on s11 is marginal. However, if we interpret means then we can conclude that experts agree more with s11 and s21 and for s22 non-experts show a higher disagreement (Table 10). Thus, experts back more firmly than non-experts the advantages of a user-centred development approach to web accessibility. Non-experts apparently think that the need for training on WCAG is less needed than experts do. This might be due to the fact that they are less experienced in using the WCAG and underestimate the underlying complexity of the evaluation and conformance assessment procedure. Finally, experts disagree more than non-experts on WCAG being the only method that can be relied upon to assess accessibility.

Effect of expertise on 'accessibility vs. UX': Expertise plays a role on only one statement of those listed in Table 8, namely s27 ('Web accessibility is necessary for good user experience'). Experts agree more with this statement than non-experts (Table 10).

3.4. Statements and technical background

Respondents are also grouped according to their technical background; as a result, 262 (87%) are characterised as being technical, 29 (10%) as non-technical, and 9 (3%) as other; 'technical' backgrounds in this case encompass among others computer scientist, designer, HCI specialist, usability practitioner, and user experience researcher; whereas 'non-technical' backgrounds include social scientist, advertiser, assistive technologist, and expressionist writer. Here, we will be looking at whether this distinction has any effect on the scores given to statements.

Effect of technical background on usability vs. accessibility: Regarding the statements dealing with accessibility vs. usability (Table 2), if we look at means there is an effect of the background on statement s1 ('Web accessibility and usability problems are not related'), but according to the Wilcoxon test the medians are not significantly different. If we interpret means, technical people express a stronger disagreement, hence they have a firmer opinion than non-technical people that accessibility and usability problems are related (Table 11). Possible explanations are that technical people know better the difference between these two concepts.

Effect of technical background on 'disability vs. all': Regarding the statements in Table 3, the background has a significant effect only on statement s5 ('Web accessibility problems only affect disabled people'). Both groups disagree with the statement, but technical people disagree more (Table 11). This could be because technical people see the overlap of accessibility concerns across different technologies, such as assistive technologies, mobile devices, and search engines.

Effect of technical background on evaluating accessibility: For the statements in Table 5, there is only a marginal effect of the background on statement s21 ('To assess accessibility of a web page you need to be trained in

Table 11. Statements and technical background: means (M) compared by two-tailed unpaired t -test and medians (Mdn) compared by the Wilcoxon rank sum unpaired test with continuity correction.

Statement	Technical (M)	Non-technical (M)	p (t -test)	Technical (Mdn)	Non-technical (Mdn)	p (Wilcoxon)
s1	1.15	1.39	0.02* [0.03, 0.44]	1.00	1.00	0.20
s5	1.62	2.25	0.02* [0.10, 1.17]	1.00	2.00	0.00*
s16	3.31	2.95	0.08 [−0.05, 0.77]	3.00	3.00	0.07
s21	3.38	2.81	0.05 [0.00, 1.14]	4.00	3.00	0.05
s27	3.89	4.24	0.07 [−0.03, 0.72]	4.00	4.00	0.21
s28	3.74	3.16	0.02* [0.10, 1.16]	4.00	3.00	0.01*
s30	4.16	4.55	0.02* [0.07, 0.70]	4.00	5.00	0.13
s32	4.45	4.71	0.05 [0.00, 0.54]	5.00	5.00	0.09

*highlights the p values smaller than 0.05.

WCAG') and on s16 ('Web accessibility can be quantified and thus compared across similar pages'). If we interpret the means, we can conclude that technical people agree more with s21 and s16 (barely significant according to Table 11), while non-technical people are more ambivalent. It may be the case that technical people have more experience with WCAG during development of sites and have experienced difficulties in applying the WCAG, hence they think that specific training is necessary; they also think that accessibility can be quantified.

Effect of technical background on accessibility vs. UX: Regarding the statements in Table 8, background has a significant effect on s28 ('Web accessibility problems are a subset of user experience problems'), on s30 ('Accessible sites enhance user experience for all'), and a marginal one on s32 ('Accessible sites enhance user experience for disabled people') and s27 ('Web accessibility is necessary for good user experience'). If we look at medians though, with the Wilcoxon test, we only see a significant difference in s28. However, if we interpret means (Table 11), we can say that technical people agree more with s28 and conversely they agree less with s30, s32, and s27 (even more marginally). Thus, technical people think that accessibility problems are particular kinds of user experience problems, similar to the accessibility vs. usability perspective. They also think that accessibility improves user experience for all, but it seems that their view on considering accessibility as a necessary component for user experience that may improve the experience of people with disabilities is not that strong.

