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D5.4 – Pilot-C Evaluation and Recommendations

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D5.4 – Pilot-C Evaluation and Recommendations

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1. Executive summary

One important challenge that the HBB4ALL project addresses is accessible services for online video and HbbTV platforms that are capable of adaption to the individual needs of users with different access requirements. An aspect that was highly demanded by users throughout the user tests of the project is the possibility to adjust the parameters of the different access services; such as the font or symbol size of the user interface, the colour scheme, the playback speed of an included screen-reader, spoken subtitles functionality or the size and position of the subtitles. As all users have different needs and preferences, a one size fits all solution e.g. providing just subtitles, does not fit every user's individual accessibility requirements.

Another aspect that needs to be taken into account is that most of the users are using different media services on their devices ranging from VoD services e.g. from broadcasters, online video services for entertainment and learning on PCs, as well as mobile video applications on smartphones and tablets. The access requirements of each particular user is the same for all services but their personal preferences (if offered by the service provider) have to be adjusted within each device, application or service separately.

The availability of cross-platform access personalisation services is very limited. There are numerous APIs available for various operating systems or application platforms (e.g. in Web browsers) that allow developers to provide accessibility features within their applications. However, there are several limitations as all solutions are restricted to a single browser or system.

Moreover, the user profiles storing the parameters in these different solutions are not interchangeable between browsers and systems. This leads to the point that users need to separately and repeatedly adjust their setting on all systems and browsers that they are using. Also, web applications are not able to get information about the user requirements in a unified abstract way in order for them to adapt their UI to be suitable for the user, without for example destroying the application's UI layout. Both iOS and OS X provides in theory a good mix of accessibility features, however, they are useless in terms of web content.

Pilot-C addresses this needs with an online platform called AccessGUIDE. It allows the personalisation of access services for online video on PCs and mobile platforms and prototypically for HbbTV applications. It is realized as an open Software as a Service (SaaS) platform that can be used by application developers to include the user's accessibility preferences into their applications and adapt their UIs accordingly. The platform comes along with a personalisable online multi-language text to speech function that can be included by the application developers to provide screen reader as well as spoken subtitle functionality. The platform supports the personalisation of the applications user interface, subtitles in video on demand applications as well as the text to speech service.

Vsonix has integrated the AccessGUIDE service into its interactive online video platform "vPlayer" that was originally developed for online learning purposes. Now, after the final year of the project vPlayer supports a number of accessibility features such as an adaptive UI with screen reader functionality, personalisable multi-language subtitles (language, size and position), spoken subtitles

in different languages as well as the possibility to switch between signed and unsigned video content. Moreover, the video player is available for PC and mobile devices.

The online video platform was used as a basis for an open online course (MOOC) on media accessibility, which was developed by UAB and produced by Vsonix during the project. The online course is available under the URL http://www.accessguide.tv/course. It contains all the accessibility features provided by the platform and consists of four different units including an introduction to accessibility in general, subtitling, audio description and sign language.

During the final year Vsonix has made both AccessGUIDE as well as the MOOC available on mobile platforms making use of a responsive UI design approach that allows the applications to adapt to different devices and displays including smartphones and tablets. Further, all course content was finally produced by Vsonix together with UAB, whereas the content is now available with subtitles in at least three different languages (English, Spanish, German).

Further, for the final evaluation of the AccessGUIDE service and the MOOC itself, Vsonix has maintained an online survey that was first published on the MOOC website in July/August 2016, where the survey will still continue for at least the first half of 2017. The aim is to continuously improve the platform as well as its content based on the quantitative survey results.

SCREEN has also further improved its teletext showcase that is making use of the AccessGUIDE API for the adaptation/customization of its user interface. The showcase was successfully demonstrated at the IBC 2016 exhibition booth of SCREEN.

Finally, Vsonix and UAB have started an online evaluation of the AccessGUIDE service and the MOOC with the same user test group that was already established for the first user tests in 2015. The aim is to get comparable results for the final evaluation in respect to previous tests with some more qualitative feedback.

2. Introduction

The Hybrid Broadcast Broadband for All project (HBB4ALL) investigates accessibility services on different platforms including the hybrid broadcast-broadband TV (HbbTV) environment as well as web based video applications for PC and mobile devices. One of the challenges faced by broadcasters and online video service providers is the requirement to add Access Services in a cost-efficient manner to audio-visual content delivered via Internet, while remaining consistent with the Access Services available on traditional broadcasts and their respective workflows.

A new challenge is the desire to offer viewers the opportunity to customise the Access Services they are using to best meet their personal preferences and needs.

HBB4ALL tested access services in four interlinked Pilots; Pilot-A: Multi-platform subtitle workflow chain; Pilot-B: Alternative audio production and distribution; Pilot-C: Automatic User Interface adaptation – accessible Smart TV applications; Pilot-D: Sign-language translation service.

The Operational phase of the HBB4ALL project (Task X.3 – Operation Phase for all Pilots A to D) gathered user feedback and assessed the acceptance and quality of services in various delivery scenarios implemented using field user tests and also in complimentary lab tests performed by UAB.

The aim of Pilot-C was the realization of an online UI adaptation and personalization service to allow the provision of personalized accessibility features for web and HbbTV based media services. The online accessibility service realised was based on the UI framework that was developed in the EU project GUIDE "Gentle UIs for elderly people" by Vsonix together with other partners and which is now further maintained as an open source project. The Software as a Service (SaaS) platform called AccessGUIDE provided by Vsonix includes APIs and functions for user management as well as the necessary mechanisms for UI adaptation. It further includes an application for the standardized definition of user profiles for UI and subtitle personalization on PC and HbbTV platforms.

The application service for the operational phase of Pilot-C that integrates the different service components is an online course (MOOC) on "Access Services for Media Content" provided by Vsonix with course content from UAB. The course was published in July/August 2016 on www.acccessguide.tv/course and is accessible via the HBB4ALL website. The aim of the operational phase was to provide the online course using the AccessGUIDE and Vsonix accessible online video platform to include advanced and personalisable accessibility features for the users and to get the user's feedback and final evaluation of the provided services.

In addition to the MOOC, SCREEN has used the AccessGUIDE framework to include advanced UI adaptation features into their HbbTV Teletext showcase.

2.1. Purpose of the document

HBB4ALL deliverable D5.1 – Pilot-C Progress Report (see [1]) provided an overview of the progress of Pilot-C during the first 12 months of the project timeline, whereas D5.2 – Pilot C Solution integration and trials [2] provided an overview on the technical activities of the pilot as well as information on the first user trials conducted.

This document (D5.4) summarizes the achievements within Pilot-C, giving an overview on the technical activities and enhancements that have taken place in the last project year, as well how the pilot services provided by the partners, including the AccessGUIDE online service for customisable accessibility in online video applications and the online course for media accessibility (MOOC), were perceived by the end users since they were published online.

The document explains the main achievements of the Pilot in chapter 3, whereas chapter 4 (sub-pilot AccessGUIDE) and 5 (sub-pilot MOOC) provide information about the activities undertaken by Vsonix in the final project year. This includes information about the technical advancements made, the functionalities provided as well as user tests/online surveys undertaken for each sub-pilot. Further information is also given about the Teletext show case provided by SCREEN that is using the AccessGUIDE online service to provide a customizable UI adaptation.

In chapter 7 we will give some information about the final online user tests that were done by Vsonix in collaboration with UAB before in chapter 8 drawing conclusions and giving some recommendations for the time beyond the project.

2.2. Acronyms and abbreviations

In this document, when necessary, identified partners within the project are referred to using the abbreviated names initially defined within the Consortium Agreement for HBB4ALL and reproduced on the cover sheet of this document. Abbreviations and acronyms are introduced in brackets in the text after the corresponding full text version.

2.3. Definitions and glossary

Access Service: The provision of additional services or enhancements that improve the accessibility of TV services for viewers with disabilities or special needs.

Accessibility: The degree to which a product, device, service, or environment is available to as many people as possible. Accessibility can be viewed as the "ability to access" and possibly benefit of some system or entity. Accessibility is often used to focus on persons with disabilities or special needs and their right of access to entities, often through use of assistive technology or Access Services.

Accessibility, Linguistic: The degree to which the language of an audio-visual work can be understood by as many persons as possible in the target audience.

Audio-visual Content: All kinds of time-based content consisting of images and sounds

Business model describes the rationale of how an organisation creates, delivers, and captures value. This may be viewed in a narrow sense (economic value, what are the costs, and if there are revenue streams to pay for those). Increasingly, a business model includes social or other forms of value.

Captioning (North America): See Subtitling, Intra-lingual. A form of subtitles primarily intended as an Access Service for viewers with hearing impairments. Captions not only display words as the textual equivalent of spoken dialogue or narration, but they may include speaker identification, sound effects, and music description. Captioning aims to include as much of the original language as possible. However, altering the original transcription may be necessary to provide time for the caption to be read and for it to be in synchronization with the audio.

Catch-up TV A service that allows a viewer to see a TV program independent of when it was broadcast. This is usually a kind of on-demand service on the internet, but may also be achieved via a Personal Video Recorder (PVR) on which the viewer has chosen to record the program, or through a push Video on Demand (VoD) subscription where the viewer receives the program via the internet, their set-top box (STB) or their PVR.

Control, Remote is also known as a remote, controller, or sometimes channel changer. It is an electronic device used for the remote operation of a machine (television set, set-top box, or PVR) over very short distances within the home. The design of such devices needs to consider their usability and accessibility. Blind and partially sighted persons and those with other disabilities often encounter difficulties with remote controls that render them inaccessible.

Dubbing is the post-production process of recording and replacing voices on a motion picture or television soundtrack subsequent to the original shooting.

DVB –Digital Video Broadcasting a set of technical guidelines, standards and specifications to benefit and advance digital media markets world-wide. It was originally European but today is a worldwide alliance of 250-300 companies.

DVB subtitles – bit-map or text captions on digital television using DVB specifications.

EBU: European Broadcasting Union

HbbTV: Hybrid Broadcast Broadband TV is a major pan-European initiative building on work in the Open IPTV Forum aimed at harmonising the broadcast and broadband delivery of entertainment to the end consumer through connected TVs and set-top boxes.

