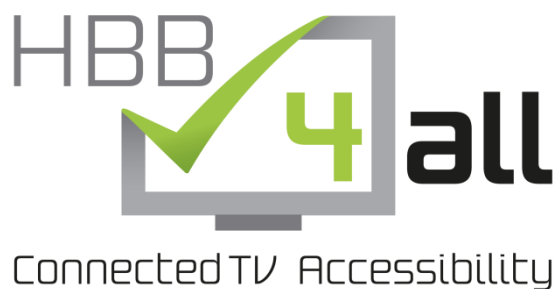


D3.4

Version	1.00
Date	2016/12/23
Author	RBB
Dissemination status	PU
Document reference	D3.4



D3.4 – Pilot-A Evaluations and Recommendations

Grant Agreement n°:	621014
Project acronym:	HBB4ALL
Project title:	Hybrid Broadcast Broadband for All
Funding Scheme:	CIP-ICT-PSP
Annex I reference version:	2013/10/22
Project Duration:	2013/12/01 – 2016/11/30 (36 months)
Coordinator:	Universitat Autònoma de Barcelona (UAB)
Beneficiaries:	Rundfunk Berlin-Brandenburg (RBB) Institut Fuer Rundfunktechnik Gmbh (IRT) Rádio e Televisão de Portugal SA (RTP) Televisió de Catalunya SA (TVC) Schweizerische Teletext (TXT) Vsonix Gmbh (VSX) Fundación Centro de Tecnologías de Interacción Visual y Comunicaciones VICOMTECH (VIC) Screen Subtitling Systems Ltd (SCREEN) Holken Consultants & Partners (HC) People's Playground BV (PPG) Universidad Politécnica de Madrid (UPM)

This project is supported by funding from the 'Competitiveness and innovation framework programme 2007-2013' of the European Union.





CIP-IST-PSP-621014

www.hbb4all.eu

D3.4 v1.00

Project no. 621014
HBB4ALL
Hybrid Broadcast Broadband for All

CIP- Pilot actions
Competitiveness and innovation framework programme 2007-2013

D3.4 – Pilot-A Evaluations and Recommendations

Due date of deliverable: 2016/11/30
Actual submission date: 2016/12/23

Start date of project: 2013/12/01
Duration: 36 months

Lead beneficiary for this deliverable: Rundfunk Berlin-Brandenburg (RBB)

Revision 1.00

Project funded by the European Commission within the Seventh Framework Programme		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

History Chart

Issue	Date	Changed page(s)	Cause of change	Implemented by
0.10	2016/07/08	-	First version of document	RBB
0.20	2016/11/18	All	Integration of partner input	RBB
0.50	2016/12/01	All	Revision and integration of partner input	RBB
0.5_extended	2016/12/14	All	Revision and integration of additional partner input	RBB
0.5_extended-revUPM	2016/12/16	All	UPM detailed revision	UPM
0.60	2016/12/20	All	Completed version	RBB
1.00	2016/12/23	All	Format and Final revision	UAB

Validation

No.	Action	Beneficiary	Date
1	Prepared	RBB	2016/12/01
2	Approved	UPM	2016/12/21
3	Released	UAB	2016/12/23

Disclaimer: The information in this document is subject to change without notice. Company or product names mentioned in this document may be trademarks or registered trademarks of their respective companies.

All rights reserved.

The document is proprietary of the HBB4ALL consortium members. No copying or distributing, in any form or by any means, is allowed without the prior written agreement of the owner of the property rights.

This document reflects only the authors' view. The European Community is not liable for any use that may be made of the information contained herein.

Table of Contents

1. EXECUTIVE SUMMARY	7
2. INTRODUCTION	9
2.1. PURPOSE OF THE DOCUMENT	9
2.2. ORGANISATION OF PILOT PHASE.....	10
2.3. ACRONYMS AND ABBREVIATIONS	10
2.4. DEFINITIONS AND GLOSSARY	10
3. CUSTOMISED HBBTV SUBTITLES FOR VOD PORTAL – GERMANY (RBB)	14
3.1. GOALS OF THE SUB-PILOT	14
3.2. DESCRIPTION OF SERVICE / APPLICATION	14
3.2.1. <i>Technical implementation (brief overview)</i>	14
3.2.2. <i>Functionalities</i>	15
3.2.3. <i>Availability of service</i>	17
3.2.4. <i>Intended audience</i>	17
3.2.5. <i>Workflow / production aspects</i>	17
3.3. DESCRIPTION OF USER TESTS	17
3.3.1. <i>Aim</i>	17
3.3.2. <i>Methodology</i>	17
3.3.3. <i>Testers</i>	19
3.3.4. <i>Report on test</i>	20
3.4. EVALUATION OF SUB-PILOT	21
3.4.1. <i>Visual questionnaire results</i>	21
3.4.2. <i>Standard questionnaire results</i>	22
3.5. RESULTS AND INSIGHTS	23
4. CUSTOMISED HBBTV SUBTITLES FOR VOD PORTAL – SPAIN (TVC/UAB)	27
4.1. GOALS OF THE SUB-PILOT	27
4.2. DESCRIPTION OF SERVICE / APPLICATION	27
4.2.1. <i>Technical implementation (brief overview)</i>	27
4.2.2. <i>Functionalities</i>	29
4.2.3. <i>Availability of service</i>	30
4.2.4. <i>Intended audience</i>	30
4.2.5. <i>Workflow / production aspects</i>	31
4.3. DESCRIPTION OF USER TESTS	31
4.3.1. <i>Aim</i>	31
4.3.2. <i>Methodology</i>	31
4.3.3. <i>Participants</i>	32
4.3.4. <i>Report on test</i>	33
4.4. EVALUATION OF SUB-PILOT	37
4.4.1. <i>Results of qualitative tests</i>	37
4.4.2. <i>Results of Quantitative Test 1</i>	38
4.4.1. <i>Results of Quantitative Test 2</i>	38
4.5. RESULTS AND INSIGHTS	39
5. HBBTV SUBTITLES FOR VOD – SWITZERLAND (TXT)	41
6. CUSTOMISED SUBTITLES FOR WIDE FOCUS MULTI-PLATFORM – PORTUGAL (RTP/UPM)	42
6.1. GOALS OF THE SUB-PILOT	42

6.2.	DESCRIPTION OF SERVICE / APPLICATION	43
6.2.1.	<i>Technical implementation (brief overview)</i>	43
6.2.2.	<i>Functionalities</i>	49
6.2.3.	<i>Availability of service</i>	53
6.2.4.	<i>Intended audience</i>	53
6.2.5.	<i>Workflow / production aspects</i>	53
6.3.	DESCRIPTION OF USER TESTS	53
6.3.1.	<i>Aim</i>	53
6.3.2.	<i>Methodology</i>	53
6.3.3.	<i>Testers</i>	54
6.3.4.	<i>Report on test</i>	55
6.4.	EVALUATION OF SUB-PILOT	56
6.5.	RESULTS AND INSIGHTS	59
7.	CUSTOMISED SUBTITLES FOR ONLINE LEARNING (MOOC) – GERMANY (VSX/UAB).....	60
7.1.	GOALS OF THE SUB-PILOT	60
7.2.	DESCRIPTION OF SERVICE / APPLICATION	60
7.2.1.	<i>Technical implementation (brief overview)</i>	60
7.2.2.	<i>Functionalities</i>	60
7.2.3.	<i>Availability of service</i>	61
7.2.4.	<i>Intended audience</i>	61
7.2.5.	<i>Workflow / production aspects</i>	61
7.3.	DESCRIPTION OF USER TESTS	61
7.3.1.	<i>Aim</i>	61
7.3.2.	<i>Methodology</i>	62
7.3.3.	<i>Testers</i>	62
7.3.4.	<i>Report on test</i>	62
8.	INTEROPERABILITY TESTS FOR EBU-TT-D	63
8.1.	TEST SET AND RENDERING SOLUTIONS	63
8.2.	EVALUATION.....	64
8.2.1.	<i>Errors in font family/colour/size</i>	65
8.2.2.	<i>Errors in positioning</i>	65
8.2.3.	<i>Errors in background rendering</i>	66
8.2.4.	<i>Overlapping of lines</i>	67
8.2.5.	<i>Gap between lines</i>	68
8.2.6.	<i>Line padding</i>	69
9.	SERVICE COMPONENTS	70
9.1.	SUBTITLING FORMAT CONVERSION FRAMEWORK (IRT).....	70
9.2.	LIGHTWEIGHT SUBTITLE EDITOR (IRT)	70
9.3.	EBU-TT-D RENDERING TESTS (IRT)	71
9.4.	SUBTITLE VALIDATION SOLUTION “SUBCHECK” (IRT).....	71
9.5.	SUBTITLE AUTHORING COMPONENT (SCREEN)	72
9.6.	SUBTITLE PROTOTYPE EBU-TT-D RENDERER (SCREEN)	72
9.7.	SUBTITLE CONTRIBUTION COMPONENT (SCREEN)	72
9.8.	SUBTITLE CONVERSION COMPONENT (SCREEN)	73
9.9.	SUBTITLE DISTRIBUTION COMPONENT (SCREEN)	73
10.	ETHICAL ISSUES AND DATA PROTECTION	74
10.1.	ETHICAL REQUIREMENTS.....	74

10.2.	DATA PROTECTION	75
10.3.	SUB-PILOT SPECIFIC ISSUES AND MEASURES	75
11.	CONCLUSIONS	76
12.	REFERENCES	77
13.	ANNEX.....	78
13.1.	QUESTIONNAIRES FROM GERMAN SUB-PILOT	78
13.2.	QUESTIONNAIRES FROM SPANISH SUB-PILOT.....	83
13.3.	DETAILED ANALYSIS OF SPANISH SUB-PILOT USER TESTS	85
13.4.	DATA PROTECTION AGREEMENTS	92
13.4.2.	<i>Consent Forms.....</i>	95
13.4.2.1.	<i>Consent form used in German sub-pilot.....</i>	96
13.4.2.2.	<i>Information for participants in German sub-pilot</i>	98
13.4.2.3.	<i>Consent form used in Portuguese sub-pilot.....</i>	99
13.4.2.4.	<i>Information form for participants in Portuguese Test</i>	100

Figures

FIGURE 1.	WORKFLOW FOR SUBTITLE PRODUCTION	14
FIGURE 2.	SUBTITLE PUBLISHING AND DELIVERY	15
FIGURE 3.	LANDING PAGE OF THE RBB MEDIATHEK	15
FIGURE 4.	SUBTITLE SETTINGS GUI	16
FIGURE 5.	FULL SCREEN PLAYER WITH PLAYER CONTROLS	16
FIGURE 6.	PARTICIPANTS DISCUSSION OPTION AT WORKSHOP	21
FIGURE 7.	EXAMPLE OF MASTER FORM FOR VISUAL QUESTIONNAIRES.....	22
FIGURE 8.	SHORT MENU TO DE/ACTIVATE SUBTITLES AND CHANGE SETTINGS	24
FIGURE 9.	OVERLAY WITH SUBTITLE SETTINGS.....	24
FIGURE 10.	SCALED VIDEO WITH SUBTITLES DISPLAYED UNDERNEATH THE VIDEO	25
FIGURE 11.	PREVIEW PAGE IN MEDIATHEK WITH SHORT SUBTITLE MENU	25
FIGURE 12.	MIRRORING TECHNIQUE	27
FIGURE 13.	MIRRORING TECHNIQUE - INVERSE ORDER ISSUE	28
FIGURE 14.	HBBTV PLAYER WITH CUSTOMIZABLE PARAMETERS	29
FIGURE 15.	BACKGROUND CUSTOMIZATION EXAMPLE.....	30
FIGURE 16.	FONT-SIZE SAMPLES	30
FIGURE 17.	POSITION CUSTOMIZATION EXAMPLE	30
FIGURE 18.	SPANISH SUB-PILOT TEST.....	33
FIGURE 19.	HELPING TESTER IN SPANISH SUB-PILOT (QUALITATIVE TEST)	33
FIGURE 20.	REMOTE CONTROL SKILLS	33
FIGURE 21.	TYPES OF PROBLEMS FOUND BY PARTICIPANTS.....	38
FIGURE 22.	CAPTURE FROM THE RTP PLAY SERVICE WITH EBU-TT-D SUBTITLES	42
FIGURE 23.	WORKING SCHEME FOR THE FUNCTIONING OF THE PLUGIN	43
FIGURE 24.	EXTRACT FROM THE HTML CODE THAT CALLS THE JWPLAYER WITH THE SELF-DEVELOPED PLUGIN	45
FIGURE 25.	THE CC BUTTON IN THE PLAYER SHOWS THE SUBTITLES MENU	45
FIGURE 26.	CAPTURE FROM THE HTML CODE THAT CALLS THE PLUGIN IN VIDEOJS PLAYER.....	47
FIGURE 27.	CAPTURE THAT SHOWS THE DEFINITION OF THE PLUGIN DEVELOPED.....	48
FIGURE 28.	CC BUTTON IN VIDEOJS PLAYER SHOWS THE MENU FOR ACTIVATING EBU-TT-D SUBTITLES	48
FIGURE 29.	WORK SCHEME OF THE CAPTIONS PLUGIN	49
FIGURE 30.	STRUCTURE OF THE EBU-TT-D FILE	50

FIGURE 31. MENU FOR CAPTIONS CUSTOMIZATION	51
FIGURE 32. FONT SIZE CUSTOMIZATION FROM SMALLER TO LARGER SIZES	51
FIGURE 33. POSITION CUSTOMIZATION FOR SUBTITLES SITUATED IN UP, CENTRE OR DOWN POSITIONS.....	52
FIGURE 34. FONT COLOUR CUSTOMIZATION FOR YELLOW, WHITE OR GREEN SUBTITLES.....	52
FIGURE 35. PHOTO OF THE DISCUSSION GROUP, SHOWING LAPTOP AND A MOBILE PHONE	54
FIGURE 36. RTP WEBSITE - ACCESSIBILITY AREA	55
FIGURE 37. VIDEO JS CUSTOMIZATION OPTIONS.....	56
FIGURE 38. SUS - PORTUGUESE RESULTS ON VIDEO JS PLAYER.....	57
FIGURE 39. SMALL SCREEN - LARGER SIZE SUBTITLE	58
FIGURE 40. FULL SCREEN - MEDIUM SIZE SUBTITLE.....	58
FIGURE 41. DIFFERENT SUBTITLE ADAPTATIONS IN MOOC.....	61
FIGURE 42. MOOC ONLINE SURVEY	62
FIGURE 43. RENDERING ERRORS IN SUBTITLE FONT, COLOUR, SIZE AND POSITION	65
FIGURE 44. RENDERING ERROR IN SUBTITLE BACKGROUND RENDERING	66
FIGURE 45. RENDERING ERROR: OVERLAPPING OF SUBTITLE LINES	67
FIGURE 46. DIFFERENCES IN RENDERING OF GAP BETWEEN SUBTITLE LINES.....	68
FIGURE 47. RENDERING ERROR IN SUBTITLE LINE PADDING.....	69
FIGURE 48. SCREENSHOT OF THE SUBTITLE VALIDATION SOLUTION "SUBCHECK"	72
FIGURE 49. 1ST QUESTIONNAIRE: LAUNCHER BAR	78
FIGURE 50. 2ND QUESTIONNAIRE: FIND VIDEOS WITH SUBTITLES IN THE RBB MEDIATHEK.....	78
FIGURE 51. 3RD QUESTIONNAIRE: SYSTEM USABILITY SCALE	79
FIGURE 52. 1ST QUESTIONNAIRE: SUBTITLE SETTINGS IN THE RBB MEDIATHEK.....	79
FIGURE 53. 2ND QUESTIONNAIRE: RATE SUBTITLE SETTING IN THE RBB MEDIATHEK	80
FIGURE 54. 1ST QUESTIONNAIRE: LAUNCHER BAR	81
FIGURE 55. 2ND QUESTIONNAIRE: SUBTITLE SETTINGS IN THE RBB MEDIATHEK.....	82
FIGURE 56. 3RD QUESTIONNAIRE: SYSTEM USABILITY SCALE PLUS NET SCORE PROMOTER	83
FIGURE 57. A LA CARTA SYSTEM	84
FIGURE 58. FRAGMENT OF SUS TEST	85
FIGURE 59. SUBTITLE SATISFACTION	88
FIGURE 60. PREFERENCES FOR SUBTITLE FONT SIZE AFTER TEST	89
FIGURE 61. PREFERENCES FOR SUBTITLE POSITION AFTER TEST.....	89
FIGURE 62. PREFERENCES FOR SUBTITLE BACKGROUND AFTER TEST	90
FIGURE 63. LEVEL OF COMPREHENSION OF THE CONTENT.	90

Tables

TABLE 1. OVERVIEW OF PHASES AND QUESTIONNAIRES IN SUB-PILOT	18
TABLE 2. IDEAL TEST GROUP CONSTELLATION BASED ON DEMOGRAPHICS	20
TABLE 3. ACTUAL TEST GROUP CONSTELLATION	20
TABLE 4. VALUES GATHERED FOR SUBTITLING ANALYTICS	28
TABLE 5. OVERVIEW OF PHASES AND QUESTIONNAIRES IN SUB-PILOT	32
TABLE 6. TEST GROUP CONSTELLATION	32
TABLE 7. TESTERS SUBTITLE SETTINGS PREFERENCES	38
TABLE 8. EBU-TT-D TEST SET: PROVIDED CONTENT AND RENDERERS USED	63
TABLE 9. TECHNOLOGY ABILITY SCALE	84
TABLE 10. FREQUENCY AND ABILITY IN TECHNOLOGY DEVICES.....	87
TABLE 11. SUBTITLE SETTINGS PREFERENCES	88

1. Executive Summary

Pilot A – Multi-Platform Subtitle Services of the Hybrid Broadcast Broadband for All (HBB4ALL) project set out to develop, pilot and test subtitle services in the hybrid broadcast-broadband TV (HbbTV) environment. To meet this challenge partners developed and implemented solutions to offer customized subtitle solutions across a number of platforms in different European countries.

This document reports on the sub-pilots carried out during the operational phase of HBB4ALL, their evaluation and outcomes. During the operational phase these services were available on-air and online to allow testing under realistic conditions.

In Germany and Spain, RBB and TVC respectively, introduced customised subtitles to their HbbTV VoD services. Implementing developments made in HBB4ALL both services went operational and were thoroughly tested for usability and acceptance among hard-of-hearing and deaf users. The services allow users to customise subtitles in terms of font size, subtitle position and background. In both cases the functions were introduced to existing graphic user interfaces. The tests showed a high level of acceptance among users in both services but also pointed out usability issues. Both RBB and TVC have optimised the usability of their respective services as a result of the user tests. They will both continue to offer the services after the end of the project. In Switzerland, associate partner TXT finished the introduction of subtitles into the HbbTV VoD services provided by SGR SSR in French, Italian and German.

Portuguese broadcaster RTP worked closely with UPM to develop and trial customisable subtitles in RTP's online VoD service. A change of policy at an operational level led to the use of a different player in the RTP online VoD service than the one originally specified. UPM, who had developed a plug-in technology for the original JWPlayer turned their development around by adjusting the coding to suit the new VideoJS player. The plug-in was implemented and the service tested with a group of users. The customisation options were found to be a very valuable and convenient feature by users.

In the sub-pilot Customised Subtitles for Online learning, VSX and UAB worked together to integrate customised subtitles into an online learning environment also known as a MOOC. Section 7 describes the technical implementation of the subtitles and the user tests.

In addition to running sub-pilots, partners in Pilot A worked together to test the interoperability of EBU-TT-D. Varying interpretations and/or coverage of specifications such as EBU-TT-D or/and HbbTV can cause the actual rendering results to differ from the rendering intended by the subtitle author. This in turn can affect the viewer's experience to a certain extent. IRT coordinated the tests with the aim of gaining insight on common issues which may occur when EBU-TT-D subtitle content and rendering solutions from different providers are combined.

IRT also continued to enhance a selection of service components during the final year of the project. They have added new modules to the Subtitling Format Conversion Framework (SCF) which continues to be used by RBB and TVC. Work on the SCF will continue beyond the end of HBB4ALL. IRT have also continued to develop the Lightweight Subtitle Editor, especially with the demands of creating comic style subtitles for youth audiences. IRT has continued to add new reference material for developers and manufacturers to facilitate a standard conformant implementation of EBU-TT-D. Finally, IRT have developed a subtitle validation solution called "subcheck". This software solution, designed for use by humans or machines, allows a contributor to check the subtitle file and if required correct possible defects before sending it to the broadcaster. Meanwhile Screen continued to develop commercial subtitle solutions.

As the user tests run in the sub-pilots involved human testers, the partners committed to following ethical and data protection guidelines covering the involvement of testers and the use of data generated during the test.

Pilot A has achieved the objective it set out to achieve. Sustainable workflows for subtitle production have been established using tools developed in the project, in the case of TVC, TXT and RTP in fully automated processes, RBB requires minimal human intervention. The partners have implemented solutions to offer customisation of subtitles in HbbTV services in the case of RBB and TVC and in online service consumed on PC and mobile devices in the case of RTP.

Results of the user tests conducted show that the customisation functionality is valued by the testers, even if they encountered usability issues.

Finally, the sub-pilots demonstrated the suitability of EBU-TT-D as a future proof standard for subtitles in online environments.

2. Introduction

The Hybrid Broadcast Broadband for All project (HBB4ALL) has investigated access services in the hybrid broadcast-broadband TV (HbbTV) environment. One of the most prominent challenges faced by broadcasters 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 additional challenge is to offer viewers the opportunity to customise the access services they are using to best meet their personal preferences or needs.

HBB4ALL has tested access services in four interlinked pilots; Pilot-A: Multi-platform subtitle services; Pilot-B: Alternative audio production and distribution; Pilot-C: Automatic User Interface adaptation – accessible Smart TV applications; Pilot-D: Sign-language translation services. The four pilots were carried out by four concurrent work packages, numbered WP3-WP6 respectively. Accordingly, WP3 was responsible for Pilot A in HBB4ALL. During the operational phase of the HBB4ALL project (for all Pilots A to D running from August 2015 – July 2016) the project partners implemented field tests to gather user feedback and to assess the acceptance and quality of services in various scenarios. For these tests, a number of different so-called sub-pilots were scheduled to be carried out in the operational phase.

To address the above challenges HBB4ALL partners in Pilot A – Multi-Platform Subtitle Services developed and implemented solutions to offer customized subtitle solutions across a number of platforms in different European countries. During the operational phase these services were available on-air and online to allow testing and evaluation under realistic conditions. In doing so the partners in this pilot achieved two of the main objectives of this workpackage¹.

During the operational phase partners also conducted interoperability tests and contributed to standardisation issues around subtitles. IRT as the main technical partner in Pilot A continued to optimise service components.