3.5. Statements and specialisation area

Based on the declared specialisation area, we classified respondents in either 'user-oriented' or 'non-user-oriented', finding, respectively, 191 and 109 respondents. Among 'user-oriented' people we put respondents whose specialisations include 'HCI specialist', 'interaction design engineer', 'IT accessibility', 'social scientist', and 'rehabilitation'. Conversely, among the 'non-user-oriented' ones, we included 'computer science', 'business', 'designer', 'general accessibility and learning', 'civil servant', etc.

These numbers suggest that we targeted the survey mainly on people who are somewhat 'close' to users.

Effect of specialisation area on accessibility evaluation: Regarding statements in Table 5, there is a strongly significant difference for statement s21 ('to assess accessibility of a web page you need to be trained in WCAG'): people who are user-oriented lean towards believing that one needs training in WCAG to assess accessibility ($M = 3.49$ vs. $M = 2.96$, $p < .01$, $ci = [0.20, 0.86]$). According to the Wilcoxon test on medians, we also see a significant difference on this statement (Mdn = 4.00 vs. Mdn = 3.00, $p < .01$).

3.6. Statements and work sector

Based on the declared work sector, we classified respondents in either 'government' or 'non-government', finding, respectively, 38 and 262 respondents. Among 'non-government' people we put respondents whose sector include 'academia', 'industry', and 'NGOs'.

Effect of work sector on need for standardisation: Only a marginal effect was found for the statement in Table 7 due to the sector. People working for the government agree marginally more with the statement s26 ('There is a definite need for a standardised definition of the term *web accessibility*'). However, according to the Wilcoxon test on medians, the difference is not significant (Table 12).

Effect of work sector on the use of WCAG: Regarding the two statements in Table 5 that are concerned with WCAG (s21 'To assess accessibility of a web page you need to be trained in WCAG' and s22 'To assess accessibility you can rely on only WCAG'), work sector affects only s21 in that people working for the government agree more with it (Table 12). That is, people in the government sector think training of WCAG is needed. Reasons could be that they are more exposed to accessibility evaluations or because they are more familiar to legal reasons for doing that, and the corresponding need to provide valid assessments.

Effect of work sector on 'disability vs. all': Finally, regarding the statements in Table 3, work sector has an effect only on s7 ('Web accessibility benefits mainly blind users'), with which people from the government sector disagree more (Table 12).

Table 12. Statements and work sector (Gov. – Government): means (M) compared by two-tailed unpaired t -test and medians (Mdn) compared by the Wilcoxon rank sum unpaired test with continuity correction.

Statement	Gov. (M)	Non-Gov. (M)	p (t -test)	Gov. (Mdn)	Non-Gov. (Mdn)	p (Wilcoxon)
s7	1.64	2.22	0.01* [0.14, 1.02]	1.00	2.00	0.00*
s21	3.79	3.24	0.03* [0.05, 1.03]	4.00	3.00	0.01*
s26	3.89	3.52	0.09 [–0.06, 0.79]	4.00	4.00	0.07

*highlights the p values smaller than 0.05.

3.7. Statements and being in the trenches

We classified participants, on the bases of their role, into ‘practitioners’ (193) and ‘others’ (107). Practitioners include roles such as ‘consultant’, ‘manager’, and ‘practitioner’; others include ‘researcher’, ‘policy-maker’, ‘student’, and ‘editor’.

Effect of role area on accessibility evaluation: With respect to statements in Table 5, role has an effect on s18 (‘Web accessibility can be assessed by only inspecting the underlying source code of a page’) and a marginal one on s21 (‘To assess accessibility of a web page you need to be trained in WCAG’) – notice that a significant effect is suggested by the non-parametric test on s21. More specifically, practitioners disagree more with s18; they also agree more on s21 (Table 13). Hence, practitioners do not think that only using the source code of the page is enough. They also think that training in WCAG is needed.

