

On Developing Validator Software XValid for Testing Home Pages of Universal Design

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Abstract. The current development of the Internet and its growing use makes it necessary to satisfy the needs of all users including those with disabilities having accessibility problems. Therefore we developed a new validator software called XValid, which is a human controlled testing tool for specific needs in light of design for all. We used the well-known WebXACT and this newly developed XValid validator for testing governmental, commercial and e-learning web pages. We made a comparison between both testing results. Based on these results we want to open web-designer's eyes to the typical errors.

Keywords: WEB, W3C, validator, accessibility, website, checkpoint, web design, usability test.

1 Introduction

The average web-designers do not take the specific needs of the handicapped users into consideration, in spite of the fact that there are several guidelines available for a software product to be accessible with minimal requirements [1]. For example the current amount of keyboard support in most common web sites is far from being sufficient [2]. Therefore we have developed a checklist and validator software XValid [3] for testing home pages and e-learning materials from the viewpoint of universal design based on the guidelines of WCAG 2.0.

Numerous validators are available as free services, for example W3C Quality Assurance Tools [4], WebXACT [5], Opera [6]. Every one has advantages and disadvantages too.

WebXACT is a free online service that lets you test single pages of web content for quality, accessibility, and privacy issues.

Opera is an easy way to browse the Web. Opera powers the Web on any device.

The W3C Quality Assurance Tools are almost universal tools for validating Web Standards, languages and CSS style-sheets, moreover it has Specific Tools - for Specific Needs, for example: RDF Validator [7] checks and visualizes RDF documents

- Feed Validator [8] checks newsfeeds in formats like ATOM and RSS.
- P3P Validator [9] checks whether a site is P3P [10] enabled and controls protocol and syntax of Policy-Reference-File and Policy.
- XML Schema Validator [11] is a form for checking a schema, which is accessible via the Web.
- MUTAT [12] is a human-centered testing tool (framework).

Almost all of these tools are web-based, are available both as downloadable source, and as free services on the w3.org site.

González and co-workers proposed a remote testing approach, performing navigability testing in the user's home, employing special silent data gathering software agents, which are able to measure the user accuracy when performing navigation tasks [13].

The University of Illinois at Urbana/Champaign has developed a set of HTML best practices and accessibility management and visualization tools to improve the design and verification of the functional accessibility of web sources [14].

Unfortunately none of these is universal, which controls at the same time the accessibility and usability viewpoints of the following user groups: standard users, blind people, visually impaired people, deaf people, hearing impaired people, people with mobility and movement problems, people with cognitive problems and, elderly people.

The XValid validator is a human controlled testing tool for specific needs in light of accessibility and usability. Usability in the Web design has to cope with important elements like: Perceptibility, Understandability, Operability, Memorability Efficiency, Technical robustness because accessibility and usability have technical aspects as well as human interaction aspects. [15] The XValid validator software examines these elements too.

2 Developing the XValid Validator Software

XValid was developed with .Net framework 2.0. The code license of validation core is free, so anyone can build, modify or distribute it. It's a traditional desktop application, but because the validation core is a standalone library an online version is possible. XValid's main advantage is WCAG 2.0 conformity and the free availability.

The application is divided into two parts: the validation core and the graphical user interface.

Validation core is a standalone library, and it's capable to work without the GUI, so a later online version, or a non-Windows version is possible (although, the P/Invoked FreeImage may be a problem in this case).

The process (and application usage) is very simple from the user's point of view. After starting the application, the following form is displayed (see Figure 1).

The application can analyze local files from the computer's file system, or a specific URL. In the first case the user clicks on the "Browse" button, and in the well-known Windows-way, selects a file. In the second case the user enters the exact URL into the textbox. After that the "Check" button can be pressed and some seconds later the report is appearing in the large white area. This report can be saved with the "Save Report" button.