2.1. Purpose of the document

HBB4ALL deliverables “D3.1 – Pilot-A Progress Report” [1] and “D3.2 – Pilot-A Solution Integration and Trials” [2] provided an overview of the Pilot-A activities and achievements during the first 20 months of the project timeline. The preparations for the sub-pilots, specifically including the technical developments and preliminary user (lab) tests and their outcome, were described there. The reader is kindly referred to these documents for detailed information (specifically regarding the implementations of technical components by the partners).

The current document – being the final deliverable for Pilot-A – gives an overview of all sub-pilots carried out in Pilot-A during the operational phase of HBB4ALL. For each sub-pilot, chapters 3, 4, 5, 6 and 7 provide an overview of the goals, the piloted service, how it was set up, what was tested and for how long, which user groups were targeted and which testing and evaluation methodology was used. Last but not least,

¹ **Objective-A1:** A prototypical complete subtitle production workflow chain for multi-platform purpose for broadcasters which enables basic (HbbTV1.1/1.5) and advanced (HbbTV2.0) customised HbbTV subtitling services aligned with existing subtitling services and integrates broadcast news transcription systems for automatic subtitling and subtitle translation provided by Screen, IRT and VIC and tested on feasibility in house with experts at RTP, RBB and TVC in Portugal, Germany and Spain, and in parts also in Switzerland at TXT.

Objective-A2: HbbTV-based VoD services allowing users to add subtitles and also to customise them for large scale provision and testing in Portugal, Germany (Berlin-Brandenburg), and Spain (Catalonia), provided by RBB, IRT, RTP, TVC, UAB. Switzerland will be considered as additional target region

the evaluation of the sub-pilots' outcome, the results and recommendations resulting from the sub-pilots are provided.

The authors have tried to refrain from technical details and detailed results analysis in these main chapters; for readers who are interested in more details, we refer to the additional information provided in separated text boxes and/or in the annexes in chapter 13.

In addition to the sub-pilots, chapter 8 describes the interoperability tests for EBU-TT lead by IRT and chapter 9 goes on to describe technical advances made in Pilot A since the writing of D 3.2[2].

Chapter 10 outlines the sub-pilots approach to and handling of ethical issues. Chapters 11 and 12 contain conclusions and references.

2.2. Organisation of pilot phase

In Pilot A there were five operational sub-pilots:

- Customised HbbTV Subtitles for VoD Portal – Germany
- Customised HbbTV Subtitles for VoD Portal – Spain
- HbbTV Subtitles for VoD Portal – Switzerland
- Customised Subtitles for Wide-focus Multiplatform - Portugal
- Customised Subtitles for Online Learning - Germany

In regular telephone conferences the partners reported on the plans, approaches and progress of their sub-pilot. A further common topic was the interoperability testing of EBU-TT-D subtitles.

2.3. 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.

2.4. Definitions and glossary

Access Service [UK] = Accessibility service [US] 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 possible 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.

Arbeitsgemeinschaft der öffentlich-rechtlichen Rundfunkanstalten der Bundesrepublik Deutschland (ARD) The "Association of Public Broadcasting Corporations in the Federal Republic of Germany" consists

of nine autonomous regional public broadcasting corporations which are state-independent and publicly funded and the “Deutsche Welle” (DW), which is the media voice of Germany around the world.

Audio-visual Content means all kinds of time-based content consisting of images and sounds.

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, his Set-top Box (STB) or his PVR.

Content Delivery Network (CDN) is a large distributed system of servers deployed in multiple data centres across the Internet. These servers cache and store the content from Internet content providers that contract this service to enhance the availability and performance of the delivery of content to end-users, while reducing demand on the content provider's own servers.

Content Management System (CMS) is a computer application that allows publishing, editing and modifying content, organizing, deleting as well as maintenance from a central interface. Content management systems typically provide procedures to manage workflows in a collaborative environment.

Control, Remote (Remote Control) is also known as a remote, controller or sometimes channel changer. It is an electronic device used for the remote operation of a viewing device (*television set, set-top box or PVR*) often over very short distances within the home. The design of remote controls 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 and that impairs their ability to switch on or configure access services.

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

European Broadcasting Union (EBU).

EBU-TT EBU Timed Text is a new Subtitling Format specification (EBU Tech 3350). The format is based on the W3C Timed Text Markup Language (TTML) specification and provides an easy-to-use method to interchange and archive subtitles in XML.

EBU-TT-D is the format for the distribution of EBU-TT subtitles over IP as defined in EBU Tech 3380 specification.

HbbTV Hybrid Broadcast Broadband TV is a major pan-European initiative, building on work of previous initiatives (e.g., the Open IPTV Forum), to formulate standards aimed at harmonizing the broadcast and broadband delivery of entertainment to the end consumer through connected TVs and set-top boxes.

HTML HyperText Markup Language, commonly referred to as HTML, is the standard markup language used to create web pages. Web browsers can read HTML files and render them into visible or audible web pages. HTML describes the structure of a website semantically along with cues for presentation, making it a markup language, rather than a programming language.

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, 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. [For speech perception, the important region is between 250 and 4,000 Hz.] The term 'deaf' is used to describe people with such profound hearing loss that they cannot benefit from amplification, while the term 'hard of hearing' is used for those with mild to severe hearing loss but who can benefit from amplification.

Impairment, visual. Visual impairment (*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.

Subtitling Format Conversion Framework (SCF) is a set of tools provided by IRT in HBB4ALL for subtitle conversion between formats.

Set-top box is a device that contains a TV-tuner and performs tuning and decoding operations to provide an audio-visual output, which is displayed on a TV screen

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

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 converting 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]. Translation subtitling, which involves a change in language between the spoken dialogue and the displayed text [See also Subtitling, Inter-lingual] aims to convey as much of the meaning of the original language as possible.

Subtitling, Closed or User-selected Subtitles. The user has to select the service, c.f. Open Subtitling which is seen by all and cannot be turned on and off.

Subtitling, In-vision is a synonym for Open Subtitling.

Subtitling, Inter-lingual is also known as translation subtitling. The dialogue in the original audio content is translated into a different language in the text output.

Subtitling, Intra-lingual also known as same-language subtitling, or subtitles for the deaf and hard-of-hearing (SDH).

Subtitling, Live. Intra-lingual [most commonly] subtitles prepared at the moment of program broadcast or distribution. Usually live subtitles are created using stenography or re-speaking.

Subtitling, Open Subtitling where the user does not have to do anything in order to see the subtitles, as they are an integral part of the picture.

Subtitling, Pre-prepared. Subtitles prepared before the program is broadcast or distributed.

System Usability Scale (SUS) provides a “quick and dirty”, reliable tool for measuring usability. It consists of a 10 item questionnaire with five response options for respondents; from Strongly agree to Strongly disagree. Originally created by John Brooke in 1986, it allows you to evaluate a wide variety of products and services, including hardware, software, mobile devices, websites and applications².

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

Teletext or broadcast 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.

Transcription is the representation of the dialogue and lyrics within the sound track of a TV program in written form. Written equivalents of sound effects (and song titles etc.) may also be included in a ‘transcript’ if the intention is to produce captions (intra-lingual subtitles).

Translation Subtitles see Subtitling, Inter-lingual

Timed Text Markup Language (TTML) is one of W3C's standards regulating timed text on the Internet. TTML is used in the television industry for the purpose of authoring, transcoding and exchanging timed text information and for delivering captions, subtitles, and other metadata for television material repurposed for the Web or, more generally, the Internet. There is partial and full support of TTML in components used by several Web browsers plugins, and in a number of caption authoring tools.

Video on Demand (VoD) A system that allows users to select and watch video content of their choice on their TVs or computers. Video on Demand is one of the dynamic features offered by Internet Protocol TV. VoD provides users with a menu of available videos from which to choose.

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

² <http://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html>

3. Customised HbbTV Subtitles for VoD Portal – Germany (RBB)

3.1. Goals of the sub-pilot

The goal of the customized HbbTV subtitles for VoD portal sub-pilot was to provide and test customized subtitles in an HbbTV environment. The technical implementations for this sub-pilot were completed in advance of the operational phase and are described in detail in D 3.2[2]. A workflow for the production of the subtitles at RBB was defined and tested, this is also described in detail in the deliverable and the GUI of the VoD portal, referred to as a Mediathek was extended to offer customization options.

With all the above mentioned measures in place one goal of the operational phase was to ensure the production and workflow over a longer period of time. The main goal however was to run a field trial to test the usability of the customization functions over a significant period of time in realistic conditions. It was necessary to understand the steps users needed to take to access the service and any difficulties they encountered.

3.2. Description of service / application

3.2.1. Technical implementation (brief overview)

To enable the provision of subtitles to RBB's Mediathek services existing subtitles created for broadcast needed to be converted into a format suitable for online distribution and integrated into RBB's existing publishing and delivery systems. RBB added an instance of HBB4ALL's component *Subtitling Format Conversion Framework* (SCF) to its workflow to produce subtitles in EBU-TT-D format. In parallel RBB implemented an upload functionality for its web content management system (CMS) allowing editors to upload the pre-produced and converted subtitle files to the CMS and assign these subtitle items to video items, coming from the video production system and then pushed to the CDN.

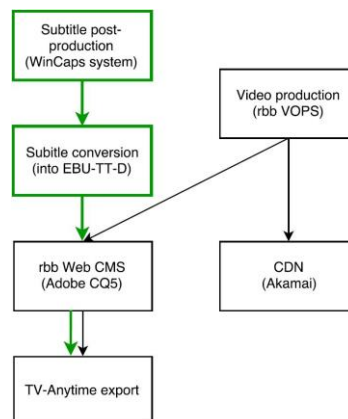


Figure 1. Workflow for subtitle production

The automatic ARD specific TV-Anytime interface is then able to export video and subtitle references to 2nd party systems, especially the actual Mediathek system ("CoreMedia") which automatically looks up the referenced subtitle resources, import and process them for delivery to end user terminals (after going through local broadcaster-specific Mediathek clients (PC, mobile and HbbTV), e.g. RBB Mediathek client).

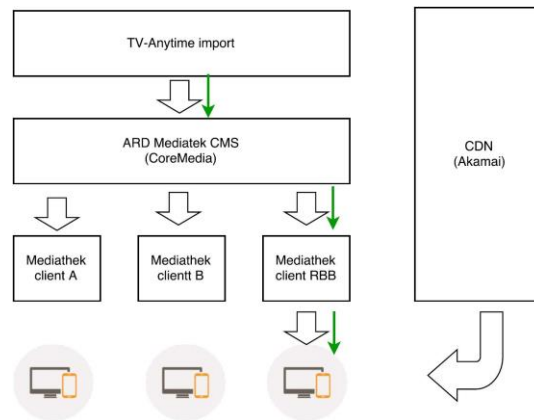


Figure 2. Subtitle publishing and delivery

During the operational phase the Mediathek system used in the ARD was based on a multi-tenant system, see **¡Error! No se encuentra el origen de la referencia..** Each regional broadcaster within the ARD had a “tenant” version of the ARD Mediathek. The tenant versions had the same or a subsection of the functions available in the master and each client had its own corporate branding and offers its own content.

3.2.2. Functionalities

The functionalities introduced to the RBB HbbTV Mediathek and tested in the operational phase were the option to activate or deactivate subtitles and options to customise the subtitles. Once the Mediathek application had been started, the user could go to the settings options called “Einstellung” in German. The settings were opened by pressing [1] button on the remote control.

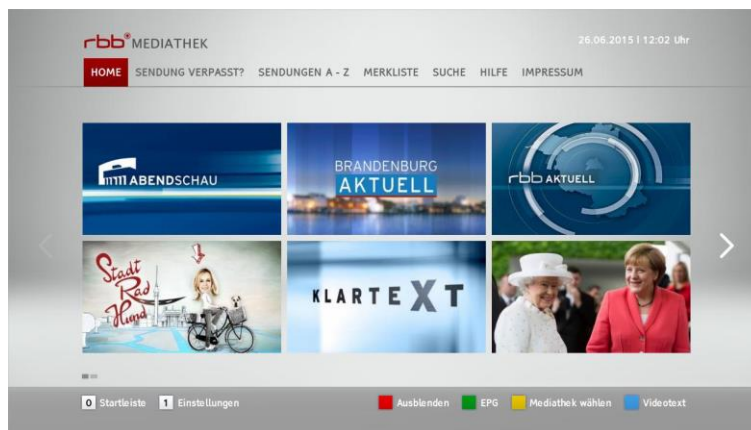


Figure 3. Landing page of the RBB Mediathek

Once the subtitle setting menu was opened the following options were available:

- Activate/deactivate subtitles

- Font Size. Users could choose from four different font sizes ranging from very large to small
- Position: Users could choose from three options, top of screen, bottom of screen or dynamic (as defined by editor)

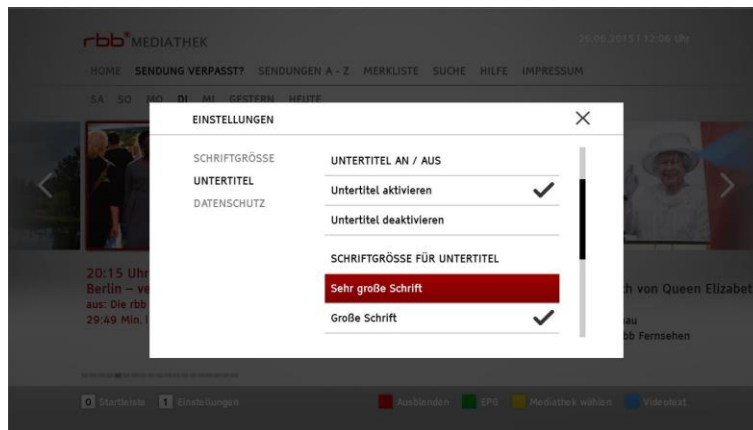


Figure 4. Subtitle settings GUI

In the video player itself the option to active/deactivate subtitles was introduced. The button UT (short for subtitles in German) was added to the player control functions. The UT button was only displayed if subtitles were available. The button logic followed the same logic as other buttons in the player controls, thus UT indicated subtitles were available and could be activated by pressing the button, and conversely UT indicated that subtitles could be deactivated by pressing the button.



Figure 5. Full screen player with player controls

While the player controls are visible on the screen the subtitles are automatically pushed to the top of the screen regardless of setting to avoid the controls covering the subtitles. The controls automatically disappear after a short time if not activated and the subtitles return to chosen setting. Videos with subtitles had the abbreviation UT added to the description of the video displayed in the Mediathek.

3.2.3. Availability of service

Customised subtitles in the RBB Mediathek were introduced in May 2015. Due to the technical set-up of the Mediathek system within the ARD, i.e. a multi-tenant system once the functionality was integrated it could also be introduced to other Mediathek services. The ARD Mediathek, i.e. “master” Mediathek that collects and offers all Mediathek content from regional broadcasters in the ARD (see Figure 2. Subtitle publishing and delivery), introduced customization option in August 2015 and three other regional broadcasters soon followed.

3.2.4. Intended audience

The intended audience is subtitle users primarily in the Berlin-Brandenburg area as this is the region RBB produces content for. However as described above the functionality was made available in the Mediathek service of a number of other broadcasters within the ARD network, automatically increasing the potential number of users of the functionalities. As a result, the application could potentially be accessed by ~6 million households in Germany with HbbTV-enabled devices.

3.2.5. Workflow / production aspects

At RBB, subtitles are converted into EBU-TT, published and delivered to the end user terminals for a synchronized display. D 3.2[2] provides a detailed description of the production workflow. This workflow was adhered to during the pilot operation phase. On average 5 video items with subtitles were published in the RBB Mediathek per week.

3.3. Description of user tests

3.3.1. Aim

The user testes conducted during the German sub-pilot had two main aims. The first aim of the user test was to quantify the long-term user experience of subtitle application and assess chances of market uptake. The second aim was to gather qualitative insights for system usability improvement of subtitle application using a visual logging approach.

3.3.2. Methodology

The methodology applied in this sub-pilot used a combination of quantitative and qualitative tools. The test concept included two parts. The first part was conceived as a field test with three phases. In each phase the testers completed questionnaires and forms in their home environment. In the second part testers were invited to participate in a co-creation workshop at RBB.

During each phase of the first part, i.e. home testing part, the users were provided with a combination of questionnaires.

- Quantifying long-term user experience

In order to monitor long-term development of user experience, the HBB4All consortium agreed upon the System Usability Scale (SUS) as a standardized instrument to measure usability as a core part of user experience. In the RBB context, it was used to assess the overall system usability of the subtitle application.

The survey was used in the first and third phase in order to assess both novice to intermediate status in using the application, while avoiding the risk of repetition when test participants have to fill the same survey too often.

In the third phase of the field trial the SUS survey was repeated, this time complemented with the Net Promoter Score in order to assess the market potential.

In the second phase a standardized Mini-AttrakDiff survey covering user experience aspects beyond usability, such as attractiveness and hedonic quality was used.

- Qualitative insights to improve system usability

The subtitle field trial was designed to gain insights on possible system improvements and new features. In order to gather related data, RBB chose to combine a visual logging technique followed-up with a co-creation workshop.

The instrument used for visual issue logging was a printed form with key screenshots of the application. The participants used the forms to log any problems they had by marking the corresponding screenshot and adding comments.

For each of the three phases, questionnaires were designed and created. Each questionnaire was colour coded and pages were numbered to ensure testers could differentiate between questionnaires. The questionnaire also had a title page with detailed instruction in simple German; this is a simplified way of writing German to ensure it is understood by people with low reading and writing competence. The visual questionnaires showed screenshots of the subtitle functions and the HbbTV launcher bar, as the Mediathek is started via the launcher bar. Testers were requested to use the screenshots to describe problems and provide comments. The other questionnaires (SUS, NPS, etc.) used standard scales.

Table 1. Overview of phases and questionnaires in sub-pilot

Phase	Instrument	Description
1	Visual questionnaire	Launcher Bar: The focus of this questionnaire was to see how well the testers understood and could use the launcher bar, which elements did they recognize and what function did they assign to it.
1	Visual questionnaire	Find Videos with subtitles in the RBB Mediathek: The focus of this questionnaire was to find out how testers looked for videos with subtitles in the Mediathek and understand the problems they encountered.
1	System Usability Scale	This was the first use of the SUS questionnaire to see how testers rated the overall experience of using subtitles in the HbbTV Mediathek.
2	Visual questionnaire	Subtitle Settings in the RBB Mediathek: The focus of this questionnaire was to find out what problems the testers encountered when they tried to change the subtitle settings, i.e. customize the subtitles to suit their needs and preferences.

2	Mini-AttrakDiff	Rate Subtitle Setting in the RBB Mediathek: This quantitative questionnaire was used to rate the overall use of the application by testers.
3	Questionnaire	Launcher Bar: This questionnaire concentrated perception, usability and understanding of details of the launcher bar identified as critical in earlier phase.
3	Questionnaire	Subtitle Settings in the RBB Mediathek: This questionnaire also concentrated on details identified as critical in earlier filed trail phase.
3	System Usability Scale plus Net Score Promoter	The standard SUS questionnaire was used to measure long-term user experience of the subtitles in the Mediathek. It was complimented with the Net Promoter Score which is used to assess market potential by asking the likelihood of recommending the system to a friend.

- Co-Creation Workshop.

Based on the visual issue reports the RBB team addressed the prevailing issues from the pilot and worked with the participants in small groups during the co-creation workshop to ideate, visualize and prioritize possible solutions.

The workshops had three parts. During the initial part testes were asked detailed questions about the HbbTV launcher bar. The intention was to deepen understanding of issues raised during the field trial. The second part was a discussion round based on solutions suggested by testers to problems identified when using subtitles in the Mediathek. Screens with the proposed solution were created in advance of the workshop and the testers were asked to rate them, the results were then discussed. The final part of the workshop was a user test of a click dummy for personalized HbbTV subtitles for linear broadcast TV. Although this application was not developed in HbbTV a prototype was developed in the EC funded Project HBBNEXT and provided the motivation and benchmark for RBB developments in HBB4ALL.

3.3.3. Testers

- Recruitment

For the tests RBB aimed to recruit 30 hard of hearing or deaf testers who used subtitles and showed a general interest in improving accessibility services for television. The groups should be as representative as possible and testers were required to be at least 18 years old. Men and women of differing ages from RBB's catchment area of Berlin and Brandenburg were contacted.

To test the service, testers needed to access RBB HbbTV based VoD service, the RBB Mediathek. Potential testers were screened to find out if they could access the service with the TV set they had at home. Testers who could not access the service because they did not have an HbbTV-enabled TV set were provided with an HbbTV set-top box by RBB which allowed them access the service.

Testers were recruited via several channels. The local user associations were provided with information about the tests and asked to inform their members. A number of testers were recruited via the RBB tester databank. This is a databank with names and contact details of testers from previous tests. New testers were recruited via RBB website, Facebook page and the RBB booth at the IFA consumer electronics fair, in September 2015. Other testers were recruited via online forum and social media groups for the target audience. Flyers were also sent to selected hearing aid practices in Berlin and the specialist clinics.

- Testers

The actual test group recruited consisted of 30 people, of who 17 were hard of hearing and 13 were deaf. Four testers participated in the workshop for the hearing impaired, and three testers participated in the workshop for the deaf.

Table 2. Ideal test group constellation based on demographics

Age	Percentage of total population	Number of testers
18-24	3, 5%	2 candidates
25-39	18%	5 candidates
40-59	30%	13 candidates
60-64	6%	10 candidates
65 and older	20%	
male/ female	50 / 50%	15 / 15 candidates
Berlin/ Brandenburg	50 / 50%	15 / 15 candidates

Initially 33 testers were recruited, in total three testers did not return any completed questionnaires and were removed from the evaluation. Thus the final evaluation is based on 30 participants.

Table 3. Actual test group constellation

Age	Percentage of total group	Number of tester
18-24	11, 76%	2 candidates
25-39	17, 65%	7 candidates
40-59	47, 06%	16 candidates
60 and older	23, 53%	5 candidates
male/ female	47, 06 / 52, 94%	16 / 14 candidates
Region Berlin/ Brandenburg	29, 41 / 52, 94%	15 / 10 candidates
Other Regions	17, 65%	5 candidates

A sub-sample of pilot panel was invited to attend the workshops, eight testers were selected to represent the distinct user patterns present in the sample (based on analysis of surveys and visual issue reports).

All testers who actively participated in the test received an allowance of 100 Euros. For the participation in the workshop they received an allowance of 50 Euro.

3.3.4. Report on test

The user testing of the customized subtitle function in the RBB HbbTV Mediathek started on 21st September 2015 and concluded on 28th January 2016.

