Deliverable

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D3.4-Accessibility Interface

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P	Public	X
C	Confidential, only for members of the consortium and the Commission Services	

Abstract: This document addresses the topic "access to accessibility services" by looking at the UI itself as well as the signalling of accessibility services. It contains the experience from the ImAc consortium regarding UI / user guidance that has been collected so far by the consortium and describes best practices for the UI as well as for the signalling of accessibility services in the content stream and regarding handling redundant, potentially inconsistent signalling information from different abstraction levels in the UI.

REVISION HISTORY

Revision	Date	Author	Organisation	Description
0.1	04-04-2019	Ronald Mies	IRT	Initial deliverable layout
0.2	22.05.2019	Ronald Mies	IRT	Stable layout
0.3	14.06.2019	Ronald Mies	IRT	Initial round of input from RBB, CCMA, i2CAT, IRT
0.4	12.07.2019	Ronald Mies	IRT	Second round of input from RBB, CCMA, i2CAT, IRT
0.5	18.07.2019	Peter tho Pesch, Ronald Mies	IRT	Updates to chapters 2, 3 and 4. Initial versions of conclusions and summary.
0.6	06.08.2019	Peter tho Pesch, Ronald Mies	IRT	Updates to chapters 3, 4, 5 and 6, by RBB, CCMA, i2CAT, IRT. Version for internal review.
1.0	15.08.2019	Ronald Mies	IRT	Version for submission

EXECUTIVE SUMMARY

The user interface (UI) of a media player / app plays a key role in providing guidance to the end user, and in giving orientation to control the media content being consumed. It should ease access to the media service and also be accessible itself. The UI specifically also should allow easy access to the accessibility services (AS), e.g. by making it easy to activate AS and to change appropriate settings. For the user to be aware of AS being offered and any applicable options, the UI should be fed with appropriate signalling attributes / metadata describing the AS, which is generated at the media provision side.

This document addresses the topic "access to accessibility services" by looking at the UI itself as well as the signalling of AS. It contains the experience from the ImAc consortium regarding UI / user guidance that has been collected so far and describes best practices for the UI as well as for the signalling of AS in the content stream and regarding handling redundant, potentially inconsistent signalling information from different abstraction levels in the UI.

Through a structured analysis of the UIs of State-of-the-Art media players, general insights and some recommendations have been provided to support users accessing AS. The current implementation of the UI giving access to the AS in the ImAc portal and player (implemented in T3.5) reflects the status after feedback from T3.4 as well as from user tests in pilot phase 1 (see D5.4 "Pilot evaluation report" [1]). This will be used for further user tests (specifically pilot phase 2), see section 3.

User guidance on access to AS could be eased by harmonising the UI design. This is not an isolated issue for immersive media but rather a general issue and clearly goes beyond ImAc: this requires cooperation between media (portal) providers and implementors.

Key findings:

- Hardly any media player currently provides access to the full set of AS (subtitles, audio description, sign language); VR players do not focus on AS at all (section 2.10, page 99).
- The documented media players that do support access to AS, allow a quick access to AS and their settings (one "step" of action via the UI). Having said that, the UIs have very diverse designs, and the way guidance is given to control the AS varies widely.
- There is no harmonised convention for icons / representations used for AS. ImAc decided to use a set of icons proposed by Danish Radio to have a universal set to represent AS for all ImAc users in all countries (section 2.10, page 100).
- A multitude of specifications and standards describing signalling and metadata for subtitles is available in the market, both for broadcast as well as online streaming media distribution. For application in 360° video / XR environment, additional metadata is required. An overview of the required ImAc extensions, comparing current specifications with required ImAc features is given (section 5.1, page 125).
- The provision of redundant AS signalling on various layers simultaneously can cause conflicts in the UI. As potentially various specifications / standards are involved, an additional harmonisation of implementation choices would be desirable. Design choices to handle these conflicts are described for the case of language settings (section 6.2) and subtitle style and positioning attributes (section 6.3).

The topic "access to accessibility services" clearly requires additional research, specifically also regarding the realisation of UIs (whether for webplayers on PC/tablets, apps running on TV or other devices). Easy access solutions also for TV application (e.g. a "one button" on a remote control) would be ideal but need a support from involved market players.

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LIST OF ACRONYMS

Acronym	Description
AD	Audio Description
AS	Accessibility Services
AST	Audio Subtitles
DASH	Dynamic Adaptive Streaming over HTTP
DSM-CC	Digital storage media command and control
DVB	Digital Video Broadcast
EA-UI	Enhanced Accessibility User Interface
EBU-TT	EBU Timed Text
EBU-TT-D	EBU Timed Text subtitle distribution format
HbbTV	Hybrid broadcast broadband TV
HMD	Head-mounted Display
IMSC	Internet Media Subtitles and Captions
ISO BMFF	ISO base media file format
MPD	Media Presentation Description
MPEG OMAF	MPEG Omnidirectional Media Format
MPEG-TS	MPEG Transportstream
OS	Operating System
PID	Packet Identifier
SL	Sign Language
SoA	State-of-the-Art
ST	Subtitles
TTML	Timed Text Markup Language
UI	User Interface
VR	Virtual Reality
WebVTT	Web Video Text Tracks Format

1. INTRODUCTION

1.1. Purpose of this document

The variations of the technical distribution contexts for audio-visual media steadily increases. New hardware and software platforms are brought into the market while legacy systems are still being used. More than ever, the user demands orientation to control the different media services. User interfaces (UI) play a key role in meeting this guidance requirement. They should ease access to the media service but also be accessible themselves.

The demand for guidance is especially high for accessibility services. The users in our target group need to activate an accessibility service such as subtitles before they can consume the media content. In general, the default presentation of a media service has all the accessibility services switched off. Therefore, it is very important that an accessibility service can be easily activated, and its settings can be easily changed.

To be able to guide the user, a UI not only shall give easy access to the content and the accessibility services, it shall also be aware of the accessibility services that are actually being offered for a specific media content and of any options that are provided with them (e.g. detailed settings for personalisation). Based on this information, the UI shall provide the user with the respective options, as applicable. This information is carried to the player application as metadata or signalling information using specific data fields/structures together with the media and accessibility services and is presented via the UI of the device / software with which the service is accessed.

It is often possible to employ signalling of accessibility services on various “layers” simultaneously, e.g. as part of the file format, as part of the container format and as part of the transport method. Mostly, it is not defined what the player / app should do, or which information is presented in the UI, when signalling information on different abstraction levels is inconsistent. Design choices need to be made to handle this and harmonisation may be desirable.

The purpose of this document is to address these issues and to recommend best practices for providing access to accessibility services (via a UI), for the signalling of accessibility services in the content stream and for handling signalling information from different layers in the UI.

1.2. Scope of this document

This document provides the experience and recommendations from the project consortium regarding UI / user guidance at the time of publication. Concretely, it includes a structured analysis of a set of State-of-the-Art media players, specifically focussing on the access to accessibility services, as well as an overview of the design considerations for the UI of the ImAc player (from the first prototype, through UI testing in pilot phase 1 up to the UI design of the player version to be used in pilot phase 2). Regarding the signalling / metadata for accessibility services also a State-of-the-Art analysis, based on existing specifications and standards, both for broadcast as well as for streaming services is presented, and an outline of metadata and signalling required for ImAc, as well as an overview of the required ImAc extensions, comparing current specifications with required ImAc features, is given. The issue of signalling of accessibility services on various layers is being outlined and initial recommendations are given.

Technical details on the signalling of accessibility services are out of scope here; these will be included in D4.4 [2]. Also detailed description of the required ImAc-specific extensions with respect to the metadata / signalling of accessibility services will be described in that deliverable.

Potential conflicts in the UI, caused by provision of redundant signalling of accessibility services on various layers simultaneously (e.g. the operating system, the browser, web player or native application and user settings), are addressed. Specifically, this document describes how these conflicts are handled in ImAc in the case of language settings, as well as subtitle style and positioning attributes coming from different layers.

1.3. Status of this document

This is version 1.0 of deliverable D3.4, also the final version of the document. The described recommendations by no means claim to be exhaustive in all dimensions. However, it was important for the consortium to capture the work done in this domain within the project. We want to provide meaningful insights, experiences and lessons learned to any interested party. We have tried to present the information in a well-structured and easy-to-handle manner.

1.4. Relation with other ImAc activities

The activities in T3.4, leading to this deliverable, closely relate with T3.5 (Player) for which input regarding the UI design was provided (up to a player version to be used in pilot phase 2). Options for an enhanced accessible UI were analysed and used in the UI implementation of the ImAc player.

Also tasks T4.1, T4.2 and T4.3, in which tools have been developed for the creation of the accessibility services in ImAc, as well as T3.3 (Content Packaging) relate to the activities described here: the required metadata / signalling information must be provided by the accessibility service tools and / or the packager, to allow the ImAc player to be aware of the accessibility services that are available and any options (e.g. with respect to personalisation) or versions (e.g. languages) being offered. These are part of the file formats, described in D4.4 [2].

There is also a link with T5.3 and T5.4, specifically regarding the pilot phase 1 tests, in which the UI was tested for user feedback (documented in the first iteration of D5.4 [1].

Specifically the issue on signalling / metadata also relates to ImAc standardization activities (T6.3). Additional metadata is required to adequately describe the accessibility services for their distribution and rendering / application in 360^{o} video, some of which have been contributed to appropriate standardization groups. Technical details on these metadata will be described in D4.4 [2].

2. STATE-OF-THE-ART ACCESS TO ACCESSIBILITY SERVICES

2.1. Introduction

User interfaces (UI) play a key role in enabling easy access to content and in guiding the user in controlling media services. At the same time, UIs should also be accessible themselves. The requirements for guidance are especially high for accessibility services. Some groups of users need to activate an Accessibility Service such as subtitles before they can consume the media content. In general, the default presentation of a media service has all accessibility services switched off. Therefore, it is very important that activating and controlling accessibility services is made as easy as possible.

This chapter documents UIs of State-of-the-Art (SoA) players / apps / implementations that allow access to currently deployed media services, focussing on the accessibility services they offer. The goal of this documentation was to derive best practices addressing access to accessibility services in UIs of media services. For a structured analysis, a template / taxonomy was used (see Annex I Taxonomy for analysis of access to accessibility services in player / App), which was developed in the context of ImAc. For later analysis / comparison, the taxonomy supports a detailed documentation of the analysed players / apps, their hardware and software environment as well as the stepwise tests being carried out (documented with screenshots and descriptive information). In ImAc we used this tool to analyse a set of relevant players currently in use by broadcasters and some online players relevant to ImAc (key players like Netflix, VR/AR players) currently in use.

The step-by-step documentation and later analysis focusses on a set of important functionalities for the UI, that are at the basis of the actual access to the accessibility services.

For each player / app, following functionalities (as far as available) have been analysed step-by-step:

- Switching Subtitles on/off
- Switching Audio Description on / off
- Switching Sign Language on/off

Specifically focussing on which steps are needed (assuming the player is running and content is loaded), how many steps are required and the differences between the 3 Accessibility Services. Additionally, the documentation covered

- Steps required to show the current settings with respect to the accessibility services (user feedback to which AS is switched on and, if relevant, with which optional settings)
- Use of player controls in the UI (aiming at harmonising the ImAc player UI, e.g. with respect to use of standard buttons for the controls, layout and use of icons (for player but specifically also for the accessibility services).

The following selection of players / apps has been analysed:

- Catch up TV services provided by public broadcasters
    - ARD Web Player (section 2.2)
    - CCMA / TV3 Web Player (section 2.3)
    - CCMA HbbTV App (section 2.4)
- State-of-the-art streaming and video-on-demand services:
    - Netflix Web Player (section 2.5)
    - YouTube Web Player (section 2.6)

- VR players
    - RTVE VR Web Player (section 2.7)
    - RTVE VR Android App (section 2.8)
    - Web VR Web Player (section 2.9)

From the step-by step documentation, best practices have been extracted (see section 2.10).