HTML HyperText Mark-up Language is the standard mark-up language for creating web pages and web applications. When used with Cascading Style Sheets (CSS), and JavaScript, it forms a triad of cornerstone technologies for the World Wide Web.

HTTP The Hypertext Transfer Protocol is an application protocol for distributed, collaborative, hypermedia information systems. HTTP is the foundation of data communication for the World Wide Web. Hypertext is structured text that uses logical links (hyperlinks) between nodes (e.g. pages) containing text.

Impairment, age-related is a collection of sensory and cognitive impairments. In the general sense, it covers matters such as the deterioration of sight and hearing, memory impairment or memory loss. In the report, we look not only at persons who are elderly but also at the challenges facing children whose

intellectual maturity has an impact on their ability to read subtitles. In principle, there can be other impairments that are related to stages in the person‘s life.

Impairment, cognitive affects the individual‘s ability to think, concentrate, formulate ideas, reason and remember.

Impairment, dexterity is reduced function of arms and hands that makes activities related to moving, turning or pressing objects difficult or impossible. This does not influence speech communication itself but makes it hard to make a phone call or use a wide range of other equipment.

Impairment, hearing is a generic term including both deaf and hard of hearing which refers to persons with any type or degree of hearing loss that causes difficulty working in a traditional way. It can affect the whole range or only part of the auditory spectrum which, for speech perception, the important region is between 250 and 4,000 Hz. The term deaf is used to describe people with profound hearing loss such that they cannot benefit from amplification, while hard of hearing is used for those with mild to severe hearing loss but who can benefit from amplification.

Impairment, visual (or vision impairment) is vision loss (of a person) to such a degree as to qualify as an additional support need through a significant limitation of visual capability resulting from either disease, trauma, or congenital or degenerative conditions that cannot be corrected by conventional means, such as refractive correction, medication, or surgery. The loss may cover visual acuity, significant central or peripheral field defects or reduced contrast sensitivity.

Internet Protocol Television, IPTV is a system through which internet television services are delivered using the architecture and networking methods of the Internet Protocol Suite over a packet-switched network infrastructure, e.g., the internet and broadband internet access networks.

Language Condensation Captioning is rarely a verbatim transcription of what is said in the soundtrack, but an edited version to convey the original sense of what was said while making sure that the viewer is comfortable reading the final result. As a result, the difference between the verbatim transcription and the final result involves language condensation.

Metadata is data about data, in this case information about television programs. This can be in the form of program listings or guides, or technical data delivered with the program to accomplish an Access Service.

Metric is a criterion or measure of success in reaching a particular objective or goal.

Metric, Quality is a measure of the perceived quality of a television picture or sound or associated service.

MOOC, a Massively Online Open Course; a course of study made available over the internet without charge to a very large number of people.

Multiplex or mux is also called a virtual sub-channel in the United States and Canada, and Bouquet in France. It is a group of TV channels that are mixed together (multiplexed) for broadcast over a digital TV channel and separated out again (de-multiplexed) by the receiver.

Over-the-top TV Over the top Television allows you to view content that is available over the internet. It is delivered via your broadband connection to your flat panel display or computer screen and so bypasses the traditional broadcast or IPTV providers of TV services - hence the term ―over-the-top.

Personal video recorder, PVR is a consumer electronics device or application software that records video in a digital format to a disk drive, USB flash drive, SD memory card or other local or networked mass storage device.

Play-out centre is the location from which a broadcaster dispatches a television channel either directly to a transmitter network or indirectly through a contribution system to one or more transmission networks.

Program Guide, Electronic, (EPG) an interactive program guide to provide users of television, radio, and other media applications with continuously updated menus displaying scheduling information for current and upcoming programming.

Program Guide, On-screen as distinct from program listings and guides on other platforms such as the Web, mobile phones and in print media.

Re-speaking is a means to provide real-time captioning for live events including television programs. It involves a captioner / subtitler re-speaking or dictating the captions that are transcribed using speech recognition trained to the specific re-speaker's voice and automatically formatted for display.

REST stands for Representational State Transfer. (It is sometimes spelled "ReST".) It relies on a stateless, client-server, cacheable communications protocol and in virtually all cases, the commonly used HTTP web site protocol is used. REST is an architecture style for designing networked applications.

Set-top box is a device that enables a television set to receive and decode digital television broadcasts.

Short-form video is video in bite-sized chunks, unlike long-form video such as television programs and motion pictures.

Simulcast Simultaneous broadcast of a program on two or more distribution networks

Smart phone is a mobile phone that offers more advanced computing ability and connectivity than a contemporary feature phone.

SMPTE The Society of Motion Picture and Television Engineers, SMPTE is a technical society for the motion imaging industry.

Spotting The offline determination of subtitle timing (i.e. when subtitles need to appear) using a proxy or copy of the associated video content.

Stakeholder is a person, group, organisation, or system who affects or can be affected by an organisation's actions. In the case of television accessibility, the stakeholders are all those who have an impact on, or are influenced by the planning, production, exchange, delivery, use and enjoyment of television.

Subtitling is a generic term for the production of text as an alternative form of the audio content of audio-visual content. The term 'subtitling' is often interpreted as the process of translating the dialogue component of audio-visual content into text and displaying the text on the screen overlaid on the video image. [See also Captioning and Subtitling, Intra-lingual].

Synthesis, Speech is a means by which human speech can be created synthetically, rather than have to use recordings. It is used for car navigation systems, point-of-information kiosks and is being introduced as a means of offering audio captioning.

Tablet or Tablet PC is a device equipped with a touchscreen as the primary input device and designed for personal use.

Teletext is a television information retrieval service developed in the United Kingdom in the early 1970s. It offers a range of text-based information including closed subtitles and closed captioning. This service is typically available on page 888, but the actual page number depends on the broadcaster and country.

Terrestrial Television is a mode of television broadcasting which does not involve satellite transmission or cables — typically using radio waves through transmitting and receiving antennas or aerials. The term is more common in Europe, while in the United States it is referred to as broadcast television or sometimes over-the-air television.

Transcription is the representation of the sound track of a TV program in written form.

Transcription, Verbatim is a word-for-word representation of the sound track of a TV program in written form.

Translation Subtitles see Subtitling, Inter-lingual

Vertical Blanking Interval, (VBI) also known as the vertical interval or VBLANK, is the time difference between the last line of one frame or field of a raster display, and the beginning of the first line of the next frame. It is present in analogue television and can be used for data casting (to carry digital data), since nothing sent during the VBI is displayed on the screen; various test signals, time codes, closed captioning, teletext, CGMS-A copy-protection indicators, and other digital data can be sent during this time period.

Work, Derivative according to US copyright law is a work based upon one or more pre-existing works, such as a translation, musical arrangement, dramatization, fictionalisation, motion picture version, sound recording, art reproduction, abridgment, condensation, or any other form in which a work may be recast, transformed, or adapted. In the case of subtitles and captions, both of these services can be regarded as derivative works. The question about their use or re-use by third parties or in new contexts is whether the original agreement contemplates such exchange and use of access services.

World Wide Web Consortium, (W3C) is an international community that develops standards to ensure the long-term growth of the Web

3. Pilot-C "Automatic UI adaptation" main outcomes

In the following we will take a detailed look at the main outcomes of Pilot-C "Automatic User Interface adaptation" pilot.

3.1. Access GUIDE - Open online platform for access service personalisation

The Software as a Service (SaaS) platform was developed by Vsonix during first two years of the project. The service platform, which is already available and will be further maintained and disseminated via the website www.accessguide.tv, includes APIs and functions for user and profile management, as well as the necessary mechanisms needed for UI adaptation on PC and HbbTV platforms.

This includes an application for the generation of user accessibility profiles for PC, mobile and HbbTV platforms. This application called AccessGUIDE was designed and implemented by Vsonix taking into account the results of user tests from the first two years of the project. The access service includes functions for UI personalisation, targeting the definition of accessible font types, size or colour schemes. Beside UI adaptation it also includes functions for personalized subtitles as well as a personalized text to speech service that could be integrated as a screen-reader or for spoken subtitle applications.

Figure 1. User interface of the Access GUIDE application

The Access GUIDE service consists of several components:

- AccessGUIDE Web-App: The Web-App serves as the frontend for the UI adaptation service. It guides the user through a series of dialogs to establish his preferred UI settings. These user preferences are then passed on to the API, which stores them on the server.
- AccessGUIDE API: The AccessGUIDE API is the JavaScript based interface to the AccessGUIDE Service. The API is used by the AccessGUIDE and third-party applications in order to access the AccessGUIDE service. The AccessGUIDE API represents the client-side part of the AccessGUIDE Service.
- AccessGUIDE Online Service: The AccessGUIDE service represents the backend component of the adaptation functionality. It exposes several functions through a publicly-available REST API that allow application developers to create, store, and retrieve adaptation profile information.

- AccessGUIDE TTS: The AccessGUIDE text to speech functionality provides application developers an 'on-the-fly' text-to-speech service with speech parameters adjusted to the adaptation requirements of the current user profile.

3.2. vPlayer: Accessible online video platform by Vsonix

The accessibility service was integrated by Vsonix into its online video platform "vplayer". The platform was developed as a basis for online applications dealing with interactive video learning content on PCs and mobile platforms.

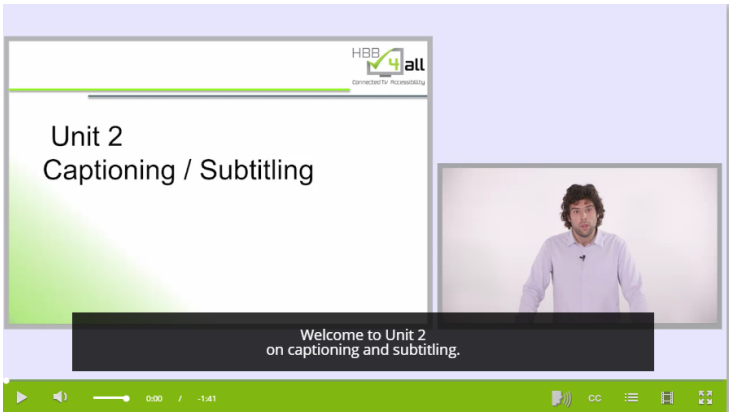


Figure 2. VSONIX vPlayer

The overall platform includes a content management service as well as a number of web based (HTML5) UI components such as an interactive online video player (vPlayer) for the playback of course content with advanced navigation and search functionality, a comment function that allows users to discuss the course content, a component to realize interactive Q + As, different UI components for playlists, content description and galleries as well as a user registration and login service. Using the ACCESS GUIDE service, the online video platform supports a number of personalisable accessibility features like multi-language subtitles, screen reader functions, multi-language spoken subtitles as well as switching between signed and non-signed content.