Effect of role area on ‘disability vs. all’: Regarding statements in Table 3, work role has an effect on s7 (‘Web accessibility benefits mainly blind users’) and on s13 (‘Web accessibility is about people with low income, people from developing regions, and illiterate people’). Practitioners disagree more with s7 (hence they think that web accessibility benefits a larger audience) and they also disagree more with s13 (Table 13). Thus, practitioners see the benefits of accessibility for other groups more than other people.

4. Discussion

Usability vs. accessibility: Accessibility and usability are seen as dependent qualities (s1); this is significantly stronger for those who are technical compared to those who are non-technical. Technical people may have acquired this awareness when addressing the technical challenges to build accessible and usable websites and observing the implications of these practices on users. It is the general belief that accessible and usable sites benefit both people with and without disabilities (s3 and s4).

Disability vs. all: The view that accessibility only benefits people with disabilities is not shared by the majority (s5). Technical people disagree that accessibility mainly affects people with disabilities more strongly than those without a technical background. This could be because they have had to address accessibility as a cross-audience, cross-device, and cross-platform quality.

Conversely, the fact that accessibility benefits all types of people regardless their abilities and situations is very strongly supported by all (s6). To a lesser extent most respondents believe that no specific user groups (i.e. blind users and low-income populations, s7 and s13) benefit most from accessibility. Experts have stronger opinions than non-experts perhaps because they are more certain and confident about the statements. This is particularly significant in the case of supporting how accessibility may benefit older users (s8).

Those working in governmental bodies and those who are ‘in the trenches’ show a stronger opposition to the statement supporting that accessibility benefits mainly the blind (s7). This could be because they have a broader perception about accessibility, less stereotypical and more general. Additionally, respondents with a practical role not only share the same view as the individuals working on the public sector but also do not believe in the relationships between accessibility and living in developing countries, having low income, or being illiterate. We can say that those who are ‘in the trenches’ have an open position on the scope of the benefits provided by accessibility – removing the focus from any particular group – which may happen because they have experienced the benefits of accessibility in multiple user groups.

Yet, there is some contradiction in that individuals agree that accessibility is about inclusion (s12) but they – especially practitioners – still do not believe that it is about low income (s13). We argue that this has two possible exclusive interpretations:

- When talking about *inclusion* people have in mind the inclusion of those who have some disabilities but not the inclusion of those who are disadvantaged due to the lack of social and financial opportunities. It should be noted that this view does not only exclude those living in developing countries but also segregates people with disabilities as they are twice as likely to live in low-income households as people without disabilities.⁴
- While still supporting that accessibility benefits all types of users including the elderly (s8), respondents believe that no particular group regardless their abilities, situation, personal, or social circumstances should monopolise accessibility.

Table 13. Statements and being in the trenches (Pract. – Practitioners): means(M) compared by two-tailed unpaired t -test and Medians (Mdn) compared by the Wilcoxon rank sum unpaired test with continuity correction.

Statement	Pract. (M)	Others (M)	p (t -test)	Pract. (Mdn)	Others (Mdn)	p (Wilcoxon)
s7	2.01	2.41	0.02* [0.08, 0.72]	2.00	2.00	0.01*
s13	1.89	2.51	0.01* [0.24, 0.99]	1.00	3.00	0.00*
s18	1.72	2.03	0.03* [0.03, 0.58]	2.00	2.00	0.03*
s21	3.42	3.12	0.05 [0.00, 0.60]	4.00	3.00	0.04*

*highlight to the p values smaller than 0.05

Accessibility evaluation: There is unanimous view on the fact that accessibility can be achieved through a user-centred design process (s11) – experts are more assertive on this – and rapid accessibility tests are discouraged by the majority of respondents (s19). In line with this, it is understood that accessibility is a subjective quality (s17) and that accessibility testing should rely on user testing in order to obtain more valid and reliable results (s15). However, user tests should not be the unique means employed (s14), and relying only on the opinion of users is broadly disliked (s20), which suggests that respondents may prefer objective usability metrics generated in user tests to opinions. This is partially supported by the fact that some respondents, particularly those having a technical background, lean towards thinking that web accessibility can be quantified (s16).

