TOWARDS MOBILE WEB ACCESSIBILITY
VISION AND CHALLENGES

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ABSTRACT
The mobile world is increasingly becoming ubiquitous throughout the world as an entry point to consult but also activate services, as more and more people use smart phones as entry points to interact with the Web. At the same time, people with disabilities are leveraging the Web and smart phones in ways never imagined before, where technologies lower the burden of becoming au pair with people with no disabilities. However, the current state of the mobile Web is suffering from the same problems of the Web with respect to its adequacy to people with disabilities. In this paper we present the current state of the adequacy of Web and Mobile Web technologies to people with disabilities, discussing the main challenges to attain the vision of Mobile Web Accessibility, taking also onboard findings from recent surveys among people with disabilities in various EU countries.

KEYWORDS
Web Accessibility, Mobile Web, Universal Usability, Evaluation.

INTRODUCTION

Mobile phone usage has been exploding all over the world. With the decrease of costs on data plans, accessing the Web through these devices is quickly becoming more important to everyone. At the same time, the Web as a medium to convey information and services is being increasingly used by people with disabilities.

Both domains pose several challenges on how Web pages are constructed, mostly through limitations imposed by devices and impairments: device size, input methods, connectivity, output format, etc. By having developers and designers taking into account all of these constraints, Web sites can be improved or tailored towards meeting these requirements.

However, to attain this vision, developers and designers should have knowledge about the technical details of ensuring the quality of such Web sites for both mobile and people with disabilities audiences. Furthermore, with the increasing usage of mobile devices by people with disabilities, this kind of scenarios becomes deeply more complex.

To lower the burden of coping with this, the World Wide Web Consortium (W3C) has devised several guidelines (under the form of checklists) that can be used by developers and designers. The rational in these processes is that, by following the checklists, developers and designers iteratively improve the quality of the Web sites they are creating towards these audiences. Next, we consider the findings of a recent survey conducted by the EC funded projects *Æ*GIS and ACCESSIBLE on the accessibility of mobile devices and applications. After that, we detail on the main W3C guidelines for improving Web site quality for these audiences.

USERS' EXPERIENCES

Data on the users' experiences on using mobile applications are limited, and quite diversified. However, the field studies conducted by both ACCESSIBLE and *Æ*GIS projects in the course of 2009 in various EU countries (Belgium, Bulgaria, Germany, Greece, Italy, Spain, Sweden, UK) with over 600 people with disabilities, indicate a high need for mobile applications that are accessible, and consider the personal users' preferences. In the context of both projects, it was obvious that AT has in fact broadened the world for many people with disabilities, especially then through the usage of the internet, whether through PC or increasingly via mobile access. However, the state of the art survey and the conducted field studies identified at the same time a number of barriers, which were also confirmed by previous studies[1].

- Awareness
    - End-users are largely unaware of the available AT solutions (albeit that people with vision impairments seem to be very well informed about available AT).
    - There is a lack of (local and accessible) dedicated training in AT products and their capabilities (e.g. for technical experts, but also for end- users), resulting in end users having AT they cannot use to a full extent, or in some cases not at all.
    - Previous training that is needed to use AT, and that requires a professional to train the user to manage and use these devices is often lacking.
    - AT that are easiest to obtain are also the ones most abandoned.
    - Non-use arises less frequently among people with repeated provision, compared with first-time users of AT.
- Price

[1] Analysing and federating the European assistive technology ICT industry, Final Report, March 2009, Jennifer Stack, Leire Zarate, Carmen Pastor, Niels-Erik Mathiassen, Ricard Barberà, Harry Knops, Hugo Kornsten

    - High purchasing costs for end users are reported as a major barrier for wider deployment by disability organisations.
    - Prohibitive cost of specialist equipment for visually impaired people does create a barrier.
- Mismatch between needs end user and offered AT:
    - End users are not provided with the required AT, resulting in a considerable percentage of obtained ATs being discarded within a year.
    - AT that is being offered does not always satisfy the actual needs of the people with disabilities, hence their refusal to use them.
    - According to some surveys, almost half of the end-users experience problems using AT.

This mismatch between the needs of the end users and the actual AT they are being offered can be directly linked to the poor assessment of consumer needs and preferences. The Matching Person and Technology (MPT)[23] model and accompanying assessment instruments, first presented in 1989, are one way to counter this gap between the user needs and what is being provided to them. MPT was successfully applied also in research studies in the USA[45], Canada and Europe[6]. The MPT Model incorporates the assessment of three primary areas[7]:

- Determination of the milieu/environment factors influencing use;
- Identification of the consumer's personal and psychosocial characteristics, needs and preferences; and
- Description of the functions and features of the most desirable and appropriate technology.