The first part of the field test consisted of three phases. For each phase all test candidates were sent a package containing detailed information about the test procedure, instructions on how to participate in the test and the contact details of their contact person at RBB if they needed any help or had any questions.

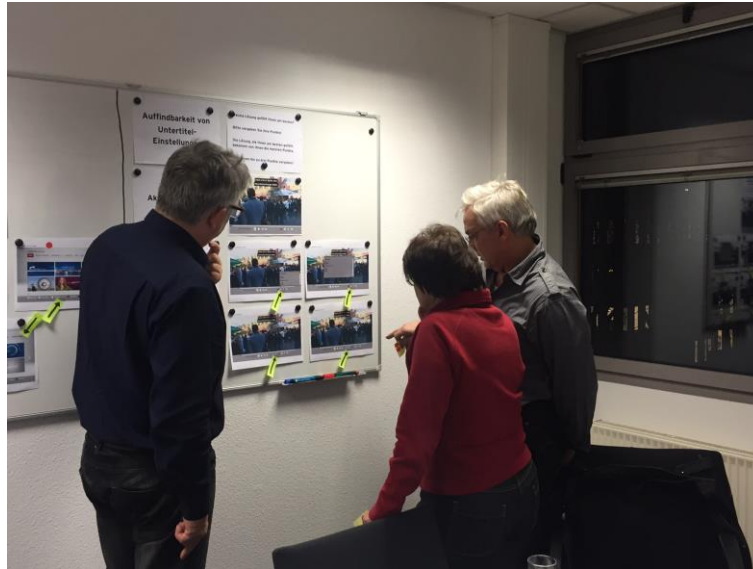


Figure 6. Participants discussion option at workshop

The second part of the field trail was co-creation workshops. The workshops were held on two consecutive evenings in January 2016 at RBB premises in Potsdam. The first workshop was attended by four hard of hearing testers and the second workshop was attended by three deaf testers.

3.4. Evaluation of sub-pilot

3.4.1. Visual questionnaire results

The visual questionnaires returned by tester were documented, coded and categorised using the Grounded Theory Method³. To provide a better overview of the problems reported by testers, for each screen all responses were collected on one master form.

³ Barney G. Glaser; Anselm L. Strauss: Grounded Theory. Strategien qualitativer Forschung (1998)

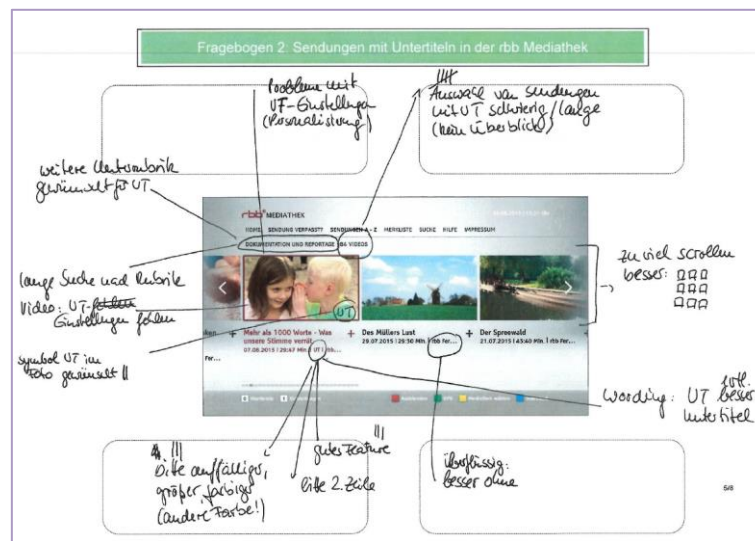


Figure 7. Example of master form for visual questionnaires

The testers used the screens to describe problems but also suggest solutions.

The most frequently reported problem in both phase 1 and phase 2 were problem finding videos with subtitles. The majority of users wanted to have quicker, more intuitive access to content with subtitles. They requested more visual feedback when navigating through the content and an additional button for “subtitles” in the navigation structure. A more structured content overview of content in the Mediathek with sub-categories was also requested.

The testers had similar problem finding the customisation options for subtitles. The majority of testers would like to see a clear, visible symbol to indicate the customisation options in the user interface. Not all participants were familiar with the abbreviation “UT” for Untertitel (German for subtitles) and would have preferred to have an unambiguous symbol.

A further problem for the participants was the logic applied to the UT button in the Mediathek player. The button in the player controls is defined as an action button and the graphical representation depicts what will happen if the user clicks on the button. Accordingly when subtitles were active the UT button was crossed out (✗). However this logic confused the majority of testers, who interpreted that a crossed out UT button (✗), meant the subtitles were deactivated.

3.4.2. Standard questionnaire results

The SUS questionnaire was used twice during the test, in the first and the third phase. The main focus of the user tests in phase 1 was to find videos with subtitles. The SUS questionnaire completed during this phase indicate that testers found the service relatively unsatisfactory. This result correlates with results for the visual questionnaires which also indicated the respondents had difficulties finding subtitled videos among the large volume of content available in RBB’s catch-up TV service.

The second time the SUS was used in the sub-pilot was during Phase 3. The focus of the user tests in this phase was on the customisation of the subtitles. The SUS results in this phase were more positive than in the first phase. This also appears to support the findings of the visual questionnaires. By phase 3, the respondents

had more experience using the Mediathek and subtitles. But although many reported problems finding the customisation setting, they did not report many problems using the settings.

In Phase 3 in addition to the SUS, the Net Promoter Score (NPS) was used. The NPS is generally used to measure loyalty between a provider and a customer by asking the respondent how likely it is that they would recommend the service or product to others. NPS can range from -100 to +100, any positive NPS is considered to be good. The NPS for customisable subtitles in the HbbTV Mediathek was 28%. This score indicates that the service could be successful. When the SUS and NPS results were compared it was found that respondents that had given the service a low usability rating gave it a high NPS score. A possible explanation is that the usefulness of the service outweighs any usability problems.

The Mini AttrakDiff, used to measure overall satisfaction with the usability of the system, contained 10 pairs of opposing adjectives. The results appear to correlate with the results of both the SUS and NPS. Even though the usability was not rated particularly highly, there was a strong identification with the product, i.e. the testers realised the subtitle function was designed for them.

3.5. Results and Insights

Based on the evaluation of the user tests in the sub-pilot, RBB Innovation Projects formulated the following recommendations improve the usability of the customisable subtitles in the Mediathek.

- Finding videos with subtitles in the HbbTV Mediathek

The first recommendation to help users easily find videos with subtitles in the Mediathek was to adopt the approach used by RBB during the trail. RBB created a teaser graphic. By clicking this testers were offered an overview of all videos with subtitles. This was available during the tests but quite often the testers did not often find it as they first had to scroll through several pages. The recommendation was to create the teaser graphic and place this on the first page of the Mediathek.

The second recommendation was to also introduce further categories of content in the Mediathek header. The categories should cover available accessible service, i.e. Subtitles, Sign Language and Audio Description

- Finding the customization settings for subtitles in the RBB Mediathek

At the time of testing, testers had to press the [1] button on the remote control to access the customization settings. Once they had left the start page of the Mediathek, or were on a preview page or had opened the full screen view of the player there was no visual reminder of the function of the [1] button. The recommendation was to use the UT button in the Player to directly access the customization settings. If a video has subtitles the UT button should automatically be displayed. By clicking the button the user accesses the setting options and can activate/deactivate the subtitles and change the change the other customization options.

A further recommendation was to use clearer wording and labelling for the settings options to distinguish between the option for changing the size of the font on the Mediathek application and for changing the subtitle settings.

- Subtitle button logic in the Mediathek player

As described in section 3.4.1 the testers found the logic on the subtitle button in the player controls confusing. The recommendation here was to reverse the logic in line with testers' expectations.

The above recommendations were presented to and discussed with members of ARD.de, who are directly responsible for technical maintenance of the HbbTV Mediathek services in the ARD. As a result, the following changes have been implemented to the ARD Mediathek player.

- The logic of the UT button has been changed. When subtitles are available for a video and activated the UT button appears. If the subtitles are deactivated the UT button is struck through (UT)
- When the user presses the UT button in the player controls a short menu opens with the following options to activate subtitles, deactivate subtitles, settings. The settings are no much easier for users to find, they now see the setting option each time they activate or deactivate subtitles via the player controls. In addition to this option users can still find subtitles settings in the general settings menu.

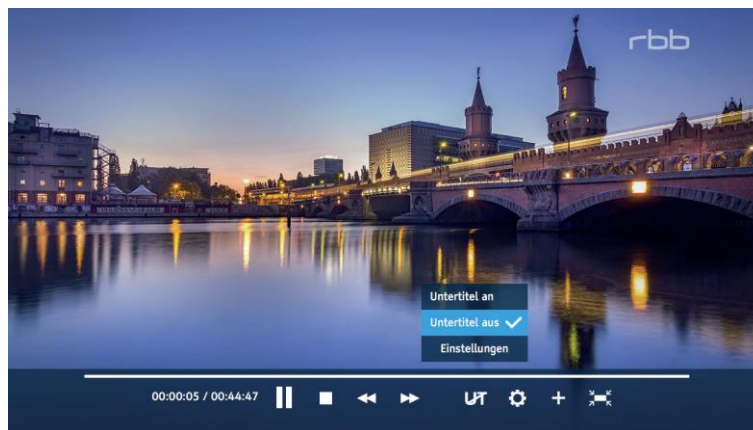


Figure 8. Short menu to de/activate subtitles and change settings

When the setting option in the short menu is selected an overlay open over the screen with the setting options.

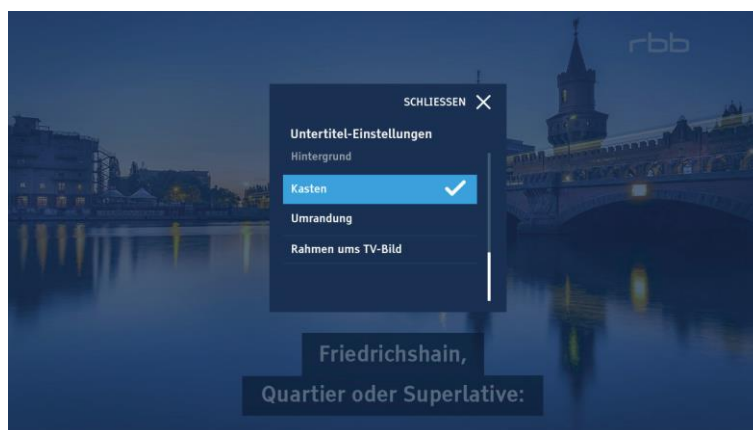


Figure 9. Overlay with subtitle settings

Several solutions to help to increase the visibility of videos with subtitles in lists, thus making it easier for users to find subtitled content, have been discussed. At the time of writing a decision about the implementation of these solutions is pending.

During the user tests, two out of three desired subtitle adaptation aspects have been implemented: font size and text positioning. The remaining feature for implementation is the adaptable subtitle background, i.e. the way a subtitle text silhouettes against the underlying TV picture. RBB plans to add an outline option to the currently implemented box option, as well as an option to scale-down the TV-picture with the display of the subtitles pushed below that picture, so that no occlusion of the video can occur.

This feature has now also been implemented in the Mediathek. Users can now choose between three backgrounds – outline, box or scaled TV screen.



Figure 10. Scaled video with subtitles displayed underneath the video

A further recommendation was to introduce subtitles and customisation options into the preview video page. This has also been implemented.

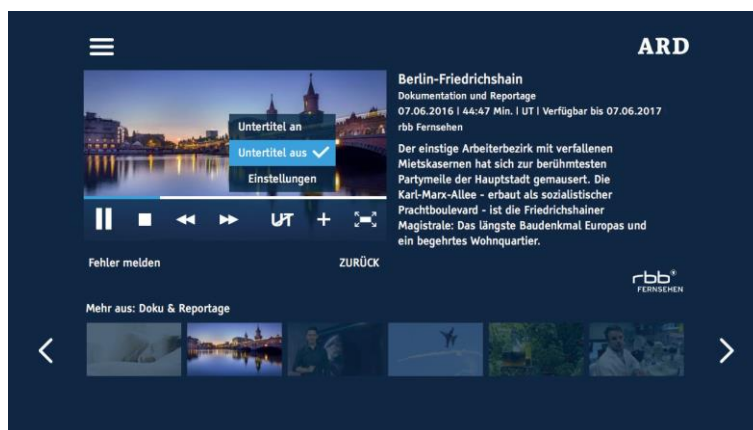


Figure 11. Preview page in Mediathek with short subtitle menu

Last, but not least, it is worth mentioning that since the sub-pilot started the ARD has changed the general structure of its HbbTV Mediathek system away from a multi-tenant system to an integrated model. This means that all broadcasters using the ARD HbbTV Mediathek structure share the same functionalities. The content is filtered according to which broadcaster or TV channels' Mediathek is selected. The system is currently used by eight regional TV channels, one national TV channel "One" and the "ARD Mediathek" which contains all content from the other Mediatheks. The implication for subtitles is that once subtitles are available in one of these Mediatheks, they are automatically customisable, thanks to the developments and progress made in HBB4ALL.

4. Customised HbbTV Subtitles for VOD portal – Spain (TVC/UAB)

4.1. Goals of the sub-pilot

This sub-pilot in Catalonia aimed to address two of the four objectives set out in this work package, namely objective A1 by implementing a single workflow platform for the production and distribution of subtitling for both, broadcast and broadband. A further goal, in line with objective A2 was to deploy and test a personalized subtitle service as part of the TVC HbbTV-based VoD service.

4.2. Description of service / application

4.2.1. Technical implementation (brief overview)

The EBU-TT-D subtitle standard was chosen as the protocol to be used in HbbTV 2.0, but nowadays HbbTV 1.0 & 1.5 devices do not support subtitling natively. To solve HbbTV limitations TVC developed a personalized subtitling layer on its HbbTV-based VoD application that allows EBU-TT-D subtitles to be displayed over video as HTML. This implementation of subtitle customization requires a processing effort that not all TV devices are able to perform (See 4.2.3 availability of service). When the TV device has the processing capability the customization of the subtitle is implemented by mapping EBU-TT-D to HTML and CSS properties. For further information see deliverable D3.2 [2]

There are three personalization configurable parameters; the background, the font-size and the position of subtitles. The personalization of the background is achieved by an override background-colour CSS property (at “Subtitle line” layer), the CSS text-shadow property is added to increment contrast when the background is transparent. The font-size personalization is carried out by means of font-size CSS property (at “Region Layer”). Finally, the position can be top or bottom of the screen based on a mirroring render technique. In the mirroring technique the positioning of subtitle regions Y axis is reversed, modifying CSS layer top property, as follows:

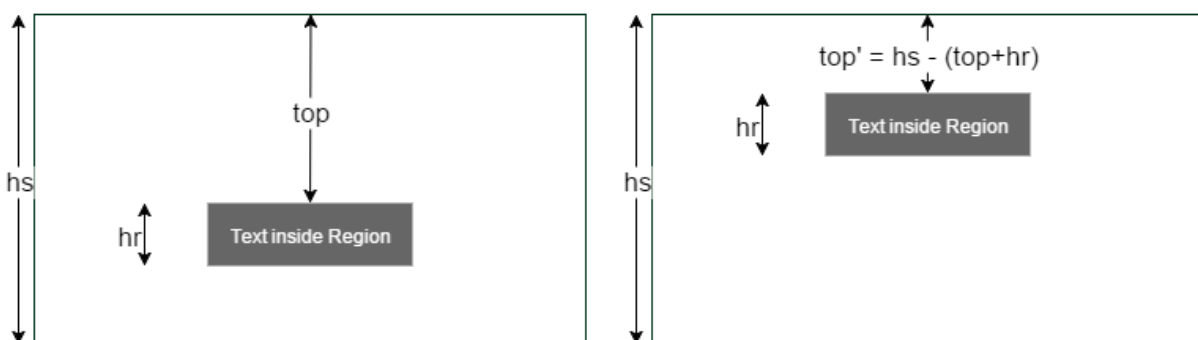


Figure 12. Mirroring technique

In mirror technique, if a couple of regions coexist in time, which is unusual but feasible, as result the order of subtitles are reversed during the painting, causing difficulties to follow some dialogues.

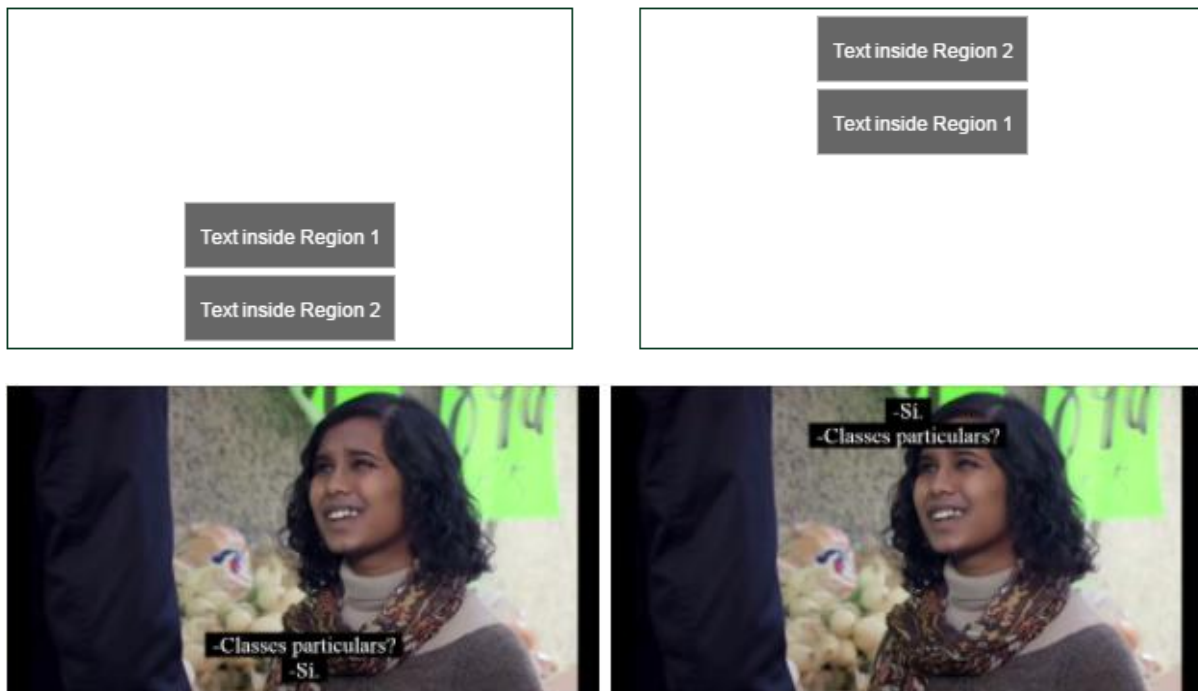


Figure 13. Mirroring technique - inverse order issue

The system uses cookies to store the user preferences, if the TV device has the cookies enabled then new personalization preferences are saved automatically and it will be used next time the subtitling is required. If cookies are disabled then the default setting personalization preferences is loaded.

Finally in order to monitor the use and consumption of the subtitles, TVC (OTT service) gather the follow information:

Table 4. Values gathered for subtitling analytics

FIELD	DESCRIPTION	VALUES
Receiver	Standard or Low profile. Some devices do not have enough performance to synchronize subtitles and are not candidates to activate them.	SP / LP
Subtitles Available	Reports whether the content has subtitle file attachments	True / False
Subtitle State	Reports whether the user has activated subtitles	Enabled / Disabled
Subtitle customization	Reports whether the user has activated customized subtitles	Enabled / Disabled
Font size	Subset. Customized subtitles Font-size choice	Small / Medium / XL
Position	Subset. Customized subtitles Position choice	Top / Bottom
Background	Subset. Customized subtitles transparent Background choice	True / False

The information collected is processed through Adobe Omniture tool allowing track the usage and acceptance of the personalization possibilities of the service.

4.2.2. Functionalities

After publishing EBU-TT-D subtitles for video on demand the next step was customization. In addition to de/activate subtitling on TVC's HbbTV player, the new added features introduced were:

- Standard subtitles (without any personalization)
- Customized subtitles based on:
 - Background or transparent
 - Font-Size
 - Position.

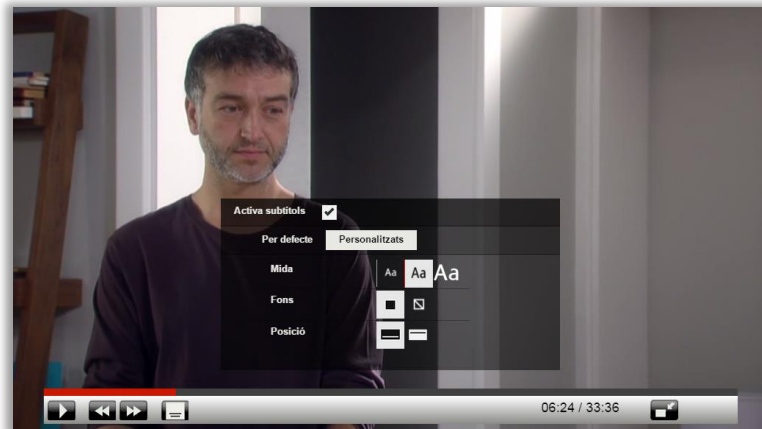


Figure 14. HbbTV player with customizable parameters

Each time the user modifies subtitles preferences, the new configuration is saved. Therefore, if subtitle content exists in the next video playback then they will be automatically activated. As a result hearing impaired users do not need to repeat the set-up process every time they choose a video because last stored preference is always recovered.

With regard to subtitles background customization, the user can choose whether the background colour is opaque or transparent. In that case, to avoid reading difficulties, a shadow has been added to characters aiming to enhance readability, i.e.: white alphabetical characters over a snow landscape could be difficult to read without this shadow.

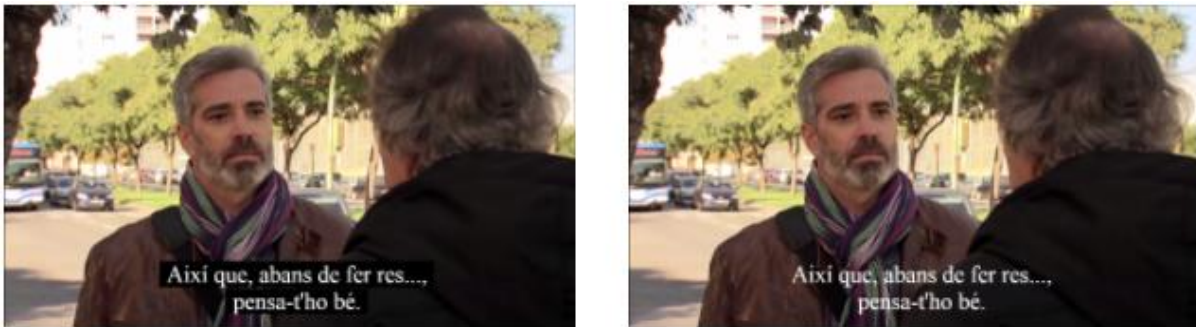


Figure 15. Background customization example

Subtitles have a default font-size, the same as in the origin EBU-TT-D file. The customization parameters allow to set-up a smaller and a larger size, referenced to default-case.