3.3. Online course on media accessibility (MOOC)

The online course on media accessibility is provided by Vsonix in collaboration with UAB. The course was published in August 2016 under www.accessguide.tv/course and is freely available to all interested parties that register for the course. The course involves videos content as well as some questions that the course participants will have to answer.

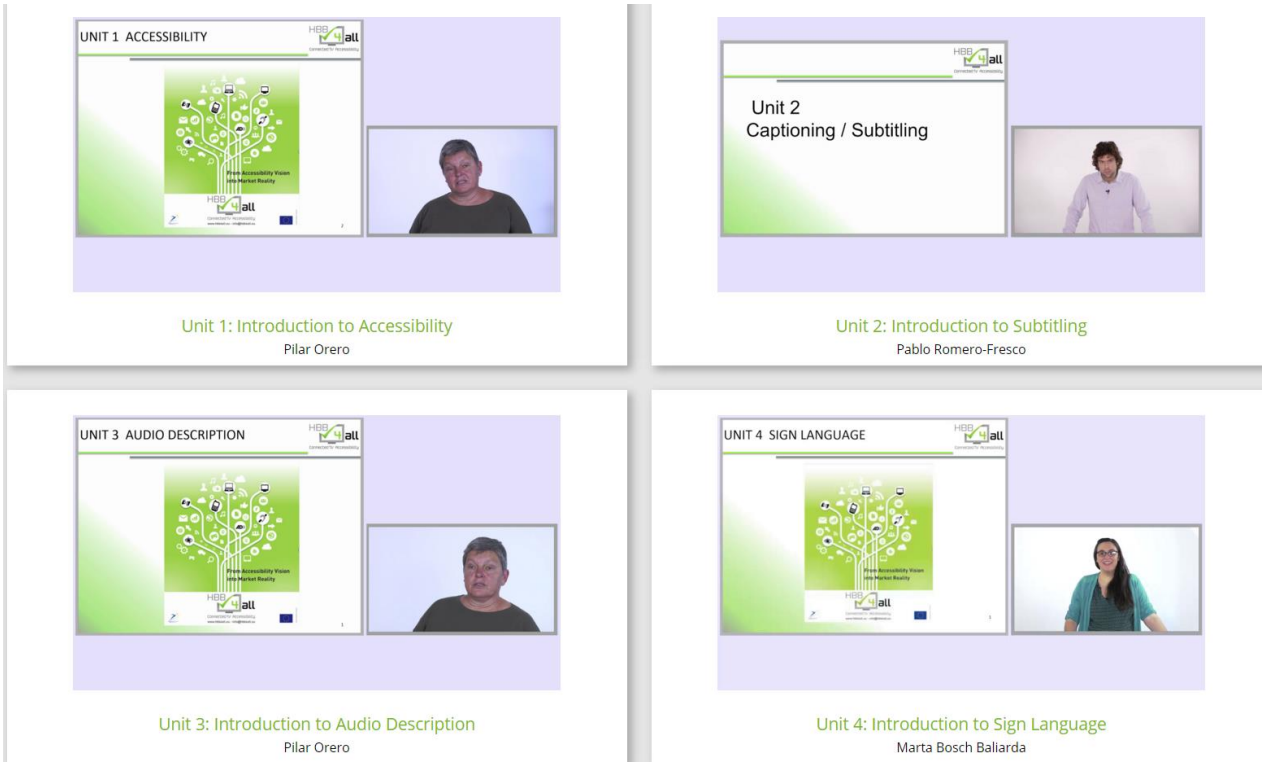


Figure 3. Four units of the online course

The course is structured in four units, which are: Accessibility, Subtitling/Captioning, Audio Description and Sign Language. In the first unit the course goes through all the issues related to: why and for whom is accessibility important or necessary, laws and regulations, as well as rights and duties. The second unit deals with the topic of Subtitling/Captioning and highlights different aspects to consider when subtitling, such as translation, timing, or scrolling. Both units are tutored by Pilar Orero from the, UAB. In the Audio Description unit, tutored by Pablo Romero-Fresco, the course shows importance of a qualitative description and how to achieve this. Finally, the fourth unit talks about Sign Language and is tutored by Marta Bosch-Baliarda.

The course is addressed to everyone: from users to policy makers, accessibility managers, broadcasters, access service providers or just anyone interested in the topic. There are some learning outcomes that the course addresses such as:

- Making students familiar with the basic concepts and services of media access services.
- Exploring fundamental techniques in the process of audio description, subtitling/captioning/sign language.
- Introducing the professional to the process of audio description, subtitling/captioning/sign language.
- Teaching the use of language technologies for accessibility services.
- Guide of good practice for accessibility services

4. Sub-Pilot 1: AccessGUIDE

4.1. Introduction

In the following chapter we will give an overview on our activities in respect to the AccessGUIDE online service platform for access service personalisation. This includes the technical advancements made in the final project year, which mainly concentrated on making the platform available for mobile devices. We will further provide information about the functionality of the service, the addressed target group as well as how we will make the service available in the future. Finally we will present the online user tests that were undertaken for the service platform based on an online survey.

4.2.Description of service

4.2.1. Technical advancements in final project year

Access GUIDE has been updated to include support for mobile platforms and small-screen devices such as tablets and smartphones. While previously there was no dedicated interface for small-screens, AccessGUIDE now automatically detects its environment and decides, based on predefined criteria, when to display the UI optimized for small screens or the regular UI for bigger screens. In the screen shots below we highlight several aspects of the new mobile UI. First of all, it obviously is optimized for touch input and provides the user with bigger actionable areas due to the lack of precision in touch inputs. Furthermore, the way AccessGUIDE is displayed is changed from a partial overlay to a full screen application overlay. This is achieved by resizing the AccessGUIDE overlay to occupy all of the browser window's width and height. Closing the overlay will immediately lead the user back to the original application without having to perform any additional action (notice how the browser URL is the same in either of the screenshots).

Figure 4. Bootstrap responsive UI framework used by AccessGUIDE

In order to be able to provide the user with the UI best suited for their device we have evaluated several approaches. We decided to implement the well-known and widespread framework Bootstrap (http://getbootstrap.com/), which is developed by Twitter Inc. Bootstrap allows for easy definition of screen behaviours based on predefined screen dimensions and grid templates. Depending on how the elements have been classified they are displayed differently. You can see this in the screenshots below: While on the tablet UI there are two rows of elements, because of the limited space in the phone screen the elements there have wrapped around and formed additional rows. Bootstrap further allows you to exactly define where and how and when elements should wrap-around. Describing all the possibilities would exceed this document, so for more information please consult the official documentation of the Bootstrap project by following this URL: http://getbootstrap.com/getting-started/.

We extended Bootstrap's predefined behaviours and introduced a more fine-grained solution, which allowed us to have two completely adapted UIs, one for small screens such as smartphones, and one for bigger screens. We have documented the approach below in several example screenshots.

In the first screenshot you see the main screen of AccessGUIDE which leads users to the individual adaptation screens. In the mobile UI the categories icons are now expanded horizontally and display from top-to-bottom instead of left-to-right as is the case for bigger screens.

Figure 5. AccessGUIDE main page using Bootstrap on smartphones and tablets

The second screenshot shows the screen for adapting the display font size. Again we have optimized the UI controls for input by touch, as they now take a significantly bigger portion of screen real estate compared to the regular UI. We moved the demonstration area to the top of the screen and decided to move all controls to the bottom in order to prevent objects from overlapping,

especially given the fact that the font size may vary depending on the setting the user makes in this very screen.

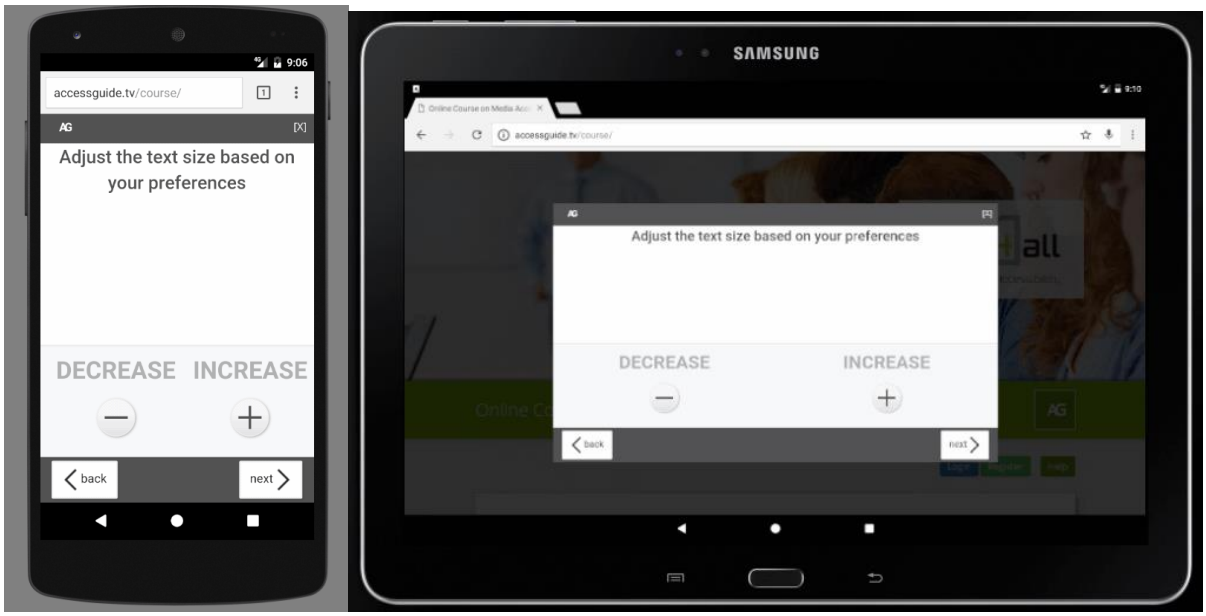


Figure 6. AccessGUIDE settings page using Bootstrap on smartphones and tablets

In the next screenshot the concept of separation becomes even more evident: All demonstration objects such as backgrounds, dummy fonts and toggles are at the top of the screen, while general navigation controls moved to the bottom of the screen. Again this allows the demonstration to fit in the screen regardless of the user's adaptation preference regarding font size.