Below table consolidates the findings from the AEGIS and ACCESSIBLE field studies.

Mobile devices and applications
Mobile use
• There is an active usage of mobile phone, mostly regular cell phones, but increasingly also smart phones.

[2] The Matching Person & Technology (MPT) Model Manual, third edition, Scherer, M.J., 1998, Webster, NY: The Institute for Matching Person & Technology, Inc.
[3] Measuring subjective quality of life following spinal cord injury: A validation study of the Assistive Technology Device Predisposition Assessment, Scherer, M.J. & Cushman, L.A., 2001, Disability & Rehabilitation, 23(9), 387-393
[4] The Matching Person & Technology (MPT) Model Manual, third edition, Scherer, M.J., 1998, Webster, NY: The Institute for Matching Person & Technology, Inc.
[5] Measuring subjective quality of life following spinal cord injury: A validation study of the Assistive Technology Device Predisposition Assessment, Scherer, M.J. & Cushman, L.A., 2001, Disability & Rehabilitation, 23(9), 387-393
[6] Predicting satisfaction with assistive technology for a sample of adults with new spinal cord injuries, Scherer, M.J. & Cushman, L.A., 2000, Psychological Reports, 87, 981-987
[7] Predictors of Assistive Technology Use: The Importance of personal and psychosocial factors, Marcia J. Scherer, Ph.D., Caren Sax, Ed.D., CRC, Alan Vanbeirvliet, Ph.D., Laura A. Cushman, Ph.D., John V. Scherer, M.S.E.E., 2005, Disability & Rehabilitation, 27(21), 1321-1331

Mobile devices and applications
• The most determining factor in the purchase of a mobile phone is the ease of use the mobile has to offer. Other common factors to influence purchase behaviour include the price of the device, the availability of the device in stores and the familiarity with a specific manufacturer.
• The surveyed people tend to use the phone anywhere they need to. On a daily basis, the participants use a mobile phone at home and at work.
• Most consider their mobiles as practical tools they like to use, some of them even consider it an essential part of their lifestyle.
Functionalities
• The main reasons for using a mobile are making calls, text messaging and managing contacts. These functionalities are also often mentioned as "desire using". This indicateds that even basic functionalities are often still (perceived as being) inaccessible for people with disabilities
• The address/contacts list is considered as a very important technological component on a mobile device.
• Chatting live and listening to books are wanted features on the mobile phone. Besides this, users would like to be able to use the internet and check email on their mobiles.
Connections
• When connecting a mobile phone to another device (e.g. AT hardware or desktop), Bluetooth is the most wanted technology.
• The connection, the network reception and the battery are often problematic.
Assistive technology
• Speech output is the most used form of assistive technology across all groups of impairments.
• Especially text messages would benefit from speech output or other communication aids.
• Users tend to use the integrated accessibility features when these are available. However, they are often unknown to the users.
Accessibility
• Experts that were interview preferred accessible mainstream mobile phones over specialised mobiles for particular market segments such as users with specific impairments. This also reduces a possible "AT stigmatisation".
• Regarding mobile devices, end-users demand the standardization of mobile interfaces (menus, icons, etc.), and also the hardware key icons and labels.
• It is difficult for many users to have modern specific mobile devices prescribed and funded as technical aids by national/local reimbursement schemes, if available at all.
User interface
• The simplicity of the user interface is considered as very important.

Mobile devices and applications
• Users encounter big problems with the day-to-day usage of a mobile phone: e.g. the menu is very complex, especially for people with visual impairments.
• Problems occur especially with the command structure of the mobile phone, which varies across models, and especially across different brands.
Training
• There is hardly any training available for people with disabilities using a mobile phone, not even at the time of the purchase.
• People don't know what AT is available for their mobile phone.
• Manuals are often only available in printed versions and the text size used is too small.
• There are 2 groups of interested users: those who want to know everything and those who want to "know enough".

From the above, it is obvious that mobile accessibility is a major issue that seemingly has been rather poorly addressed so far, albeit that this is largely due to ignorance of end-users with regards to existing (affordable) solutions. An aspect that needs more attention is the overall accessibility of provided content. In the light of these problems and opportunities, the next Section presents a novel approach in the assessment of Mobile Web Accessibility.