There are weak opposite views on WCAG training to be indispensable to assess accessibility (s21): on the one hand, experts, those with a technical background, individuals dealing with users, people who belong to the public sector, and those who are ‘in the trenches’, show a favourable opinion about WCAG training to be necessary; on the other hand, non-experts, those without a technical background, those who belong to private sector, and people who do not deal with end users or are not practitioners, hold a weaker and ambivalent view.

For those dealing with end users, WCAG training is perceived as having actual value, while those working in public bodies may find WCAG training useful as guidelines are instrumental for those who promulgate and enforce regulations, leading to individuals working in the government to support guidelines.

Respondents believe that source code testing should not be the unique means to assess accessibility (s18); practitioners believe that even more. Their positive position on WCAG training and reluctance to relying on source code analysis suggests that those who have a practical role find guidelines relatively useful, which highlights the practical aspect of guidelines as one of their strengths. This is somewhat contradictory as source code analysis is often required to verify whether guidelines are met. However, practitioners may understand that this is not the *unique* way of checking conformance, entailing that user testing may be a complementary or better mechanism.

There is high consensus on thinking that guidelines alone do not suffice (s22), especially by non-experts. This statement, jointly with the previous one, could be explained

in that experts, who acquired their expertise in previous years, (1) may feel attached to WCAG due to its influential role during this period of time or (2) because they have experienced the benefits of applying guidelines. Therefore, even if they are not in favour of relying on guidelines alone, they do not have a strong negative position, while non-experts may be more sceptical.

Broadly speaking, it can be said that people consider accessibility as a quality that should be included in the design process, taking into account the particular needs and preferences of end users. To do so, training on WCAG is potentially helpful although relying on guidelines alone is not agreed and moreover that source code checking should be done. It is understood that user testing yields more reliable and valid results although relying alone on users’ opinion is not understood to be a good practice either. Therefore, it seems that a process-oriented accessibility testing could be appropriate, where WCAG are useful, and user testing is indispensable.

The relationship between accessibility and UX: Individuals have a very strong and assertive position about accessibility and user experience: they not only claim that both qualities are strongly related but also that the scope of UX covers the experience of people with disabilities (s29). Similarly, accessible sites are understood to benefit the experience of all users (s30) and especially of those who are disabled (s32). Those with a technical background have a less firm opinion about these two statements. The implications in the statements are maybe too strong for those who have been exposed to the technicalities of web accessibility, which as a result tone down their position.

Accessibility is also understood to be a subset of UX (s28), and respondents believe that web accessibility paves the way towards a good UX (s27). Those who are not technical are ambivalent about the former statement, whereas experts have a firmer opinion about the latter, reinforcing the view of web accessibility to be necessary for a good UX. A broader and experience-based view of the positive consequences of accessibility may have shaped this view.

However, this understanding is not reciprocal from the UX community in that current UX definitions (Law *et al.* 2009), frameworks (Bargas-Avila and Hornbaek 2011), or research agendas (Hassenzahl and Tractinsky 2006) do not contemplate accessibility as a quality of UX. If accessibility wants to be prominent and reach beyond its

current community of users, researchers, and practitioners, it should be included in UX research agendas. Or instead, the accessibility community should embrace UX and conduct studies that would shed some light (and empirical evidence) on the relationship between accessibility and UX.

Dynamic and contextual: People agree on the contextual nature of accessibility (s24); also, on how prior exposure determines accessibility (s25). The view that accessibility is dynamic and therefore it changes while interacting with a web page (s23) is controversial.

Driven by legislation vs. driven by law: People do not believe that accessibility is driven by business (non-experts having a stronger opinion on this). When it comes to whether legislation is the main motivator to adopt accessibility, responses are evenly divided although no strong positions are held. This may suggest that for half of the respondents law enforcement may be more persuasive than successful business cases. It seems that more compelling evidence than existing cases⁵ needs to be provided.

The need for a standard definition: Respondents agree on having a standard definition for accessibility (s26). Those that work for public bodies or in governmental institutions are slightly more in favour of a standard definition. It is reasonable to claim that a standard definition that would generate consensus and remove ambiguities is a useful tool for those dealing with regulation policies.