Figure 7. AccessGUIDE settings page using Bootstrap on smartphones and tablets

4.2.2. Functionalities

AccessGUIDE allows the user to change several parameters in a website in order to provide the user with an improved accessibility experience, such as display font size, use of transparency in UI elements, use of high contrast colours, use of integrated TTS system and various parameters regarding subtitle display. Each of the adaptations may be changed at any time by the user. Changes will be reflected on the host website in real-time and will be permanent until changed, even across browser sessions, so that the user does not need to restore their settings each time they access the host website.

Of course it is possible to have multiple different adaptation settings for several domains at the same time. AccessGUIDE is able to differentiate settings made for e.g. http://accessguide.tv and a second website with AccessGUIDE integration, and will only restore settings that apply for the current website. The figure below shows an example screen of how a screen in AccessGUIDE looks like after the AccessGUIDE software has been triggered.

Figure 8. AccessGUIDE settings page of TTS service

AccessGUIDE has been developed mobile-first, which means it is fully functional and optimized for display on mobile devices. The service is extensible, which means new adaptation criteria can be added to the existing set of adaptations at any time. Existing profiles can be upgraded to include new adaptation profiles easily, since all adaptation data is stored centrally in the database on the server and only a unique client ID is stored on the client in a browser cookie.

AccessGUIDE also features an integrated TTS service, which enables website developers to easily provide access for users that rely on auditory guidance in order to be able to navigate around their website. The text-to-speech system is based on cloud-based real-time speech synthesis that also

adapts to the adaptations specified by the user, such as volume, speed or gender. In order to generate speech data, the developer simply passes any string and language identifier to the API and receives a JavaScript object in return. Behind the scenes, the API fetches the applicable adaptation parameters, as listed earlier, and queries the TTS service for a synthesised representation of the input text. You can see the control sequence in the illustrated sequence chart below.

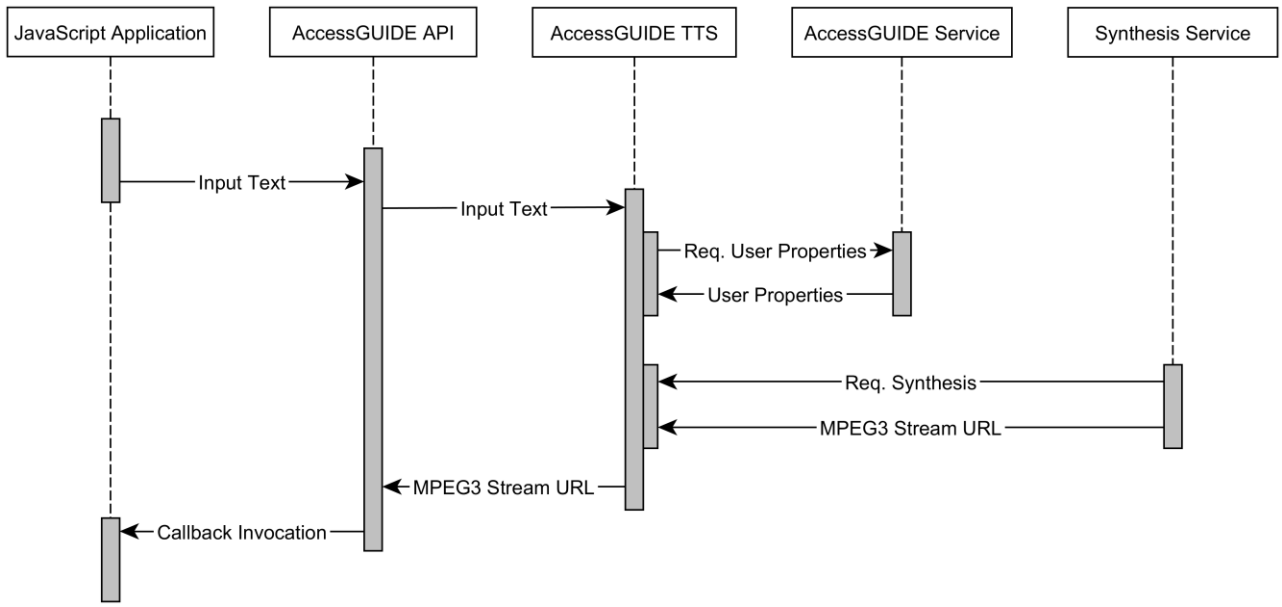


Figure 9. Sequential function calls used by TTS service

After the API returns the synthesised speech, audio playback is as simple as invoking the "play" method on the returned JavaScript object. The AccessGUIDE API takes care of how specifically the audio will be played and abstracts away technical details. For an example usage of the TTS system please refer to the MOOC, where we added a more sophisticated queueing based TTS playback system. Refer to chapter 5 for more information about the MOOC and its TTS usage.

Finally, since AccessGUIDE is an API to be used by third parties, it is very important to provide easy methods for integration of the API into existing websites and other web services. In fact, integrating AccessGUIDE into pre-existing websites is as simple as inserting a small HTML fragment into an existing website. Afterwards, the API is available to the website developer and adaptations may be added to the website as per the AccessGUIDE documentation.

4.2.3. Availability of service

The AccessGUIDE service will be available and further maintained and disseminated via the website www.accessguide.tv. The aim of Vsonix is to integrate the service into its online video application platform vPlayer (see section 3.2) to become an integrated platform for accessible online video. vPlayer is an essential part of the Vsonix service and application portfolio being an online video service provider and integrator of online video applications. vPlayer is already available in various online video applications that are provided by Vsonix to its industry customers.

In the future it is planned to integrate and extend both services further in order to become a dedicated online platform for accessible video content. This platform could be used by third parties to host their video content online while benefiting from the accessibility features of the platform. One aim will be to develop and integrate additional accessibility services into the AccessGUIDE backend such as an online service for automatic subtitling as well as an avatar based signing service. To realize such kind of services additional research is still needed to improve the quality e.g. of the automatically generated subtitles. From our point of view those services are needed to provide a cost effective accessibility service for online video content.

4.2.4. Intended audience

The intended audience for the AccessGUIDE service are application developers and content service providers that would like to integrate Access Service personalisation into their accessible online video services. The intended audience for the integrated online video service of vPlayer and AccessGUIDE are online video service providers and other content providers that would like to provide accessible video content on their website. This also includes Vsonix' multinational industry customers that have the need to provide multi-language educational content to their employees, e.g. for staff training purposes.

4.3.Description of user tests

4.3.1. Objectives

Before the MOOC was available online, Vsonix prepared the final user evaluation of the AccessGUIDE service as well as on the MOOC content based on online questionnaires. Those were available for all MOOC users from the moment the course was available online until the end of the project, and will continue to be available in 2017.

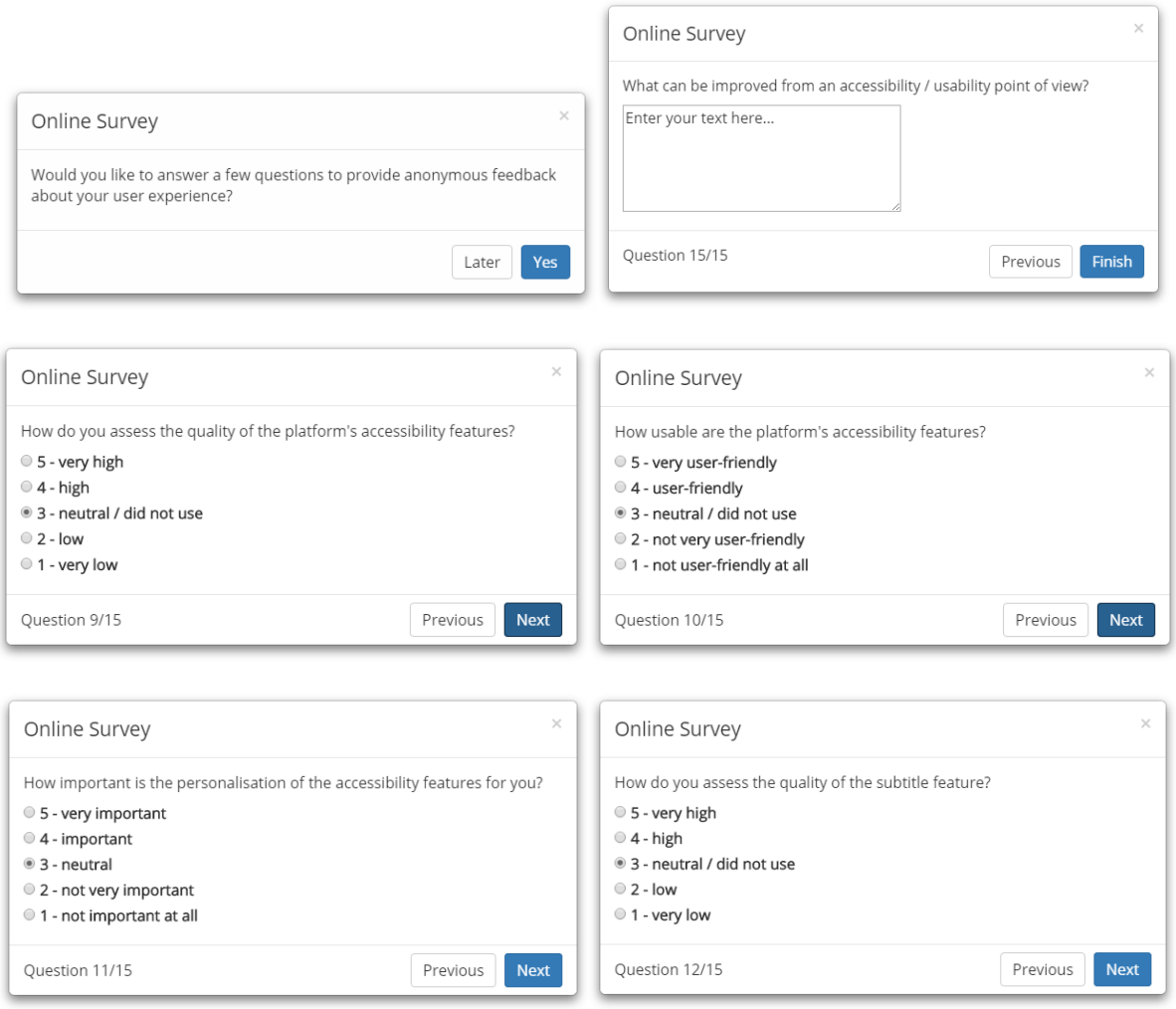
The objective of these user tests was to ensure that the corrections and implementations made in the application were correct and suitable for all the users. To gather the information from as many users as possible we needed to make the data collection as easy and smooth as we could.

