Accessibility Perspectives on Enabling South African Sign Language in the South African National Accessibility Portal

Louis Coetzee
Meraka Institute
(African Advanced Institute for Information Communication Technology),
Meiring Naude Street, Brummeria,
Pretoria, South Africa
louis.coetzee@csir.co.za

Guillaume Olivrin
Meraka Institute
(African Advanced Institute for Information Communication Technology),
Meiring Naude Street, Brummeria,
Pretoria, South Africa
golivrin@csir.co.za

Ilse Viviers
Meraka Institute
(African Advanced Institute for Information Communication Technology),
Meiring Naude Street, Brummeria,
Pretoria, South Africa
iviviers@csir.co.za

ABSTRACT

Persons with disabilities are often marginalised from economy and society due to the lack of access to disability related information and services. Through the use of assistive technologies access to the information and services can often be obtained e.g. a visually impaired user using a screen reader. The Deaf however, cannot use such technology to break the barrier because of differences in literacy and comfort with written material. The Deaf thus requires another intervention to improve their access to information and services. One such mechanism is by embedding animated Sign Language in Web pages. This paper analyses the effectiveness and appropriateness of using this approach by embedding South African Sign Language in the South African National Accessibility Portal. Through experiments, user evaluations and web-metrics it is found that such techniques can improve the accessibility for Deaf users in experimental conditions. However, real world pervasiveness will be limited because of practical concerns such as the difficulty to create and maintain animated Sign Language and bandwidth constraints that impact on users' browsing experience.

Categories and Subject Descriptors

D.14 [**Human Factors in Software Design**]: User interfaces; H.5.1 [**Multimedia Information Systems**]: Animations, Video; H.5.4 [**Hypertext/Hypermedia**]: User issues

Keywords

South African Sign Language, Accessibility, South African National Accessibility Portal, Internet, Web, Deaf

1. INTRODUCTION

Significant challenges exist in addressing marginalisation of persons with disabilities from the mainstream economy and society. These challenges include access to information and services with regard to the disability domain. In developing worlds, these challenges are compounded by other factors such as low levels of literacy, limited information and communication technology related skills as well as limited infrastructure.

Web sites are often not developed with accessibility in mind, thus introducing additional barriers for persons with disabilities. Assistive technologies have broken some of the barriers in accessing information but unfortunately, not all accessibility issues can be resolved through assistive technologies. One example is applicable to the Deaf community. Deaf people are rarely at ease with spoken languages or written material and many prefer to access and exchange information in their mother tongue, Sign Language [1].

Alternative mechanisms to provide accessible information to this community needs to be explored.

This paper investigates the effectiveness of using animated South African Sign Language (SASL) "snippets" in Web pages as a mechanism to enhance accessibility and usability for the Deaf community and why the use of Sign Language on Web browser interfaces is limited to date.

Section 2 presents background information. An overview of Sign Language on the Web is presented in Section 2.1. Section 2.2 introduces the South African National Accessibility Portal, which was used as the experimental platform. Section 3 analyses the issues in incorporating Sign Language in Web pages on the browser, while Section 4 presents experimental and user evaluation results from utilising this modality to potentially improve access to information. Section 5 contains conclusions with regards to our research.

2. BACKGROUND

This section provides background information regarding Sign Language on the Web and an overview of the South African National Accessibility Portal, which was used as the experimental platform.

2.1 Sign Language on the Web

Even though video on the Web has long been available in the form of QuickTime, Real Media and Windows Media,

the technology only became popular through integrated Internet video services and Flash. There are various technical solutions for the inclusion and visual representation of Sign Language on the Web [9], but there are very few examples of Web sites making use of them.

The Deaf community uses video as the medium of predilection for sharing information in Sign Language on the Web: Vlogs and video portals are becoming popular in Deaf communities. For example DeafRead.com and DeafVideo.tv gather American and British Sign Languages videos.

The Sutton Sign Writing [11] community Web site provides navigation, content and content authoring in Sign Writing, a graphical notation for Sign Languages. If this written form was more widespread and more widely recognised in the South African Deaf community, the use of Sign Writing would have been a simple solution to including Sign Language in graphical forms on the Web.

Other Web sites also demonstrate the use of signing avatars to render animations of Sign Languages. The eSign project uses HamNoSys [12] to generate animated gestures rendered by an ActiveX plug-in for Internet Explorer; the Vsigns [10] project used VRML animations generated from Sign Writing and, finally, Vcom3D [14] offers both content authoring and makes use of VRML rendering capabilities.

2.2 The South Africa National Accessibility Portal

The South African National Accessibility Portal (NAP) is an accessible information sharing portal for the South African disability sector that promotes inclusivity [8]. The portal Internet presence is one of the elements being developed as part of the 5 year NAP research and development initiative which is aimed at addressing the marginalisation of people with disabilities from the economy and society [7].

Other NAP initiative elements include accessible centres, research into assistive technologies, use of other modalities such as mobile and telephony, as well as sustainability models in developing countries [4, 5].