2.2. ARD Web Player

Client

- Manufacturer: ARD (wrapper for hls.js, dash.js using MSE or native browser playback)
- Name: ARD Player
- Version: -
- Type: Browser player – tested on Mozilla Firefox 60.7.0

Hardware

- Manufacturer: Fujitsu
- Model: -
- Version: -
- Type: PC

Operating System

- Name: Windows
- Version: 10
- Version Name: Windows 10 Enterprise, Version 1803

Content

- Media Channel: ARD Mediathek
- Content Provider: Das Erste

2.2.1. Switching Subtitles on/off

Target (Goal of the interaction)

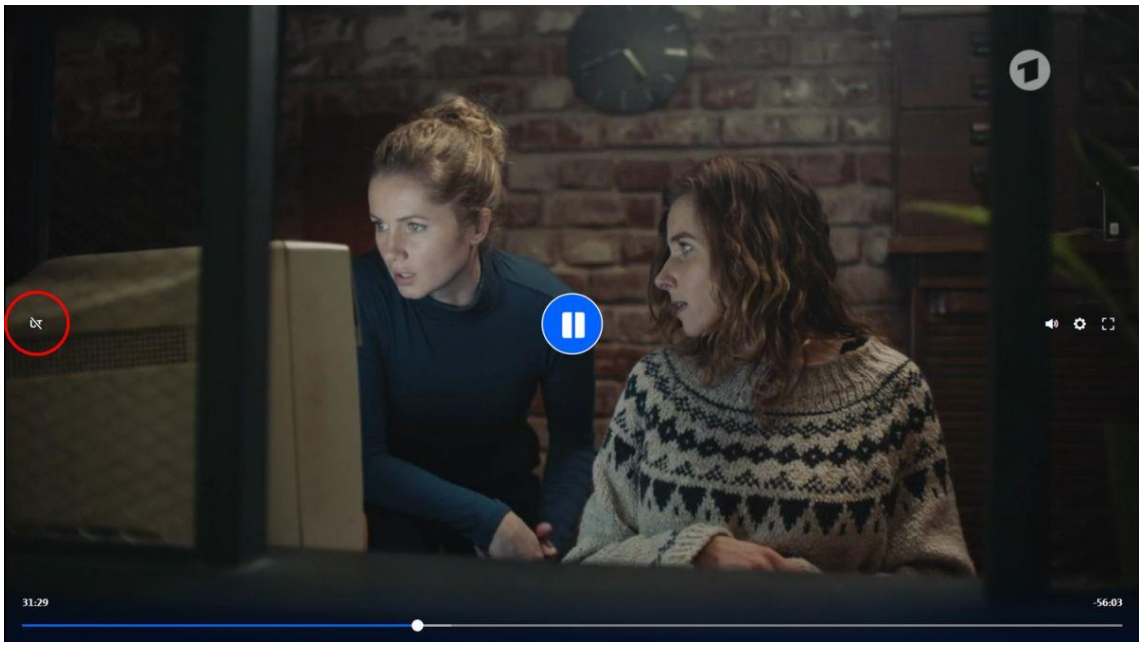
- Name: Activation of Subtitles
- Type: Activation of Service

Steps

Step 1 – Mouse over video

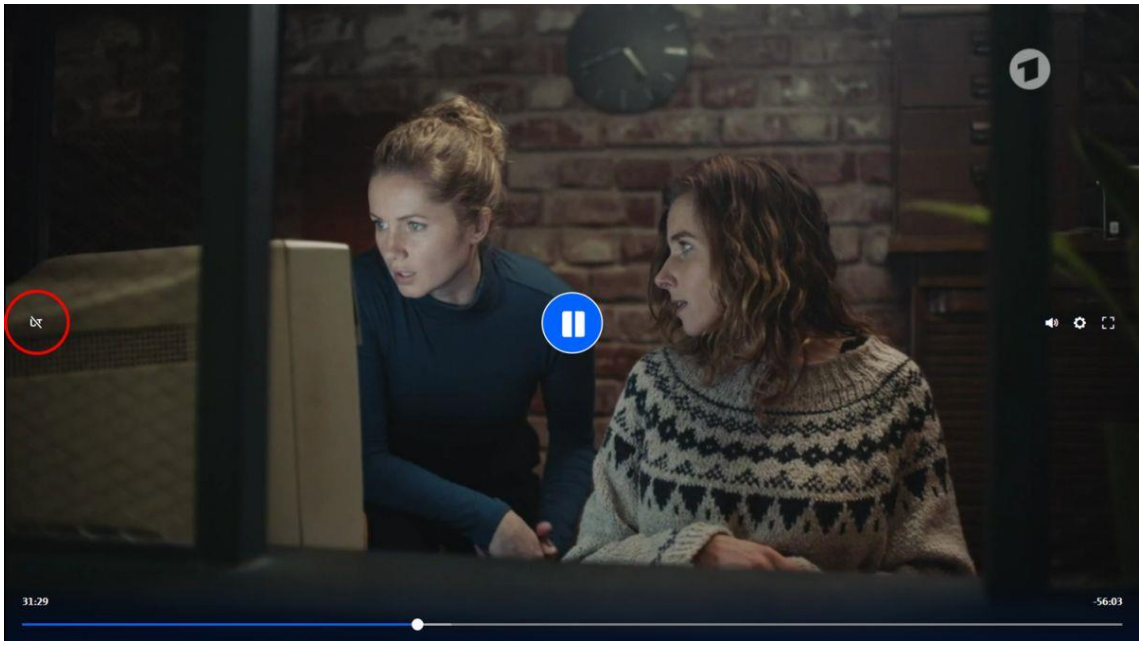
Before: Video is playing, no controls are visible in the screen.

After: UT icon is visible in the left of the video image.



Step 2 – Click on icon “UT”

Before: Subtitles are disabled, the icon has strike (showing disabled status)



After: Subtitles are enabled, the icon has no strike (showing enabled status)

2.2.2. Switching Audio Description on/off

Target (Goal of the interaction)

- Name: Activation of Audio Description
- Type: Activation of Service

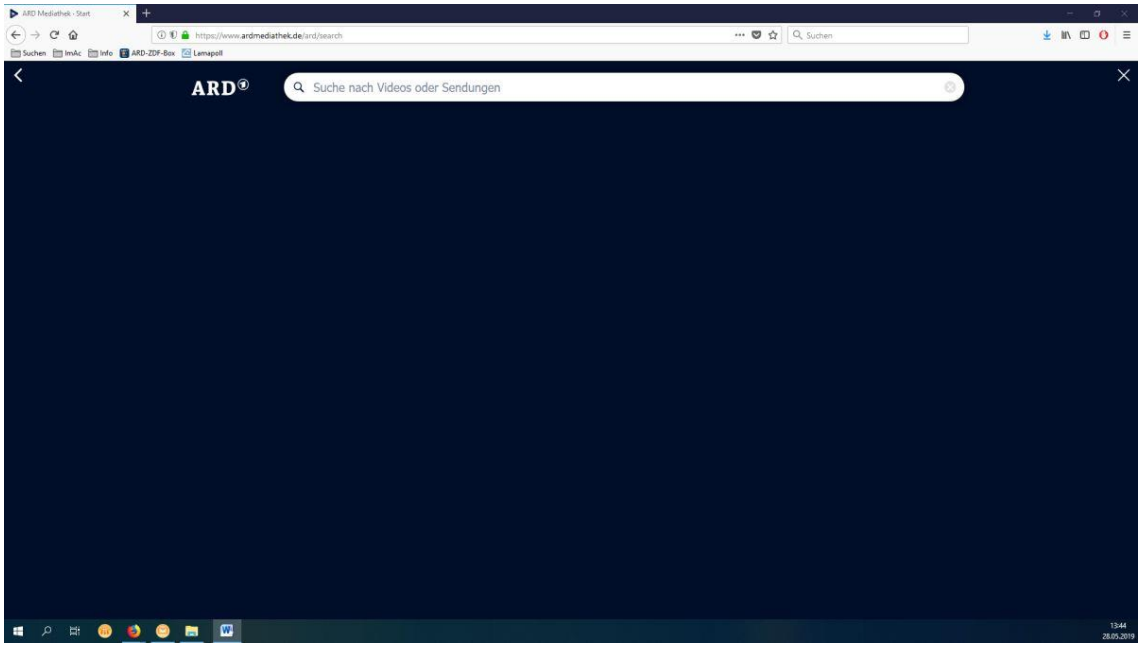
Alternative 1

Steps

Step 1 – Click on the search icon of the platform

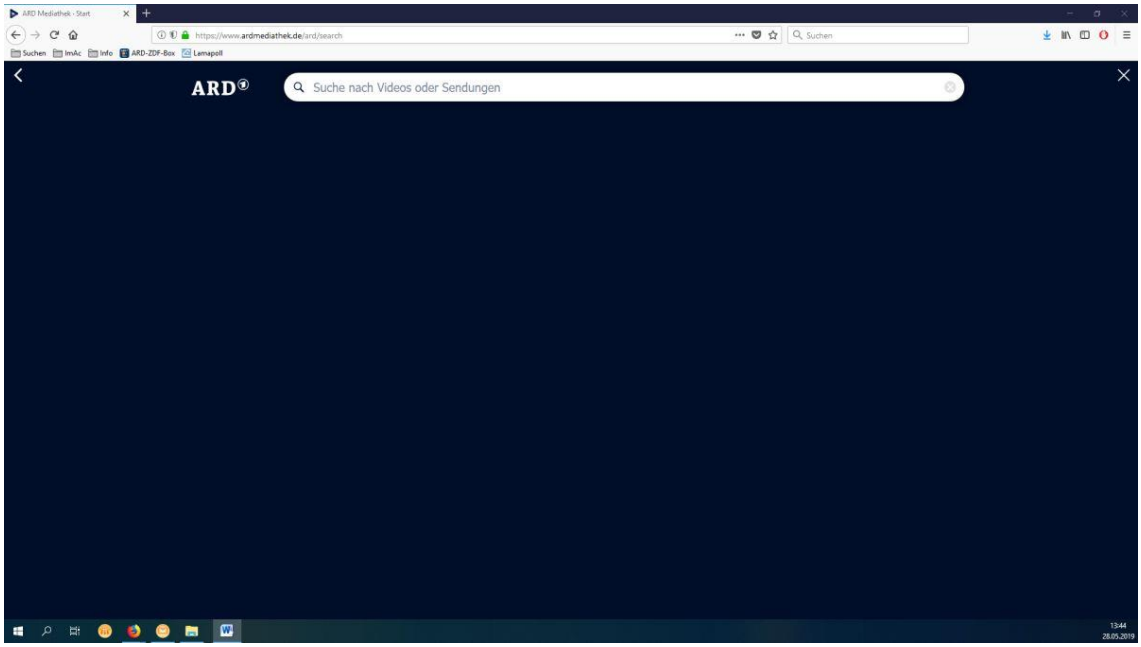
Before: Selected contents of the ARD Mediathek are listed in the initial page of the platform