4.3.2. Methodology

User Feedback was collected on the MOOC website (www.accessguide.tv/course) directly, where the AccessGUIDE service is currently active. Each active user of the website received a popup notification that offered them the possibility to take part in the user tests by simply answering several questions without having to leave the MOOC website. The popup notification is displayed in the figure below. It would pop up shortly after users entered the site if the user had not completed the survey earlier.

Once users agree to participate they receive several questions related to AccessGUIDE and its features, partly given as open questions and partly given as scale-based questions with a scale of 1 (worst) to 5 (best). These are the questions that were asked during the user tests regarding the AccessGUIDE. The possible answers are given in parenthesis after each question:

- Q1: How do you assess the quality of the platform's accessibility features? (1: very low – 5: very high)
- Q2: How usable are the platform's accessibility features? (1: not user-friendly at all – 5: very user-friendly)
- Q3: How important is the personalisation of the accessibility features for you? (1: not important at all – 5: very important)
- Q4: How do you assess the quality of the subtitle feature? (1: very low – 5: very high)
- Q5: How do you assess the quality of the screen reader feature? (1: very low – 5: very high)
- Q6: How do you assess the quality of the UI adaptation feature? (1: very low – 5: very high)
- Q7: What can be improved from an accessibility / usability point of view? (open question)



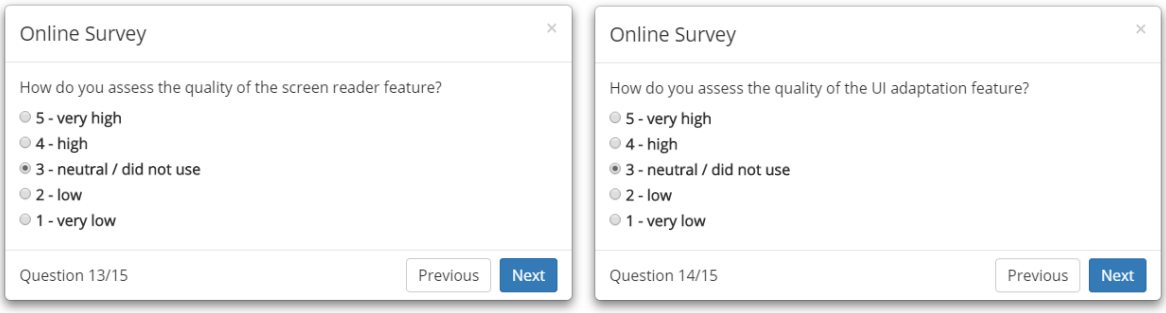


Figure 10. Online survey questions for AccessGUIDE service

4.4. Testers

In total 20 users have completed the online questionnaires, which is quite a good basis already to assess the quality of the service from a user point of view. As the users have been acquired anonymously, we cannot say anything about their age, experience with digital services or level and kind of impairment, if any. The testers have been recruited via the Hbb4All project's online channels including the project website, announcements on Facebook and Twitter. Further the members of the project advisory board were asked to distribute the link to the MOOC via their channels.

4.5. Results and Recommendations

The feedback that we gained from the users was quite encouraging so far. Nearly all users that completed the online forms gave positive feedback (+ or even ++) to the different questions asked. This related to the questions about the quality of the accessibility features in general, as well as in respect to the particular features such as the quality of the subtitle feature, the screen reader functionality as well as the UI adaptation feature. Moreover, all users see the personalisation feature as being valuable.

Via the open question responses we gained some recommendations, which we can take into account in further versions. Many users claim that the course should be available in more languages than those currently available.

Also they say that the survey itself should be available in Spanish, German or even international sign language in order to also give people the chance to feedback if they don't speak English. Table 1 below gives an overview on the test results:

Table 1. Results of the online survey for the AccessGUIDE service

			Scale				
			--	-	0	+	++
Question	q1	Quality of Accessibility Features	0	0	0	4	16
	q2	Usability of Accessibility Features	0	0	0	4	16
	q3	Importance of Personalisation	0	0	0	0	20
	q4	Quality of Subtitle Feature	0	0	0	4	16
	q5	Quality of Screen Reader Feature	0	0	0	0	20
	q6	Quality of UI Adaptation Feature	0	0	0	4	16

5. Sub-Pilot 2: MOOC

5.1. Introduction

In the following chapter we will give a detailed overview on the final year's activities in respect to the MOOC sub pilot including the technical and content related advancements made. This included the realisation of the course website (www.accessguide.tv/course), which now provides functions for user management, a media library giving access to all course content as well the description of the content for each course. Like the AccessGUIDE framework, the online course has been adapted to be used also on mobile devices. This was based on the responsive UI framework Bootstrap (see section 4.2.1), which was also used for the AccessGUIDE service. Similarly the MOOC includes an online survey to get the final user feedback on the course content, including recommendations how we can improve the service in the future.

5.2. Description of service

5.2.1. Technical advancements in final project year

Since August 2016, the MOOC has been hosted on a dedicated website (www.accessguide.tv/course), which gives access to all the course content including an overview page with an introduction to the course including a short video by Pilar Orero at the beginning, that explains the course concepts. In order to gain full access to course and to be able to discuss on the course content, users need to register in a one-step registration process.

Figure 11. Overview page on the course website

After logging in, the users get access to the course content, related Q+As and are able to discuss the course content with other registered users.

Technically, the MOOC has been updated to support the most prominent mobile platforms such as iOS and Android (other mobile platforms may be supported, but have not actively been tested). The platform the user is using will be detected automatically and, based on the detection result, the appropriate streaming mechanism will be used for video streaming. Supporting mobile platforms requires utilizing native HTML5-based video streaming technologies such as HLS and MPEG-DASH, since Flash-based streaming mechanisms are not available on mobile platforms (and, additionally, are in decline on desktop platforms, too). The layout and content-flow will automatically be adjusted based on the available screen real estate according to the mobile-first paradigm using the well-known Bootstrap framework, which allows easy integration into existing websites. For more information about Bootstrap, please visit the official project website: http://getbootstrap.com/. Below you see some screenshots of the MOCC running on mobile platforms. One can clearly see the different layouts being used depending on the available screen real estate.

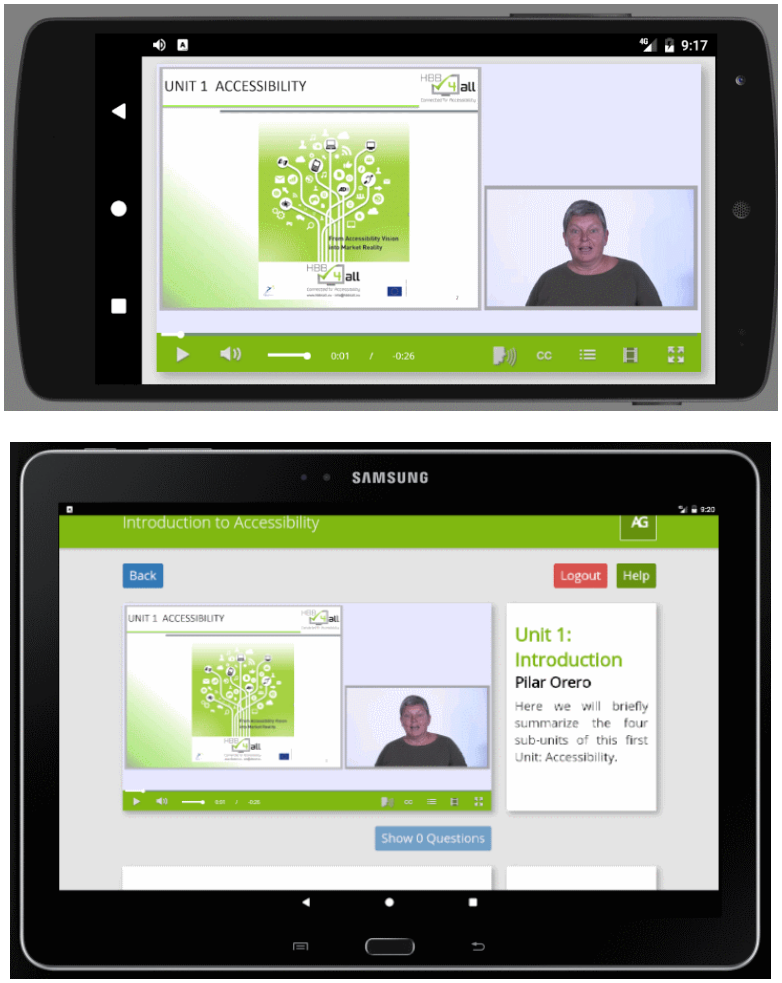


Figure 12. Course playback on smartphones and tablet PCs

In the previous year we have expanded the accessibility features of the MOOC platform by including a sign language option for some of the recorded lecture content. Now viewers are able to

toggle on or off a sign language view of the content. If the viewer toggles the sign language view on, then the speaker is replaced by a signing translator and the video stream used for streaming the video content is switched seamlessly to an alternate content for that matter. Of course, the viewer may switch back to the original view at any time.