Final remarks: To summarise our discussion, we found that respondents think that accessibility and usability are highly related and that accessibility has a greater impact on both usability and UX than vice versa. They also think that accessibility is applicable to everyone and not just people with disabilities. Respondents strongly agree that accessibility must be grounded on user-centred practices and that accessibility evaluation is more than just inspecting source code; however, they are divided as to whether training in WCAG is necessary or not to assess accessibility. This said, our survey is not without shortcomings and limitations; however, these show the potential for future work. We have two major shortcomings in our methodology:

- *Ambiguous statements:* Some of the statements in our survey were a little ambiguous and may have been hard to rate with a five-point Likert scale (strongly agree–strongly disagree). In this case, our survey could have included a comment part for each of these statements; we would then be able to better analyse the qualitative responses.
- *Contextual responses:* Some of our statements could have received different responses depending on the context considered. This problem could have been alleviated if we have used a comment part for our survey. We could have also conducted a follow-up interview session with our respondents to better understand their motivation in answering these statements.

In order to address some of these shortcomings, we have conducted a follow-up panel at WWW2012⁶ and are also planning to conduct a follow-up survey which is designed in such a way as to address the shortcomings above and targeted at non-experts.

Finally, it is important to note that the language of the survey and origin of the respondents played an important role in the results. Our survey was conducted in English which means people who speak other languages could not participate in our survey. Similarly, majority of our respondents were from USA and Europe, which could potentially bias the results presented here towards the view in USA and Europe. However, we believe these two issues are exactly the point and the problem – disharmony of language leads to variations in understanding and so an inability to communicate with shared understanding.

4.1. Practical implications

Practical implications of this study are centred around the concepts we introduced earlier (Section 3).

Guide and help in teaching web accessibility: The study supports the claim that accessibility benefits all types of people regardless of their abilities and situations. This suggests that the scope of teaching accessibility needs to broaden up. People studying accessibility need to be educated that accessibility is applicable to everyone and not just disabled people, and that accessibility is not only about the abilities of users, but it is about the technology employed, the situation, and context of use.

We have shown that the stakeholders involved in building accessible websites may disagree on certain aspects. This disagreement is not only generated when individuals have opposing views, but also when they agree on a statement that contains a term that can evoke different meanings (e.g. accessibility is about *inclusion*). As a result, teaching materials should highlight the tensions that may arise between individuals of different expertise, background, and position. This could change students' view on web accessibility and how they would tackle accessibility.

Our study shows that accessibility, usability, and user experience are perceived as interrelated qualities. While current HCI curricula considers the design of interactive interfaces for people with disabilities,⁷ accessibility tends to be dealt as an isolated topic. We argue that accessibility should be taught jointly with usability and user experience, highlighting the commonalities and boundaries of each quality. This way, the misconceptions and confusions about the scope, benefits, and overlap of each quality could be avoided.

Finally, relying on source code evaluation alone for assessing web accessibility is not enough, but is complementary to user testing. However, it seems that there is a disconnect between what people believe and do, similar to what Lazar *et al.* (2004) found: webmasters are aware of

web accessibility practices, while the evidence supports that the web is non-accessible. The fact that conformance badges are displayed on non-conformant websites (Gilbertson and Machin 2012) may indicate an overreliance on tools and might be a symptom of communication problems between the HCI specialist and programmers (Law et al. 2005). This means that if one is educated in web accessibility, it should be strongly emphasised that using only automated tools to assess accessibility might not be enough to identify all the accessibility problems in a web page. People need to learn that accessibility has to be grounded on user-centred practices and accessibility evaluation is a complex process that needs to be carefully tackled throughout the development process.