After: The search field is enabled, search terms can be entered

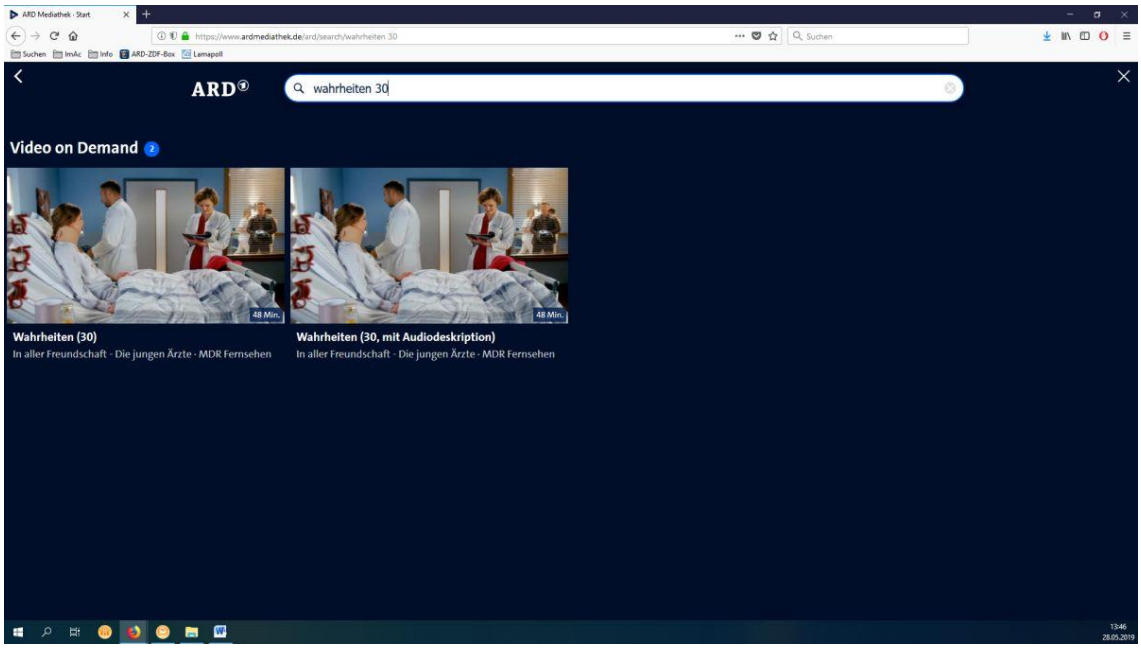


Step 2 – Enter name of desired video into the search field

Before: The search field is enabled

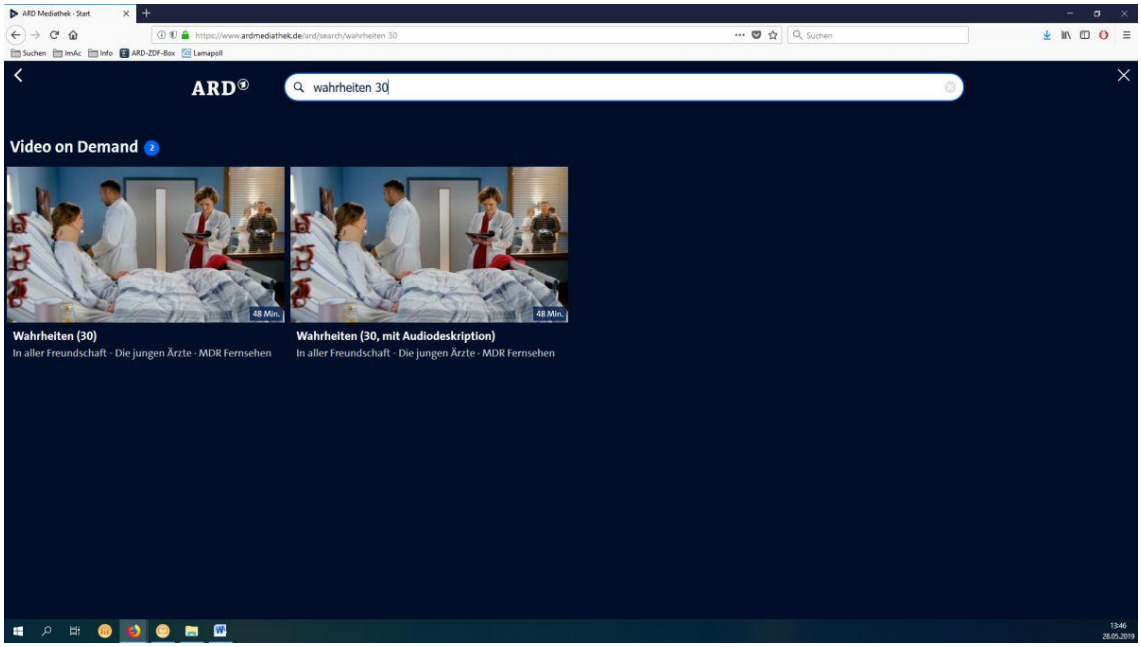


After: The search term is displayed in the search field and the search results are automatically displayed below. If audio description is available for a specific film, two versions are displayed (one without AD, one with AD)

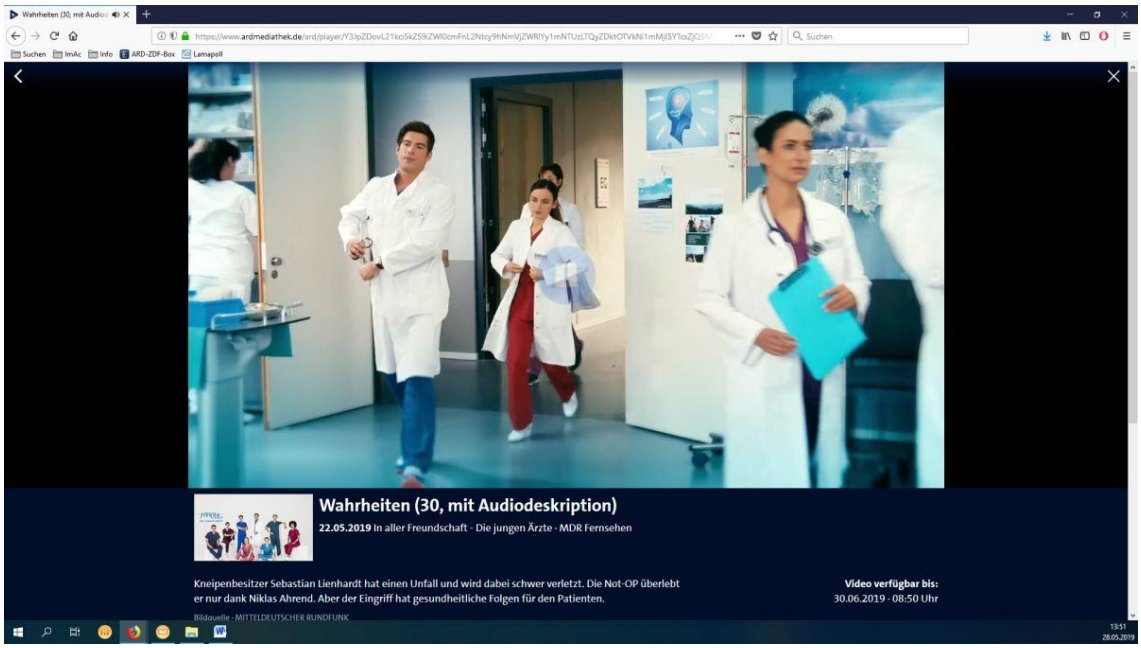


Step 3 – Click on desired video with audio description

Before: The search results are displayed



After: A new page is loaded with the video and it automatically starts playing



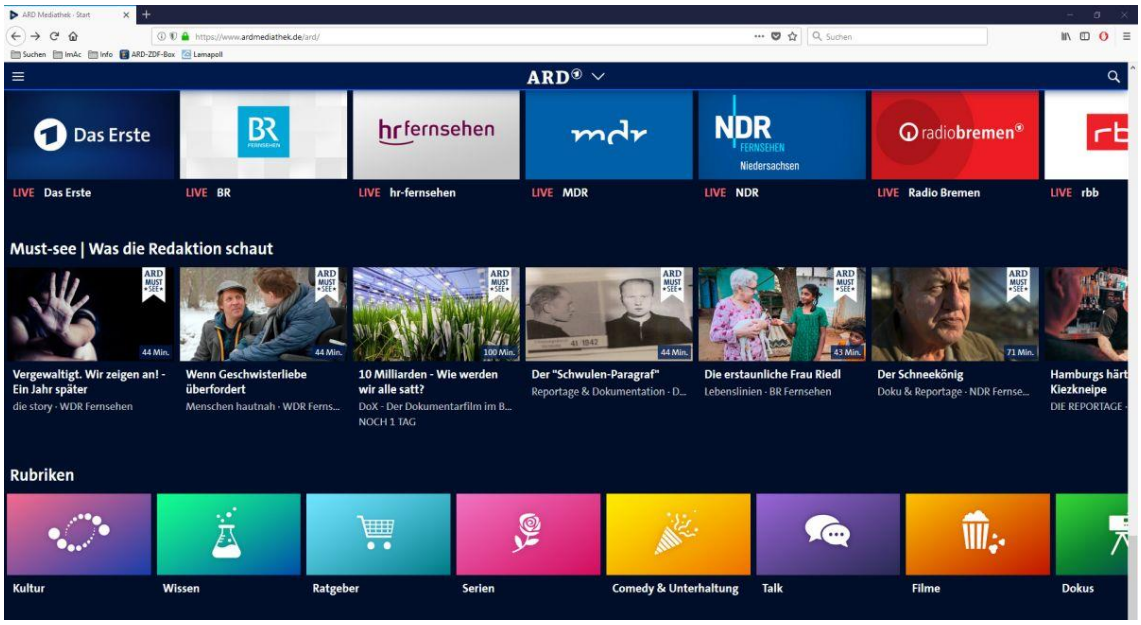
Alternative 2

Steps

Step 1 – Scroll to bottom of the player website

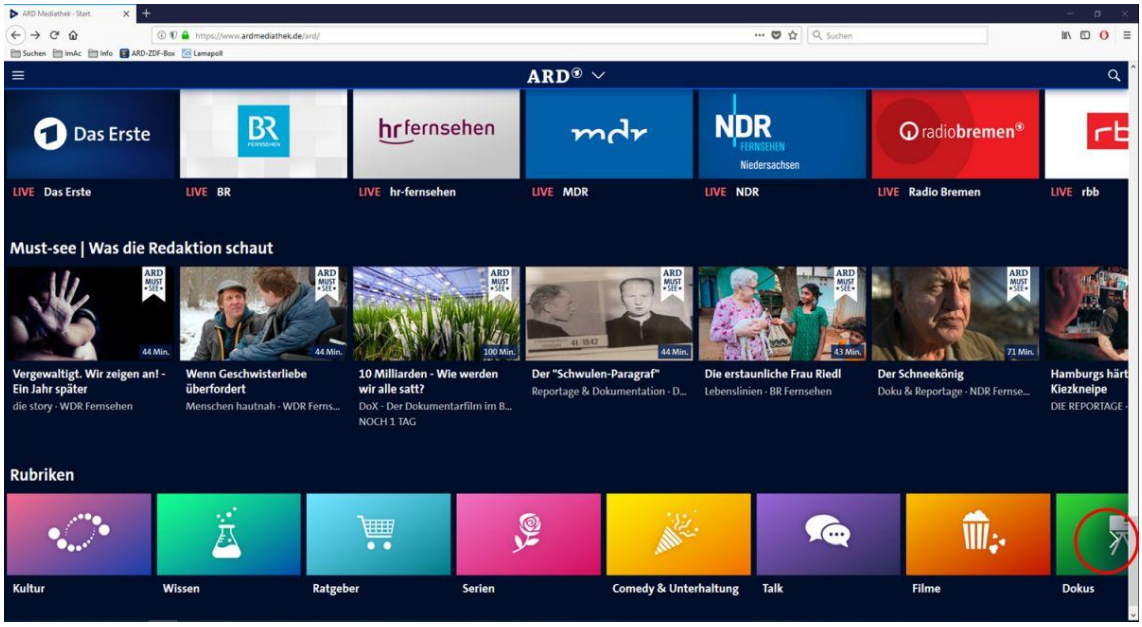
Before: The top of the ARD player website is shown

After: A horizontal list of content categories is shown

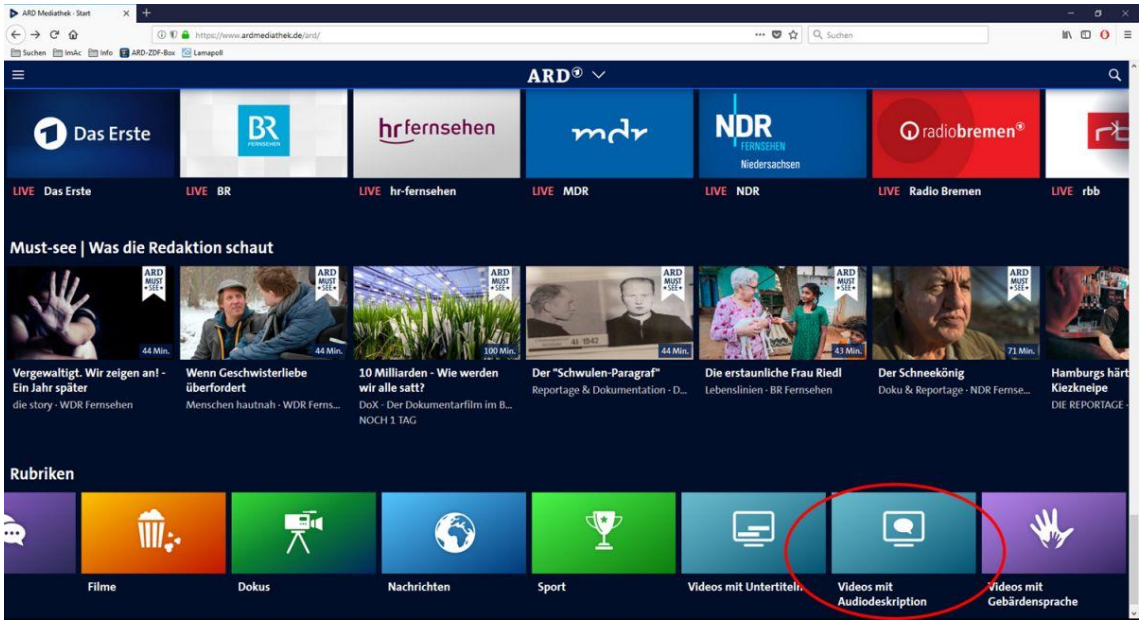


Step 2 – Click on arrow icon on the right to scroll through the horizontal list of content categories