5.2.2. Functionalities

In the last final project year, content production of the MOOC has been completed and all four anticipated course parts are available:

- Part 1: Introduction to Accessibility, by Pilar Orero
- Part 2: Introduction to Subtitling, by Pablo Romero-Fresco
- Part 3: Introduction to Audio Description, by Pliar Orero
- Part 4: Introduction to Sign Language, by Marta Bosch Balliarda

All courses feature subtitles in German, Spanish, and English, and parts of the course contents have been recorded with the option to display sign language alongside to the course video.

The MOOC is an interactive course constituting several topics related to media accessibility. In total there are 4 different lectures available. Each lecture is divided into several parts to ease navigation within the lecture and to provide comfortable access to the course contents.

Participants are able to consume the courses as-is, or with several accessibility-related enhancements. Accessibility features include a sign language-enabled view, which enables deaf or hard-of-hearing persons to follow the presentation smoothly. A comparison of the standard view and the sign-language view is shown below.

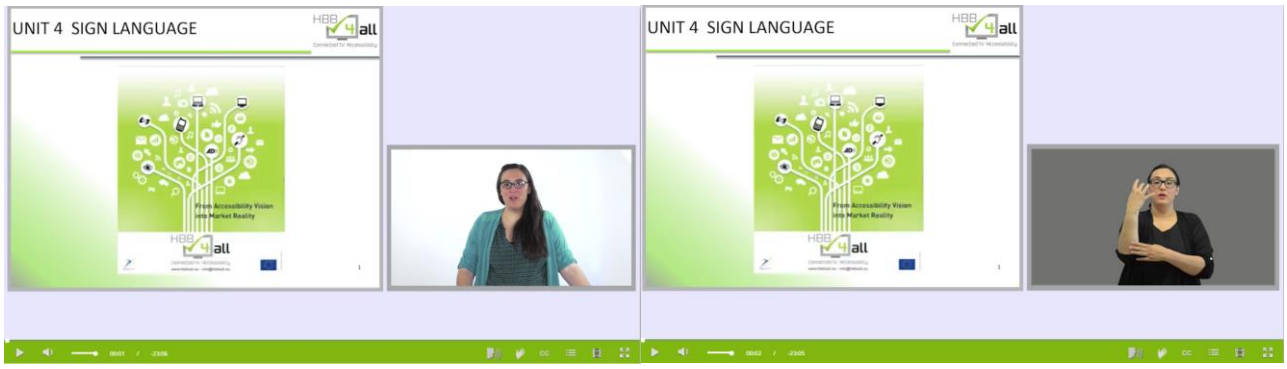


Figure 13. Sign Language feature implemented in vPlayer

Furthermore the MOOC features subtitles for each course which can be enabled or disabled at any time in the video player and provide the viewer the usual support in combination with the adaptations of AccessGUIDE (see Chapter 3). The subtitles have been created in English, Spanish

and German so that even if the viewer is not a native speaker they are now easily able to follow the course contents by toggling subtitles on in their native language.

The subtitle feature is complemented with the Spoken-Subtitle feature that allows viewers to have the active subtitle read out by a TTS service. The synthesized speech output will replace the presenter's audio. While this serves as a clean audio service by effectively removing any background noise in e.g. videos shown in the presentations, it will at the same time serve as a real-time audio translation service. The figure below shows the arrangement of the player controls to toggle adaptation features.

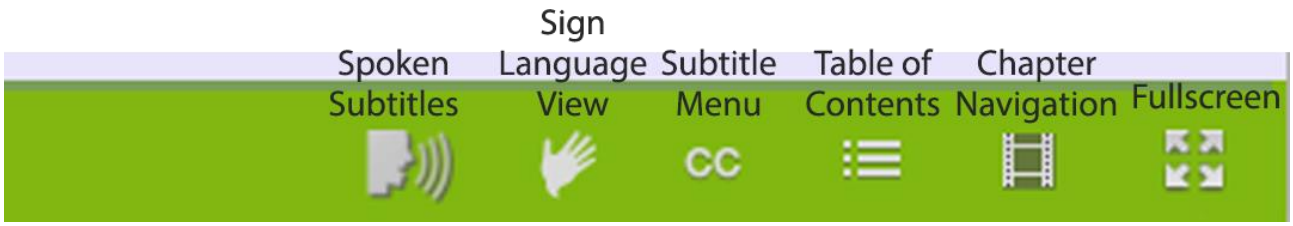


Figure 14. Advanced functionality of vPlayer including provided accessibility features

5.2.3. Availability of service

The course was published in August 2016 under www.accessguide.tv/course and is freely available to all interested parties that register to the course. Vsonix will maintain and support the availability of this website for at least the next two years. The aim is to create awareness for the topic of media accessibility and to disseminate the topic based on the content of the online course.

5.2.4. Intended audience

The course is addressed to everyone: from users to policy makers, accessibility managers, broadcasters, access service providers or just anyone interested in the topic.

5.3.Description of user tests

5.3.1. Objectives

The online survey that we created for the MOOC was more related to the MOOC content including its quality and comprehensiveness. The questions are dedicated to topics like how understandable and how complete the course content is. As for the AccessGUIDE service, the online survey was available online during much of 2016 so that we had a basis to assess the quality of the content and were able to adapt it accordingly if needed.

5.3.2. Methodology

User Feedback was collected on the site of the MOOC directly, where AccessGUIDE is currently active. Each active user of the website received a popup notification that offered them the possibility to take part in the user tests by simply answering several questions without having to leave the MOOC website. The popup notification is displayed in the figure below. It would pop up shortly after users entered the site. Once users agreed to participate they received several questions related to MOOC and its features, in part asked as open questions and partly asked as scale-based questions with a scale of 1 (worst) to 5 (best). The figure below shows an example of a question popup for a scale-based question. These are the questions that were asked during the user tests regarding the MOOC. The possible answers are given in parenthesis after each question:

Q1: How would you assess the quality of the course content? (1: very low – 5: very high)

Q2: Is the amount of content sufficient to cover the topic? (yes, don't know, no)

Q3: How understandable are the courses? (1: very low – 5: very high)

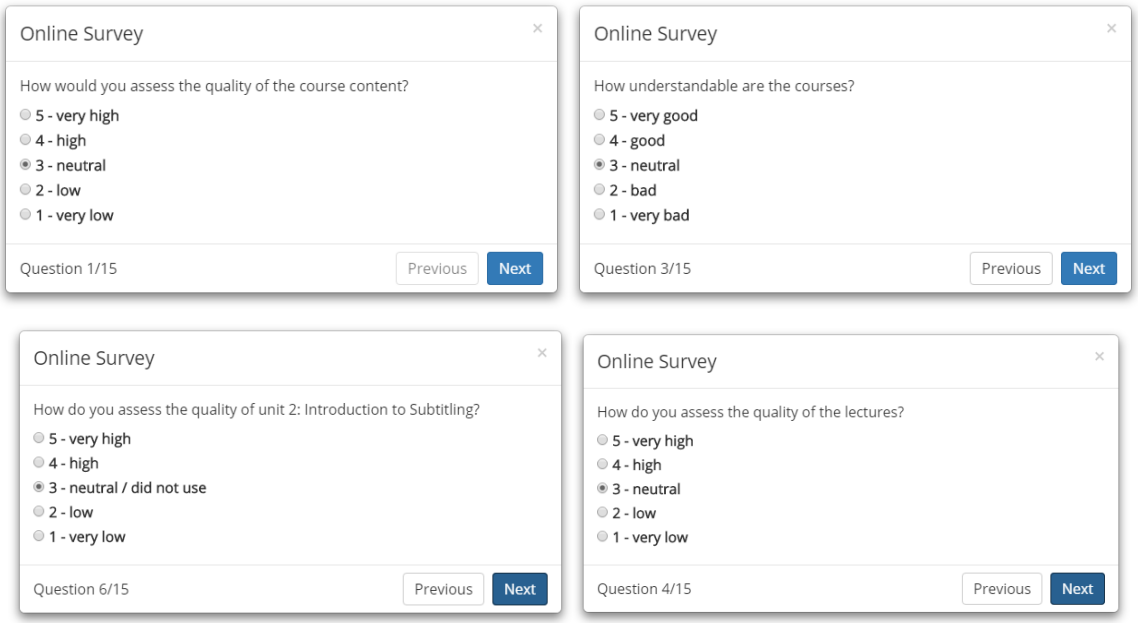
Q4: How do you assess the quality of the lectures? (1: very low – 5: very high)

Q5: What can be improved from a content point of view? (open question)

Q6: How do you assess the quality of unit 2: Introduction to Subtitling? (1: very low – 5: very high)

Q7: How do you assess the quality of Unit 3: Introduction to Audio Description? (1: very low – 5: very high)

Q8: How do you assess quality of Unit 4: Introduction to Sign Language? (1: very low – 5: very high)



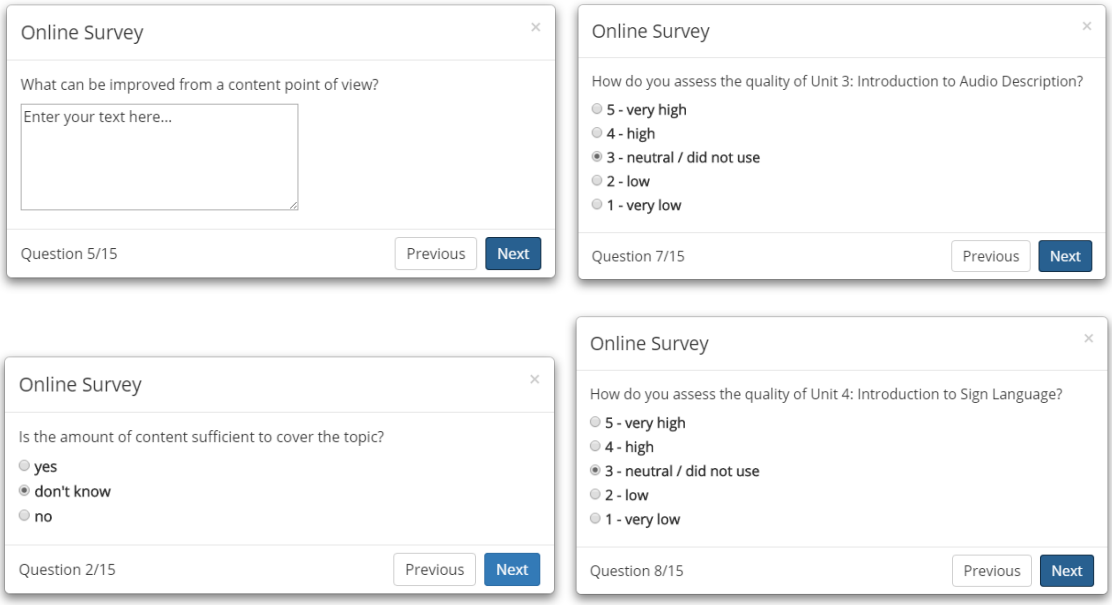


Figure 15. Online survey questions for MOOC

5.3.3. Testers

The testers were the same that we recruited for the AccessGUIDE service since essentially we had one survey with two independent parts for the MOOC and for the online service.