NAP's main aim is to provide information sharing and a means for communication relevant to people in the disability sector in an accessible manner. NAP was conceived from the start as an accessible platform to provide maximum inclusiveness for all. For example, NAP provides alternative cascading style sheets (CSS) to present different font sizes and colour schemes. NAP passes the W3C XHTML compliance recommendations and is screen reader friendly. In addition, NAP has been evaluated for accessibility through user testing [2, 3]. NAP is also multilingual with the ability to contribute multiple translations of the same information.

Improving Web accessibility is an important aspect of Web development as it allows more people to access and contribute to the Internet in an effective manner. In the NAP context, improved accessibility empowers more persons with disabilities to live independently. In addition, accessible Web sites enhance service delivery and knowledge dissemination, which are important elements for both industry and government.

The next section presents the approach followed to incorporate Sign Language in NAP.

3. INCLUSION AND LOCALISATION OF SIGN LANGUAGE CONTENT

Figure 1: Quality SASL video localisation requires both video production and linguistic expertise.

Figure 2: Each localised link has a "SASL snippet" activation icon visible next to it.

An important aspect of presenting Sign Language on the Web is the creation of localised SASL content.

NAP first introduced SASL video content in alternative formats, such as Flash (video for online preview) and MPEG (for download and off-line playback). These SASL video content items were for example SASL help and support tutorials on how to use NAP. Videos were produced in a variety of video formats for inclusion. Figure 1 shows the studio used by the SASL team to create the various SASL content.

Animated GIF snippets for labels and other static descriptions were created to optimise the browsing experience and aid in the navigation of the site. These GIF snippets were rendered on demand through the use of Asynchronous JavaScript and XML (AJAX) combined with CSS techniques, without dependencies on third party plug-ins.

An "activate" icon was designed that presents a little Sign Language hand on the browser page. When this icon is clicked, the Sign Language snippet with a "de-activate" icon is rendered just below the main menu bar. The Sign Language snippet plays continuously until the user decides to stop the playback by clicking the de-activate icon.

While a specific snippet is being played the other "activate" icons become invisible to the user. If a snippet exists, an icon is positioned next to the text to indicate the availability of the SASL translation. The fixed playing position of the Sign Language snippet just below the main menu bar ensures that the user is familiar with the location of the playback. Figures 2 and 3 depict this behaviour.

As part of the process to localise NAP for Sign Language, functionality was developed which allows Web site admini-
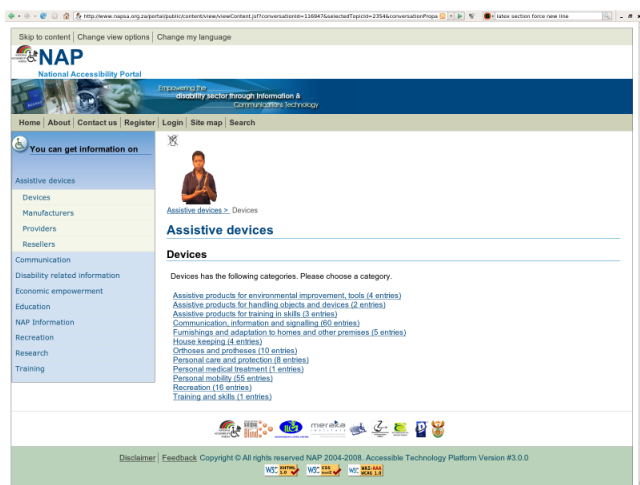
Figure 3: An animated SASL snippet is activated for the chosen section and a de-activation icon appears.

strators to upload various SASL snippets of labels and other static descriptions and to associate them with existing elements of the portal.

Creating Sign Language video is not difficult but requires some post-processing to make the snippet appropriate for Web usage. The post-processing consists of converting the original video into appropriate alternative formats, frame-rates, bit-rates and resolutions. The post-processing optimises the quality and response of the animated SASL video snippets for intelligibility with such constraints as low bit-rates, low resolutions, low frame-rates and low bandwidth. In addition, the animated GIF snippets were limited to a four second duration to further improve the browsing experience.

A variety of experiments were conducted in combination with experiences and comments from users gathered through questionnaires. These results depicting the feasibility and usefulness of included SASL are presented in the next section.

4. EXPERIMENTAL RESULTS AND USER EVALUATIONS

In order to assess whether users benefited from the inclusion of animated SASL snippets on NAP, we conducted experiments, evaluations through questionnaires and applied Web metrics.

The NAP team initially set up experiments utilising Deaf consultants to determine acceptable video quality parameters for Sign Language to be intelligible in a low bandwidth context [6]. Results show that a low resolution such as 176x144 provides enough detail for SASL snippets to be *readable*, provided that compression is low and that the snippet is a close-up including no more than the interpreter's signing space. Depending on how fast a Sign Language interpreter signs, it is possible to lower the frame-rate and still preserve the signing flow. Since Sign Language for NAP was created with a wide audience in mind, the SASL interpreter signed slowly and it was thus possible to generate animated SASL snippets with a low frame-rate, generally 12.5 frames per second.