Before: A horizontal list of content categories is shown

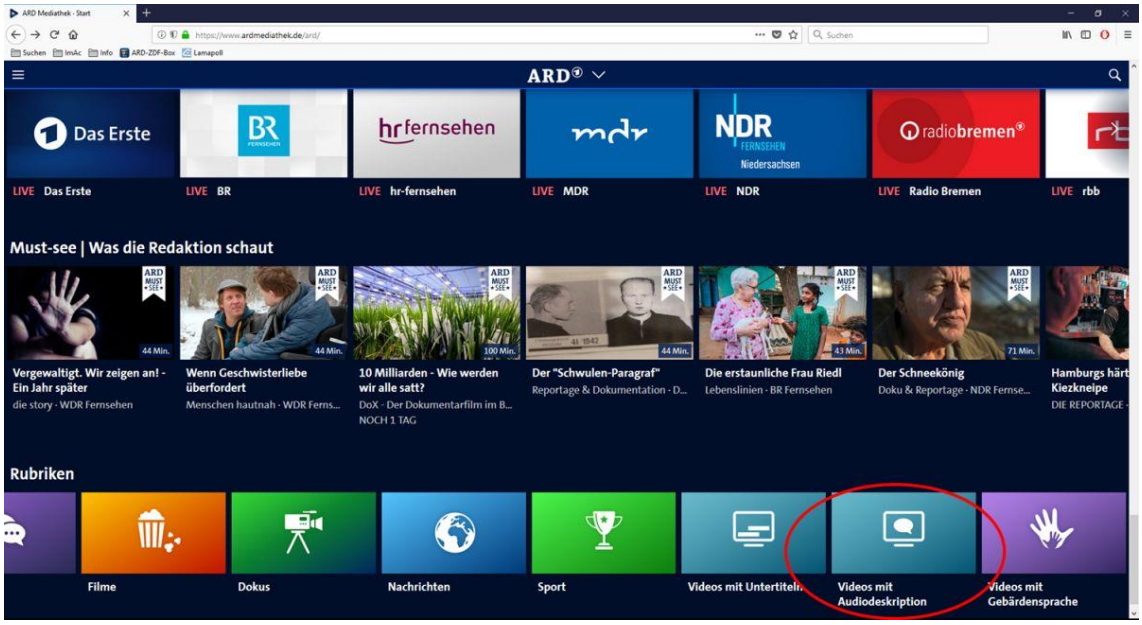


After: A category for content with AD appears

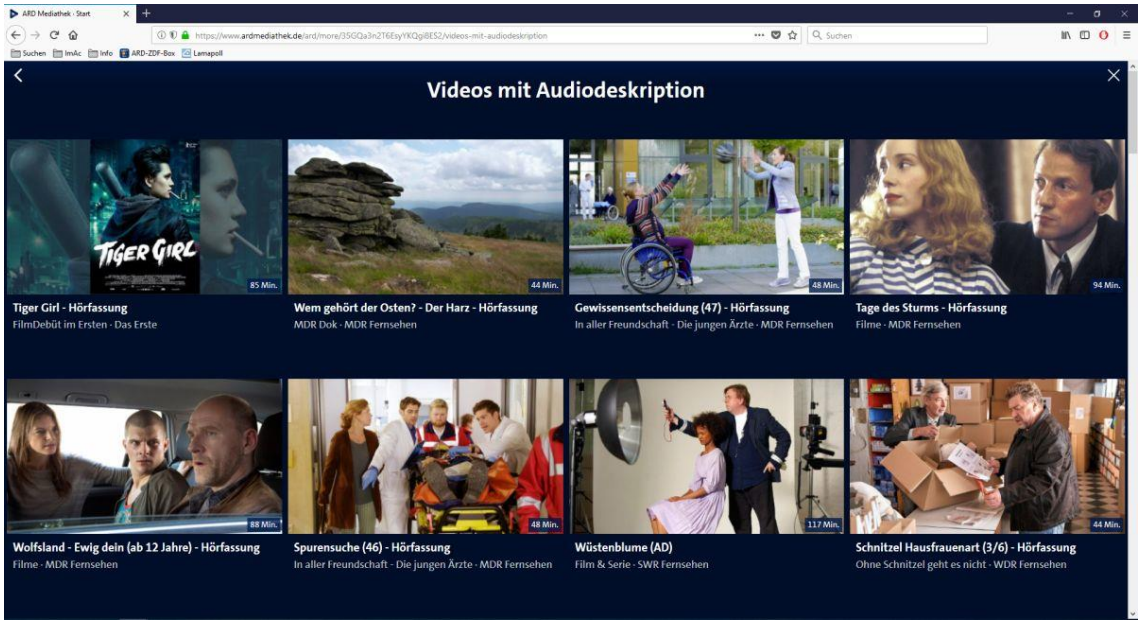


Step 3 – Click on content category "Videos mit Audiodeskription" (videos with AD)

Before: A category for content with AD is shown

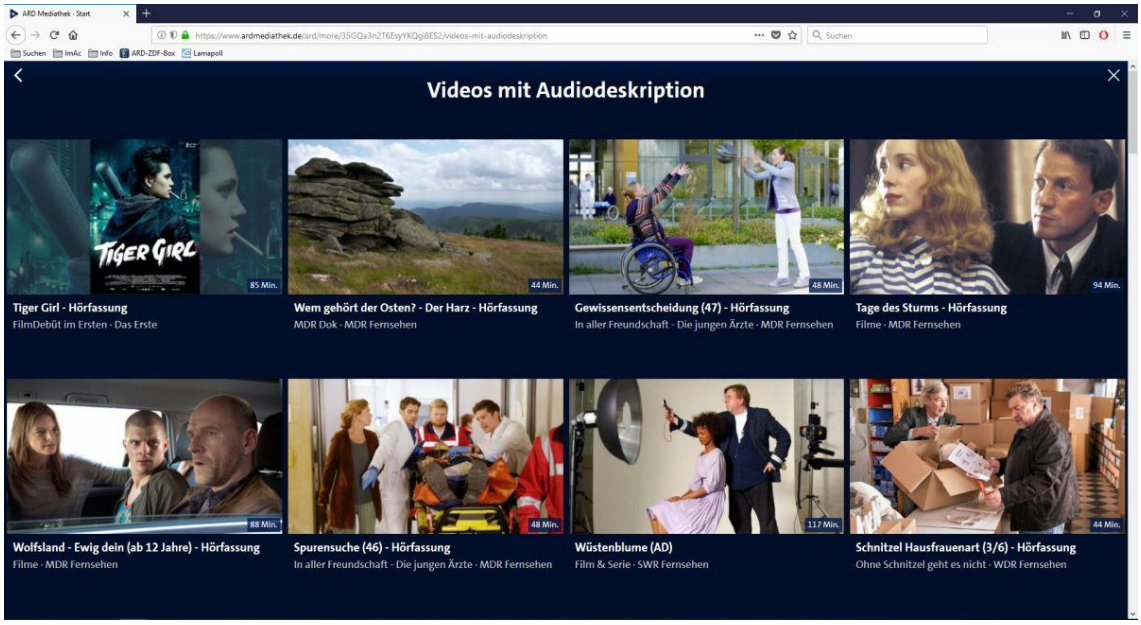


After: A list with all available films with AD appears

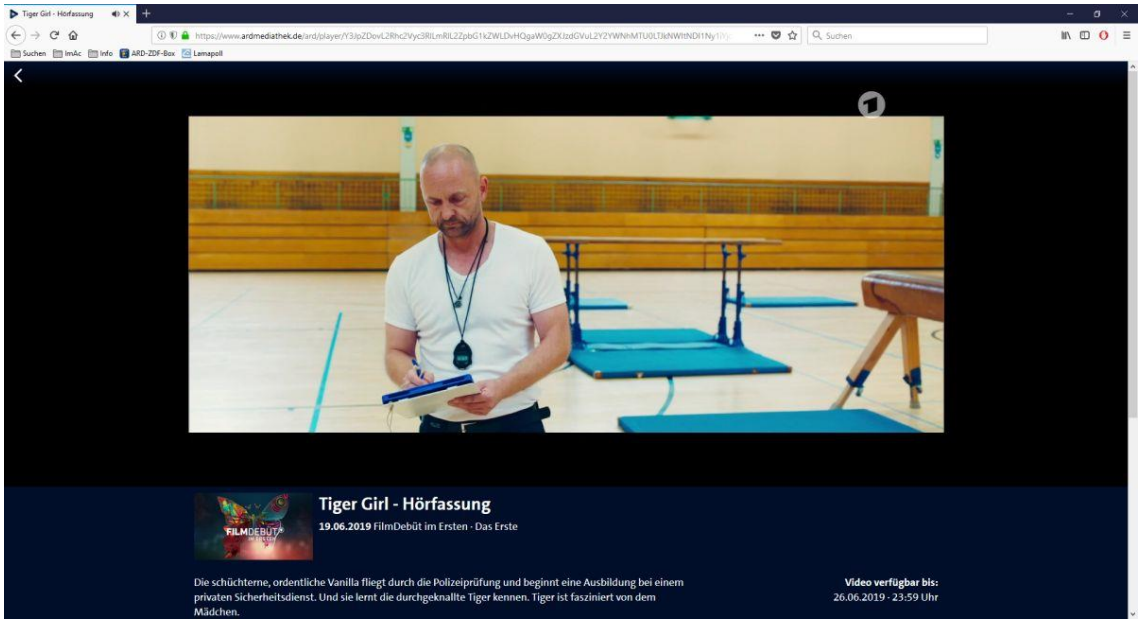


Step 4 - Click on desired video

Before: A list with all available films with AD is shown



After: A new page loads and the video starts playing.



2.2.3. Switching Sign Language on/off

Target (Goal of the interaction)

- Name: Activation of Sign Language
- Type: Activation of Service

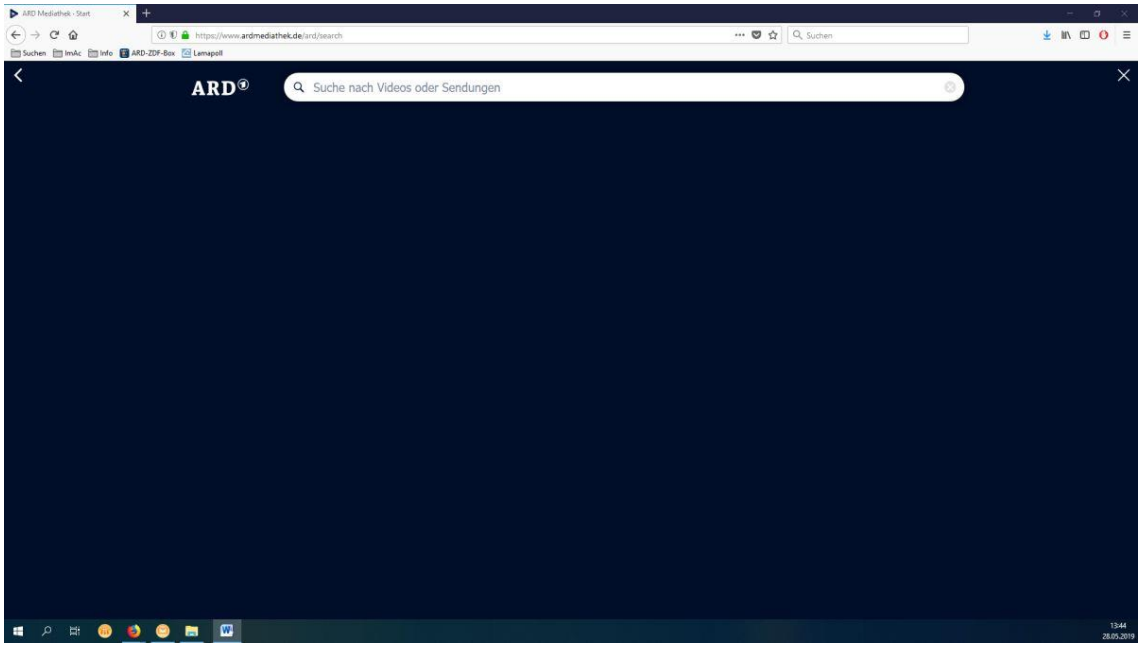
Alternative 1

Steps

Step 1 – Click on the search icon of the platform

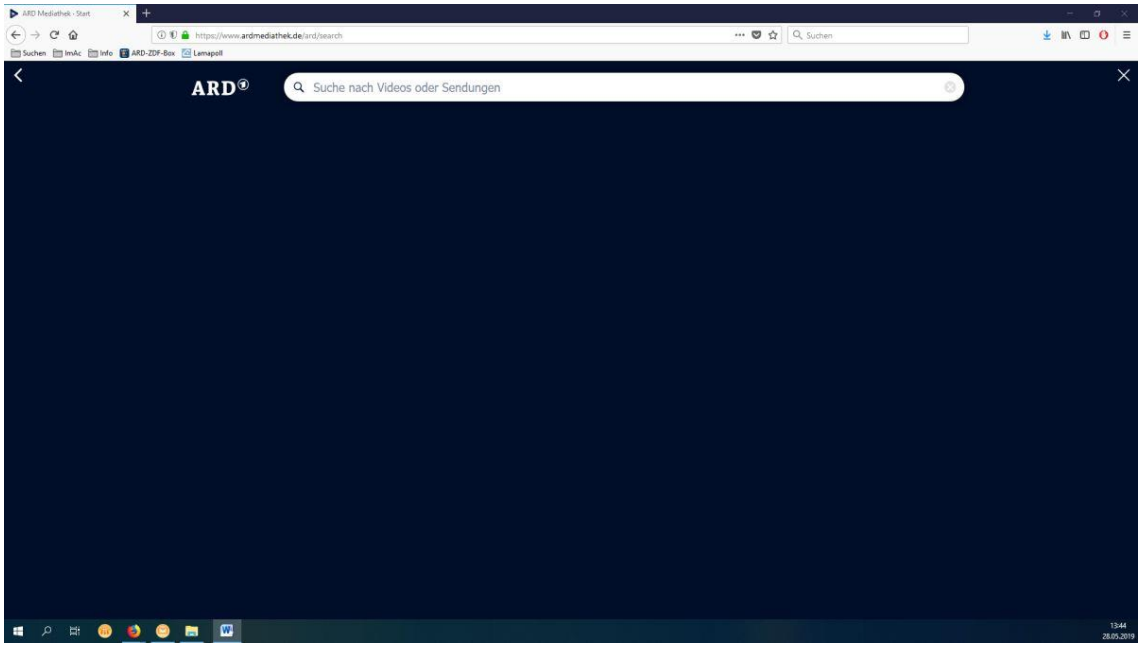
Before: Selected contents of the ARD Mediathek are listed in the initial page of the platform