5.4. Results and Recommendations

As for the AccessGUIDE, the results of the survey have been very promising. All users gave positive feedback to the quality of the course content as well as to the individual units of the course. Explicitly it was stated that all information was understandable, accurate and that the course contains a lot of data. The amount of content was seen mainly as being sufficient. The table below gives an overview on the test results:

Table 2. Results of the online survey for the MOOC content

			Scale				
			--	-	0	+	++
Question	q1	Quality of Course Contents	0	0	0	4	16
	q3	Comprehensibility of Contents	0	0	0	0	20
	q4	Quality of Lectures	0	0	0	4	16
	q6	Quality of Unit 2	0	0	0	4	16
	q7	Quality of Unit 3	0	0	4	0	16
	q8	Quality of Unit 4	0	0	4	4	12

6. SCREEN Teletext Showcase

6.1. Introduction

The AccessGUIDE application programming interface (API), originally developed by Vsonix for PC platforms, was converted by PPG and SCREEN to run on HbbTV 1.5 platforms and used to evaluate concepts related to User Interface Adaptation by viewers of interactive content delivered by an HbbTV system.

A prototype Teletext Showcase HbbTV application containing predominantly text content was created using a version of Screen's Plasma Gold content publishing system that was extended to support the adaptation of the service for different viewer's needs. The overall design of the information service used in the user tests was based on real world applications and content that has been deployed by Screen's customers. The complexity of the prototype application was minimised to facilitate testing, by having a single index page that allowed access to several 'news' stories.

6.2. Activities performed by SCREEN for the showcase in the final project year

To support user adaptation, parallel / alternate versions of the content were created within Plasma Gold to match the combinations of offered user preferences. The different user adaptation choices, 3 text sizes chosen, and 3 colour schemes, resulted in 9 parallel sets of content that was automatically generated and maintained by the Plasma Gold system. An investigation and implementation of 'stored cookies' on the viewer's device was subsequently added as the trials demonstrated situations when this would be required, e.g. when the user's profile stored in the AccessGUIDE service is not accessible due to the internet not being available to the viewer's device.

An investigation was performed into dynamically changing the content using a combination of style sheets, HTML5.0 and JavaScript running in the browser on the user's device, rather than having content pre-published in the 9 parallel forms (as was the case in the trial). Clearly, if additional user adaptation choices were offered (e.g. Font family, selective display of images, colour blindness adaptations), using this 'dynamic approach' would reduce the requirement to store and pre-render parallel content, but significant disadvantages were found with this approach. The disadvantage included the additional complication of previewing the content when authoring, an inability to predict the content layout and the implications for reading and navigating the content and the reliance upon HTML5.0, JavaScript and font features that may not be implemented in some viewer's set top boxes.

For the trials, the content available via the HbbTV application was static but in a 'real world' deployment the content would typically be continually modified during operation, e.g. from connected automated data feeds, even whilst the application is being accessed by end-users. This automated modification of page content would require significant pre-rendering so would also benefit from the above 'dynamic approach' to user adaptation at the viewer's device.

For the user trials, the user preference adaptation page was implemented as a grid of visual options, allowing the user to choose an adaptation preference. The use of a grid was necessary as the

AccessGUIDE functionality was not a natural fit with the Screen Plasma Gold system. Investigation into offering a greater number of user adaptation choices concluded that the choice of adaptation preferences is best performed within a controlled and consistent environment such as AccessGUIDE, with the choices made by a specific user being stored and subsequently used by applications which directly access the user's profile on the AccessGUIDE service or use a 'stored cookie' on the user's device.

6.3. Availability of service and outlook

Screen have continued to develop and investigate the concepts of user adaptation, as supported by the web based UI adaptation and personalisation service, to the HbbTV related products within the Screen product range. Screen are now able to deploy a web based simulation of the adaptive user interface experience (using an emulation of HbbTV devices by using a compatible browser) for evaluation by broadcasters interested in supporting user adaptation of HbbTV applications. A standalone system suitable for small scale HbbTV demonstrations, including the user adaptation used in the trials, is also available and was demonstrated at IBC 2016.

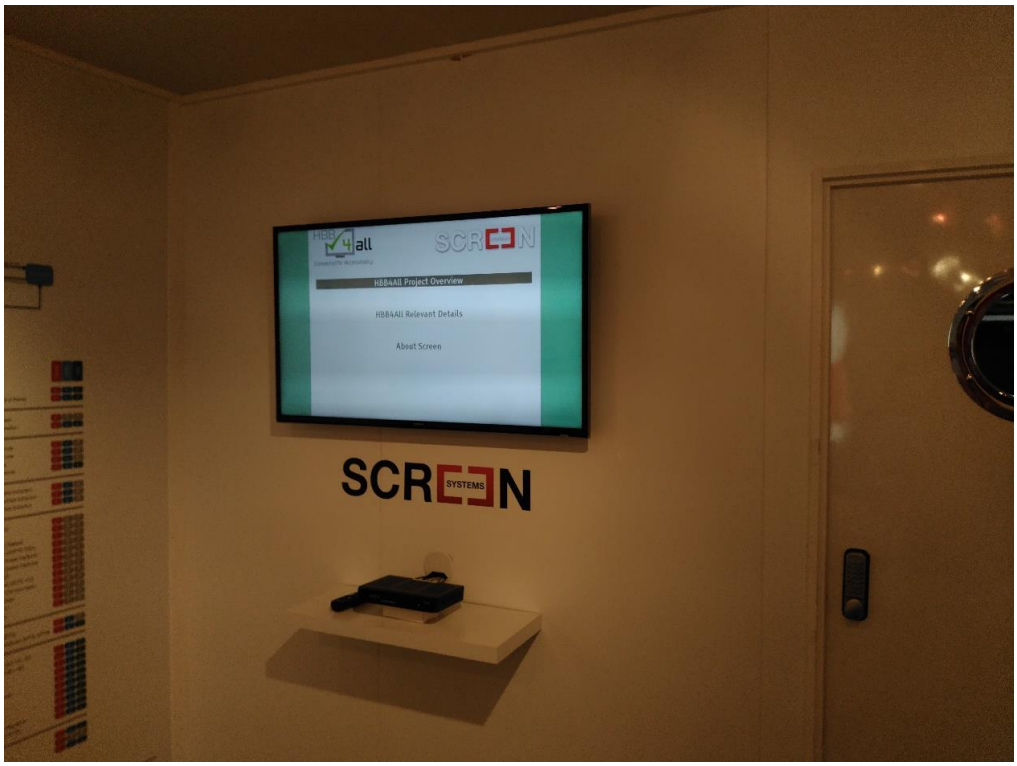


Figure 16. SCREEN demonstration on UI adaptation at IBC 2016 conference

Screen have not performed any user trials incorporating 'real data', as there has been no interest in user adaptation of these services currently. Screen do anticipate that the very recent adoption of the HbbTV standard within specific regional broadcasting strategies (e.g. FreeView in the U.K.) will result in increased future interest, and Screen expect that organisations with a specific accessibility

orientation (e.g. RNIB, RNID) will be active in both supplying content and in supporting more sophisticated user trials.

Screen have considered the implications in adding speech alternatives to text to suit visually impaired users of an HbbTV application. This would support 'speaking' of the highlighted item within the HbbTV application. Screen have developed functionality that can pre-generate speech fragments from text content stored in the Plasma Gold system. It is anticipated that these generated speech fragments would be played out at the HbbTV device by applications specifically designed to support this concept, but it has also been determined that this will require specific support in the user's device.

6.4. Conclusions for SCREEN teletext showcase

All objectives of the project have been met. The project has illustrated the potential for user selected adaptation of HbbTV applications, and has additionally highlighted the limitations that are imposed by the HbbTV 1.5 version of the standard. The principal limitation is the lack of mandatory support within HbbTV 1.5 devices for the HTML5.0 standard (which is required to implement dynamic styling) and a lack of extensive font support. We conclude that this lack of mandatory features implies that broadcasters wishing to offer user adaptation must currently use pre-rendered content in order for a user adaptable HbbTV application to work correctly for all potential service users.