Communicate the concept: Individuals perceive that accessibility is for all. Results also show that there is some reluctance to support that a specific user group benefits most from accessibility. There are some groups of respondents that take stronger positions than their counterparts in this regard: for instance, when it comes to the idea that accessibility mainly benefits blind users, those working on governmental bodies and those who are 'in the trenches' stand out rejecting such statement. The former group also takes a more extreme negative position regarding the relationship between accessibility and developing countries. While it is widely accepted that older users benefit from accessibility, it seems to be less accepted how those who are socially excluded benefit from it. However, there is enough evidence showing how accessibility is also about those living in the developing world (Kumar and Agarwal 2012); therefore, we have to better communicate that when one designs accessible products he or she will make the product accessible to a much wider population, including those who are socially disadvantaged. This would help us to broaden the scope of web accessibility. Studies that provide evidence about the overlap of the problems encountered by people with disabilities and situationally impaired users, such as Petrie and Kheir (2007) and Yesilada et al. (2010), can help to reinforce this idea to those who are not in the field.

Advance web accessibility research: Our study can be considered as a step towards understanding how the perceptions on web accessibility are backed by empirical evidence.

- (1) *Accessibility vs. user experience.* There is little evidence pointing to the relationship between accessibility and user experience; one of the few examples that analyses the relationship between aesthetics and accessibility suggests that visual cleanliness and accessibility are related (Mbipom and Harper 2011). More research is needed to know whether this relationship exists between some other aesthetic and affective qualities.
- (2) *Accessibility vs. usability.* We also encourage to conduct empirical research to further explore the

initial findings on the interrelationship between usability and accessibility (Petrie and Kheir 2007). More empirical evidence can be provided not only to analyse the overlap of problems encountered by users, but also to show how accessible design can benefit all users. Some work has been carried out in this regard; for instance, hints on how able-bodied users benefit from designing websites for dyslexics have been provided (Rello et al. 2012).

- (3) *Situational impairments.* More evidence is also required to support the situational impairments paradigm. In this regard, the overlap between the problems faced by users who are situationally impaired by mobile devices and users with physical disabilities operating on desktop computers has been analysed elsewhere (Yesilada et al. 2010). We therefore claim that more evidence is needed to build a corpus of research that backs the situational impairments paradigm and supports that accessibility benefits all.
- (4) *Evaluation.* As far as accessibility evaluation is concerned, further empirical research should be conducted to better understand the consequences of using different evaluation techniques in assessing web accessibility. Guidelines have been challenged as it has been found that WCAG 2.0 only covers the 50% of the problems encountered by users (Power et al. 2012) and that their validity and reliability are overestimated (Brajnik et al. 2012). This should encourage researchers to explore new evaluation methods that go beyond conformance-based evaluation.

Penetration of web accessibility into industrial setting. Since accessibility, usability, and user experience are considered to be interrelated, when companies invest on usability or user experience, one could expect that accessibility would be implicitly included too. This would give web accessibility a broader acceptance and reach. Furthermore, if companies can also understand that accessibility is not just for disabled people, then this could better motivate the companies make their sites accessible.

Many claims have been made regarding the increased revenue aspect of accessibility: multidevice development, increased interoperability, and search engine optimisation to name a few. However, we found elsewhere (Yesilada et al. 2012) that most people are driven by the ethical issues when adopting accessibility practices. Initiatives such as the Web Accessibility Initiative business cases (Henry and Arch 2012) would help to spread the awareness and attract those who might be sceptical or unaware. Regarding the evaluation aspect, relying on guidelines and tools alone is not enough and it should be employed jointly with some other techniques such as expert review, automatic accessibility predictors, and user tests. If this message could be

better communicated to companies than they can better plan, budget, and enact policies to conform to accessibility requirements and legislation.

When it comes to WCAG training to assess accessibility, we have uncovered the tensions that may arise within multidisciplinary teams and between teams that belong to different domains: these collisions may emerge when public sector bodies hire private contractors, when establishing a relationship between users and NGOs/academia, and between experts and non-experts who participate in any forum.

5. Conclusions

In a constantly evolving field, understanding each other can be tricky; indeed, there are many different definitions in the literature, all with a different perspective. This makes it difficult for our community to interact, reach agreement, or share understanding. What is more, it makes it very difficult for those outside the web accessibility community to understand, plan, budget, enact policy, or conform to accessibility requirements and legislation when the community itself has so many, in some cases, conflicting definitions. Our work goes some way to addressing these issues by shining a light on the perceptions of web accessibility professionals. By understanding their views, opinions, and conceptualisations we can understand how dispersed the community is; how much a shared understanding might influence research, development, and application; and how those outside the community will be able to get a feel for the innate direction and meaning in web accessibility, indeed, will both communities share a common understanding?