After: The search field is enabled, search terms can be entered

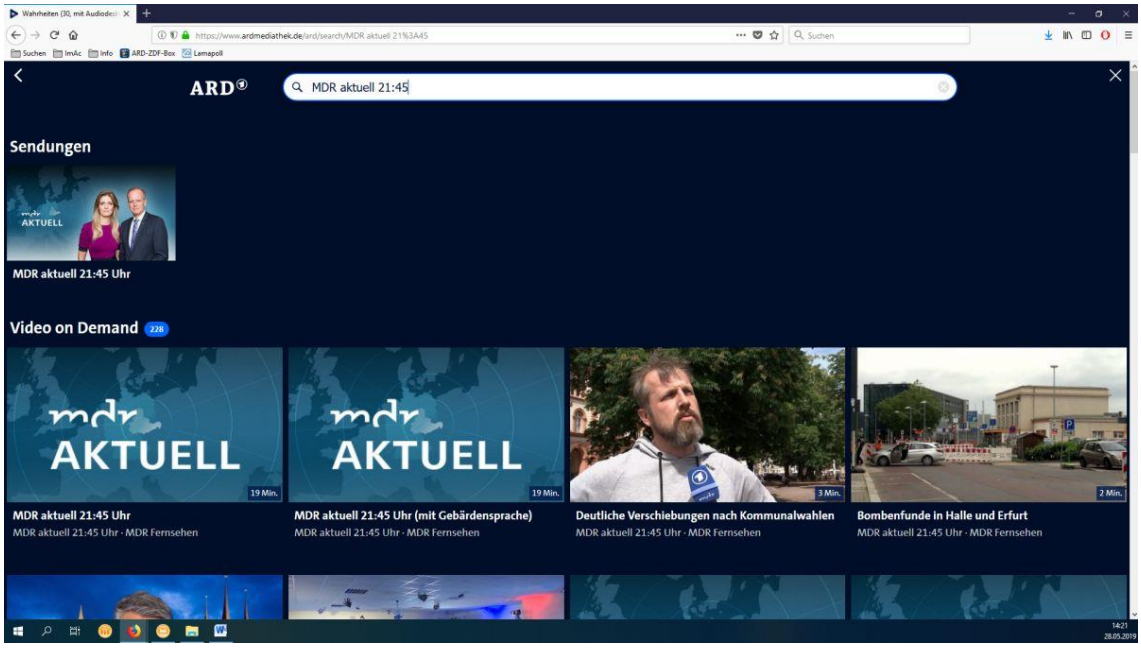


Step 2 – Enter name of desired video into the search field

Before: The search field is enabled

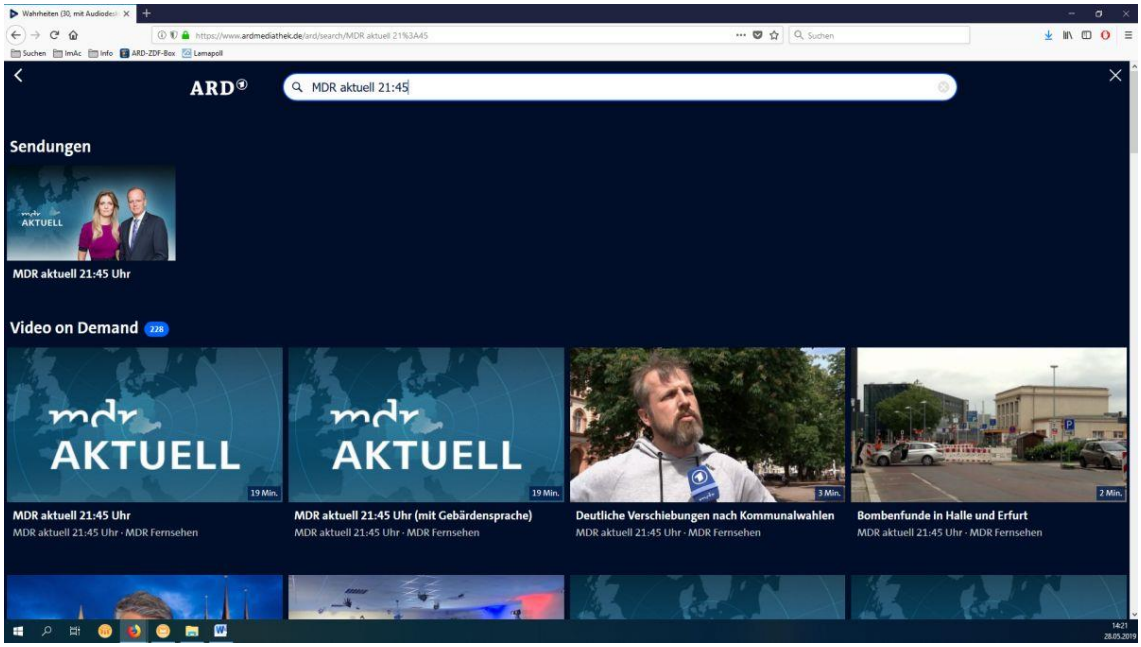


After: The search term is displayed in the search field and the search results are automatically displayed below. If audio description is available for a specific film, two versions are displayed (one without SL, one with SL (“mit Gebärdensprache”))



Step 3 – Click on desired video with sign language

Before: The search results are displayed



After: A new page is loaded with the video and it automatically starts playing

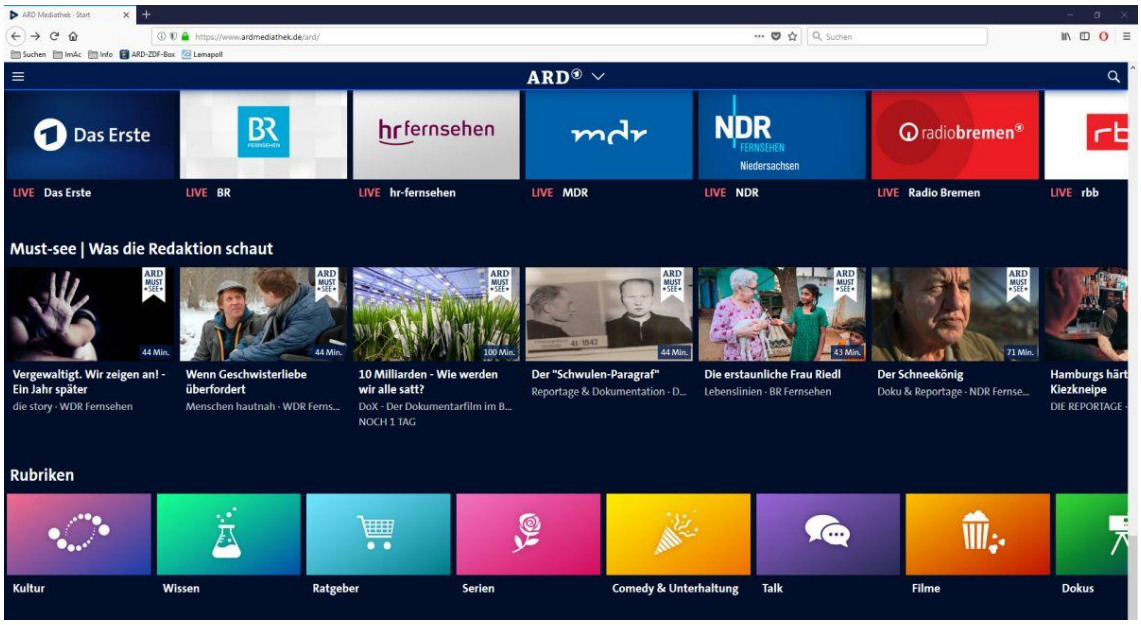
Alternative 2

Steps

Step 1 – Scroll to bottom of the player website

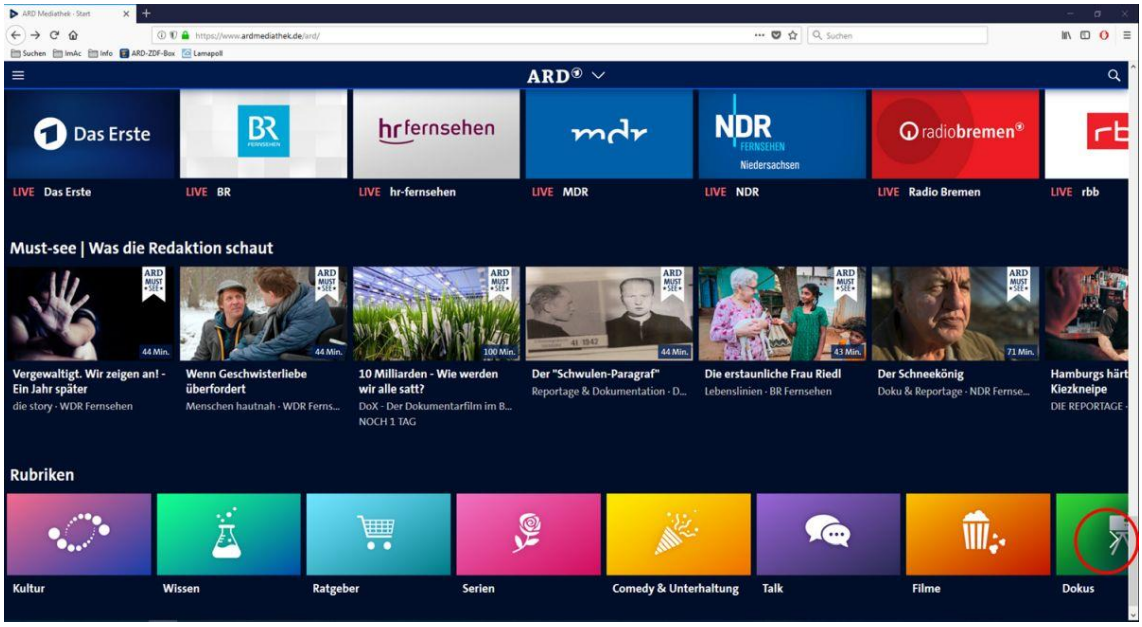
Before: The top of the ARD player website is shown

After: A horizontal list of content categories is shown

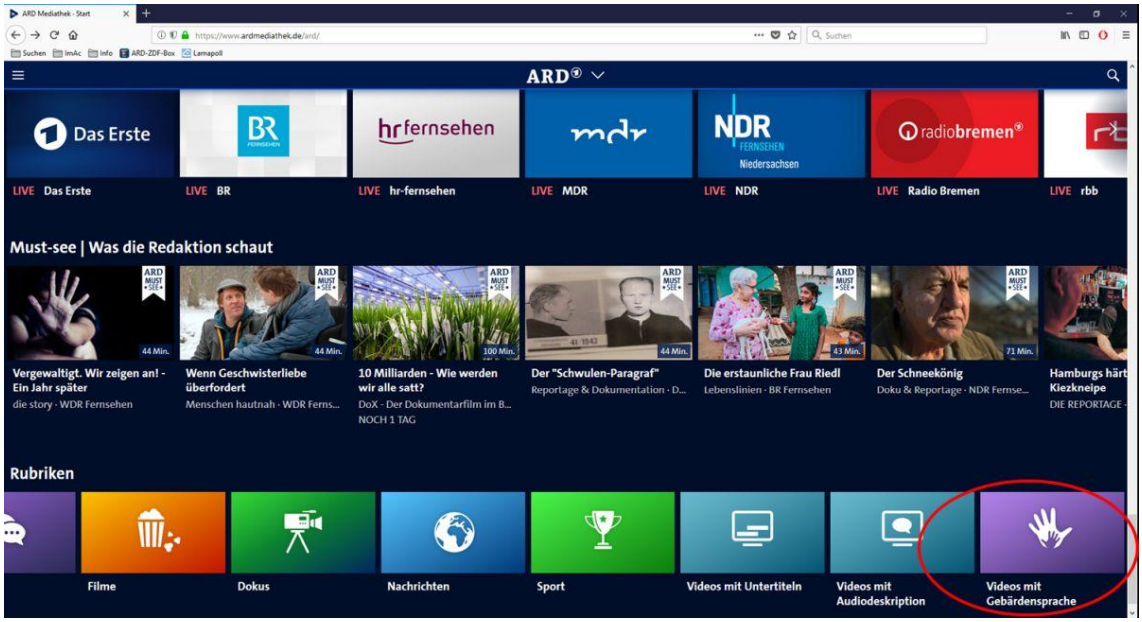


Step 2 – Click on arrow icon on the right to scroll through the horizontal list of content categories