IMPROVING WEB SITES FOR NON-TRADITIONAL AUDIENCES

Through W3C, several groups and experts have come with straightforward guidelines to tailor and improve Web site quality for different audiences. In the context of this paper, we focused on Mobile Web and Web accessibility. This type of guidelines is based on the concept of checklists targeted to HTML, CSS, JavaScript, content, etc., that must be improved according to their corresponding domain of application. Furthermore, through evaluation software, developers and designers can be aided in this analysis process. This type of software allows them to verify if the Web site they are creating is compliant or not, with regards to the guidelines.

Through the Mobile Web Initiative (MWI) [4], experts have devised the Mobile Web Best Practices (MWBP) [3], i.e., a set of checkpoints that, if accomplished by developers and designers, allow Web sites to be used effectively by everyone through data-enabled mobile phones (and which have a Web browser available). MWBP checkpoints are categorised in 5 *statements*, thus grouping these guidelines into their functional properties: Overall Behaviour, Navigation and Links, Page Layout and Content, Page Definition, and User Input.

On the accessibility side, the Web Accessibility Initiative (WAI) [5] strives for ensuring that Web sites do not pose any kind of access barriers to people with disabilities. This behaviour is well defined in the Web Content Accessibility Guidelines (WCAG) [1],

where an extensive checklist of applicable techniques is clustered around four principles: Perceivable, Operable, Understandable, and Robust.

Ideally, by following MWBP and WCAG, developers and designers should be able to create Web sites that are both usable on mobile phones, and accessible to users with disabilities. Next, we present how the concept of Mobile Web Accessibility emerges from these two fields.

MOBILE WEB ACCESSIBILITY

Bridging the mobile Web with Web accessibility can be a complex task. The effort required to strictly coping with all the guidelines of MWBP and WCAG amounts to compliance checking of 112 guidelines in total. Due to this reason it is of the uttermost importance to have the aid of evaluation tools for Mobile Web Accessibility [6].

Furthermore, both domains have similar technical solutions to tailor Web pages to their guidelines. Consequently, skipping the repeated techniques decreases the burden of evaluation. To mitigate this issue, both the MWI and WAI groups at W3C have devised a study that intersects MWBP and WCAG [2].

Based on these standards and guidelines, we designed and implemented a first prototype evaluation tool that allows developers and designers to check the mobile adequacy and Web accessibility compliance of Web sites, as presented in Figure 1:

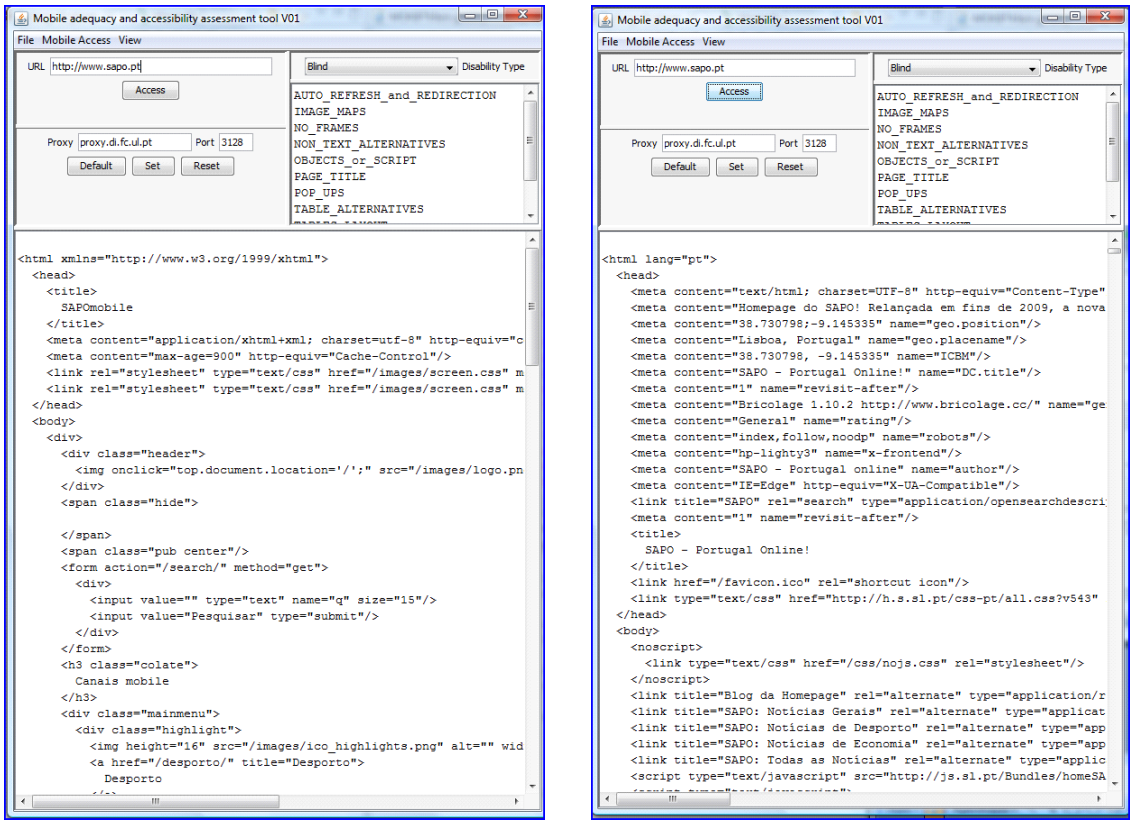

Figure 1 – Mobile Web Accessibility Evaluator Tool, applied to both desktop and mobile representations of a Portuguese Web Portal.

This tool implements core aspects as defined by MWBP and WCAG, in order to evaluate the mobile adequacy and accessibility of Web sites. In order to attain this goal, the tool implements an HTTP content negotiation with any given Web site, which allows it to mask itself as a mobile Web browser. This way, if a Web site is tailored to mobile phones, MWBP and WCAG compliance is performed against the best mobile Web experience provided by Web sites.

FUTURE CHALLENGES

The approach we propose for the evaluation of Mobile Web Accessibility is still in its nascent form. Based on our research and analysis of both the mobile Web and Web accessibility domains, and from the experience gathered with the design and implementation of the prototype evaluator tool, some of the major challenges ahead of Mobile Web Accessibility are:

1) *Diversity of mobile devices.* The constant pace of hardware production in the field of mobile phones poses enormous challenges on coping with the singular capabilities of all devices. It is certain that some of the guidelines described in

MWBP must not be taken into account for some devices. The opposite situation is also true, where advancements in the capabilities of some mobile phones (e.g., touch screens) not being taken into account by the MWBP.

2) *Diversity of users with disabilities.* No person is like another. The same applies to people with regards to their impairments. Consequently, not every single guideline of WCAG is applicable to all users with disabilities. Attaining this goal will allow for personalised Web accessibility assessment per case.

3) *Coping with idiosyncrasies of Mobile Web Accessibility.* While the intersection of MWBP and WCAG provides a smaller set of guidelines to be verified, when the diversity of devices and users is taken into account, new guidelines might have to emerge to cope with this kind of scenarios. For example, a touch-screen based device being used by a person with vision impairment (aided by built-in screen-reading software), imposes a new set of interaction restrictions that must be taken into account in Web pages, for a proper support of this scenario.

CONCLUSIONS

This paper presented the concept of Mobile Web Accessibility. We discussed the purpose of coping with Web accessibility in the context of the challenges imposed by the Mobile Web, presenting a prototype evaluation tool that can bridge both domains. In the light of this, we discussed some of the open issues of Mobile Web Accessibility, under the form of future challenges for this research and development field, and how this can address some of the concerns that were identified among end-users with regards to mobile usage.

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REFERENCES

[1] Caldwell, B., Cooper, M., Reid, L. G., and Vanderheiden, G., Web Content Accessibility Guidelines (WCAG) 2.0, W3C Recommendation, World Wide Web Consortium (W3C), December 2008. http://www.w3.org/TR/WCAG/

[2] Chuter, A., and Yesilada, Y., Relationship between Mobile Web Best Practices (MWBP) and Web Content Accessibility Guidelines (WCAG), W3C Working Group Note, World Wide Web Consortium (W3C), July 2009. http://www.w3.org/TR/mwbp-wcag/

[3] Rabin, J., and McCathieNevile, C., Mobile Web Best Practices, Basic Guidelines, W3C Recommendation, World Wide Web Consortium (W3C), July 2008. http://www.w3.org/TR/mobile-bp/

[4] Mobile Web Initiative (MWI). http://www.w3.org/Mobile/

[5] Web Accessibility Initiative (WAI). http://www.w3.org/WAI/

[6] Rogério Bandeira, Rui Lopes and Luís Carriço, Towards Mobile Web Accessibility Evaluation, Free and Open Source Software for Accessible Mainstream Applications (FOSS-AMA), collocated with ETAPS 2010, Paphos, Cyprus, 27−28 March 2010

[7] Karel Van Isacker, Mariya Goranova-Valkova, ÆGIS-ACCESSIBLE: Users Involvement Driving Accessibility Forward, Free and Open Source Software for Accessible Mainstream Applications (FOSS-AMA), collocated with ETAPS 2010, Paphos, Cyprus, 27−28 March 2010