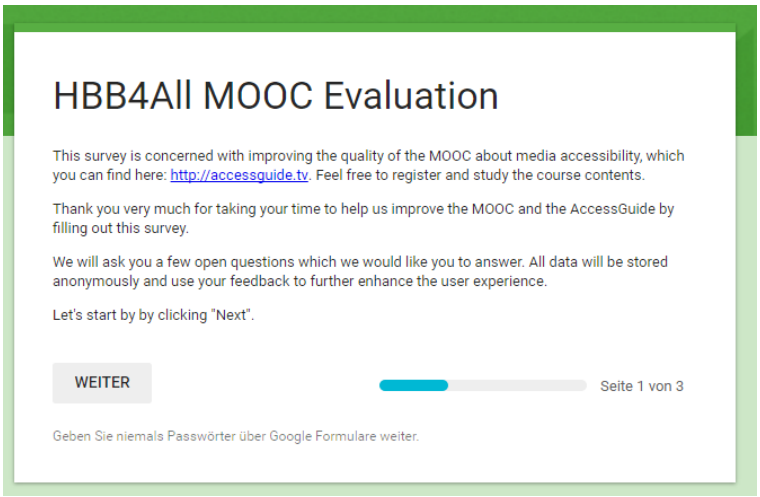
7. Complimentary user tests [UAB + VSX]

7.1. Objectives

Beside the quantitative online surveys that we have undertaken within the two sub pilots presented in chapter 4 and chapter 5, Vsonix decided to get some more qualitative data from the target group. For this we prepared online questionnaires that contain open questions in respect to the accessibility features and the content of the MOOC. In order to have comparable results to former user tests, we decided to present these online questionnaires to the users that had already participated in our first lab tests, which were done in 2015. This comprised 15 Participants, where 6 were men and 9 women, aged between 24 and 69, with 11 of them hearing impaired and 4 visually impaired. All the participants use the internet for at least 2h a day, most of them use it half of the time at their workplace and the other half for leisure. As the MOOC at that time was publically available online we decided to let the people test the service within their own environment giving them the chance to fill out the online questionnaires.

7.2. Material

The survey concerning the MOOC consisted of several open questions that gave the participants an opportunity to express their full opinion in detail. In cases where the participant had difficulty filling out full text form fields on the computer (due to physical impairments, for instance), assistance was provided by letting the participant speak to an assistant who entered the feedback directly into the online form. The survey closed with a scale-based question that asked the participant to summarize their experiences with the MOOC in one final rating in the range of 1 to 10, with 1 being the worst rating. We used this question as a rough indicator of how well the course contents were suited for the different targets groups with different expectations, skills, professions and impairments. The MOOC evaluation was created using the online service, Google Forms. We compiled the set of questions in Spanish, English, and Catalan. Below you see the questionnaire in detail in the English translation.



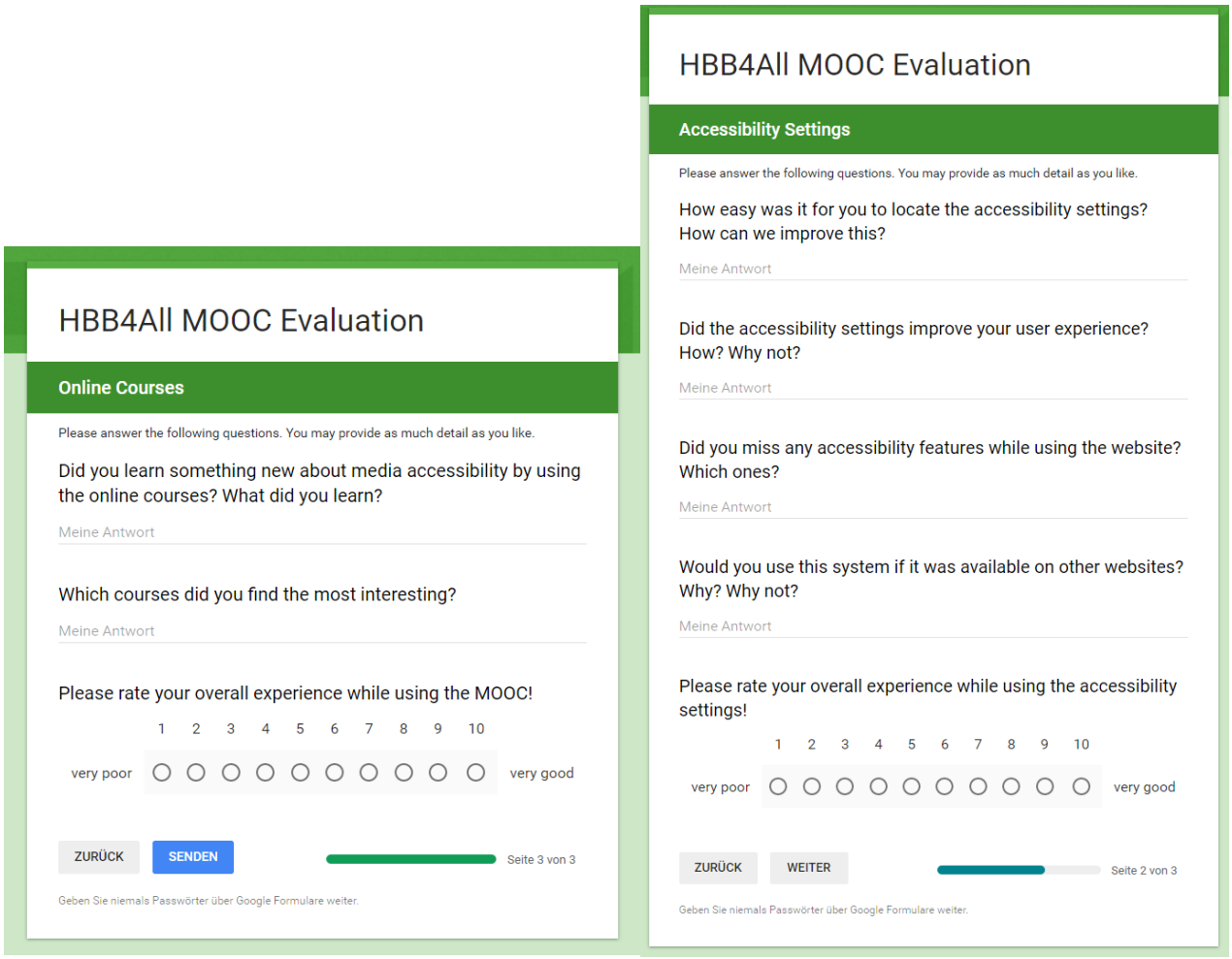


Figure 17. Online forms to be filled by participants

7.3.Results

By the end of the project only 8 users had filled the online forms, however their feedback was already of value and was taken into account for further improvements of the MOOC service.

Some of the users complained, that the accessibility settings were not very easy to find, they were looking for a clear symbol to find the access services. Further they also demanded multi-language support for the user interface. Another issue that was criticized was the need to register to the course content, since without the registration of the user only the first course video was available.

The users mainly agreed that the personalisation of the access services improved their user experience and that no accessibility features were missing.

Some of the respondents proposed that it would be great to achieve the translation and interpretation from every spoken language into sign language, from each country or region in the world, with an informative, explicative and educative purpose and available in every media channel. Also they said that the online course was a great initiative towards education, communication and deaf people's self-esteem.

One conclusion that was drawn from this results is that we should make the course available without the need for the users to register.

8. Conclusions

In conclusion, it can be said that Pilot-C has been successfully completed in the final project year and all objectives have been met. The AccessGUIDE online service as well as the MOOC was released online in July / August 2016 and will still be up and running beyond the project's lifetime. Vsonix aims to further maintain the course, disseminating it together with UAB to become available to everyone that is interested in the topic.

Vsonix has also made both services also available on mobile platforms, making use of a completely responsive design approach for smartphones and tablet PCs. Moreover, SCREEN has successfully demonstrated the usage of the AccessGUIDE service in an alternative HbbTV service environment.

All the course content for the MOOC is available to the public with subtitles in at least three different languages (English, German and Spanish). Another feature that Vsonix has integrated into the MOOC platform is the possibility to seamlessly switch between sign language and non-signed content. This was integrated prototypically into Unit4 of the online course on "Sign Language". We actually assess the possibility to make the course available with even more subtitle languages and with more content signed in international sign language with the help of the project's active community.

The feedback that we have gained from the online survey (see chapters 4.3 and 5.3) as well as from the online questionnaires (see chapter 7) was very promising, and some valuable feedback to improve the services have been gained. All user test results will be taken into account for the further improvement of the MOOC and the related accessible online video service after the end of the project.

9. Ethical issues and data protection

9.1. Ethical requirements

The HBB4ALL project carried out tests with humans, as end users, in WP3, 4, 5 and 6. Access services were tested and trialled. Testing with end users was considered one of the project's strengths: the participation of those for who the services are mainly designed. This fulfils the UN CRPD "nothing about us without us"[1].

All tests were designed and complied with the relevant national, EU and international ethics-related rules and professional codes of conduct.

Universitat Autònoma de Barcelona (UAB), HBB4ALL coordinator, has an Ethical Commission on Human and Animal Research to supervise the experimentation on human and animal beings in compliance with the European directives 86/609/CEE, 91/628/CEE and 92/65/CEE. Given that other partners didn't have an Ethical Commission, and given the fact that the UAB commission fulfils all EU directives, it was decided that UAB would seek certificates for all tests.

There were three aspects which were requested permission by all tests:

(i) test design

(ii) informed consent and

(iii) privacy and data protection

In all tests the following issues were respected:

- Tests were planned, implemented and evaluated in a free and independent way.
- Contact with end users was conducted in a respectful way on an equal footing with all users. Especially people who are less competent must have increased attention by the test leaders.
- The tester must be informed honestly and give their consent. The communication must be adapted to the needs of users.
- The tests were anonymous and privacy was ensured.
- A pleasant atmosphere for the user needs was created, so that the test results were as free and objective as possible. To put the users under pressure regardless of the type (time, understanding, empathy) would distort the test results.

Forms used during the project:

[1] http://www.un.org/disabilities/documents/convention/convoptprot-e.pdf

1. Form to request permission
2. Consent form
3. Information to participants

9.2.Data protection

All data was anonymized. Also in HBB4ALL we took on board EU data protection policies following the European Directive 95/46 with date 24/10/1995, and also local policies such as the German Federal Data Protection Act (BDSG) or the Spanish Ley Orgánica de protección de datos 15/1999, and the different countries where tests were performed. Data was stored in an internal UAB server.

10. References

[1] D5.1 – *Pilot-C Progress Report*, HBB4ALL deliverable, December 2014

[2] D5.2 – *Pilot-C Solution Integration and Trials*, HBB4ALL deliverable, December 2015