Before: A horizontal list of content categories is shown

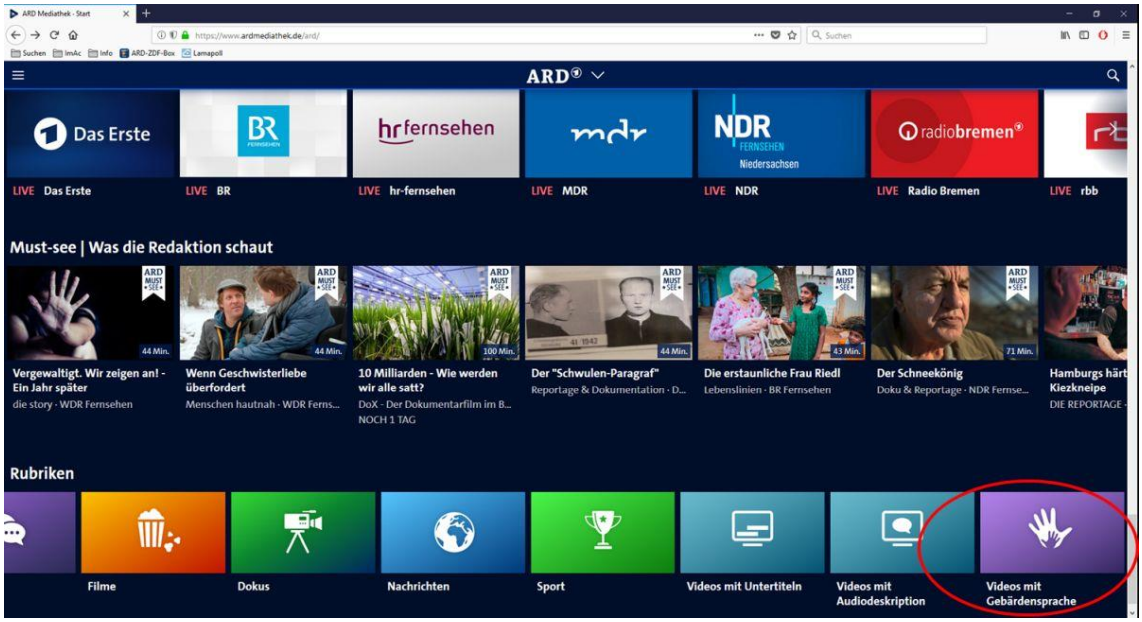


After: A category for content with sign language appears

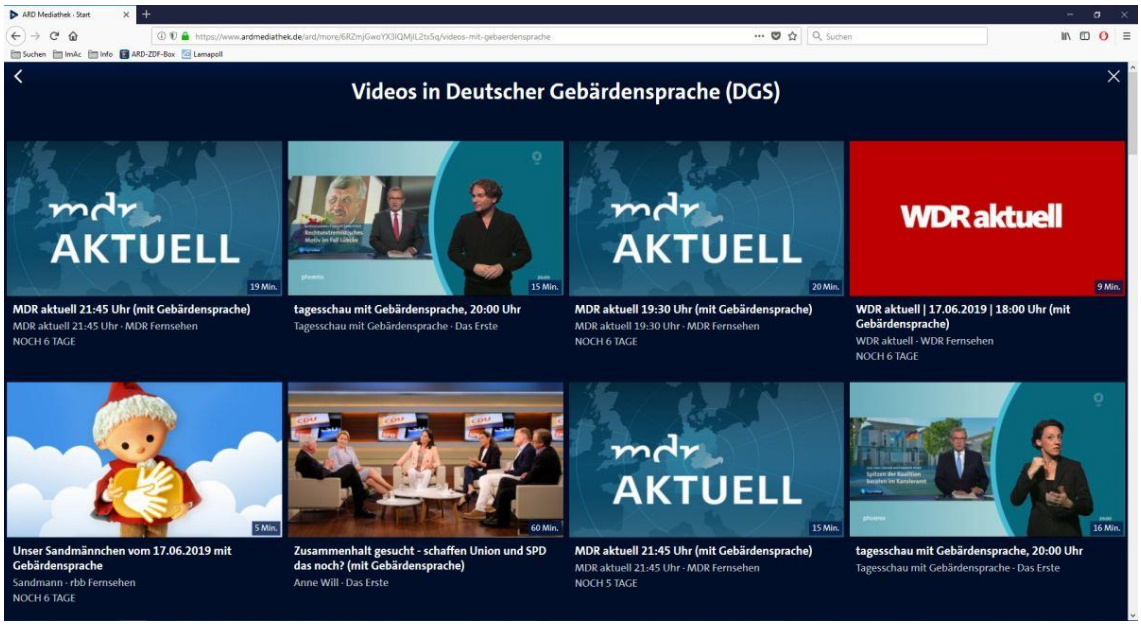


Step 3 – Click on content category "Videos mit Gebärdensprache" (videos with Sign Language)

Before: A category for content with SL is shown

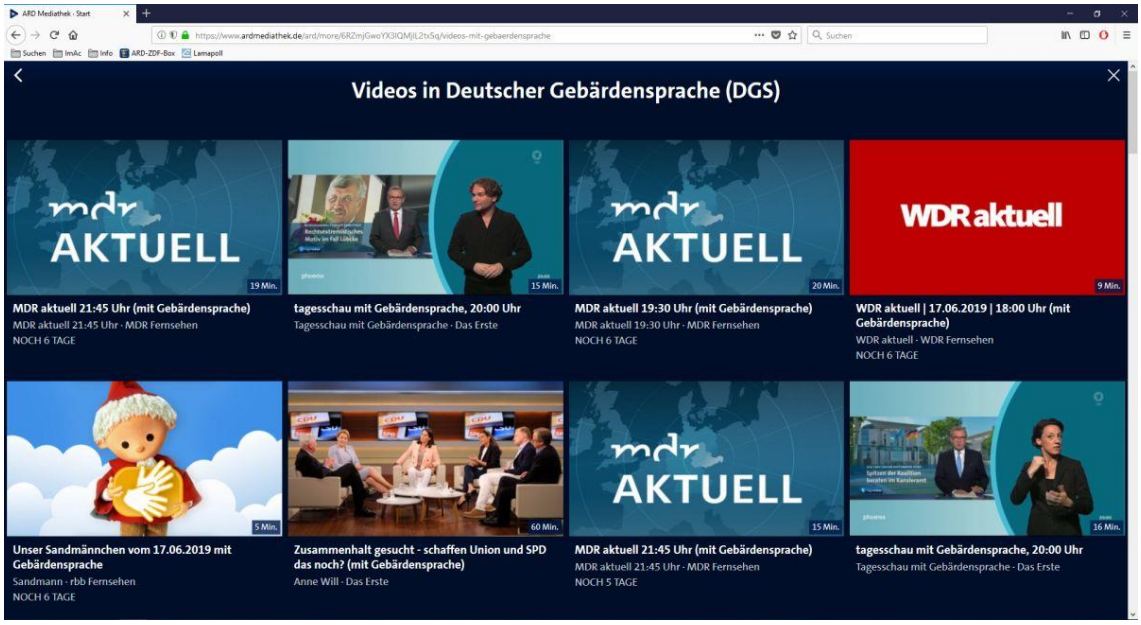


After: A list with all available films with SL appears

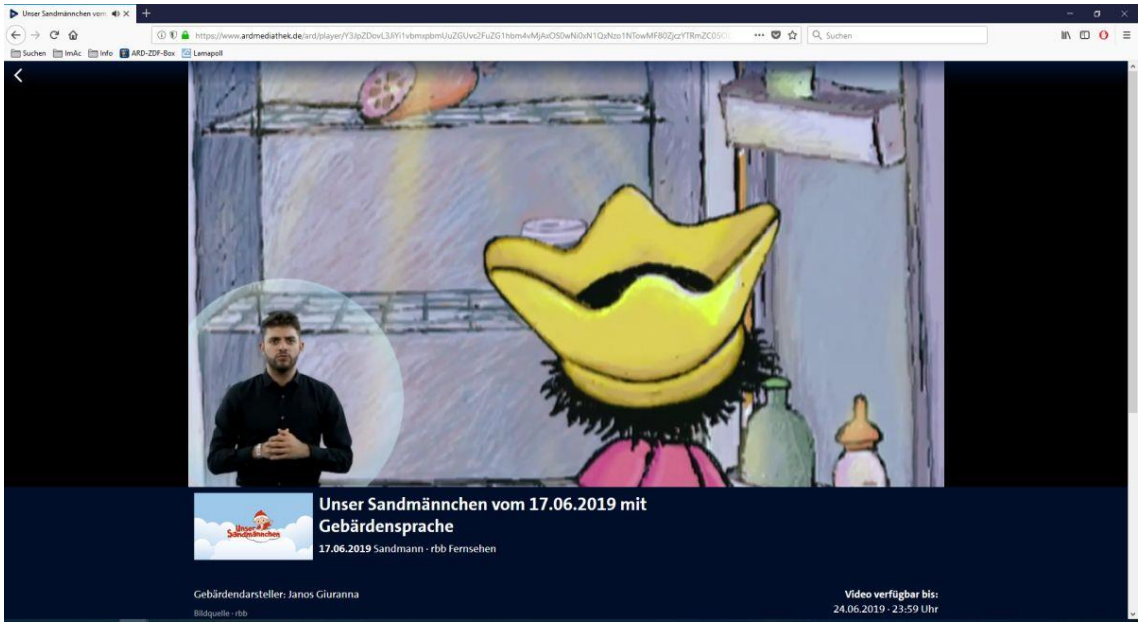


Step 4 - Click on desired video

Before: A list with all available films with SL is shown



After: A new page loads and the video starts playing.



2.2.4. Show current accessibility services settings

ARD Mediathek, Browser

Target (Goal of the interaction)

1. Name: Show current AS settings
2. Type: Show Settings

Show settings for subtitling service

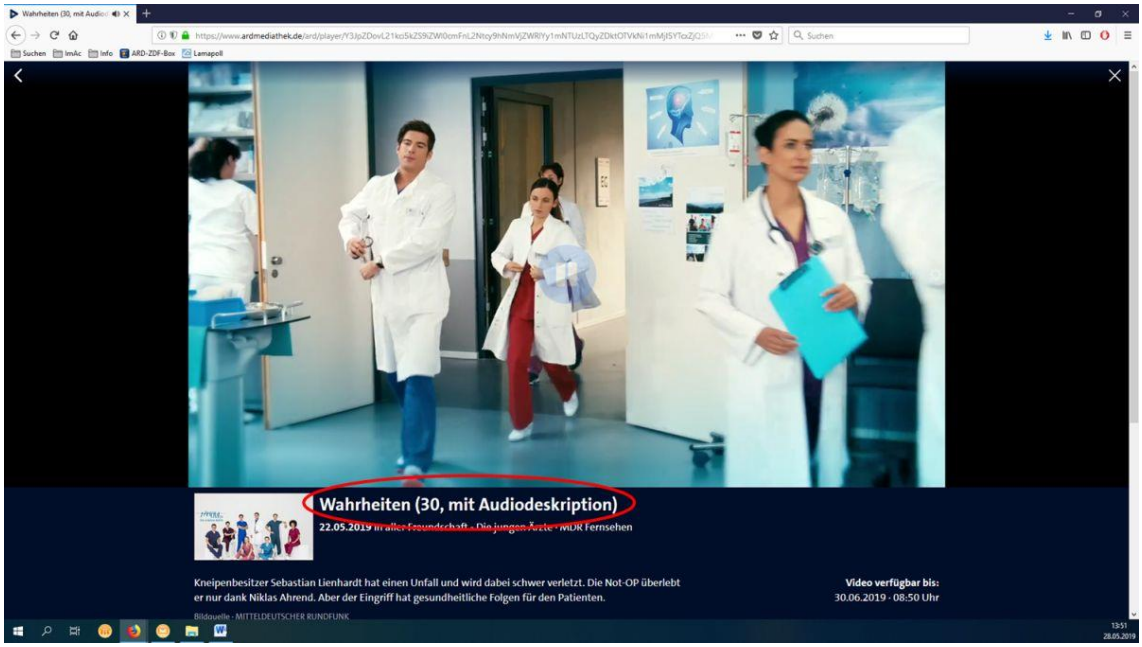
Step 1 – Move mouse over video

Before: User interface is hidden

After: User interface is shown. On the right side of the screen the user sees the “UT” icon with or without strike, showing if the subtitles are switched off or on, respectively.