Notes

1. <http://www.surveygizmo.com/s3/599408/Web-Accessibility-Survey>.
2. <http://lists.w3.org/Archives/Public/w3c-wai-ig/2011JulSep/0102.html>
3. Here we only report significant results.
4. The Poverty Site. The UK site for statistics on poverty and social exclusion. <http://www.poverty.org.uk/40/index.shtml>.
5. <http://www.w3.org/WAI/bcase/Overview.html>.
6. <http://www.w3.org/WAI/bcase/Overview.html>.
7. ACM SIGCHI Curricula for HCI, <http://www.sigchi.org/cdg/>.

References

- Arch, A., 2009. Web accessibility for older users: successes and opportunities (keynote). In: *W4A '09: proceedings of the 2009 international cross-disciplinary conference on web accessibility (W4A)*, 20–21 April 2009, Madrid. New York: ACM, 1–6.
- Bargas-Avila, J.A. and Hornbaek, K., 2011. Old wine in new bottles or novel challenges: a critical analysis of empirical studies of user experience. In: *Proceedings of the 2011 annual conference on human factors in computing systems*, 7–12 May 2012, CHI '11, Vancouver. New York: ACM, 2689–2698.
- Brajnik, G., Yesilada, Y., and Harper, S., 2012. Is accessibility conformance an elusive property? A study of validity and reliability of WCAG 2.0. *ACM Transactions on Accessible Computing*, 2 (4), 8. doi: 10.1145/2141943.2141946.
- Capra, E.P., et al., 2011. Evaluation of web accessibility from the perspective of functional illiteracy. In: *Proceedings of the 10th Brazilian symposium on human factors in computing systems and the 5th Latin American conference on human-computer interaction*, 25–28 October 2011, IHC+CLIH '11, Porto de Galinhas, Pernambuco. Porto Alegre: Brazilian Computer Society, 280–288.
- Currana, K., Waltersa, N., and Robinsona, D., 2007. Investigating the problems faced by older adults and people with disabilities in online environments. *Behaviour and Information Technology*, 26 (6), 477–453.
- Frandsen Thorlacius, O., et al., 2009. Non-universal usability? A survey of how usability is understood by Chinese and Danish users. In: *Proceedings of the 27th international conference on human factors in computing systems*, 4–9 April 2009, CHI '09, Boston, MA. New York: ACM, 41–50.
- Freire, A.P., Russo, C.M., and Fortes, R.P.M., 2008. A survey on the accessibility awareness of people involved in web development projects in Brazil. In: *W4A '08: proceedings of the 2008 international cross-disciplinary conference on web accessibility (W4A)*, 21–22 April 2008, Beijing. New York: ACM, 87–96.
- Gilbertson, T.D. and Machin, C.H.C., 2012. Guidelines, icons and marketable skills: an accessibility evaluation of 100 web development company homepages. In: *Proceedings of the international cross-disciplinary conference on web accessibility*, 16–17 April 2012, W4A '12, Lyon. New York: ACM, 17:1–17:4.
- Harper, S., Yesilada, Y., and Chen, T., 2011. Mobile device impairment ... similar problems, similar solutions? *Behaviour & Information Technology*, 30 (5), 673–690.
- Hassenzahl, M. and Tractinsky, N., 2006. User experience – a research agenda. *Behaviour & Information Technology*, 25 (2), 91–97.
- Hendler, J., 2012. Increasing access to the web of 'broad data'. In: *Proceedings of the international cross-disciplinary conference on web accessibility*, 16–17 April 2012, W4A '12, Lyon, France. New York: ACM, 31:1–31:2.
- Henry, S., 2004. *Just ask: integrating accessibility throughout design*. Raleigh, NC: Lulu.
- Henry, S.L. and Arch, A., 2012. Developing a web accessibility business case for your organization: overview [online]. Available from: <http://www.w3.org/WAI/bcase/> [Accessed 20 November 2012].
- Hertzum, M. and Clemmensen, T., 2012. How do usability professionals construe usability? *International Journal of Human-Computer Studies*, 70 (1), 26–42.
- Kelly, B., Lewthwaite, S., and Sloan, D., 2010. Developing countries; developing experiences: approaches to accessibility for the real world. In: *Proceedings of the 2010 international cross disciplinary conference on web accessibility (W4A)*, 26–27 April 2010, W4A '10, Raleigh, NC. New York: ACM, 3:1–3:4.
- Kumar, A. and Agarwal, S.K., 2012. Spoken web: using voice as an accessibility tool for disadvantaged people in developing regions. *SIGACCESS Accessibility and Computing*, (104), 3–11.
- Law, C., Jacko, J., and Edwards, P., 2005. Programmer-focused website accessibility evaluations. In: *Proceedings of the 7th international ACM SIGACCESS conference on computers and accessibility*, 9–12 October 2005, Assets '05, Baltimore, MD. New York: ACM, 20–27.
- Law, E.L.C., et al., 2009. Understanding, scoping and defining user experience: a survey approach. In: *Proceedings of the*