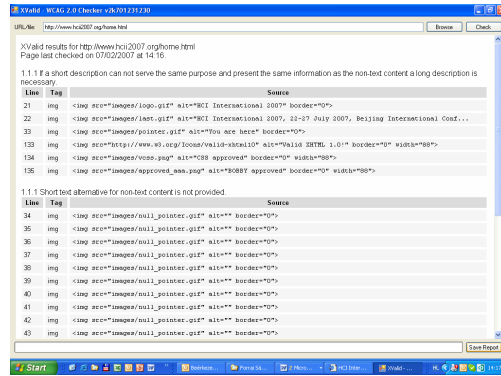


Fig. 1. Testing the HCI 2007 conference home page with XValid

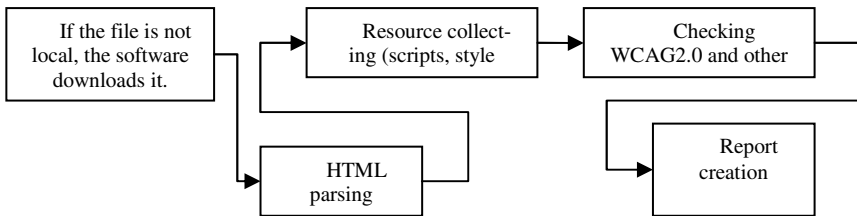


Fig. 2. The validation process

The following guidelines are checked at this stage:

- 1.1.1: Alternative texts, Image maps (client- and server-side), Short descriptions, Long descriptions
- 1.3.1: Alternative texts
- 2.4.3: Titles
- 2.4.4: Alternative texts
- 3.1.1: Text direction and language
- 3.2.5: User requestable functions
- 4.1.1: Tag closings, Unique ids
- 4.1.2: Captions, Labels

The validation core tries to analyze every image for improper sizing, every script for unsafe functions (windows.open(), window.alert(), browser-specific codes...) and every style sheet for improper styles (although not capable to cover every problem).

The application is actually growing every month. (Not every guideline can be checked (even not by software)).

The software uses the following 3rd party libraries:

- FreeImage.NET 3 - this is a free wrapper for the excellent FreeImage (which is used under the “FreeImage Public License - Version 1.0”), a free open source graphics library.
- Self-modified version of MIL HTML Parser.

3 Websites Accessibility Analysis

The Web Content Accessibility Guidelines 1.0, were created in 1999 by the W3C, aiming to explain to web designers how to make the web content accessible for people with disabilities [16]. The document includes fourteen guidelines, or general principles of accessible web design. Each guideline includes a statement and an explanation. We tested Hungarian, English and German languages journals, Web Shops, Government Sites, TV channels’ sites, e-learning and further home pages with WebXACT for checking these guidelines as well as with our newly developed XValid validator. The Web Content Accessibility Guidelines 2.0 is under construction, it has four principles and 13 guidelines [17].

3.1 Categorization of the Tested Sites

The tested sites were categorized by their information content.

Table 1. Test sites investigated in this study

Language /category	Hungarian	German	English
Governmental	szmm.hu	bundestag.de	ogc.gov.uk
education	felvi.hu	focus.de	ox.ac.uk
commerce	unicum.hu	zeit.de	marksandspencer.uk
buying via the Internet	oriflame.hu	mediamarkt.de	kelkoo.uk
buying healthcare items via the Internet	patikamagazin.hu	otto.de	healthcarecomision.uk
newspapers	origo.hu	spiegel.de	250.co.uk
media-TV	rtlklub.hu	rtl.de	mediauk.uk
railway and airline time-tables	malev.hu	lufthansa.de	nationalrail.uk
banks	otpbank.hu	postbank.de	natwest.uk
entertainment	szorakozas.hu	brigitte.de	timeout.uk
museums	hnm.hu	dhm.de	londontourist.uk
chat pages	magyaronline.hu	spruchtalk.de	ukchatterbox.uk
sport news	nemzetisport.hu	spiegel.de/sport	bbc.uk/sport

3.2 Using the WebXACT Validator for Testing the WCAG1.0 Guidelines with Home Pages

The results of testing these home pages are shown on Figure 3. As can be seen e.g. 94.87 % of all tested homepages do not conform to Priority 2.