The NAP initiative has recently established two pilot NAP centres at South African Deaf associations. These offices were equipped with desktops, high resolution web-cams and 3G Internet connectivity. NAP also implemented a continuous feedback mechanism in the form of online surveys and polls to collect responses from visiting Deaf users at the NAP centres. Six NAP centre trainers working at the Deaf associations have responded to the survey and continuously update the polls as they conduct interviews with Deaf users. The online survey revealed that only two centre trainers found the "activation"/"deactivation" icons for the animated SASL snippets intuitive. During their first visit to the portal, none of the trainers found the existing SASL video help content on the portal. Once snippets and video content were demonstrated, trainers reported that the users' attitude towards the technology improved: Deaf users then actively looked through the portal to find topics they would be interested in. Users and trainers expressed the need for more SASL localisation (in particular error messages) and, above all, more SASL content. NAP centres now assist users to film and edit localised and original content with web-cams. Localising existing content on NAP in order to have both written and signed information creates valuable bilingual resources and encourages Deaf and hearing people to learn from each other. Some users expressed concern about SASL evolving at a fast rate and signs becoming rapidly obsolete, thus increasing the load in keeping SASL on NAP localised and actual. Many users who were familiar with the SASL interpreter found the "role model" motivating. Localisation has a higher impact when "community interpreters" or well-known personalities are involved.

Results from the surveys at the associations show that one Deaf person in ten is familiar with computers. After visiting NAP, one user in five registers with centre trainers to learn how to use the computer and create SASL video content. This initiative has the challenging objective of engaging previously marginalised people to become active contributors to the information society. Inclusion of SASL in portals prompts these people to use information, communication and Web technologies. Through the early example of NAP's localisation and user training, the team hopes to find a sustainable model to localise and create content in Sign Language on the Web.

Web measurements and informal experiments conducted through the Internet showed that in a bandwidth constrained environment such as South Africa, user satisfaction and benefit of rendering SASL snippets were limited. Practically however, the combination of asynchronous technology, fast 3G connectivity at the Deaf NAP centres and improved Web hosting of the portal yielded an acceptable browsing experience attested by the responses to the opinion polls. With an average file size of 450Kb for SASL animated GIF and of 105Kb for a SASL Flash video, it takes around 8s and 2s respectively, to play the animated SASL snippets at the Deaf centres. It takes an additional 4s on average to actually watch the SASL snippets.

5. CONCLUSION

This paper interrogated the use of Sign Language on a Web interface as mechanism to improve accessibility for users from the Deaf community. This was done through the inclusion of SASL in NAP. SASL was used in two ways in NAP: To represent content (such as SASL tutorials) and to aid

with navigation (by presenting labels and other navigation elements on demand).

Based on user evaluations and developer experiences the following conclusions can be made as why Sign Language on a Web interface as accessibility aid has not become more pervasive:

- It is challenging to offer Sign Language content to present information. A Sign Language interpreter as well as adequate studio facilities containing appropriate equipment are required. The quality of these snippets is important because facial expressions and hand movements need to be clearly visible.

- Substantial work is still required to automatically interpret and to dynamically generate Sign Language [13]. Most Web sites will find it too expensive to include recorded video by default.

- Technical limitations have also limited the uptake of Sign Language on the Web; reasonable bandwidth is required to allow for an adequate browsing experience. In a developing world context, bandwidth is very limited, thus becoming a severe bottleneck.

- Users with assistive technologies might currently be excluded from accessing Sign Language on the interface. Assistive technologies have problems dealing with asynchronously updates to Web pages, for example a screen reader may not be aware of the dynamically updated content. However, the intention of the addition of Sign Language snippets to a Web site was to provide supportive navigational information and thus to enhance access to existing content. The same approach is followed when *alt* attributes are used to describe images.

- Sign Language inclusion is technically possible, but has not reached a state of sufficient maturity and understanding to break down the barriers of accessibility for all.

On a positive note it was found that the inclusion of SASL aided in the following ways:

- The addition of Sign Language snippets to a Web site provides additional support for Web navigation and enhance access to existing content.

- Content in SASL promotes the uptake of technology in the Deaf community. It increased Deaf confidence and trust in the information they found in the portal and it spurred great interest and motivation to come back to find more.

Some research questions remain unanswered: What is the optimal presentation of Sign Language in Web pages? Are there better mechanisms and knowledge representations and techniques to incorporate Sign Language on the Web?

The impact of including Sign Language is high, even though the improvement in accessibility is currently limited. Some of the mentioned challenges will be addressed over time with the progress in technology that eases the creation of Sign Language content and with subsequent developments that lead to accepted practices and standards for information systems. The inclusion of SASL in NAP is a step forward in terms of localisation and accessibility and the quest to cater for all.

6. ACKNOWLEDGEMENTS

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