Figure 16. Font-size samples

Subtitles position setting allows the user to watch subtitles painted at the top or bottom of the screen.

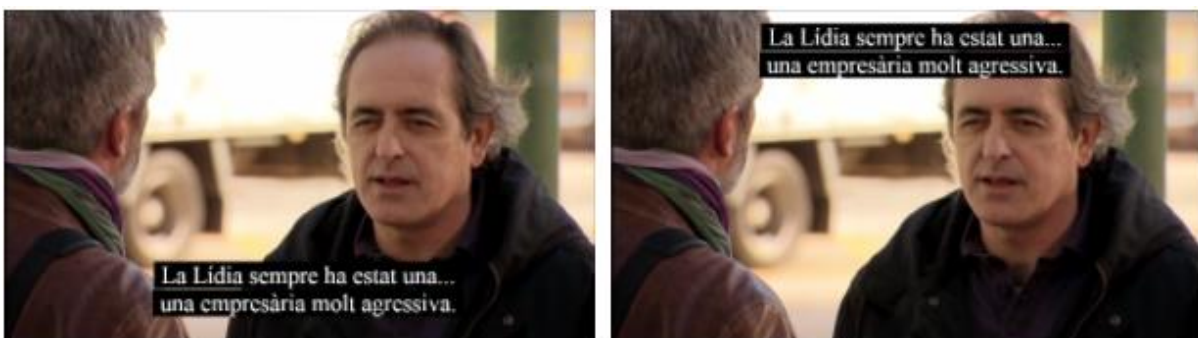


Figure 17. Position customization example

4.2.3. Availability of service

The HbbTV subtitles service is available since June 2015. A new service version with customizable options was released in January 2016 aiming to remain in production indefinitely. Specifically, the pilot period started in March 2016 and finished in August 2016.

4.2.4. Intended audience

Initially all potential HbbTV viewers were offered this service but some limitations were detected during the subtitle application development related to performance capabilities of the TV devices. Some devices were

not powerful enough to accurately reproduce synchronized subtitles. To solve this issue, it was necessary to add a process to the subtitling service which analyses and classifies the device as a low profile or standard profile TV. If the device is classified as a low profile, the subtitling service will not be available. The data collected in the pilot period showed that HbbTV standard profile reaches 90% of the total HbbTV devices in the Catalonia region.

4.2.5. Workflow / production aspects

No changes were made at workflow level to those described in detail in D3.2 [2]

4.3. Description of user tests

4.3.1. Aim

The user tests conducted during the customized HbbTV subtitles for VoD portal in Catalonia sub-pilot had two main aims. The first aim of the user test was to quantify the user experience of subtitle application and assess chances of market uptake in terms of user satisfaction and comprehension. The second aim was to gather qualitative insights for system usability improvement of subtitle application using a visual logging approach. Some control variables were included, such as sociodemographic or technology ability variables.

The test concept included three stages. The first stage was conceived as an observation of the user trying to set the program required and the subtitle options, with or without the assistance of the researcher. The second stage consisted of visualization of the contents and the tech ability scales. And the third stage was the comprehension test plus the possibility to change subtitle settings according to user satisfaction.

4.3.2. Methodology

The methodology applied to the user test combined both qualitative and quantitative tools. The test included three phases, each of which used a combination of tools.

- Qualitative insights to improve system usability

The subtitle field trial was designed to gain insights on possible system improvements and new features. In order to gather related data, UAB choose to follow a two-option approach: some users were given instructions on how the system functioned (“with instructions test”) beforehand and some users were not (“without instructions test”). The duration of the program and subtitle settings was timed. In both cases, assistance was given if required, and if so it had to be reported in the test by the tester. The user had to choose the subtitle settings (customization): size, position and background.

Instrument: observation and stopwatch.

- Quantifying user experience

In order to monitor the user experience, the HBB4All consortium agreed upon the System Usability Scale as a standardized instrument to measure usability as a core part of user experience. In the TVC context, it was used to assess the overall system usability of the subtitle application. The survey was used in the second phase. In addition, a standardized technology ability scales covering user experience aspects with technology was used. In the third phase of the field trial, users responded to a comprehension test with eight questions.

Overall, these are the instruments that were used: Observation, Technology ability scales, System Usability Scale, Comprehension test.

Table 5. Overview of phases and questionnaires in sub-pilot

Phase	Instrument	Description
1	Observation and stopwatch.	The participants were given the task of changing the subtitle settings (customization): size, position and background. While they were doing this they were observed and timed.
2	Sociodemographic questionnaire	The questionnaire contained eight sociodemographic questions (age, place of birth and residence, sex, education, fluency in spoken and written Catalan, frequency of subtitle and media use), a question to verify whether the participants had seen the program tested (“QuèQuiCom”) - and if so, how long ago - and another question to check whether they had seen the specific episode (“Fer el lluç”).
2	Technology Ability Scales	The technology ability scales was used to control the dummy variables “technology experience and ability”.
2	SUS	System Usability Scale was used to assess the user satisfaction with the whole system
3	Comprehension Test	The comprehension test contained eight questions about the content of the video and a question about how to “improve” the subtitle setting previously chosen.

4.3.3. Participants

- Recruitment

Researchers from UAB recruited 44 people, 22 of whom were over 65 years old, as participants for the test. The participants showed a general interest in improving television access services. The groups of participants tried to be as representative as possible, including men and women of different ages from TV3’s catchment area of Barcelona.

In order to test the service, participants needed to access TV3 HbbTV based VoD service, TV3 A la Carta, select the episode and program as required and set the subtitles. Next, they had to watch the content for 11 minutes. Participants were recruited at a gym in Barcelona in April 2016.

- Participants

The actual test group recruited consisted of 50 people, of whom 6 were discarded due to several problems: dyslexia, reading problems or unfinished tests. Thus, the final evaluation was based on 44 participants (see table 6).

Table 6. Test group constellation

Age	Percentage of total group	Number of participants
4-18	2.3%	1 candidates
25-34	2.3%	1 candidates
35-44	11.4%	5 candidates
45-54	18.2%	8 candidates
55-64	15.9%	7 candidates
+65	50%	22 candidates

male/ female	40.9% / 59.1%	18 / 26 candidates
Region Barcelona	100%	44 candidates

4.3.4. Report on test

The user test was conducted over three days from 25th to 27th April 2016 from 8 am to 8 pm. Researchers from UAB recruited the participants and conducted the test with them at a gym in Barcelona. The tests were conducted in a quiet area using two HbbTV sets provided by TVC.

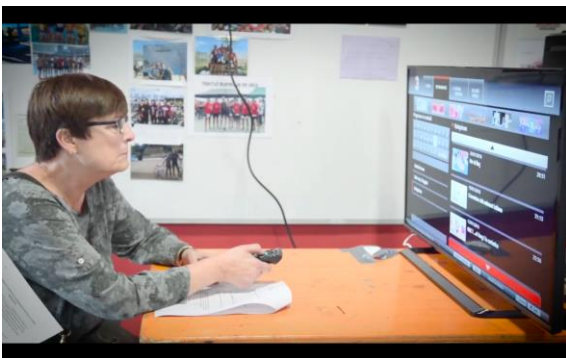


Figure 18. Spanish sub-pilot test



Figure 19. Helping tester in Spanish sub-pilot (qualitative test)

As described in section 4.3.3, the users were asked to select a program and episode and set the subtitles. They were timed while completing this task. 23 users had been given prior instructions on how to use the system and 21 had not. The focus of the observation phase was to see how well the participants used the system, the time it took them to set the subtitles and what specific problems they encountered.

- Quantitative test 1

As part of this test the technology ability questionnaire was used to control the influence of “dummy” variables on the opinion and ability with the system, and the comprehension of content. As can be seen in Figure 20, the majority of participants had regular skills, although some of them confessed to have few skills.

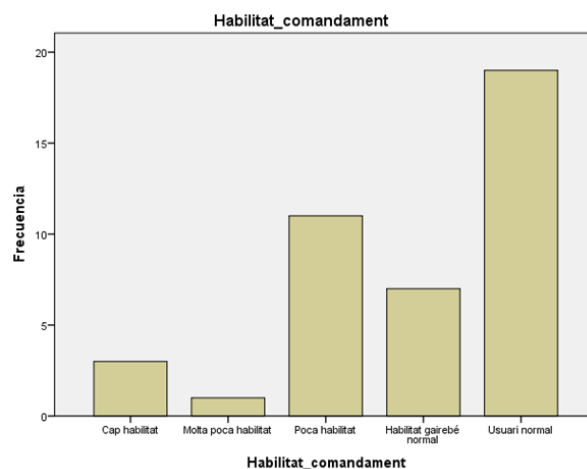


Figure 20. Remote control skills

- Quantitative test 2

The focus of this test was to look for links between different levels of comprehension and the customization of subtitles. Participants were given the chance to change the initial customization of subtitles, so the observers could see the satisfaction and, most importantly, the final preference of subtitles settings after having some experience with them during the tests.

4.4. Evaluation of sub-pilot

4.4.1. Results of qualitative tests

The following is a list of the problems participants encountered when using the system for the first time:

1. “Triangle button” to scroll down the episodes of programs: instead of using this button, 9 users were pressing the down arrow on the remote control.
2. “Triangle button” and “subtitles setting disappearing too quickly”: 3 users had these two problems simultaneously.
3. “Multiple problems”: 9 users said the system had more than two problems, especially the triangle button, the subtitles settings disappearing too quickly and other general steps of the system.
4. “Remote arrows to navigate in the system”: 5 users from the non-instruction tests did not understand right away the use of these arrows.
5. “Subtitles settings disappearing too quickly”: 3 users confessed to have this specific problem.
6. “Icon of subtitles setting”: only one user did not recognize this button from the remote.
7. “The system step-by-step:” one user could not follow the steps of the system to find and select contents, and customize the subtitles.
8. “Speed of subtitles”: one user complaint about this.

As can be seen in Figure 21, there were three main problems: the triangle button, the subtitles setting disappearing too quickly and the arrows of the remote control. The rest of the problems are insignificant.

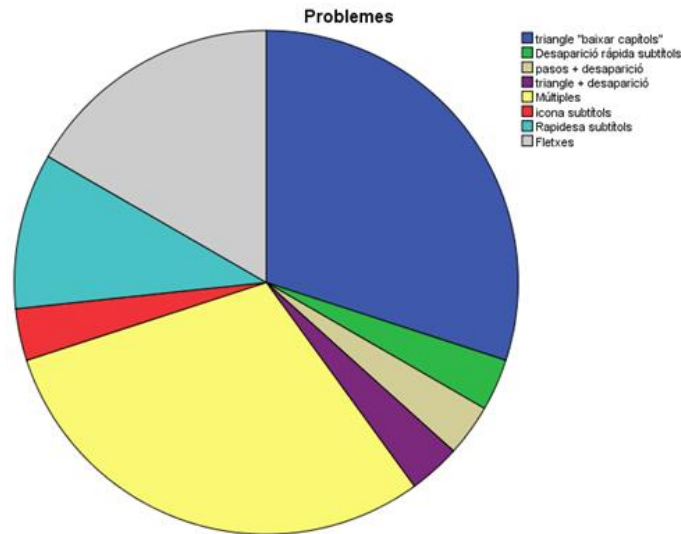


Figure 21. Types of problems found by participants.

The average time spent in the program selection and subtitles customization was 2 minutes and 52 seconds. For those that received instructions beforehand, the average was 1 minute 38 seconds while for those having received no instructions was 3 minutes and 7 seconds.

And thirdly, the subtitles were customized as follows:

Table 7. Testers subtitle settings preferences

Size	Users	Position	Users	Background	Users
Large	15	Top	5	Black	26
Medium	19	Bottom	39	Transparent	18
Small	10				

There are some clear patterns, especially regarding the position and background options of subtitles.

4.4.2. Results of Quantitative Test 1

The results detailed in Chapter 13.3 indicate that sociodemographic, educative and technology variables among the participants were quite homogenous, typical of an advanced society rapidly adapted to the new technological paradigm, so no influence of these variables on the system's management, subtitles selection and content comprehension was expected.

The results of the SUS always pointed to a moderate satisfaction with the system, with positive statements having a score closer to 5 and negative statement always having a score closer to 1. If required directly in a yes-no question, participants were clearly rather satisfied with the whole experience.

4.4.1. Results of Quantitative Test 2

As expected, the second test reinforced certain patterns observed in the first part of the user test. Firstly, the most favoured position for subtitles is the bottom of the screen. There is no clear consensus about whether

small or medium size is the most preferred but the large subtitles are not preferable. Likewise, in terms of background, half of the users prefer a black frame while half prefer a transparent background.

Finally, the level of comprehension was very satisfying. From a total of eight questions on the content of the TV show, 5 users responded correctly to all of them, 18 users responded correctly to 7 questions, 12 users to 6, 5 users to 5 and 3 users responded correctly to 3 questions.

One may conclude that, although participants have clear preferences for subtitles settings (probably due to comfort, ability or culture), this does not influence the comprehension of content.

4.5. Results and insights

The evaluation of the user tests in the sub-pilot allowed CCMA to detect and address some issues related to user interaction with the front-end of the HbbTV "TV3alacarta" service. As a result, some improvements were implemented in the TVC HbbTV service to allow a better navigation through menus and options, while other improvements are planned to be implemented in future service versions.

As an example, users would appreciate more information about which content has subtitles and which content has no subtitles. This information is being implemented and will be added in future service versions.

As demonstrated by results of Quantitative Test 2, the most favoured position for subtitles is the bottom of the screen, and large subtitles are less preferred than other sizes. Based on the results, the default subtitle settings in TVC HbbTV VoD service were modified to show subtitles at the bottom of the screen with normal size. Once the user changes the default settings the new subtitle settings are saved for future playback.

Some changes were also implemented in CCMA software code to improve the display of EBU-TT subtitles on HbbTV SmartTVs using a more accurate reading and better analysis of the protocol during the translation process to HTML and CSS which finally overprints the subtitles on the TV screen.

The Corporació Catalana de Mitjans Audiovisuals (CCMA), TVC owner, is committed to universal accessibility and has shared the software code used to show subtitles on its TV3alacarta HbbTV VoD service. This was one more step by CCMA towards universal access to content, aimed to push the widespread accessibility services among all actors involved in the global television market through HbbTV.

The software, which is now publicly shared as open source, allows printing subtitles over video using the EBU-TT-D standard, regardless of the player and version of the HbbTV standard. The open source code and a use case example can be found on the GitHub⁴ platform, specializing in open source under licenses for unrestricted reuse.

CCMA also published details of the operation of its subtitling service in a dedicated HbbTV developer's portal, the HbbTV-developer⁵. Thus, the code is opened to professionals who want to develop subtitling systems that use the same technical standards.

TVC HbbTV "TV3alacarta" is available as a public service since June 2015, and was extended with customized subtitling features in November 2015. So now TVC has established one subtitling workflow for

⁴ More information: <https://github.com/CCMA-Enginyeria/ebu-tt-d-parser>

⁵ More information: <http://www.hbbtv-developer.com/site/blog/?p=897>

broadband and broadcast which uses DVB for broadcast, WebVTT for web catch-up and EBU-TT-D for HbbTV services.

Future implementations are foreseen to extend subtitles to all mobile apps and some private content provider portals. TVC is also studying a possible customization of subtitle colours by end-users with the aim of achieving better visualization for people with some degree of colour blindness.

HbbTV version 2.0.1 will add EBU-TT-D subtitles compatibility, so a new TVC HbbTV catch-up implementation is foreseen to take advantage of new HbbTV 2.0.1 features for VoD and live subtitling. As legacy with previous HbbTV 1.0 and 1.5 versions is important, any implementation will identify which HbbTV version is installed on the SmartTV and implement the best VoD execution for every screen.

5. HbbTV Subtitles for VoD – Switzerland (TXT)

The aim of the sub-pilot in Switzerland was to introduce subtitles to the three HbbTV VoD services, each in a different language, provided by SRG SSR⁶. In a fully automated process, the existing subtitles created for broadcast are converted from TTAF into JSON. JSON is used as HbbTV 1.1, which is used for the SRG SSR HbbTV client, does not natively support the rendering of any subtitle format.

TXT subsequently introduced subtitles into the Italian language HbbTV VoD service offering in Switzerland (RSI+) by December 2014. In May 2015, TXT introduced subtitles in the French language HbbTV VoD service (RTS+); this was followed by the introduction of subtitles to the German HbbTV VoD service in 2016. The VoD player used in the services allows users to activate or deactivate the subtitles. The subtitles, which offer no further customisation options, are presented in the optimal size, as defined in the DTV4ALL project. No user trials were planned in this sub-pilot.

⁶ The Swiss Broadcasting Corporation, owner of SWISS TXT

6. Customised Subtitles for Wide focus multi-platform – Portugal (RTP/UPM)

6.1. Goals of the sub-pilot

RTP Play is an Internet catch-up service for viewing programmes and content previously broadcasted on the radio and television channels of the public Portuguese broadcaster RTP. It includes programmes from RTP1, RTP2 or RTP International, for example, presenting pre-recorded content. Users can access the service via desktop browsers as well as smartphone and tablets.

The main objective for RTP for this sub-pilot in HBB4ALL was the deployment and testing of a plugin for the player used by the RTP Play platform, to provide subtitles over broadband to be presented on a variety of devices, including PC, tablets and smartphones. A team from UPM with expert knowledge in the implementation of accessibility tools, such as presentation of sign language videos or subtitles, supported RTP during the sub-pilot.

The inclusion of the specification EBU-TT-D among the access services of RTP is an important issue to improve the distribution and contents for all. While RTP is interested in the delivery of multimedia content via Internet its main focus is on the distribution for IT devices, such as laptops, computers, tablets and smartphones. In this way, this sub-pilot offered the opportunity to deploy subtitles using the EBU-TT-D format to other types of devices besides HbbTV receivers. The advantage of the web players considered in this sub-pilot is that they only require a web browser to run. The Figure 22 shows a screenshot of the subtitling interpretation tool deployed in this sub-pilot.



Figure 22. Capture from the RTP Play Service with EBU-TT-D Subtitles

At the start of HBB4ALL, the video player used for the RTP Play platform was JWPlayer. The JWPlayer is a much used web player in different distribution platforms because it implements a collection of intuitive tools for customizing the player interface, managing users, and organizing or segmenting videos. Additionally, it

is easy for enterprise publishers to manage video distribution at scale and it presents a powerful set of APIs that give publishers and developers control and flexibility to align with their workflow.

However, to use JWPlayer a software license must be purchased. For that reason, RTP has considered a second player in this sub-pilot: VideoJS, which is licensed under the Apache License, Version 2.0. An open-source solution may be more affordable for any broadcaster.

UPM initially developed a solution based on the JWPlayer for the sub-pilot. After the change from JWPlayer to the new solution VideoJS, also based on HTML and JavaScript code, the team from UPM adapted the code developed for the first solution to this alternative. This is what was used in the user tests.

6.2. Description of service / application

6.2.1. Technical implementation (brief overview)

As explained in the previous subsection, the plugin developed in JavaScript language was adapted to two different players:

- **JWPlayer.** JWPlayer is a New York based company which has developed video player software of the same name. The player, for embedding videos into web pages, is used by well-known companies, including ESPN, Electronic Arts and AT&T. It is widely used for self-hosted web videos.
- **VideoJS.** Brightcove is the main sponsor of the VideoJS project, employing many of the core members and investing engineering hours in improving the player and video.js plugins. The Brightcove Player is built on video.js and used in thousands of video websites, ensuring video.js can handle the most professional use cases.

For both players the working scheme is similar. For JWPlayer, the work scheme is collected in next figure.

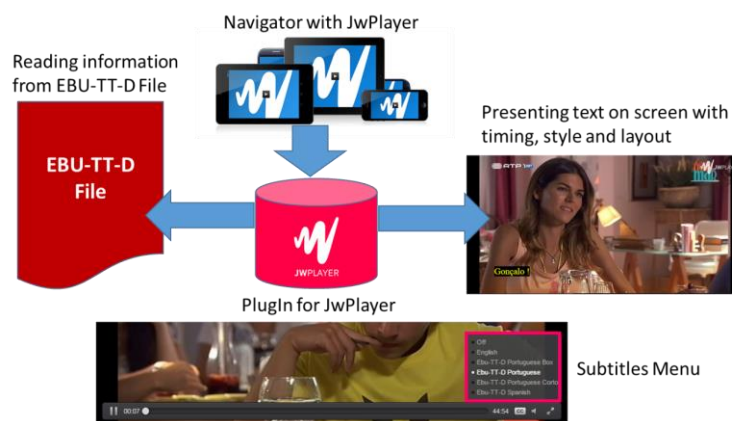


Figure 23. Working scheme for the functioning of the plugin

The elements that take part in the working process are the following:

- A device which contains a browser with JWPlayer or the player used to present the videos.

- The EBU-TT-D file, which is an XML-based file, containing the headers, text and timing of each subtitle.
- The plugin for the player, which contains the appropriate tools to present the text on screen based on timing, style and layout.
- Subtitles Menu. It is necessary for the end user to activate the subtitles.
- Customization Menu. For customization of the subtitles, there are three additional buttons that appear when the EBU-TT-D captions are active. This option is only available for the VideoJS plugin.

The plugin gets timing, text and styling information by parsing the XML-based EBU-TT-D subtitle file. The most common internet browsers in market have been covered. Because the browsers are different two different approaches have been implemented:

- Google Chrome and Safari use **jQuery** (a cross-platform JavaScript library designed to simplify the client-side scripting of HTML).
- Mozilla Firefox and Internet Explorer (v.11) required the usage of **XML DOM** (a standard for accessing and manipulating XML documents). The DOM presents an XML document as a tree-structure.

JWPlayer

There are different versions of the JWPlayer, which differs in the content. For the implementation in HBB4ALL, UPM worked with the API 6 of the player.

Below is the link to include JWPlayer (it could be linked or included as a library close to the html file, for use in offline implementations). The source must be included in the header as follows (depending on the version used, in this example “api6”):

```
<script type="text/javascript" src="api6/jwplayer/jwplayer.js"></script>
```

The file “jwplayer.js” corresponding to the JavaScript API of JWPlayer must be copied in a file connected to the HTML file (the complete path or the relative reference).