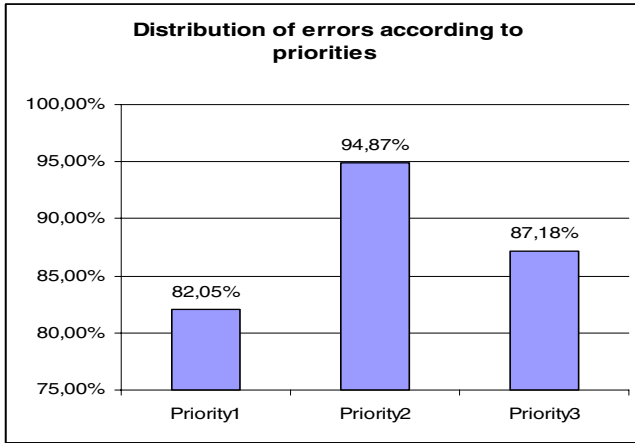


Fig. 3. Distribution of errors according to priorities

Table 2. Results of the web accessibility test

	Language	Priority1	Priority2	Priority3
Number of websites satisfying all checkpoints of the appropriate priority	English	7	0	0
	German	2	0	0
	Hungarian	3	1	1
Percentage	English	53.85%	0%	0%
	German	15.38%	0%	0%
	Hungarian	23.08%	7.69%	7.69%

Table 3. Percentage of websites with checkpoint errors of Priority 1

Priority 1 checkpoints	Number of websites not satisfying the appropriate checkpoint	Percentage	Number of errors
1.1 Provide alternative text for all images.	23	58.97%	441
6.2 Each FRAME must refer to an HTML file.	1	2.56%	1
12.1 Give each frame a title.	10	25.64%	12
12.4 Provide alternative text for all image-type buttons in forms.	9	23.08%	18

As we can see from Table 3 the reason for violating Priority 1 is mainly (58.97%) caused by not providing alternative text for images.

Table 4. Percentage of websites with checkpoint errors of Priority 2

Priority 2 checkpoints	Number of websites not satisfying the appropriate check-point	Percentage	Number of errors
3.2 Use a public text identifier in a DOCTYPE statement	9	23.08%	9
3.4 Use alternative sizing and positioning, rather than absolute	24	61.54%	1683
3.5 Nest headings properly	7	17.95%	13
7.4 Do not make a page refresh automatically	2	5.13%	2
9.3 Make sure event handlers do not require using the mouse	26	66.67%	456
12.4 Explicitly associate form controls and their labels with the LABEL element	25	64.10%	80
13.1 Create link phrases that make sense when read out of context.	29	74.36%	582
13.2 Include a document TITLE	1	2.56%	1

Table 4 indicates that Priority 2 checkpoints 3.4, 9.3, 12.4 and 13.1 are mainly ignored by web designers when creating a website.

Table 5. Percentage of websites with checkpoint errors of Priority 3

Priority 3 checkpoints	Number of websites not satisfying the appropriate check-point	Percentage	Number of errors
1.5 Until user agents render text equivalents for client-side image map links, provide redundant text links for each active region of a client-side image map	4	10.26%	17
4.3 Identify the primary natural language of a document	26	66.67%	27
5.5 Provide summaries for tables	26	66.67%	567
10.4 Until user agents handle empty controls correctly, include default, placeholder characters in edit boxes and text areas	26	66.67%	67
10.5 Until user agents render adjacent links distinctly, include non-link, printable characters between adjacent links	33	84.62%	2495

From Table 5 we can see that violating Priority 3 Checkpoints usually happens due to not respecting guidelines 4.3, 5.5, 10.4 and 10.5.

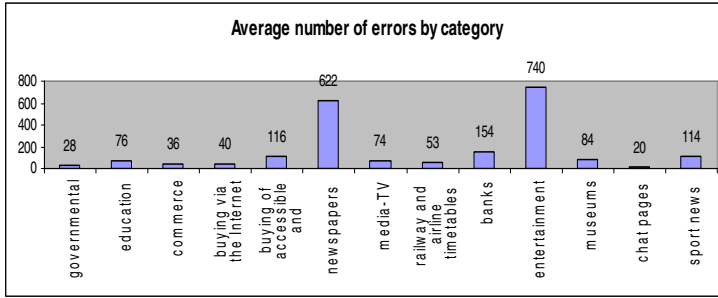


Fig. 4. Number of errors in each category occurring on a WEB page

As can be seen most errors were found in the newspaper and entertainment home-pages.

3.3 Using the XValid Validator for Testing the WCAG2.0 Guidelines with Home Pages

As can be seen from the 1st and 2nd rows of Table 6 Principle 1 is violated by 87.18 % and 89.74 % of the tested homepages.