Show settings for audio description service

No action is necessary to see the status of the audio description service. The videos with AD are available as separate assets in the ARD Mediathek. The title of these assets contains the words “mit Audiodeskription”.



Show settings for sign language service

No action is necessary to see the status of the sign language service. The videos with SL are available as separate assets in the ARD Mediathek. The title of these assets contains the words “mit Gebärdensprache”. Furthermore, the sign language interpreter is clearly visible in the video.

2.2.5. Player controls in the UI

ARD Mediathek, Browser

Target (Goal of the interaction)

- Name: Player Controls

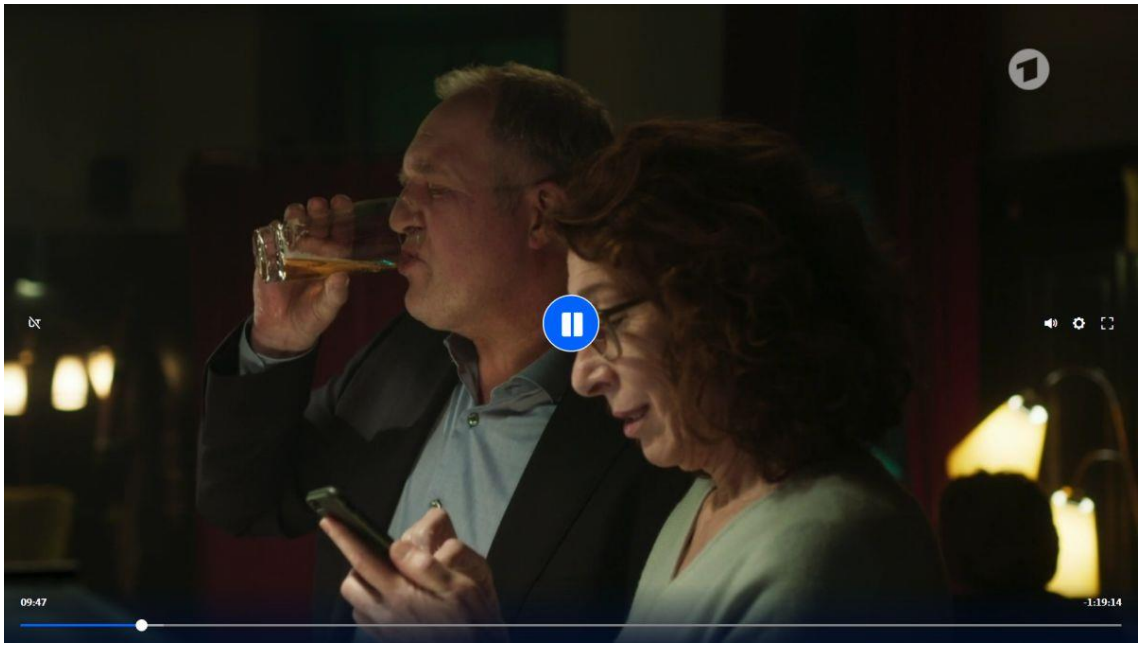
- Type: Use Player Controls

Steps

Step 1 – Move mouse over video

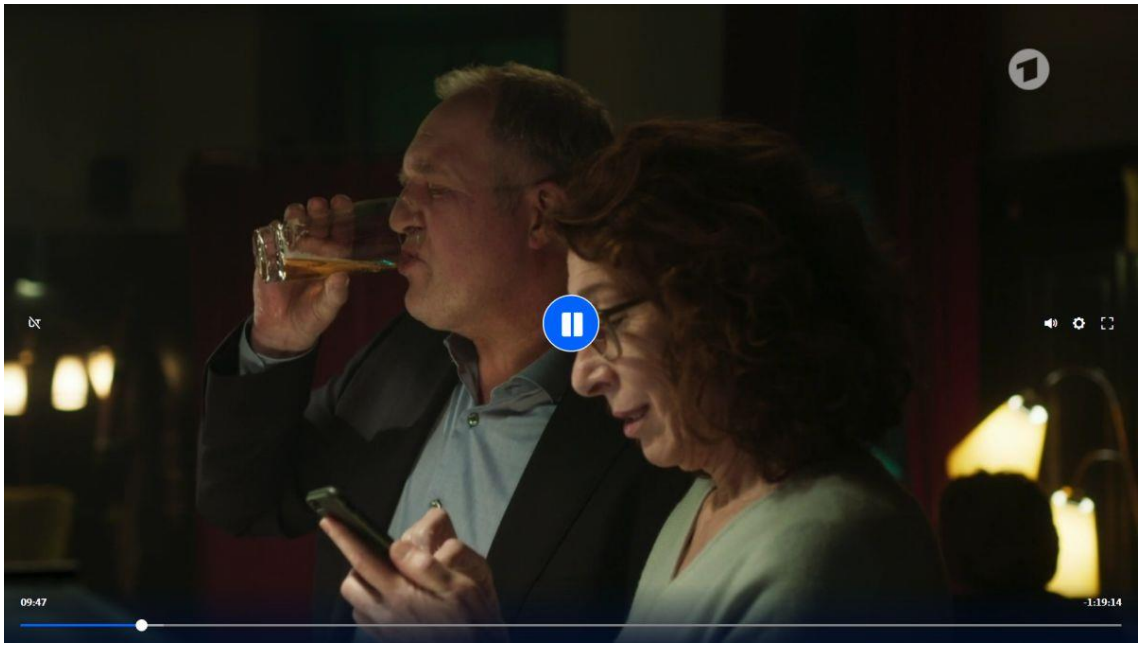
Before: Video is playing, no controls are visible.

After: Pause button is shown in the middle of the video

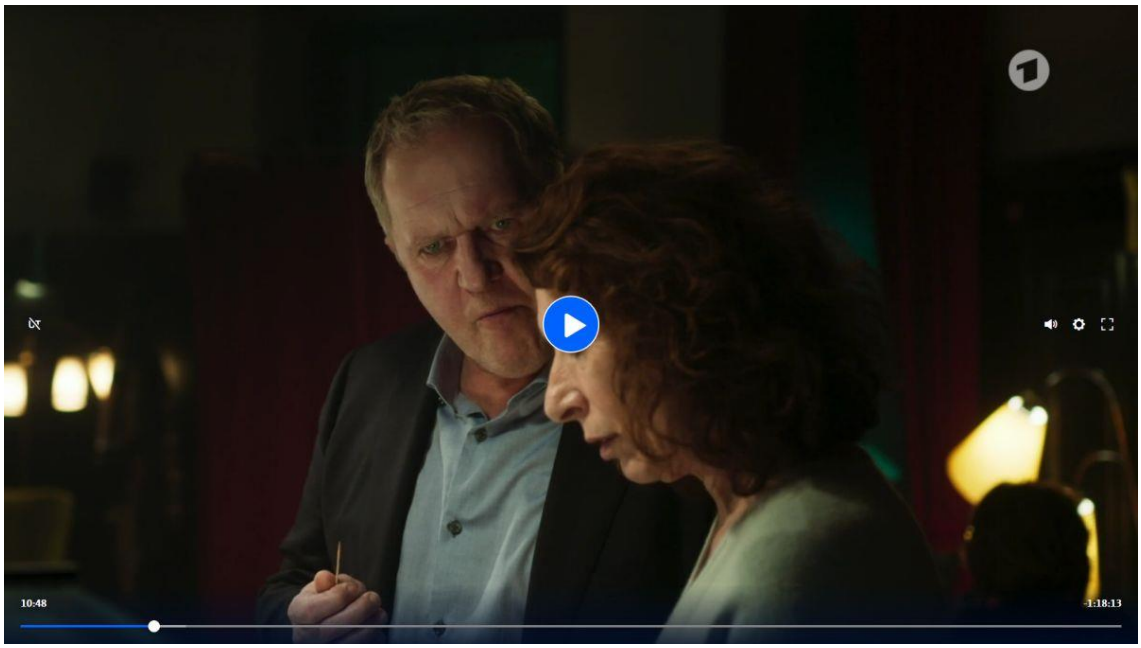


Step 2 – Click on “Pause”

Before: Pause button is visible in the middle of the screen.

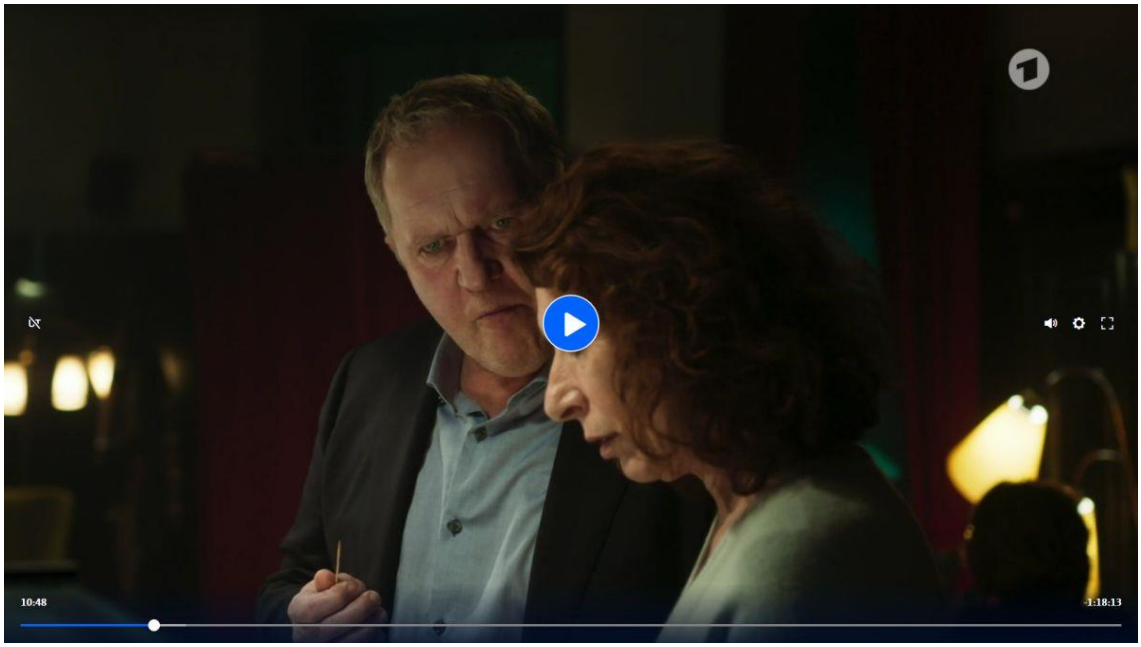


After: Video is paused. The icon in the middle of the screen shows “Play”.



Step 3 – Click on “Play”

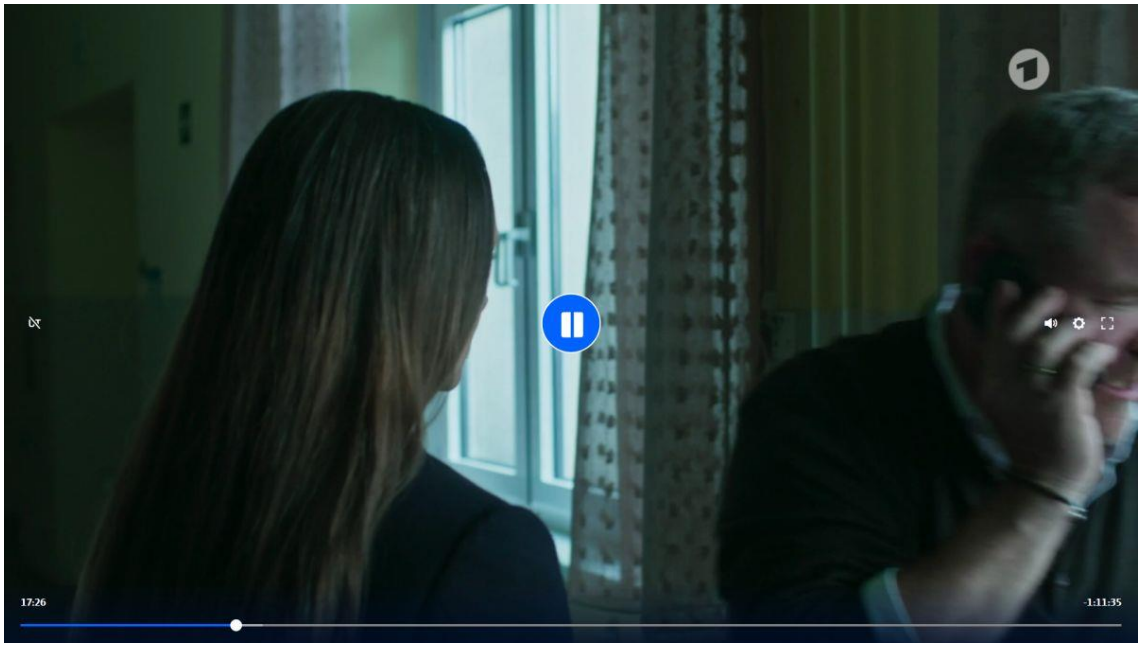
Before: Video is paused. The icon in the middle of the screen is changed to “Play”.