The script with the link to the plugin in JavaScript code works in this way: the video file is referenced with the property “file”, the subtitles files are referenced with the property “tracks” and the plugin is referenced with the property “plugins”.

```
<script type="text/javascript">
  jwplayer("myElement").setup({
    displaytitle: true,
    width: 1024,
    height: 576,
    sharing: {},
    playlist: [{
      file: "http://cdn-ondemand.rtp.pt/nas2.share/h264/512x384/p1599/p1599_1_20140901.mp4", // Agua de Mar
      image: "imagenes/fondo.jpg",
      tracks: [
        { file:"subtitles/p1599_1_20140901.xml", label: "Ebu-TT-D Portuguese", kind: "captions" } // Subtitulos EBU-TT-D PT
      ]
    }
  ]},
  plugins: {
    plugins/subtitulos14.js:{
    }
  }
});
</script>
```

Figure 24. Extract from the HTML code that calls the JWPlayer with the self-developed plugin

To activate the subtitles (referred to as captions in software), the “CC” button in the video menu needs to be activated. In the plugin code, it is activated through the player listener “onCaptionsChange”, or in later versions player.on (“captionsChange”).



Figure 25. The CC button in the player shows the subtitles menu

When a button is pushed, the label “ebu-tt-d” (in this case) is detected and the file opened by the plugin to download the subtitles included in it.

JWPlayer has a lot of event listeners, which are included in the JS plugin file: “subtitulos14.js”.

- The plugin registration in the JS file (subtitulos14.js in this case):

```
jwplayer().registerPlugin('subtitulos14', '6.0', function(player, config, slowmo){  
    function setup(evt){  
        //alert("Rendering HTML5 1");  
        if (player.getRenderingMode() == "html5"){
```

- “onCaptionsChange”: The function that detects the change of captions in the menu. Listener that waits for a click in the menu (click) in element

```
player.onCaptionsChange(  
    function captionsChange(event) {  
        haySubtitulosEBUTTD = false; // Inic
```

- This controls the instant in time to activate each line of subtitle (JWPlayer has the function .onTime() or .on('time').

```
player.onTime(  
    function(event) {
```

- This one is for adaptation to screen changes. The subtitles size depends on the size of the screen and the configuration must be quickly changed when “full screen” button is pushed.

```
player.onResize(  
    function resize2(event) {  
        borraMyElementCaption();  
        //alert("Resize " + event.width + ":" + event.height);  
        setGeneralSizes(event.width, event.height);  
    }  
);
```

- This listener waits for the video to be paused.

```
player.onPause(  
    function(event) {
```

VideoJS

Video.js is an open source JavaScript framework for embedding and working with HTML5 and Flash video. This application uses the HTML5 video tag as an embedded code, and has a common HTML/CSS skin and API for both HTML5 and Flash. It allows the insertion of self-developed plugins for different purposes because it provides a consistent JavaScript API facilitating the interaction with the video.

For the integration of the VideoJS plugin, an HTML file available in the UPM server was used. The code corresponding to the VideoJS player and the online information of video.js is included in the following link:

<http://vjs.zencdn.net/5.10.2/video.js>

This file could be linked or included as a library close to the HTML file through the next sentence in the metadata of the HTML file which includes the URL to access the video and the subtitles:

```
<script src="http://vjs.zencdn.net/5.9.2/video.js"></script>
```

The script with the link to the plugin in JavaScript code is included in the next figure.

```
1 <!DOCTYPE html>
2 <html hola_ext_inject="disabled">
3 <head>
4 <link href="http://vjs.zencdn.net/5.9.2/video-js.css" rel="stylesheet">
5
6 <!-- If you'd like to support IE8 -->
7 <script src="http://vjs.zencdn.net/ie8/1.1.2/videojs-ie8.min.js"></script>
8 <script src="http://www.gatv.ssr.upm.es/~jlv/hbb4all/playerVideoJS/plugins/subtitulos.js"></script>
9 <script src="https://ajax.googleapis.com/ajax/libs/jquery/2.2.2/jquery.min.js"></script> <!-- JQuery Code -->
10 </head>
11
12 <body>
13 <video id="player" class="video-js" controls preload="auto" width="800" height="440"
14 poster="imagenes/rtpplay.jpg" data-setup="{}">
15 <source src="http://cdn-ondemand.rtp.pt/nas2.share/h264/512x384/p1599/p1599_1_20140901.mp4" type="video/mp4">
16 <track default kind="captions" src="subtitulos/sub3.vtt" srclang="es" label="Español">
17 <track kind="captions" src="http://www.gatv.ssr.upm.es/~jlv/hbb4all/playerVideoJS/subtitulos/p1599_1_20140901.xml" srclang="pt" label="EBU TT-D">
18 <p class="vjs-no-js">
19 To view this video please enable JavaScript, and consider upgrading to a web browser that
20 <a href="http://videojs.com/html5-video-support/" target="_blank">supports HTML5 video</a>
21 </p>
22 </video>
23 <!--<button id="my-button" onclick="javascript: pulsa();">Pulsa</button> -->
24 <script src="http://vjs.zencdn.net/5.9.2/video.js"></script>
25 <script type="text/javascript" src="http://www.gatv.ssr.upm.es/~jlv/hbb4all/playerVideoJS/plugins/plugin-subtitlesebuttd.js"></script>
26 <script>videojs('player').pluginDev();</script>
27
28 </body>
29 </html>
```

Link to the video.js basic code

Link to the plugin in javascript code (.js)

Figure 26. Capture from the HTML code that calls the plugin in VideoJS player

The definition of the plugin and the subtitles (indicates as <track> must be included in the html file). The plugin is called at the end as a function.


```

1 <!DOCTYPE html>
2 <html hola_ext_inject="disabled">
3 <head>
4 <link href="http://vjs.zencdn.net/5.9.2/video-js.css" rel="stylesheet">
5
6 <!-- If you'd like to support IE8 -->
7 <script src="http://vjs.zencdn.net/ie8/1.1.2/videojs-ie8.min.js"></script>
8 <script src="http://www.gatv.ssr.upm.es/~jlv/hbb4all/playerVideoJS/plugins/subtitulos.js"></script>
9 <script src="https://ajax.googleapis.com/ajax/libs/jquery/2.2.2/jquery.min.js"></script> <!-- JQuery Code -->
10 </head>
11
12 <body>
13 <video id="player" class="video-js" controls preload="auto" width="800" height="440"
14 poster="imagenes/rtpplay.jpg" data-setup="{}">
15 <source src="http://cdn-andemand.rtp.pt/nas2_share/h264/512x384/p1599/p1599_1_20140901.mp4" type="video/mp4">
16 <track default kind="captions" src="subtitulos/sub3.vtt" srclang="es" label="Español">
17 <track kind="captions" src="http://www.gatv.ssr.upm.es/~jlv/hbb4all/playerVideoJS/subtitulos/p1599_1_20140901.xml" srclang="pt" label="EBU TT-D">
18 <p class="vjs-no-js">
19 To view this video please enable JavaScript, and consider upgrading to a web browser that
20 <a href="http://videojs.com/html5-video-support/" target="_blank">supports HTML5 video</a>
21 </p>
22 </video>
23 <!--<button id="my-button" onclick="javascript: pulsa();">Pulsa</button -->
24
25 <script src="http://vjs.zencdn.net/5.9.2/video.js"></script>
26
27 <script type="text/javascript" src="http://www.gatv.ssr.upm.es/~jlv/hbb4all/playerVideoJS/plugins/plugin-subtitlesebuttd.js"></script>
28 <script>videojs('player').pluginDev();</script>
29
30 </body>
31 </html>

```

Link to the subtitles file (<track> Included in <video>

The plugin is defined with the name "pluginDev" So here it must be called with this exact name

```

videojs.plugin('pluginDev', function() {
  var player = this;
  ...

```

Figure 27. Capture that shows the definition of the plugin developed

To activate the subtitles, the user pushes the “CC” button in the video menu, as shown in the next figure.



Figure 28. CC button in VideoJS player shows the menu for activating EBU-TT-D subtitles

The listener waits for a click in the menu (click) in the element (ul.vjs-menu-content li)

```

$('ul.vjs-menu-content li').click(function(e) {

```

When a button is pushed, the label “ebu-tt-d” (in this case) is detected and the file opened by the plugin to download the subtitles included in it.

VideoJS has a collection of listeners, which are included in the JS plugin file: “plugin-subtitlebuttd.js” in this case.

This listener controls the instant in time to activate each line of subtitle (in JWPlayer it was the function .onTime() or .on(‘time’)).

```
player.on('timeupdate', function(evt) {
```

This one is for adaptation to screen changes. The subtitles size depends on the size of the screen and the configuration must be quickly changed when “full screen” button is pushed.

```
player.on('webkitfullscreenchange', function resize2(event) {
```

This listener waits for the video to be paused.

```
player.on('pause', function(event) {
```

6.2.2. Functionalities

The basic functionalities of the plugin are described in **Figure 29**.

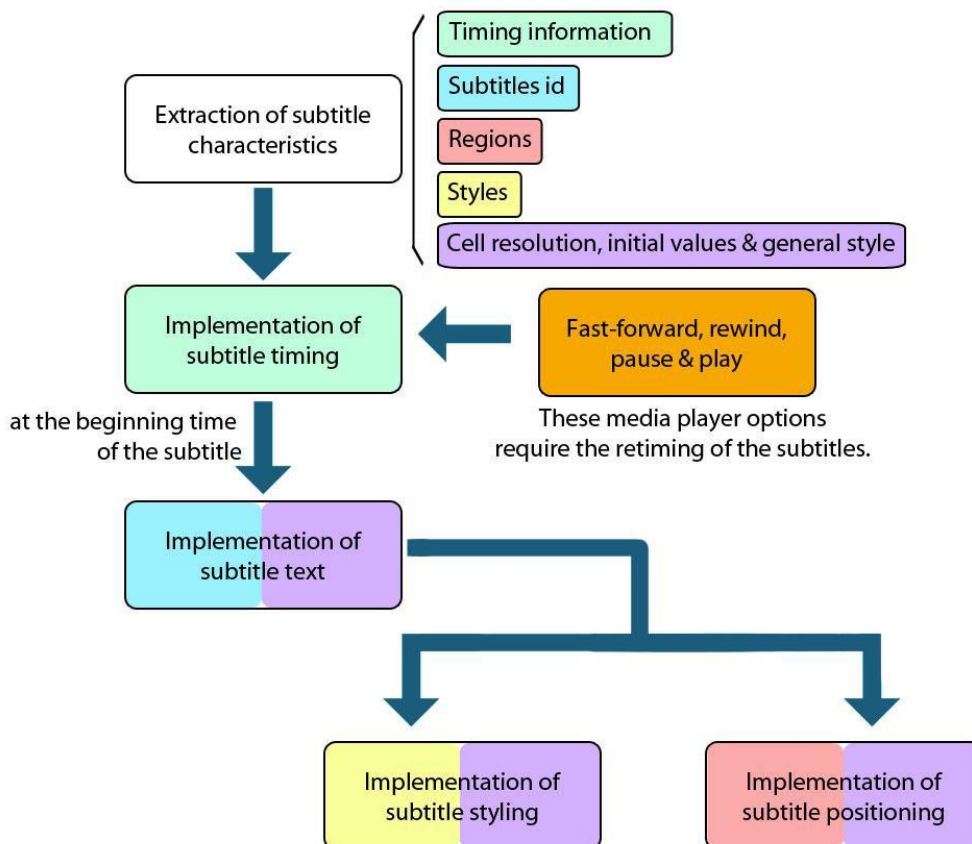


Figure 29. Work Scheme of the captions plugin

These functionalities, technically implemented in both plugins for JWPlayer and VideoJS, include:

- Extraction of subtitle characteristics. This phase is completed and tested for four different JWPlayer navigators (Google Chrome, Mozilla Firefox, Internet Explorer 11 and Safari). Information about regions, styles and texts is extracted from the EBU-TT-D file.
- Implementation of subtitle timing. This phase is completed by using the function `jwplayer.onTime()`, which controls the timing by clock ticks in JWPlayer and `player.on("timeupdate")` for VideoJS. The timing information included in EBU-TT-D file needs to be transformed to milliseconds, which is the type of content that the JWPlayer understands. Timing information gets extracted from the `<p>` elements in the EBU-TT-D file.
- Implementation of subtitle text. Completed with the information extracted from the span elements.
- Fast-forward, rewind, pause & play. This phase requires an improvement for cases where the user interacts with the playback of the video.
- Implementation of subtitle styling and positioning. This phase requires an improvement in some subtitle characteristics where style concepts between CSS and TTML/EBU-TT-D are different.

The EBU-TT-D file offers information about metadata, styling, layout in the header, and text, timing, style and regions through `<div>`, `<p>` and `` tags in the body.

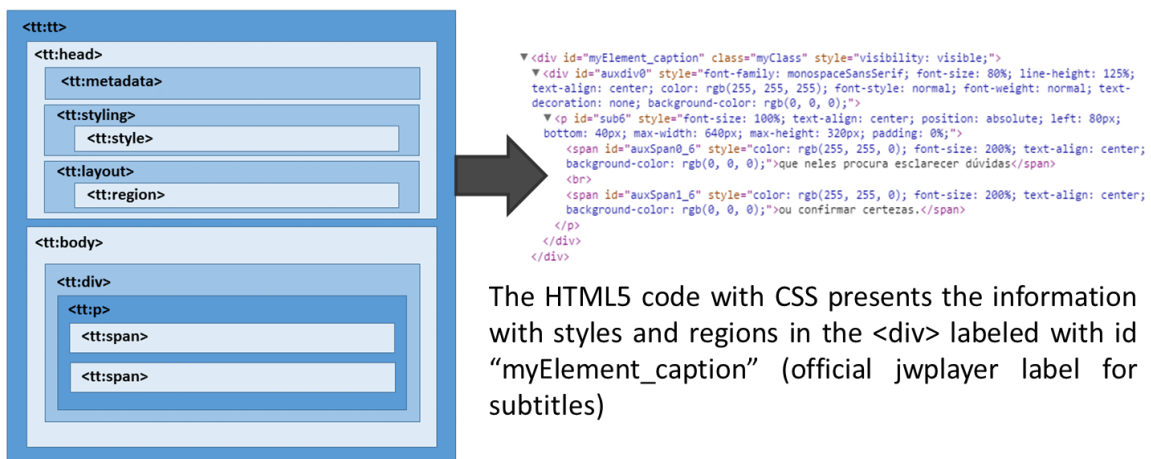


Figure 30. Structure of the EBU-TT-D file

Customization of subtitles in plugin for VideoJS player

RTP Play must be built with all users in mind. So it is necessary to offer several accessible customisation features for low-vision or blind users, hard-of-hearing or deaf users, individuals who have physical or motor difficulties, and individuals with learning difficulties, which are some of the motivations of the HBB4ALL project.

Next paragraphs explain how customisation options have been considered in this sub-pilot. Customisation pays attention to three different parameters:

- Font size.
- Subtitle position
- Font colour

To enable the EBU-TT-D subtitles, the user must select the captions in the CC menu (CC is a usual form to name subtitles and it means "closed captions"). After selecting the EBU-TT-D file, the player opens up a new menu with three accessibility buttons for customising the presentation of subtitles. This could be useful for any user who needs special adaptations or has concrete preferences.



Figure 31. Menu for captions customization

- Font size.

The font-size property of an HTML element (in this case, the text of the subtitle) sets the size of a font.



Figure 32. Font size customization from smaller to larger sizes

To change the font size, there are three different styles to choose from: large, medium and small size. An example on how each style will look is shown in Figure 32. If the user selects "Off", the font size style will be obtained directly from the EBU-TT-D file.

- Position

The vertical-align property of an HTML element (in this case, the text of the subtitle) sets the vertical alignment of an element in the framework.

To change the position property, there are three different styles to choose from: up, centre and down position. Figure 33 shows how a subtitle is depicted in the up position. If the user select “Off”, the vertical alignment style will be obtained directly from the EBU-TT-D file.



Figure 33. Position customization for subtitles situated in up, centre or down positions

- Font colour

The font-colour property of an HTML element (in this case, the text of the subtitle) sets the colour of the text of the element in the framework.



Figure 34. Font colour customization for Yellow, White or Green subtitles.

To change the font colour property, there are three different styles to choose from: yellow, green and white. An example of how white font is depicted is shown in Figure 34. If the user select “Off”, the font colour style will be obtained directly from the EBU-TT-D file. It must be taken into account that broadcasters usually take advantage of a colour code to mean different things (e.g., yellow for characters in screen and white for characters out the screen). The selection of a given colour does not allow this code but it may provide a more accessible service for some users.

6.2.3. Availability of service

The user tests in this sub-pilot were focused on the subtitling interpretation tool developed for VideoJS. Using the plugin created by UPM, RTP implemented a web interface where the service is offered for a given set of RTP programmes. The web interface was added to the accessibility section of RTP website (<http://www.rtp.pt/wportal/acessibilidades/>) and it has been available openly for any website user from the first weeks of November 2016.

The test interface included a set of six available programmes, which integrated EBU-TT-D subtitles.

6.2.4. Intended audience

The service was published in the accessibility section of RTP website, as such it was available for use to any visitor to the site, although the set of programmes used to test the service was limited to six. To get concrete feedback from users, RTP contacted Portuguese associations of deaf people and organised a focus group in RTP premises, as described below.

6.2.5. Workflow / production aspects

The service used subtitling conversion framework provided by IRT in HBB4ALL. RTP has not changed the production workflow to deploy this service, but it has integrated the framework to obtain the EBU-TT-D subtitle files from the STL format. RTP has also included the respective EBU-TT-D URL in the REST services that provides information about RTP catch-up contents.

On the production side, RTP has created the web interface to provide the service in the accessibility area of the RTP website.

6.3. Description of user tests

6.3.1. Aim

The aims of the user tests carried out during this sub-pilot were:

- To validate the subtitling tools created and deployed in the project for web players.
- To test the suitability of the subtitling tools for different types of screen.
- To test the usability of the proposed services
- To collect feedback about the customisation options to know the settings preferred by users.
- To learn about user preferences in order to deploy more satisfying subtitling services in the future

6.3.2. Methodology

The methodology designed to test the service includes two approaches:

- A discussion group to obtain qualitative information about services performance and suitability. For this purpose, RTP invited representatives of the Portuguese deaf people associations. The figure shows a picture taken during the discussion group.
- The availability of the service in the accessibility area of RTP website to extend the number of possible users. This service will continue available after the end of HBB4ALL.



Figure 35. Photo of the discussion group, showing laptop and a mobile phone

For the discussion group the following documents were created:

- Informed consent (included in annex 13.4.2.1). It was revised and signed by all the participants before the test session. For this purpose, the sub-pilot has counted on the collaboration of UAB.
- SUS questionnaire, to know the usability of the subtitling tool (not the functionality).
- Questionnaire to obtain information about the service, the user preferences concerning customisation options and the opinion of users concerning RTP access services.

These documents were produced in English and then translated into Portuguese.

6.3.3. Testers

The user tests, carried out in RTP premises, occurred in 7th November 2016, from 1 p.m. to 6 p.m. The group of three users, all male, that participated in this user tests session are member representatives of the two major Portuguese associations of Deaf People – Associação Portuguesa de Surdos and Federação Portuguesa das Associações de Surdos. All the users presented in the tests session were suggested by their own associations. Two of the three users are profoundly deaf, and one acquired deafness as a child.

6.3.4. Report on test

At the beginning of the test session, the main objectives of the WP3 and the motivations that led UPM and RTP to the development of the implementation presented for the tests were explained to the users.

Since it was a small group of users a methodology based on a discussion group was adopted. Before the first contact with the technology, the users had the possibility to discuss several issues related to subtitling, such as the lack of subtitled content on internet, the quality of subtitles and the difficulties they have in their daily lives to access to Portuguese TV programmes in web context.

As outlined above, the tests were carried out at RTP premises in a controlled environment, and all the session was conducted in the presence of a sign language interpreter. This ensured all users had the possibility to ask any questions they considered to be important during the session. The users were also informed that the main goal of this session was to evaluate the technology used and not the subtitling service itself.

Following the introduction, the player used in the Portuguese sub-pilot, available online, in the Accessibility area of RTP website was presented.



Figure 36. RTP website - Accessibility area

The users were then asked to interact with the player. Each one had the opportunity to interact and explore the player. They easily identified the CC button as the way to activate the subtitles. Then it was explained to them that the player had customisation features, such as subtitles size, position and colours. After these explanations, the users activated the EBU-TT-D captions, in order to access to the customization bar.



Figure 37. Video JS customization options

At the end, each user was asked some questions based on their experience on the system usability and preferences on the customization options, using a laptop and tablet

6.4. Evaluation of sub-pilot

In order to evaluate the level of usability the System Usability Scale (SUS) was used at the end of each user's experience. (Scale: 1 - Strongly disagree / 5 - Strongly agree)

SUS - System Usability Scale			
Video JS subtitle plug in - RTP Play			
	User 1	User 2	User 3
1 I think that I would like to use this system frequently	5	5	4
2 I found the system unnecessarily complex	1	1	2
3 I thought the system was easy to use	5	5	4
4 I think that I would need the support of a technical person to be able to use this system	1	1	4
5 I found the various functions in this system were well integrated	5	5	3
6 I thought there was too much inconsistency in this system	1	1	2
7 I would imagine that most people would learn to use this system	4	4	3
8 I found the system very cumbersome to use	1	1	2
9 I felt very confident using the system	4	5	3
10 I needed to learn a lot of things before I could get going with this system	4	1	2
TOTAL	87,5	97,5	62,5

Figure 38. SUS - Portuguese results on Video JS player

In general, the answers show that the system is not complex, on the contrary, the results indicate that three users felt confident when using the player, as they considered the system very easy to use and also very intuitive.

The users were asked some questions about the customization options for subtitles available in the player:

SUBTITLE SIZE:

The three users preferred the medium size as the most appropriate size. Although, they also considered that the best size will depend on screen dimension. In a full screen mode the most suitable size for subtitles is the medium one, and for small screen the most appropriate size will be a bigger size.