Table 6. Percentage of websites with checkpoint errors of Guideline 1.1 of Principle 1

Guideline 1.1. Provide text alternatives for all non-text content	Number of websites not satisfying the Guideline 1.1	Percentage	Number of errors
If a short description can not serve the same purpose and present the same information as the non-text content a long description is necessary	34	87.18%	423
Short text alternative for non-text content is not provided	35	89.74%	1195
Short text alternative for non-text content is too long	15	38.46%	35
NOEMBED tag for EMBED tag is not provided	6	15.38%	13
Short/long description for non-text content is not provided. (Use elements' body.)	6	15.38%	11
Short text alternative is part of image URL	9	23.08%	24
Short text alternative for non-text content is too short	15	38.46%	39
Alternative content for <iframe> element is not provided	11	28.21%	18
Client-side image map associated with this image, long description is necessary	3	7.69%	5
Redundant text link for some of the image maps' link is not provided	5	12.82%	12

Table 7. Percentage of websites with checkpoint errors of Guideline 1.3 of Principle 1

Guideline 1.3. Ensure that information and structure can be separated from presentation	Number of websites not satisfying the Guideline 1.3	Percentage	Number of errors
Use 'title' attribute to identify form controls when the <label> element cannot be used.	31	79.49%	198
Use <label> element to associate text label with form control.	30	76.92%	221
Advisory information provided with 'title' attribute is too long.	1	2.56%	2
Advisory information provided with 'title' attribute is too short.	1	2.56%	2

Table 8. Percentage of websites with checkpoint errors of Guideline 2.4 of Principle 2

Guideline 2.4 Provide mechanism to help users find content, orient themselves within it, and navigate through it	Number of websites not satisfying the Guideline 2.4	Percentage	Number of errors
Title tag correctly provided but it's important to check if it identifies the subject of the Web page.	36	92.31%	36
Title tag is missing.	1	2.56%	1
Title tag has too long value.	7	17.95%	7
Short text alternative for non-text content is not provided.	1	2.56%	4
Short text alternative for non-text content is too short.	1	2.56%	4

As can be seen from the 1st row of Table 8 Principle 2 is violated by 92.31 % of the tested homepages.

Table 9. Percentage of websites with checkpoint errors of Guideline 3.2 of Principle 3

Guideline 3.2 Make the placement and functionality of content predictable	Number of websites not satisfying the Guideline 3.2	Percentage	Number of errors
Script on page call window.open() function. Check that this is a user requestable function.	14	35.90%	38
Script on page call alert() function. Check that this is a user requestable function.	37	94.87%	40

Table 10. Percentage of websites with checkpoint errors of Guideline 3.1 of Principle 3

Guideline 3.1 Make text content readable and understandable	Number of websites not satisfying the Guideline 3.1	Per-centage	Num-ber of errors
The <html> element doesn't have 'dir' attribute, which specifies the base direction of directionally neutral text. (The default direction is left-to-right.)	37	94.87%	40
The <html> element although has 'xml:lang' attribute but doesn't have 'lang' attribute.	26	66.67%	26
The <html> element doesn't have 'lang' attribute, which specifies the base language of text content.	20	51.28%	81
Script on page call window.open() function. Check that this is a user requestable function.	14	35.90%	38
Script on page call alert() function. Check that this is a user requestable function.	37	94.87%	40

Table 11. Percentage of websites with checkpoint errors of Guideline 4.1 of Principle 4

Guideline 4.1 Support compatibility with current and future user agents (including assistive technologies)	Number of websites not satisfying Guideline 4.1	Per-centage	Number of errors
This tag is not closed correctly. Assistive technologies may can't parse the content accurately.	37	94.87%	2262
The 'id' attribute isn't unique.	6	15.38%	29
Use 'title' attribute to identify form controls when the <label> element cannot be used.	31	79.49%	190
Use <label> element to associate text label with form control.	32	82.05%	228
Advisory information provided with 'title' attribute is too long.	1	2.56%	2
Using <legend> element allows authors to assign a caption to a <fieldset> and improves accessibility.	1	2.56%	4

3.4 Comparison of the Two Validating Software

Comparing WebXACT and Xvalid software we see that while WebXACT found in 84.62% of all tested homepages some mistakes, the XValid software found in the same homepages 94.87 % mistakes.

4 Summary

We developed a new validator software called XValid for specific needs in light of design for all. We used this validator for testing governmental, commercial web pages, TV channels' sites and educational web pages. XValid found 10.25% more mistakes than the WebXACT. We offer the XValid for everybody who wants to develop sites for specific needs and would like to test it an easy way.

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