- 27th international conference on human factors in computing systems, 4–9 April 2009, CHI '09, Boston, MA. New York: ACM, 719–728.
- Lazar, J., Dudley-Sponaugle, A., and Greenidge, K.D., 2004. Improving web accessibility: a study of webmasters perceptions. *Computers in Human Behaviour*, 20 (2), 269–288.
- Mbipom, G. and Harper, S., 2011. The interplay between web aesthetics and accessibility. In: *The proceedings of the 13th international ACM SIGACCESS conference on computers and accessibility*, 24–26 October 2011, ASSETS '11, Dundee, Scotland. New York: ACM, 147–154.
- Nielsen, J., 2000. *Designing web usability: the practice of simplicity*. Indianapolis: New Riders Publishing.
- Petrie, H. and Kheir, O., 2007. The relationship between accessibility and usability of websites. In: *Proceedings of CHI 2007*, 28 April–3 May 2007, San Jose, 397–406.
- Power, C., et al., 2012. Guidelines are only half of the story: accessibility problems encountered by blind users on the web. In: *Proceedings of the SIGCHI conference on human factors in computing systems*, 5–10 May 2012, CHI '12, Austin, TX. New York: ACM, 433–442.
- Rello, L., Kanvinde, G., and Baeza-Yates, R., 2012. Layout guidelines for web text and a web service to improve accessibility for dyslexics. In: *Proceedings of the international cross-disciplinary conference on web accessibility*, 16–17 April 2012, W4A '12, Lyon. New York: ACM, 36:1–36:9.
- Sears, A., et al., 2003. When computers fade ... pervasive computing and situationally-induced impairments and disabilities. In: C. Stephanidis and J.A. Jacko, eds. *Human-computer interaction: theory and practice* (Vol. II). Mahwah, NJ: Lawrence Erlbaum Associates, 1298–1302.
- Shackel, B., 1991. Human factors for informatics usability. In: B. Shackel and S.J. Richardson, eds. *Usability & context, framework, definition, design and evaluation*. New York: Cambridge University Press, 21–37.
- Shneiderman, B., 2000. Universal usability. *Communication of the ACM*, 43 (5), 84–91.
- Thatcher, J., et al., 2002. *Constructing accessible web sites*. San Francisco, CA: Apress.
- WAI, W., 2005. *Introduction to web accessibility* [online]. Available from: <http://www.w3.org/WAI/intro/accessibility.php> [Accessed 20 November 2012].
- Yesilada, Y., Chuter, A., and Henry, S.L., 2008. *Shared web experiences: barriers common to mobile device users and people with disabilities* [online]. Available from: <http://www.w3.org/WAI/mobile/experiences> [Accessed 21 November 2012].
- Yesilada, Y., et al., 2010. Small device users situationally impaired by input. *Computers in Human Behavior*, 26 (3), 427–435.
- Yesilada, Y., Brajnik, G., and Harper, S., 2011. Barriers common to mobile and disabled web users. *Interacting with Computers*, 23 (5), 525–542.
- Yesilada, Y., et al., 2012. Understanding web accessibility and its drivers. In: *Proceedings of the international cross-disciplinary conference on web accessibility*, 16–17 April 2012, W4A '12, Lyon. New York: ACM, 19:1–19:9.