Figure 39. Small screen - larger size subtitle

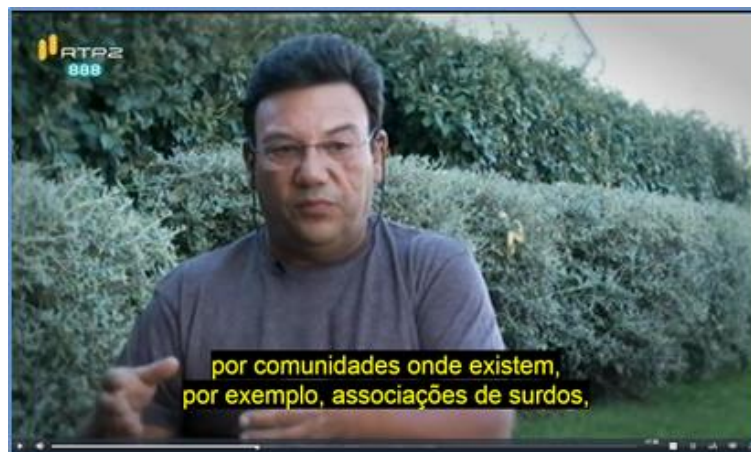


Figure 40. Full screen - medium size subtitle

POSITION:

All three users considered that the most appropriate subtitle position to be bottom of the screen. They also considered that the position customization feature is not very important for them and it could be removed from the customization bar.

COLOUR:

From all the colours available in the customization bar, all three users considered that the most appropriate colours for subtitles are the colours used in RTP teletext subtitles: white, yellow and cyan.

They all agreed that the green colour is not suitable for this kind of service, because green does not offer enough contrast when inside a black box.

When the users were asked if the customization features are useful for the deaf, the answer was yes, especially for those that prefer to use subtitles service to the sign language service.

6.5. Results and Insights

The experience gained in the sub-pilot has allowed RTP and UPM extract the following conclusions and recommendations about the provision of the service:

- Customisation options are considered as a very valuable and convenient feature by users
- The parameters traditionally used for the provision of the service may influence user preferences, i.e., in the test users preferred the parameters they were familiar with such as subtitles at the bottom of the screen.
- A few usual characteristics in RTP subtitles are not supported in EBU-TT-D or in the framework used in the project (e.g., different colours in the same subtitles lines).
- The preferred subtitle size depends on the screen size. Smaller screens require larger subtitles (in comparison with the screen size).

7. Customised Subtitles for Online learning (MOOC) – Germany (VSX/UAB)

7.1. Goals of the sub-pilot

Partners VSX and UAB worked together in this sub-pilot, the aim of which was to bring personalised subtitles to the masses, allowing each user to adapt subtitles to their individual needs and requirements. The sub-pilot allows users to modify various aspects of the presentation of subtitles, which are then applied on-the-fly on a per-user-per-device basis. Existing subtitle content can be easily integrated since no further modifications are required..

7.2. Description of service / application

7.2.1. Technical implementation (brief overview)

The sub-pilot has been developed as a plugin for the vsonix webcast video player, which is based on VideoJS. Subtitle adaptation parameters are stored as part of the UI adaptation framework developed during WP5 and applied to any existing subtitles that are displayed by the webcast video player. Subtitle display and adaptation are managed by the sub-pilot by issuing and reacting to events based on the timing information provided by the subtitle content.

7.2.2. Functionalities

The sub-pilot has been realised as a plugin for the vsonix webcast video player. The plugin can be enabled or disabled, meaning that subtitles are displayed using the system default settings or using the custom preferences selected by the user.

Using the plugin, the subtitles can be adapted in terms of overlay position (top or bottom), font size given in pixels, and background opacity (fully opaque or fully transparent). All of these adaptation parameters are seamlessly integrated into the UI adaptation framework developed in WP5, which is where the adaptation profiles are stored and retrieved from.

In figure 41 you can see a side-by-side comparison of two very different subtitle adaptation settings, where the subtitles vary in font size, background transparency, and display position.

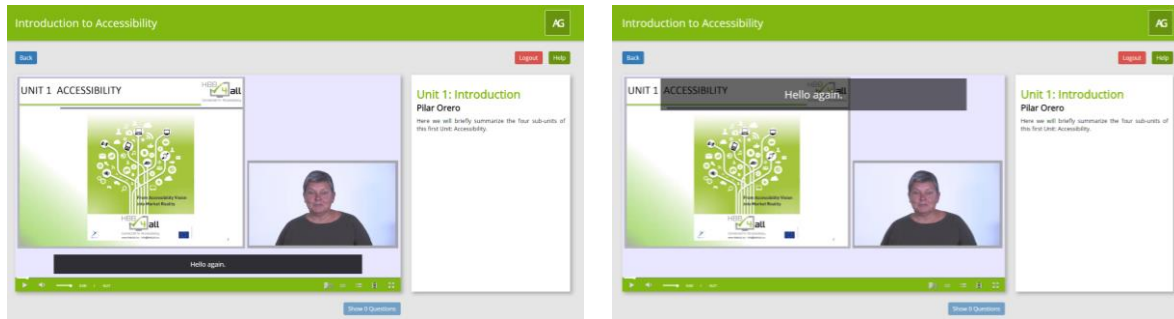


Figure 41. Different subtitle adaptations in MOOC

7.2.3. Availability of service

The service has been deployed for the MOOC and is used by the webcast players on the course pages. The MOOC is publicly available since August 2016 on the website <http://accessguide.tv>. It can be accessed free-of-charge on PCs and mobile phones using any web browser that is compatible with recent web technologies.

7.2.4. Intended audience

The MOOC is primarily intended for people who are part of the accessibility community or those with a general interest in accessibility and topics related to accessibility for either personal reasons (such as impairments or disabilities) or academic reasons. It was therefore mandatory to make the course content as accessible as possible. The content itself is of an introductory nature.

7.2.5. Workflow / production aspects

One of the goals of the sub-pilot was to not interfere with existing workflows. This is why the workflow does not differ from standard procedures of subtitle generation. In a first step the media needs to be transcribed in order to obtain the textual representation of the information contained in the media. This is currently done manually. In a second step the transcript needs to be timecoded and divided into pieces of information that can be presented to the user one at-a-time. Finally, the subtitles need to be converted to the webVTT file format, which is a standardized subtitle file format supported by many browser vendors. Once the user decides to enable customized subtitles, the VSX subtitle plugin will then load the webVTT file, transform them according to the adaptations enabled by the user and display them.

7.3. Description of user tests

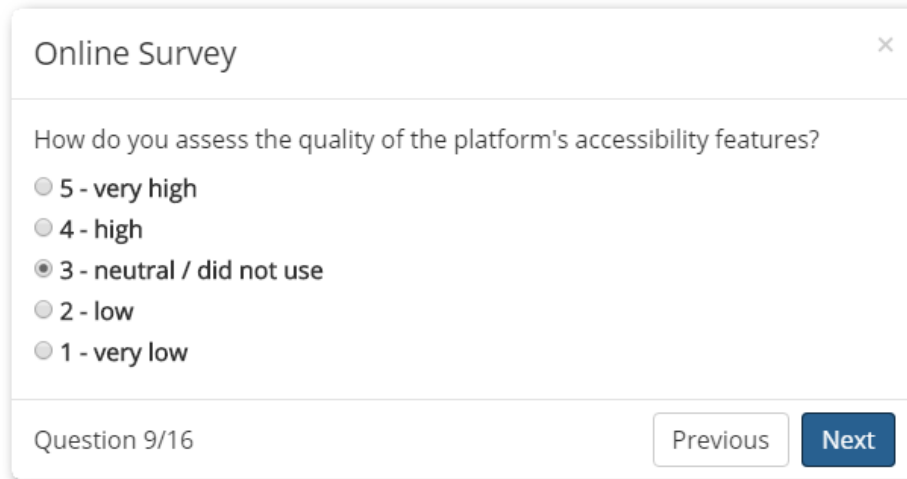
7.3.1. Aim

The sub-pilot was developed following a very user-centric approach. During the development-phase a first round of user tests was conducted with a predefined user group to verify that the VSX approach to subtitle adaptation fits the requirements and needs of the target user group.

The aim of the later user tests during the sub-pilot was to gain insights into the quality of the adaptations that were made. These results serve as a starting point for further improvements to VSX services and, specifically, the MOOC.

7.3.2. Methodology

For the final evaluation of the sub-pilot an online-survey for quantitative analysis and a user study for qualitative analysis of the MOOC and its supported user interface adaptations were conducted. An example of how the survey was presented to the user can be seen in figure 26.



Online Survey

How do you assess the quality of the platform's accessibility features?

5 - very high

4 - high

3 - neutral / did not use

2 - low

1 - very low

Question 9/16

Previous Next

Figure 42. MOOC online survey

The survey result data is stored anonymously and no correlation between survey results and human individuals can be made. A cookie stored on the user's browser which indicates a completed survey (but does not store survey results or any kind of user identification) ensures that each participant could only participate once in the survey

7.3.3. Testers

The survey is offered to every person using the MOOC. To gather as much feedback through the survey as possible, participation was not limited to any specific group in terms of age, impairment or other factors.

7.3.4. Report on test

This sub-pilot was part of a joint WP3 and WP5 activity, for this reason the results of the online survey are published in deliverable D5.4 [3].

8. Interoperability Tests for EBU-TT-D

In practice, the subtitle content of various content providers will be rendered by a variety of software/hardware players. Due to varying interpretations and/or coverages of the applicable specifications (EBU-TT-D⁷ and also HbbTV⁸ where appropriate) the actual rendering results may differ from the intended rendering. This can affect the viewer's experience to a certain extent.

IRT examined the interoperability of the EBU-TT-D content provided by some of the partners with the rendering results of some of the partners' player solutions. The intended rendering results – according to the EBU-TT-D source document – were compared with the actual ones by means of visual comparison. This way it was possible to get an insight on common issues which may occur when EBU-TT-D subtitle content and rendering solutions from different providers are combined.

8.1. Test set and rendering solutions

For the tests the rendering results of combinations of EBU-TT-D content and software/hardware rendering solutions were kindly provided by the partners involved in this test. Table 8 shows the combinations that were tested.

Table 8. EBU-TT-D test set: provided content and renderers used

Content ► Renderer ▼	CCMA (TVC)	RBB	RTP
CCMA (TVC)			
Samsung prototype			
RBB			
RTP/UPM			

The following rendering solutions were used for the interoperability tests:

- CCMA (TVC) uses an HbbTV player which can be used in any HbbTV application (no specific version) as it translates EBU-TT-D to HTML before presentation.
- Samsung provided a Smart TV to IRT, which was equipped with a prototype firmware that was capable of performing EBU-TT-D rendering natively in the device (mandatory part of the HbbTV 2.0 specification).
- The RBB renderer is a custom software player designed especially for the EBU-TT-D-Basic-DE⁹ profile used by the German public broadcasters.
- The software renderer of RTP/UPM is based on the widespread video player *JW Player*. It is extended with a custom EBU-TT-D plugin developed by UPM.

While in some cases (e.g. text colour) comparing the rendering result with the EBU-TT-D source document is sufficient, other cases (e.g. positioning) require a visual comparison of the partner's rendering result with a

⁷ [“EBU Tech. 3380: EBU-TT-D Subtitling Distribution Format”, version 1.0, 03/2015](#)

⁸ [“Hybrid broadcast broadband TV”, version 2.0.1, 07/2016](#)

⁹ [“XML-Format for Distribution of Subtitles in the ARD Mediathek portals \(EBU-TT-D-Basic-DE\)”, version 1.1, 07/2013](#)

reference rendering. To realise the latter, specific subtitles from the EBU-TT-D source documents were converted to XSL-FO¹⁰ and rendered by a supporting solution (Apache FOP or Antenna House Formatter).

8.2. Evaluation

All rendering results were examined in detail and the identified issues were grouped wherever possible. They show that sometimes there are still diverging interpretations of the relevant specifications and/or not all features which are used in practice – optional as well as mandatory – are currently implemented.

In summary, our tests have shown the following issues:

- Errors in
 - font family/colour/size
 - positioning
 - background rendering
- Overlapping of lines
- Gap between lines
- Line padding

The following sections provide an overview of these issues, ordered by a (subjective) estimation of impact on the viewer's experience. Each issue is briefly described, together with the background / reason for its occurrence. Additional technical details have been added in a separate text box where appropriate.

Please note that the details of the issues that are described here, are specific for the test set that was used. It is assumed, however, that their occurrence is more general: any party who plans to deploy EBU-TT-D subtitles is kindly invited to check the issues, including their causes and potential solutions to avoid similar interoperability problems.

Last but not least, as the test set was limited, this overview cannot be an extensive list of interoperability issues.

¹⁰ [“Extensible Stylesheet Language - Formatting Objects“ \(XSL-FO\)](#) is a markup language which allows the definition of a logical tree of to be rendered objects. It is used to adapt the hierarchy of an EBU-TT-D subtitle in order to get a reference rendering (to a certain extent). XSL-FO is also the main standard reference for positioning and styling for TTML and EBU-TT-D.

8.2.1. Errors in font family/colour/size



Figure 43. Rendering errors in subtitle font, colour, size and position

The rendering result does not correspond to the styles used in the EBU-TT-D source document:

- The font should be monospace but is proportional.
- The font colour should be yellow but is white.
- The font size is smaller than signalled.

Reason

The renderer does not correctly consider the specific style properties which were set.

Further technical details

Regarding the font colour it seems that the additional Alpha component (present but set to opaque) leads to the colour value being completely ignored.

8.2.2. Errors in positioning

Please refer to Figure 43 in section 8.2.1.

The vertical position of the rendered text is in the middle but should be lower down the screen.

Reason

The renderer does not correctly consider the specific region properties which were set.

8.2.3. Errors in background rendering



Figure 44. Rendering error in subtitle background rendering

The background colour of the subtitle lines should be partly transparent but is not rendered at all (as shown in Figure 44) or only rendered opaque.

Reason

In this case, the background colour value is not only opaque but also contains a transparency component. In cases where such colour values are not supported by the renderer, they are ignored and no background is visible.

In cases where such colour values are only partly supported by the renderer, the transparency component is ignored and the background rendered opaque.

Further technical details

The `tts:backgroundColor` of this renderer only supports RGB values. RGBA values are either completely ignored or only the RGB part is processed.

8.2.4. Overlapping of lines



Figure 45. Rendering error: overlapping of subtitle lines

The lower part of the upper subtitle line (visible from the “g” character in Figure 45) is partly overlapped by the upper part of the lower line.

Reason

The EBU-TT-D source document specifies two regions each containing one of the two subtitle lines. These regions are vertically directly adjacent to each other – which is fine by itself. However, the line height, which results from the style settings in the document, exceeds the vertical subtitle size and therefore leads to overlapping with certain renderers.

Further technical details

Both subtitle lines refer to separate regions which have a height of 8% each and are vertically directly adjacent to each other. As the `tts:lineHeight` is set to “normal”, its value is implementation-dependent and may be up to 125% (which is assumed here). Due to the used values of `ttp:cellResolution`, `tts:fontSize` and `tts:lineHeight`, a subtitle line can have a height of up to 9% here though, which exceeds the mentioned 8%.

The unintended presentation can be avoided if instead of a “region per line” strategy all lines are placed in one content element that references one region.

8.2.5. Gap between lines



Figure 46. Differences in rendering of gap between subtitle lines

The gap between the lines differs among the different renderings. There is either no, a tiny or a noticeable gap.

Reason

The line height is set to the value “normal”. This value does not refer to a specific line height but rather is implementation-dependent (up to a certain extent). Thus this is not an error but should be paid attention to as it could affect the height of the region which contains a subtitle and thus may lead to overlapping of lines (please also refer to section 8.2.4).

Further technical details

When the attribute `tts:lineHeight` is set to “normal”, the resulting value is implementation-dependent and may be up to 125%.

Alternative reason

The line height is set to a percentage value which is higher than 100%. Therefore a visible gap will be rendered. However this gap is undesired from the point of view of some content providers. Therefore the HbbTV 2.0.1 specification¹¹ enforces that under certain circumstances no visible gap shall be rendered instead. Therefore, at the moment there is no guaranteed behaviour in terms of line gap among different devices and implementations.

Further technical details

HbbTV 2.0.1 section 7.3.1.5.1:

"On terminals that support EBU-TT-D version 1.0 and no later version, where the `tts:lineHeight` attribute of a `tt:p` element has the value "normal" or a value less than or equal to 125%, the background of each generated inline area shall be rendered such that there are no gaps between the rendered backgrounds of adjacent lines."

¹¹ [“Hybrid broadcast broadband TV”, version 2.0.1, 07/2016](#)

8.2.6. Line padding



Figure 47. Rendering error in subtitle line padding

The rendering shows a visible (horizontal) line padding at the left and right edges of the subtitle lines, though the respective property in the EBU-TT-D source document is not set (and therefore should default to a zero line padding).

Reason

The EBU-TT-D-Basic-DE profile¹² – which is used by the German public broadcasters – contains an informative clause stating that a line padding should be rendered, despite the respective property of the EBU-TT-D source document. Thus the rendering in this case is correct.

Nevertheless it should be considered to add the respective property in the EBU-TT-D source document as other renderers (which are not aware of the mentioned profile) will not render the line padding.

Further technical details

The mentioned property is the `ebutts:linePadding` attribute and the mentioned clause is 1.3.3 of the EBU-TT-D-Basic-DE profile.

Opposite case

The rendering does not show a visible (horizontal) line padding at the left and right edges of the subtitle lines though the respective property in the EBU-TT-D source document is set.

Reason

The rendering has to be fixed though the issue is not necessarily an error: extension features like the line padding property – which are not part of TTML 1.0¹³ (upon which EBU-TT-D is based) – should be implemented, but also may not.

Further technical details

The mentioned property is the `ebutts:linePadding` attribute and the mentioned rule can be found in EBU-TT-D1 in clause 2.8.

¹² [“XML-Format for Distribution of Subtitles in the ARD Mediathek portals \(EBU-TT-D-Basic-DE\)”, version 1.1, 07/2013](#)

¹³ [W3C Timed Text Markup Language \(TTML\), version 1.0 \(Second Edition\), 09/2013](#)

9. Service Components

This chapter gives an update with regard to D3.2 [2] on the status of Service Components that have been further developed as part of HBB4ALL activities in parallel to the sub-pilots described in the previous chapters.

9.1. Subtitling Format Conversion Framework (IRT)

Summary

The Subtitling Format Conversion Framework (SCF) uses open standard technologies to convert subtitles from legacy formats used in broadcast production into EBU-TT-D subtitles [4]. To encourage a wide adoption, this framework has been published as open source (used in pilots Customised HbbTV Subtitles for VoD portal - Germany (see section 3.2), Customised Subtitles for Wide focus multi-platform – Portugal (see section 6.2), and in pilot Customised HbbTV Subtitles for VOD portal - Spain (see section 4.2)). A detailed description of the SCF can be found in Annex 8.1.12 of HBB4ALL deliverable D3.2 [2].

Status of completion

Two new conversion modules have been added to the SCF:

1. The new STLXML2STL module (contributed by company BaseX GmbH in cooperation with IRT) provides a conversion from the STLXML format – an intermediate format used by the SCF to represent EBU STL files in XML – to the EBU STL format. Together with the EBU-TT2STLXML module (under development at the time of writing), a stepwise back-conversion from the EBU-TT format to the EBU STL format will become available.
2. The FLASHDFXP2EBU-TT-D-Basic-DE has been developed (in cooperation with the German public broadcaster ZDF). It provides the conversion of DFXP files – which are used by some web video players based on Flash technology – to the EBU-TT-D format according to the EBU-TT-D-Basic-DE profile (used by German public broadcasters for catch-up TV services).

In addition, a few helper modules have been added to the SCF. Furthermore, some minor bugs were fixed and additional test cases have been added.

The development of the SCF will continue beyond the scope of the HBB4ALL project. It is currently in alpha state but nevertheless used in production. It is planned to release a beta version by the end of the HBB4ALL project.

9.2. Lightweight Subtitle Editor (IRT)

Summary

The Lightweight Subtitle Editor is a low-cost XML editor for EBU-TT-D subtitles that is customized for the re-purposing of subtitles for Internet distribution. This authoring tool is built on the XML editor oXygen. A detailed description of the Lightweight Subtitle Editor can be found in Annex 8.1.13 of D3.2 [2].

Status of completion

The development of the editor has continued. The ability to create subtitles addressing a specific audience has been evaluated. In order to target adolescent people, this involved subtitles whose style mimics comic strips.

9.3. EBU-TT-D Rendering Tests (IRT)

Summary

Reference material has been provided by IRT for the use by HBB4ALL partners and manufacturers to facilitate a standard conformant implementation of EBU-TT-D [4]. All partners may use the material to verify their EBU-TT-D implementations (RBB and UPM already have the material in use). A detailed description of the EBU-TT-D Rendering Tests can be found in Annex 8.1.15 of D3.2 [2].

Status of completion

New examples have been added to the test set to consider further fundamental issues that were not yet covered (e.g. font download) as well as special cases (e.g. overflow). This includes (among others) the presentation of bidirectional subtitles, line padding and further formatting options.

9.4. Subtitle validation solution “subcheck” (IRT)

Summary

During the HBB4ALL project the demand for a subtitle validation solution arose: when a broadcaster receives a subtitle file contribution, the file often does not comply with certain subtitle specifications or in-house requirements. This can happen, amongst others, because of the amount of parties and software solutions involved in the process. The compliance check typically occurs at the side of the broadcaster and the feedback communication with the contributor is a time consuming process.

To facilitate this process, the compliance checking as a whole may be moved to the contribution side. A software solution was targeted, which can be used by human operators (through a user-friendly web interface) as well as by computer systems (by means of a standardized REST interface). Such a solution allows a contributor to check the subtitle file and if required correct possible defects before sending it to the broadcaster.

Status of completion

In cooperation with the company BaseX GmbH a subtitle validation solution called “subcheck” as described above has been prototyped. In cooperation with the German/French broadcaster Arte, “subcheck” was applied to a real world use case and Arte’s in-house rules for subtitle files were successfully implemented.

To demonstrate the flexibility and versatility of the solution, adding further rule sets has been started and is currently in progress. The development of “subcheck” will continue beyond the scope of the HBB4ALL project.

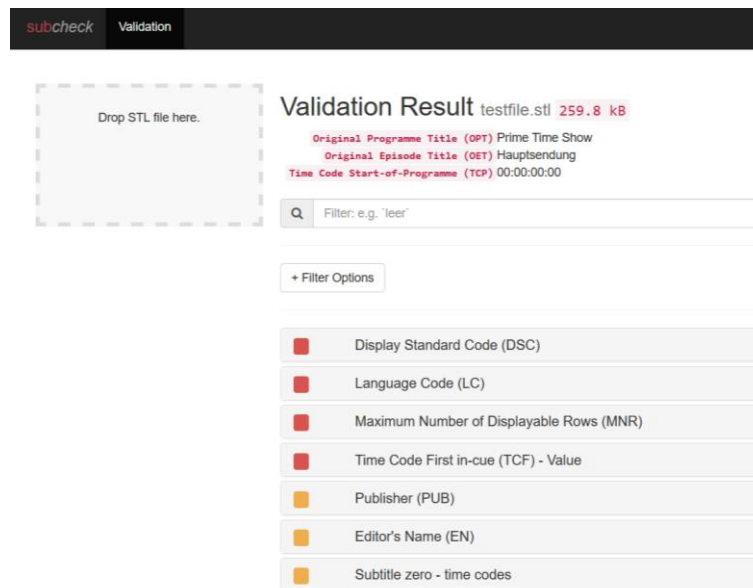


Figure 48. Screenshot of the subtitle validation solution “subcheck”

9.5. Subtitle Authoring Component (Screen)

Screen implemented an EBU-TT-D export function as an option within the standard commercial product for subtitle preparation from Screen (WINCAPS QU4NTUM).

Status of completion

The development of the export function has continued in order to resolve limitations identified during the HBB4ALL project.

9.6. Subtitle prototype EBU-TT-D renderer (Screen)

Screen developed a prototype renderer that decodes EBU-TT-D documents and produces corresponding subtitle images using HTML 5 and JavaScript.

Status of completion

This prototype is currently being used to evaluate the possibility of a subtitle preparation tool for EBU-TT-D documents that is completely web-based.

9.7. Subtitle Contribution Component (Screen)

Screen developed a data insertion component for transporting EBU-TT data in the VBI / VANC spaces of an SDI video signal.

Status of completion

This component is being used for on-going evaluation of strategies for the optimal carriage of EBU-TT content within SDI signals beyond the scope of the HBB4ALL project. This component will be offered for use within the commercially available Screen subtitle transmission system.

9.8.Subtitle Conversion Component (Screen)

Screen developed an EBU-TT conversion component for the real-time conversion of (live) subtitle content in proprietary formats into EBU-TT-D format for onward delivery to HbbTV distribution systems.

Status of completion

Development of this component continues and this component will be offered for use within the commercially available Screen subtitle transmission system. This will enable the real time conversion of a wide range of other formats of subtitle data into EBU-TT-D format for live subtitling and recorded subtitles that are ‘played out’ in real time.

9.9.Subtitle Distribution Component (Screen)

Screen developed a conversion tool that supports the conversion of EBU-TT files to EBU-TT-D files. This functionality was implemented as two new components designed for use within a commercially available Screen data conversion tool (MediaMate). Using these new components and existing components in the tool it is possible to convert any supported format of subtitle file into an EBU-TT format file and vice versa.

Status of completion

Development of these components continues and this functionality is now available commercially in the Screen data conversion tool (MediaMate).

10. Ethical Issues and Data Protection

10.1. 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"¹⁴.

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 did not 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. Form to request permission (see Annex 13.4.1)
2. Consent form (see Annex 13.4.2)

¹⁴ <http://www.un.org/disabilities/documents/convention/convoptprot-e.pdf>

3. Information to participants

10.2. 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.

10.3. Sub-pilot specific issues and measures

In addition to these general measures, following sub-pilot specific measures were taken:

With the aim of gathering quantitative usage data, TVC collects information about the navigation in its HbbTV service and the playback of the media offered. This, and no other kind of data was collected during the Catalan Sub-Pilots: only the information that was strictly necessary to know the navigation and use of media items available to users in TVC's Catch-Up TV service was recorded. This data was collected anonymously and only referred to identifiers of session and user, this second identifier depending on the user TV device configuration about cookies behaviour. Moreover, the platform on which data were collected and analysed is a third party tool, Adobe Omniture. This tool always outputs its reports in an anonymized fashion - without the possibility of regaining detailed user information through the reports.

The forms used in the Portuguese sub-pilot were read to the users in a group situation. The forms ensured that participants were:

- Aware of the experiment and have enough information to do the tests;
- Aware of the fact that their participation was completely voluntary and their personal information will be kept in anonymity;
- Aware that they had the opportunity to interrupt their participation at any time by their own will without any kind of loss for them.
- It also included a point concerning the use of pictures/photographs of the session tests in future publications (such as this deliverable or any other publication related to the project).

The forms were signed by each user and RTP and UPM representatives.

11. Conclusions

The sub-pilots carried out in Pilot A demonstrated some clear results. Firstly it is possible for broadcasters to implement customisable subtitles in catch-up TV services on both HbbTV devices but also other devices such as PC and mobile.

As all the broadcasters in the project had legacy systems and established workflows for subtitle production, for each one it was necessary to implement a solution that suited their existing technical set-up and workflows. The sub-pilots demonstrated that this is possible and can be run fully automatically or with a limited amount of user interaction.

Tools were developed within the project to help achieve the goal of using the EBU-TT-D standard. The introduction of services during the operational phase by RBB, TVC and RTP proves the usefulness and reliability of the tools.

The results of the user tests in Pilot A “Multiplatform Subtitle Services” indicate that users rate the option to customise subtitles positively. Users often encountered usability issues. This can be explained by the difficulty of retrospectively introducing new functionalities into existing interfaces.

Results from sub-pilots in Spain and Portugal demonstrated that in practice the settings chosen by the majority of users reflect established subtitle presentation, i.e. at the bottom of the screen and a medium sized font. Conversely, the results demonstrated that some users choose different settings, thus reinforcing the need for customisation options.

User tests in both Germany and Spain underline how important it is to offer clear, unambiguous symbols and labelling in applications. Instructions within the application should be short and clearly worded. Options for setting subtitles should be easy to find and remain visible on screen for long enough to allow the users read any instructions and change the setting. Any changes to navigation should be tested with the intended user group to ensure they understand icons or wording used in the application.

An issue that arose for testers in both the German and Spanish user tests was finding content with subtitles. Unless a service offers subtitles for all of its content, then developers and designers need to work together to find a solution to indicate which content is subtitled and which is not in a manner that is easy for users to recognise when browsing through lists and collections of content. They also need to develop solutions to make it easy for users to find the subtitled content and not have to scroll through long lists to find subtitles.

The results of the user tests have already lead to application optimisation and will continue to inform further developments in Germany, Spain and Portugal. The activities in HBB4ALL Pilot A “Multiplatform Subtitle Services” have allowed a first deployment in multiple sub-pilots of innovative subtitle services (as detailed in this deliverable), which will remain active beyond the end of the project. This is the case e.g. of the customised HbbTV subtitles for VoD portals of RBB and CCMA. These experiences have also reached other European broadcasters, for example other members of the ARD group in Germany. The project has enabled the development of several service components and modules whose exploitation will continue after the end of HBB4ALL.

From the start of the project EBU-TT-D has played an important role. The EBU-TT content generated for the sub-pilots was also used in the interoperability tests coordinated by IRT. The results of these tests helped to highlight some issues developers need to be aware of when developing players and thinking of rendering of subtitles.

12. References

- [1] D3.1 – Pilot-A Progress Report, HBB4ALL deliverable, October 2013 (<http://www.hbb4all.eu/wp-content/uploads/2015/03/D3.1-Pilot-A-Progress-Report.pdf>) (Last accessed Nov. 2016)
- [2] D3.2 – Pilot-A Solution Integration and Trials, HBB4ALL deliverable, October 2015 (<http://www.hbb4all.eu/wp-content/uploads/2015/03/D3.2-Pilot-A-Solution-Integration-and-Trials-2015.pdf>) (Last accessed Nov. 2016)
- [3] D5.4. – Pilot-C Evaluations and recommendations, HBB4ALL deliverable, November 2016
- [4] EBU Tech 3380: TECH3380 EBU-TT-D Subtitling Distribution Format. Version 1.0. March 2015. <https://tech.ebu.ch/docs/tech/tech3380.pdf> (Last accessed Nov. 2016)

13. Annex

13.1. Questionnaires from German sub-pilot

Field Test Phase 1

First Questionnaire: The focus of this questionnaire was to see how well the testers understood and could use the launcher bar, which elements did they recognize and what function did they assign to it.



Figure 49. 1st Questionnaire: Launcher Bar

2nd Questionnaire: The focus of this questionnaire was to find out how testers looked for videos with subtitles in the Mediathek and understood the problems they encountered

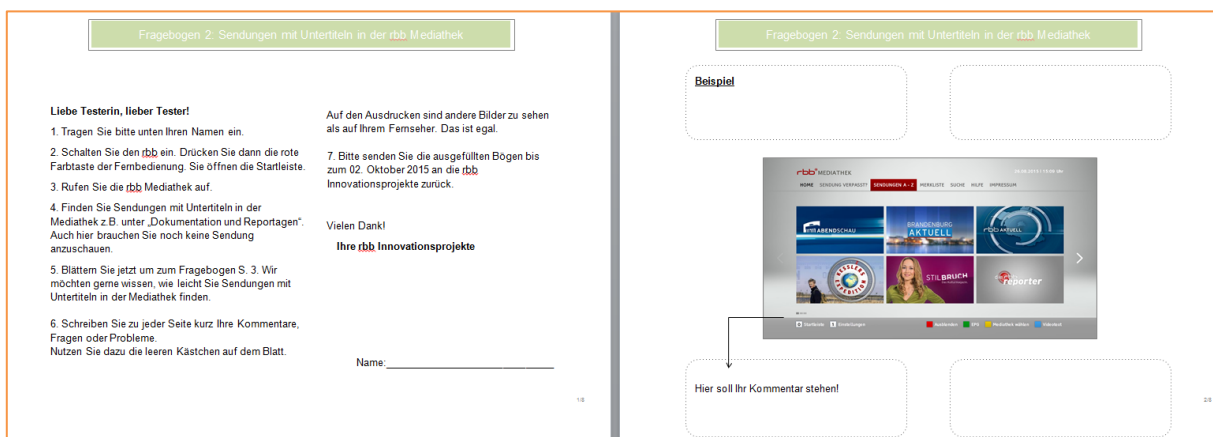


Figure 50. 2nd Questionnaire: Find Videos with Subtitles in the RBB Mediathek

3rd Questionnaire: System Usability Scale. This was the first use of the SUS questionnaire to see how testers rated the overall experience of using subtitles in the HbbTV Mediathek.

Figure 51. 3rd Questionnaire: System Usability Scale

Field Test Phase 2

1st Questionnaire: Subtitle Settings in the RBB Mediathek. The focus of this questionnaire was to find out what problems the testers encountered when they tried to change the subtitle settings, i.e. customize the subtitles to suit their needs and preferences.

Figure 52. 1st Questionnaire: Subtitle Settings in the RBB Mediathek

2nd Questionnaire: Rate Subtitle Setting in the RBB Mediathek. This quantitative questionnaire was used to rate the over use of the application by testers.

**Fragebogen 2:
Bewertung der Untertitel in der rbb-Mediathek**

1. Vor- und Nachname der TesterIn

Wie finden Sie die Untertitel in der rbb-Mediathek?

Anleitung
Kreuzen Sie bei jedem Wortpaar an, welcher der beiden Begriffe eher zutrifft.

Beispiel
Sie finden die Untertitel in der rbb-Mediathek eher schön als hässlich. Sie finden sie aber auch nicht wunderschön. Dann kreuzen Sie die 2 an.

schön 1 2 3 4 5 6 7 hässlich

Bitte kreuzen Sie EINE Zahl in jeder Zeile an.

einfach 1 2 3 4 5 6 7 kompliziert

unpraktisch 1 2 3 4 5 6 7 praktisch

voraussagbar 1 2 3 4 5 6 7 unberechenbar

verwirrend 1 2 3 4 5 6 7 überschaubar

stillos 1 2 3 4 5 6 7 stilvoll

wertvoll	1	2	3	4	5	6	7		minderwertig
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
fantasielos	1	2	3	4	5	6	7		kreativ
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
nüchtern	1	2	3	4	5	6	7		anregend
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
schön	1	2	3	4	5	6	7		hässlich
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
gut	1	2	3	4	5	6	7		schlecht
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		

Figure 53. 2nd Questionnaire: Rate Subtitle Setting in the RBB Mediathek

Field Test Phase 3

1st Questionnaire: Launcher Bar. This questionnaire concentrated perception, usability and understanding of details of the launcher bar identified as critical in earlier phase.

Fragebogen 1: Nachfragen zur Startleiste


Vor- und Nachname Tester/in:

Anleitung

Bitte setzen Sie sich für die folgenden Fragen vor Ihren Fernseher.
Schalten Sie den rbb ein.
Drücken Sie dann die rote Farbtaste.
Sie öffnen so die Startleiste.

1. Frage zu den sogenannten „Widgets“ auf der Startleiste

Die folgenden Fragen beziehen sich auf die sogenannten „Widgets“.
Das sind die quadratischen Elemente, die Sie auf der Startleiste anwählen können.
Unten im Bild sind sie hervorgehoben.









	eindeutig <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> nichtssagend Freiwilliger Kommentar:
	eindeutig <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> nichtssagend Freiwilliger Kommentar:
	eindeutig <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> nichtssagend Freiwilliger Kommentar:
	eindeutig <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> nichtssagend Freiwilliger Kommentar:
	eindeutig <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> nichtssagend Freiwilliger Kommentar:
	eindeutig <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> nichtssagend Freiwilliger Kommentar:

Figure 54. 1st Questionnaire: Launcher Bar

2nd Questionnaire: Subtitle Settings in the RBB Mediathek. This questionnaire also concentrated on details identified as critical in earlier filed trail phase.

Fragebogen 2: Probleme bei den Einstellungen der Untertitel

VOR- UND ZUNAME DER TESTER:IN

.....

ANLEITUNG

Kreuzen Sie bitte das Kästchen an, das am ehesten auf Sie zutrifft.
Beispiel:
Sie konnten die Einstellungen der Untertitel nicht schnell finden.
Kreuzen Sie also wie in der Beispielfrage die 1 an.

Beispiel-Frage: Ich kann die Einstellungen für die Untertitel schnell finden.

Stimme überhaupt nicht zu

1	2	3	4	5
x	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

 Stimme voll zu

FRAGE

Welche Probleme hatten Sie mit den Untertiteln (UT) in der rbb-Mediathek?

1. Ich konnte die Sendungen mit Untertiteln schnell finden.

Stimme überhaupt nicht zu

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

 Stimme voll zu

2. Es gibt genügend Hinweise auf Sendungen mit Untertiteln in der Mediathek.

Stimme überhaupt nicht zu

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

 Stimme voll zu

3. Die Suche nach Sendungen mit Untertiteln dauert mir zu lang.

Stimme überhaupt nicht zu

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

 Stimme voll zu

4. Die angebotenen Möglichkeiten zur Einstellung der Untertitel reichen aus.

Stimme überhaupt nicht zu

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

 Stimme voll zu

Fragebogen 2: Probleme bei den Einstellungen der Untertitel

5. Das Symbol verwirrt mich, wenn die Untertitel eingeschaltet sind.

Stimme überhaupt nicht zu

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

 Stimme voll zu

6. Ich habe schnell verstanden, dass ich mit der Taste 1 der Fernbedienung die Untertitel einstellen kann.

Stimme überhaupt nicht zu

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

 Stimme voll zu

7. Ich möchte die Untertitel mit einem zusätzlichen Schalter/Button sofort einstellen können, wenn ich ein Video ausgewählt habe.

Stimme überhaupt nicht zu

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

 Stimme voll zu

8. Ich möchte bei der Videoauswahl innerhalb einer Rubrik sofort sehen können, welche Videos Untertitel haben.

Stimme überhaupt nicht zu

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

 Stimme voll zu

9. Beim Start der Mediathek finde ich die Videos mit Untertiteln auf den ersten Blick.

Stimme überhaupt nicht zu

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

 Stimme voll zu

10. Hier können Sie Ihre sonstigen Anmerkungen und Kommentare aufschreiben:

Figure 55. 2nd Questionnaire: Subtitle Settings in the RBB Mediathek

3rd Questionnaire: System Usability Scale plus Net Score Promoter. The standard SUS questionnaire was used to measure long-term user experience of the subtitles in the Mediathek. It was complimented with the Net Promoter Score which is used to assess market potential by asking the likelihood of recommending the system to a friend.

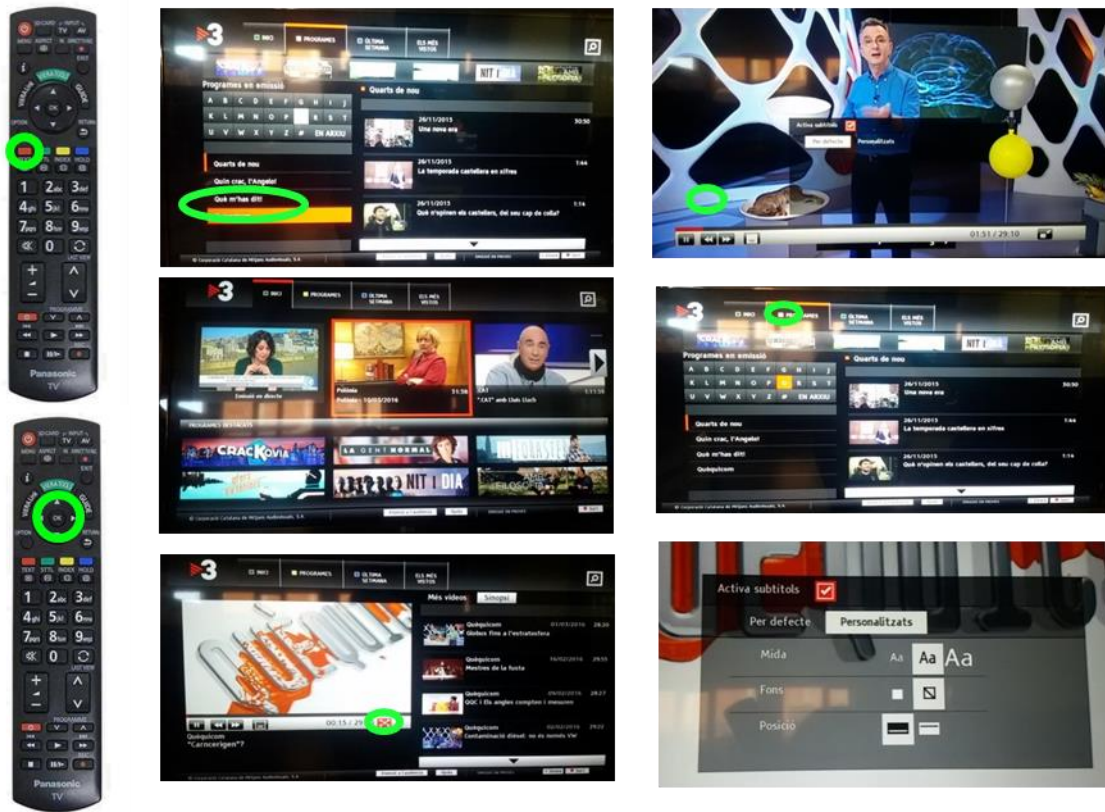


Figure 57. A la Carta System


- **Quantitative test 1**

The following technology ability scales used in the first quantitative test


Table 9. Technology Ability Scale

Device	I have at home	I know how to use it	I use it	Time of use (years)	Frequency of use (1 = never/ 5= very often)	Ability (1 = none/ 5 = normal user)
TV with remote control	YES-NO	YES-NO	YES-NO	.....	1 2 3 4 5	1 2 3 4 5
Computer	YES-NO	YES-NO	YES-NO	.....	1 2 3 4 5	1 2 3 4 5
Tablet	YES-NO	YES-NO	YES-NO	.....	1 2 3 4 5	1 2 3 4 5
Cell phone	YES-NO	YES-NO	YES-NO	.....	1 2 3 4 5	1 2 3 4 5
Internet	YES-NO	YES-NO	YES-NO	.....	1 2 3 4 5	1 2 3 4 5

The following System Usability Scale (SUS) was used in the first quantitative test

c. El símbol  em confon en anar a activar els subtítols.

Totalment en desacord				Totalment d'acord
-----------------------	--	--	--	-------------------

d. He entès ràpidament que puc activar els subtítols amb la tecla  del comandament.

Totalment en desacord				Totalment d'acord
-----------------------	--	--	--	-------------------

e. He reconegut la icona del subtítol.

Totalment en desacord				Totalment d'acord
-----------------------	--	--	--	-------------------

f. Deixaria aquesta configuració com a predeterminada.

Totalment en desacord				Totalment d'acord
-----------------------	--	--	--	-------------------

g. Utilitzaria aquest sistema amb freqüència.

Totalment en desacord				Totalment d'acord
-----------------------	--	--	--	-------------------

Figure 58. Fragment of SUS test

13.3. Detailed analysis of Spanish sub-pilot user tests

Qualitative Observation, time and subtitles customization

First, these are the problems found by users when using the system:

1. “Triangle button” to scroll down the episodes of programs: instead of using this button, 9 users were pressing the down arrow on the remote.
2. “Triangle button” plus “subtitles setting disappearing too quickly”: 3 users had these two problems simultaneously.
3. “Multiple problems”: 9 users said the system had more than two problems, especially the triangle button, the subtitles settings disappearing too quickly and other general steps of the system.
4. “Remote arrows to navigate in the system”: 5 users from the non-instructions test did not understand right away the use of these arrows.
5. “Subtitles settings disappearing too quickly”: 3 users confessed having this specific problem.
6. “Icon of subtitles setting”: only one user did not recognize this button from the remote.
7. “The system step-by-step:” one user could not follow the steps of the system to find and select contents, and customize the subtitles.
8. “Speed of subtitles”: one user complaint about this.

Overall there were three main problems: the triangle button, the subtitles setting disappearing too quickly and the arrows of the remote control. The rest of the problems are insignificant.

Second, the average time spent in the program selection and subtitles customization is 2 minutes and 52 seconds. For those that received instructions beforehand, the average is 1 minute 38 seconds while for those having received no instructions was 3 minutes and 7 seconds.

And third, the subtitles were customized as follows:

1. Size:
 - a. Large: 15 users
 - b. Medium: 19 users.
 - c. Small: 10.
2. Position:
 - a. Top: 5 users.
 - b. Bottom: 39 users.
3. Background:
 - a. Black: 26 users.
 - b. Transparent: 18 users.

There are some clear patterns, especially the position. This will be commented in the 3rd stage when comparing it with the final customization selected by users.

Quantitative 1: dummy variables and SUS questionnaire.

In general, the education level was high, with 23 users having a university degree plus 11 having high school diplomas, and 5 having a professional degree. The level of Catalan was also very high: 27 were native, 8 had a high level, 6 an average level and only 3 had a basic level. 41 users could read correctly and only one could read “more or less” (there were 2 missing individuals). According to these data, the formation and language level of participants does not seem to pose problems for the understanding of contents and subtitles.

We now turn to the technology possession and technology use test. 41 users had remote control at home and only 1 user had not. Only three users reported they did not know how to use it. Of these three, only one reported many problems using the system, and another one could not set the system so no duration was calculated. Apart from this, no other discordant data have been found. In fact, only four users do not use it on a regular basis.

Remarkably, 38 users have a computer at home and 35 users use it daily. 20 users have a tablet and 20 have not. 39 have and know how to use a cell phone. 35 have and know how to use the internet, and 31 actually use it. 34 reported not having seen the episode and 3 did not recall. The rest were missing values with none reporting to have seen it. 26 users use the remote control on a regular basis or almost; 11 users reported a low ability and only 4 reported having no ability at all. The use of computers resulted in similar results, while the tablet was generally not used.

Finally, 27 users considered themselves as being skilful using the cell phone, 7 users reported having average skills, and only 2 and 3 users considered they had low or very low skills.



In general, the picture of sociodemographic, educative and technology variables are quite homogenous, typical of an advanced society rapidly adapted to the new technological paradigm, so no influence of these variables on the system's management, subtitles selection and content comprehension is expected.

The following table shows the level of frequency and skills of participants in the different technologies. As can be seen (see table 8), results are very close to maximum frequency and ability (5):

Table 10. Frequency and ability in technology devices

Media escala de 1 (Nunca/ninguna) a 5 (siempre/usuario normal)	
Freqüència ús comandament	4,05
Habilitat comandament	3,93
Freqüència ús ordinador	4,21
Habilitat ordinador	4,08
Freqüència ús tauleta	3,54
Habilitat tauleta	3,56
Freqüència ús cellular	4,22
Habilitat celular	3,87
Freqüència ús internet	4,25
Habilitat internet	3,80

Next, the results of SUS test are presented. The average values of the 1 to 5 scales (from totally disagree to totally agree) are presented:

- a. No he aconseguit trobar ràpidament els programes subtitulats (2.82).
- b. Les opcions disponibles per a ajustar els subtítols són suficients (3.93).
- c. El símbol  em confon en anar a activar els subtítols (2.36).
- d. He entès ràpidament que puc activar els subtítols amb la tecla  del comandament (4.17).
- e. He reconegut la icona del subtitulat (4.10)
- f. Deixaria aquesta configuració com a predeterminada (3.90).
- g. Utilitzaria aquest sistema amb freqüència (3).
- h. Penso que el sistema és massa complex (2.37).
- i. Crec que el sistema és fàcil d'utilitzar (3.84).
- j. Crec que em caldria suport tècnic per a poder configurar aquest sistema (2.36).
- k. Les funcions de configuració dels subtítols estan ben integrades en el sistema (4.23).
- l. Crec que el sistema de subtítols no és consistent (1.93).

- m. Crec que la majoria de gent aprendria a utilitzar el sistema ràpidament (3.79).
- n. Penso que el sistema és incòmode (2).
- o. M'he sentit confiat amb el sistema (4.07).
- p. He hagut d'aprendre com funciona abans de fer-lo anar (3.19).

As can be seen, results always point to a moderate SUS satisfaction with the system, with positive statements having a score closer to 5 and negative statement always having a score closer to 1. If required directly in a yes-no question, participants were clearly rather satisfied with the whole experience (see Figure 58).

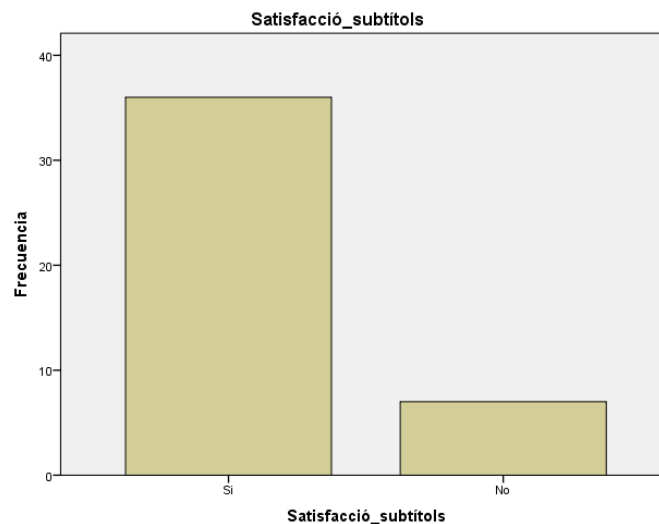


Figure 59. Subtitle satisfaction

Quantitative 2: comprehension test and final customization of subtitles

First, some descriptive results are given. The totality of users reported having been able to follow the plot. 41 could deliver a good summary, 1 could not and 1 only partially.

Second, this is the summary on the subtitles settings final selection after having the possibility of changing the former setting or not:

Table 11. Subtitle settings preferences

		Before the test	After the test
Size	Large	15	7
	Medium	19	20
	Small	10	16
Position	Top	5	2
	Bottom	39	41
Background	Black	26	21
	Transparent	18	22

The following are graphical representations of results after the subtitle settings test:

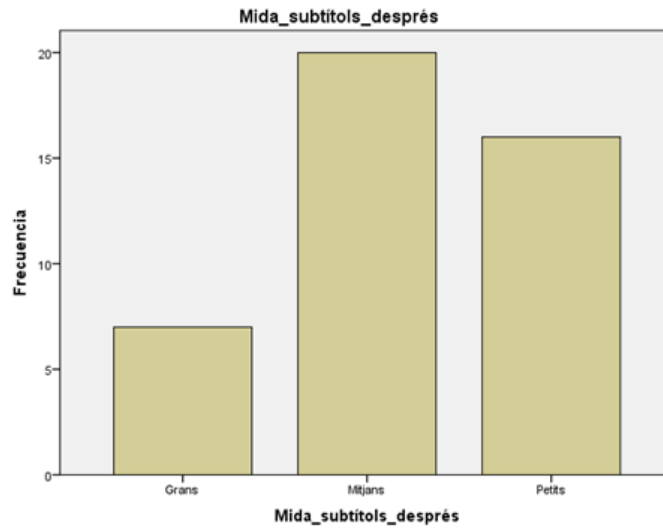


Figure 60. Preferences for subtitle font size after test

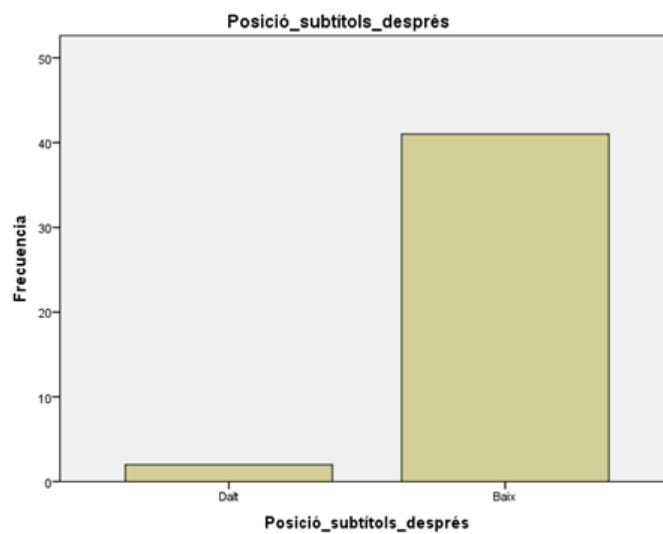


Figure 61. Preferences for subtitle position after test

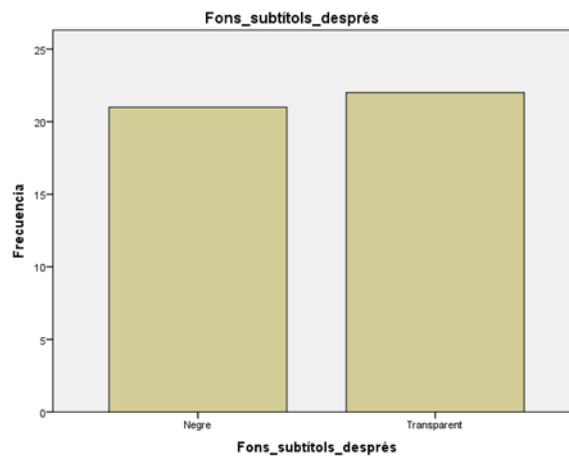


Figure 62. Preferences for subtitle background after test

As expected, the test reinforced certain patterns. First, it seems quite clear that the position of subtitles should be at the bottom of the screen. Second, large subtitles are not preferable. Third, there is no consensus about whether it is preferable a small or medium subtitle. Likewise, half of the users prefer a black frame at the back while half prefer none (transparent), although, quite unexpectedly, the supposedly better background -black back – has been less chosen after the test.

Finally, the level of comprehension was very satisfying. From a total of eight questions on the content, 5 users responded correctly to all of them, 18 users responded correctly to 7 questions, 12 users to 6, 5 users to 5 and 3 users responded correctly to 3 questions. The average is 6.33.

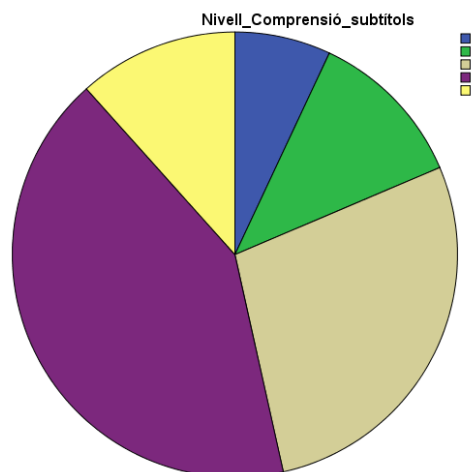


Figure 63. Level of comprehension of the content.

Finally, the analysis of comprehension is complemented with an experimental design in which independent variables are the yes-instructions or no-instructions tests and the different customization of subtitles and the dependent variable is the level of comprehension. As most of the questions in the test are not based on quantitative data and the sample of participants is small (44), no correlations can be found. However, a chi square regression analysis (contingency tables) can be applied.

Firstly, the fact that participants were receiving instructions or not was crossed with the level of comprehension of the content. This connection was not statistically supported. Secondly, there was no pattern of dependence found between the satisfaction of participants with subtitle customizations and the independent variable (yes-instruction or no-instructions). Finally, the different subtitles settings (size, position and background) were taken as independent variables to see they influence users' comprehension of content and satisfaction. The subtitles setting were found not to have an influence on the level of comprehension.

One may conclude that, although participants have clear preferences for subtitles settings (probably for comfort, habit or culture), the settings do not influence the comprehension of content.

13.4. Data Protection Agreements

13.4.1. *Form to Request Permission*

The following internal HBB4ALL form was sent to all partners requiring Ethical Commission approval, and it was then sent to UAB commission for approval. The form has the questions in Catalan but the replies are in English.

Títol Hybrid Broadcast Broadband for All

Breu descripció del projecte (3500 caracters)

The project HBB4ALL addresses media accessibility possibilities in the new hybrid broadcast-broadband TV (HbbTV) environment. To turn the accessibility vision into reality, Hbb4All will address all relevant stakeholders and all components of the value chain. One of the prominent challenges of the coming years will be the multi-platform delivery of audio-visual content (anytime, anywhere, any device), be it a broadcast or an Internet service. Hybrid delivery platforms such as connected TVs and two-screen solutions enable a cost-efficient and convenient delivery of access services for those who need them. The elderly and people with various disabilities rely on subtitles, Audio Description, dialogue enhancement or sign interpretation. Customizing to personal preferences shall be possible within predetermined limits. The HBB4ALL project builds on HbbTV (from the existing versions 1.1.1 and 1.5 to the version 2.0 that is currently in development) as the major European standard for converged services and looks at both the production and service side. HbbTV provides a straight-forward specification on how to combine broadcast and broadband content plus interactive applications.

The project will test access services in various pilot implementations (from the definition to the operational phase) and gather implicit and explicit user feedback to assess the acceptance and the achievable quality of service in the various delivery scenarios.

HBB4ALL is elaborating pertinent guidelines, guides of good practice, metrics, and recommendations and will initiate campaigns to promote the project results. The results of HBB4ALL will be of worldwide relevance and will, through standardization bodies such as the ITU, also be publicized on a world-wide level. The overall objective of HBB4ALL is to become a major platform/player in the e Inclusion economy currently taking place, fostering the future market take-up while satisfying the diverse interests of all societal groups.

Area del procediment Antropologia

Objectius del procediment d'experimentació amb humans (3500 caracters)

Descriure els principals objectius que es pretenen assolir amb la realització d'aquest procediment d'experimentació

The objective of the user tests carried out in this project is to obtain quantitative and qualitative information about user's preferences and experience regarding accessibility services such as subtitling, Audio Description and Sign Language Translation.

The information gathered from users will be used to various ends:

- to determine the optimal parameters for the user's information processing
- to provide feedback to project partner's in order to customize and adapt existent accessibility technologies according to user's recommendations.
- to establish quality standards and guidelines for the presentation of different accessibility technologies to the public.

Archivo: No (Els fitxers adjunts han de ser com suport. Mai per substituir el text principal. Tots els documents han d'estar en format PDF)

Metodologia del procediment d'experimentació (3500 caracters)

Descriure breument la metodologia emprada justificant les dades, mostres biològiques i o respostes conductuals obtingudes de les persones sota experimentació

The general procedure of the user tests in this project is to present audiovisual content to the users such as films, clips or audio files, and verify user responses to a number of variables.

In order to do this, several qualitative and quantitative techniques are taken into account, namely administration of questionnaires, focus groups or interviews. Where needed, data will be recorded during the visualization phase (i.e. eye movements or time needed to perform a certain task).

Also, users will be required to perform certain actions like activating accessibility services (for example, activating subtitles or Audio Description) following previous instructions from the researcher.

Since this is a project aimed at addressing the needs of all the population, apart from people with no impairments, among the users there will also be the elderly and persons with hearing or vision loss. If a participant with a particular impairment needs assistance, a personal assistant will help him/her to perform the task in a given study. The participants with hearing or visual impairments will be recruited via official channels, i.e. by sending information to associations and institutions concerned with actions devoted for deaf and hard of hearing persons and blind and partially sighted persons and inviting them to our studies.

Before each actual test, a demographic questionnaire will be administered to gather background information on the participants.

Archivo: NO (Els fitxers adjunts han de ser com suport. Mai per substituir el text principal. Tots els documents han d'estar en format PDF)

Informació a les persones participants

S'annexa un full d'informació del projecte de recerca que inclou de forma entenedora els objectius de la investigació, els investigadors/res responsables i la forma d'obtenir fàcilment més informació?

Si.

Adjuntar Archivo: (veure al final)

S'annexa un full de consentiment informat signat per l'investigador/a i la persona en qüestió on queda clarament expressat que la participació és voluntària, que es podrà retirar en qualsevol moment sense donar explicacions, que disposa de la informació suficient i que en el cas d'estar sota tractament aquest no es veurà afectat de cap forma?

Adjuntar Archivo: (veure al final)

Compensació

Està previst algun tipus de compensació per la participació en el projecte?

No

Gestió i emmagatzematge de les dades obtingudes

Està prevista l'anonimització de les dades obtingudes?

Si

Està previst l'emmagatzematge de les dades en un servidor segur?

Si

Data collected in the course of the study will be stored on the Nebula server. Nebula is the space for collaborative work on documents as well as a repository for documents.

Feedback

Està prevista alguna forma de feedback a les persones participant un cop finalitzat el projecte?

Si

The participants will be given access to the project reports and academic articles produced in relation to the study.

Name of the project: HBB4ALL. Hybrid Broadcast Broadband for All

Aim of the tests

Methodology

Contact person

Forms were filled in in the many EU languages used for the tests: English, German, Polish, Italian, and Spanish.

13.4.2. Consent Forms

As to informed consent, the partners were instructed to describe the procedure for obtaining the consent of persons, through a specific informed consent form. The informed consent form will be drafted in the language of the user, and will include standard features such as an explanation of the purposes of the tests, the expected duration of the test, a description of risks/discomforts/benefits to the subject etc., and will also indicate a contact person for pertinent questions. Since tests will take on board users of different sensorial disabilities, alternative communication channels (for example sign language or texts to be read by the visually impaired with Jaws) will be used.

Researchers will also describe the procedure the arrangements for protecting the confidentiality of personal data of the individuals concerned. If the researchers wish to retain the data for further research, they will have to ensure that the consent form mentions it and that the measures taken to encode or anonymize banked data are explained. In case only anonymized data will be retained, researchers will ensure adequate security for storage and handling of such data.

The following are example of information and consent forms used in sub-pilots

13.4.2.1. Consent form used in German sub-pilot

Datenschutzerklärung

Ich bin damit einverstanden, dass meine Daten gespeichert werden.

Die **rbb** Innovationsprojekte speichern die Daten für die gesamte Testphase des Projektes bis zum Ende der Auswertung im August 2016.

Danach werden die Daten gelöscht.

Die Daten werden anonymisiert.

Die Daten werden nur im Rahmen der Auswertung weitergegeben.

Bei einem vorzeitigen Ausstieg aus dem Projekt werden meine Daten gelöscht.

Ich als Tester/Testerin kann mein Einverständnis für die Speicherung der Daten schriftlich widerrufen.

*Rundfunk Berlin-Brandenburg
Innovationsprojekte
Marlene-Dietrich-Allee 20
14482 Potsdam*

Eine weitere Teilnahme an dem Test ist in diesem Fall nicht mehr möglich.

Mit der Vereinbarung zum Datenschutz bin ich einverstanden.

Ort,

Datum:

.....
.....

.....
.....

Vorname und Nachname

Unterschrift



CIP-IST-PSP-621014



www.hbb4all.eu



D3.4 v1.00

13.4.2.2. Information for participants in German sub-pilot

Innovationsprojekte der
Produktions- und
Betriebsdirektion
21.09.2015

TELEFO +49 331 97 99 3 – 50 065
N +49 331 97 99 3 – 50 049
TELEFA innovationsprojekte@rbb-online.de
X
E-MAIL

Liebe Testerinnen und Tester,

vielen Dank, dass Sie uns helfen möchten, die Untertitel (UT) in der rbb HbbTV-Mediathek zu verbessern. Der Test zu den Untertiteln läuft insgesamt 10 Wochen.

Er besteht aus mehreren Teilen.

Sie werden nicht viel Zeit für die einzelnen Fragebögen benötigen.

Wir haben diese in einfacher Sprache verfasst.

Sie erhalten auch eine Beispielsicht sowie zu jedem Test eine schriftliche Anleitung.

Wir starten mit

- 1 Fragebogen zum Ausfüllen
- 2 Zettelsätzen von ausgedruckten TV-Bildschirmansichten zum Markieren und Beschriften
 - Fragebogen1: Startleiste
 - 2. Bildschirmansicht: Untertitel in der rbb-Mediathek

Notieren Sie bitte Ihren Namen auf dem jeweiligen Testbogen.

Gehen Sie dann Blatt für Blatt durch die Tests.

Auf den Ansichten können Sie Anmerkungen oder Probleme markieren und kurz beschreiben.

Sie können die Ausdrucke eine Woche lang auf dem Couchtisch liegen lassen. Falls Ihnen in der Zeit weitere Probleme, Fragen oder Anregungen einfallen, schreiben Sie diese einfach dazu.

Bei den Tests interessieren uns drei Bereiche:

- Wie gut gelingt es Ihnen, Sendungen mit UT zu finden?
- Wie gut gelingt es Ihnen, diese UT anzuschalten und
- an Ihre Bedürfnisse anzupassen?

Bitte beachten Sie: Wir möchten nicht Sie persönlich überprüfen, sondern unsere Mediathek.

Senden Sie bitte alle ausgefüllten Testblätter nach einer Woche an uns zurück. Nutzen Sie dafür den beigegefügt frankierten Rückumschlag.

Vielen Dank für Ihre Mithilfe!

Ihre rbb Innovationsprojekte

13.4.2.3. Consent form used in Portuguese sub-pilot



DECLARAÇÃO DE CONSENTIMENTO

RTP (Rádio e Televisão de Portugal) e UPM (Universidad Politécnica de Madrid)

NOME DO PROJETO

HBB4ALL. Projeto de investigação sobre tecnologias de acessibilidade para dispositivos desenvolvidos segundo as normas padrão para HbbTV.

DESIGNAÇÃO DO ESTUDO

Teste de utilização e eficácia para a configuração de sistemas de legendagem e interpretação em língua gestual no sítio de internet da RTP

DESIGNAÇÃO DO GRUPO DE INVESTIGADORES

Transmedia Catalonia, RTP e UPM

CONSENTIMENTO

- Declaro ter lido e compreendido a informação disponibilizada sobre a experiência, e tive a oportunidade de fazer as perguntas que julguei necessárias;
- Tive conhecimento de que a minha participação na experiência é voluntária e que os meus dados pessoais se manterão sempre sob anonimato;
- Os resultados obtidos no presente estudo poderão ser utilizados na elaboração de material académico relacionado com este projeto e na apresentação final à Comissão Europeia;
- Autorizo a realização de fotografias durante a sessão de testes, para documentação futura do projeto;
- Declaro que tive conhecimento de que posso suspender a minha participação a qualquer momento e sem justificação prévia, sem que isso tenha qualquer repercussão adicional.

Nome do participante: _____

Assinatura do participante (ou representante): _____

Assinatura(s) do(s) investigador(es): _____

Data: _____

13.4.2.4. Information form for participants in Portuguese Test



INFORMAÇÃO AO PARTICIPANTE

HBB4ALL. Projeto de investigação sobre tecnologias de acessibilidade para dispositivos desenvolvidos segundo as normas-padrão para HbbTv.

O objetivo do projeto HBB4ALL é o de estabelecer normas de qualidade para a disponibilização de tecnologias de acessibilidade para o utilizador final. Estas tecnologias incluem: legendagem, audiodescrição e interpretação em língua gestual.

Para isso, serão realizados diversos estudos nos quais se pretende estabelecer boas práticas na produção de conteúdos fílmicos. Desta forma, pretende-se melhorar a usabilidade destes serviços e permitir que todas as pessoas possam aceder aos serviços de acessibilidade oferecidos pela norma HbbTv.

Testes de usabilidade e eficácia na configuração de sistemas de legendagem e interpretação em língua gestual no sítio de internet da RTP

Este estudo pretende analisar o nível de aceitação e de usabilidade da aplicação desenvolvida pela RTP/UPM para o projeto HBB4ALL.

PARTICIPAÇÃO VOLUNTÁRIA

A participação neste estudo é completamente voluntária, podendo ser interrompida a qualquer momento se o participante assim o desejar. Os resultados obtidos são absolutamente confidenciais e serão utilizados exclusivamente em publicações científicas relacionadas com o projeto em que se enquadram.

EQUIPA DE INVESTIGAÇÃO

A equipa de investigadores responsáveis por esta experiência pertence à RTP e UPM.

Contactos: mario.sequeira@rtp.pt
cam@gatv.ssr.upm.es

RTP – Rádio e Televisão de Portugal
Avenida Marechal Gomes da Costa, n.º 37
1849-030 Lisboa Portugal