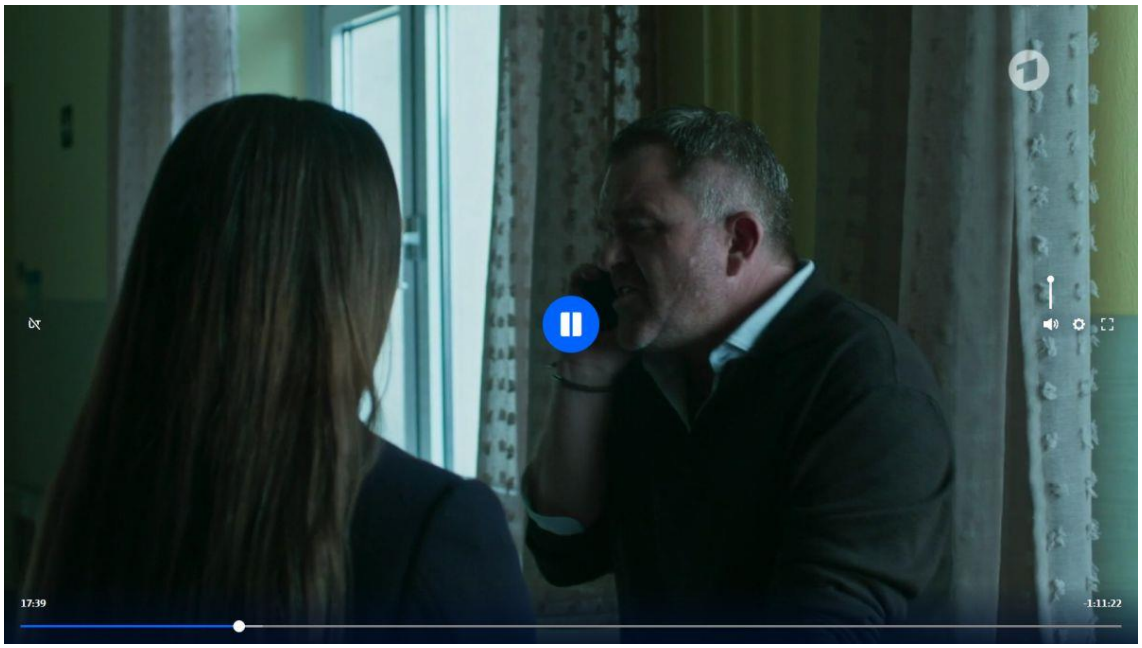
After: Video starts playing. Icon changes to “Pause”. Control buttons/progress bar start to fade out.

Step 4 – Move mouse over volume icon

Before: Volume icon is shown to the right of the video.

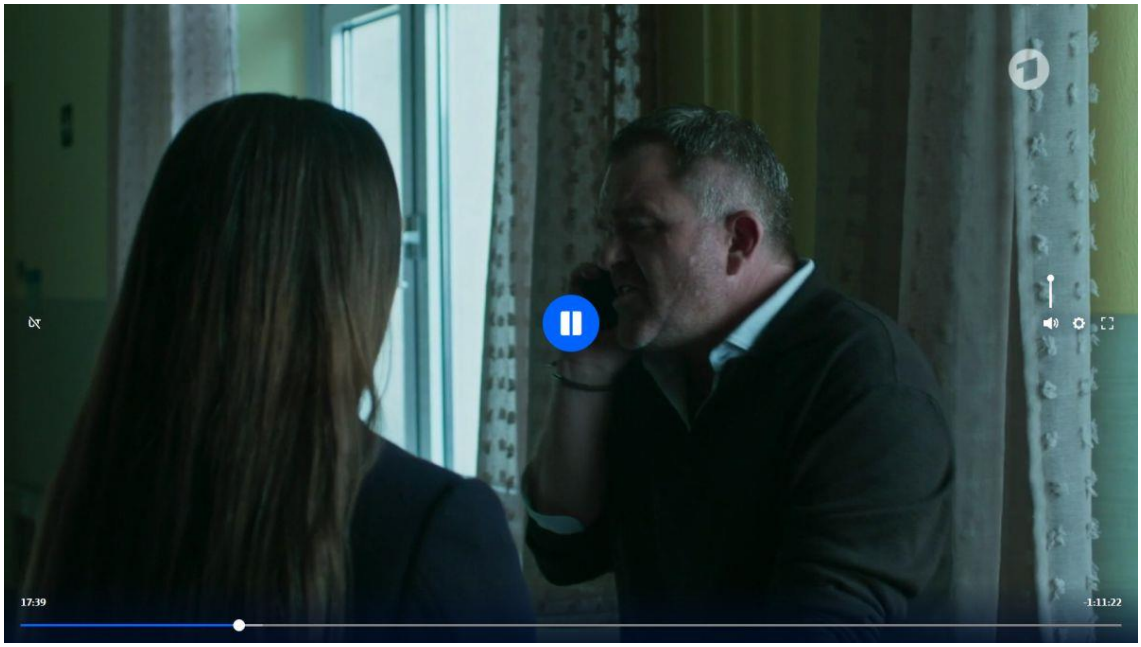


After: A bar appears above the volume icon.

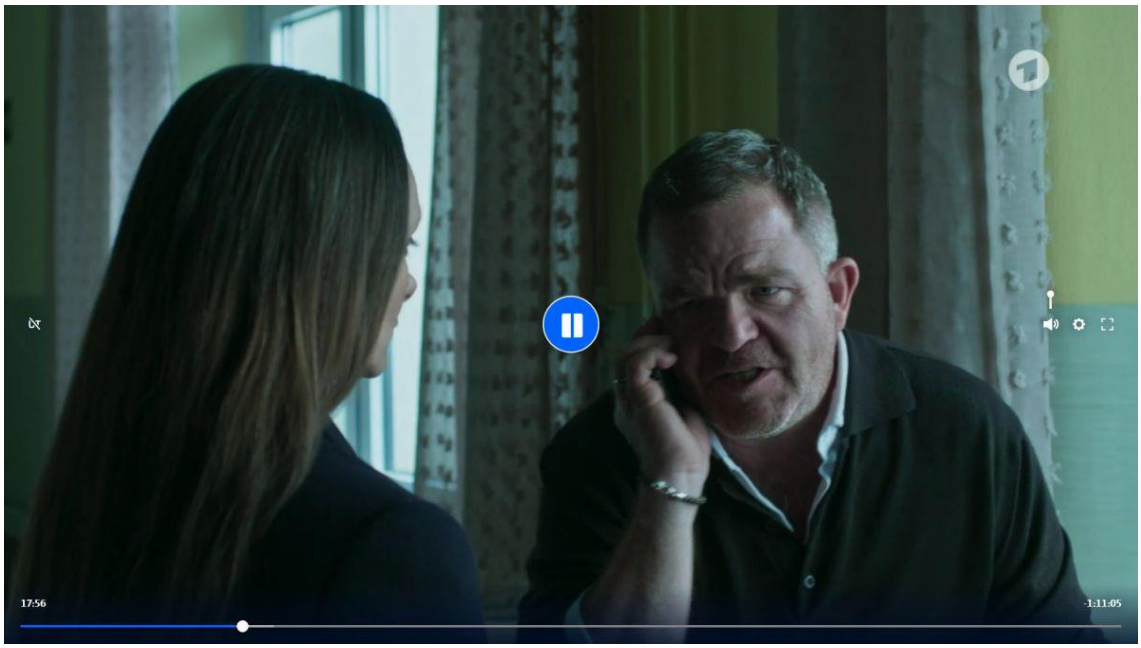


Step 5 – Change volume

Before: bar is shown above volume icon. The user can change the volume by dragging the circle up or down.



After: Volume is decreased/increased.



2.3. CCMA / TV3 Web Player

The following sections contains the analysis of the CCMA Web player.

Client

- Manufacturer: CCMA (JWPlayer 7.12.13 embedded)
- Name: CCMA player
- Version: ---

- Type: Browser player - tested on Google Chrome Version 74.0.3729.169 (Build official) (32 bits)

Hardware

- Manufacturer: DELL
- Model: LATITUDE E5440
- Version: ---
- Type: laptop

Operating System

- Name: MS Windows 7
- Version: Windows 7 Professional SP1
- Version Name: ---

Content

- Media Channel: CCMA Catch Up
- Content Provider: CCMA

2.3.1. Switching Subtitles on/off

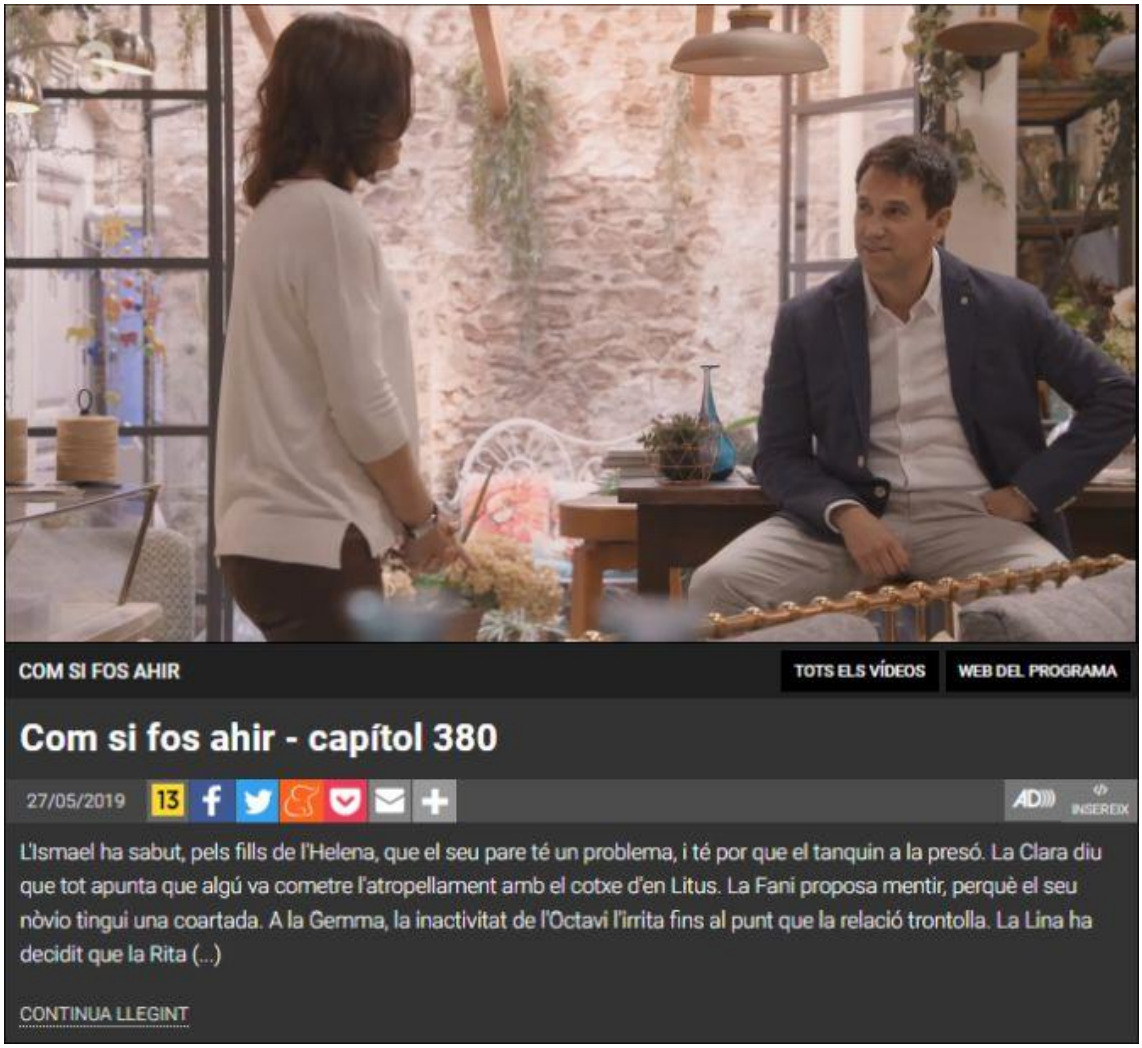
Target (Goal of the interaction)

- Name: Activation of Subtitles
- Type: Activation of Service

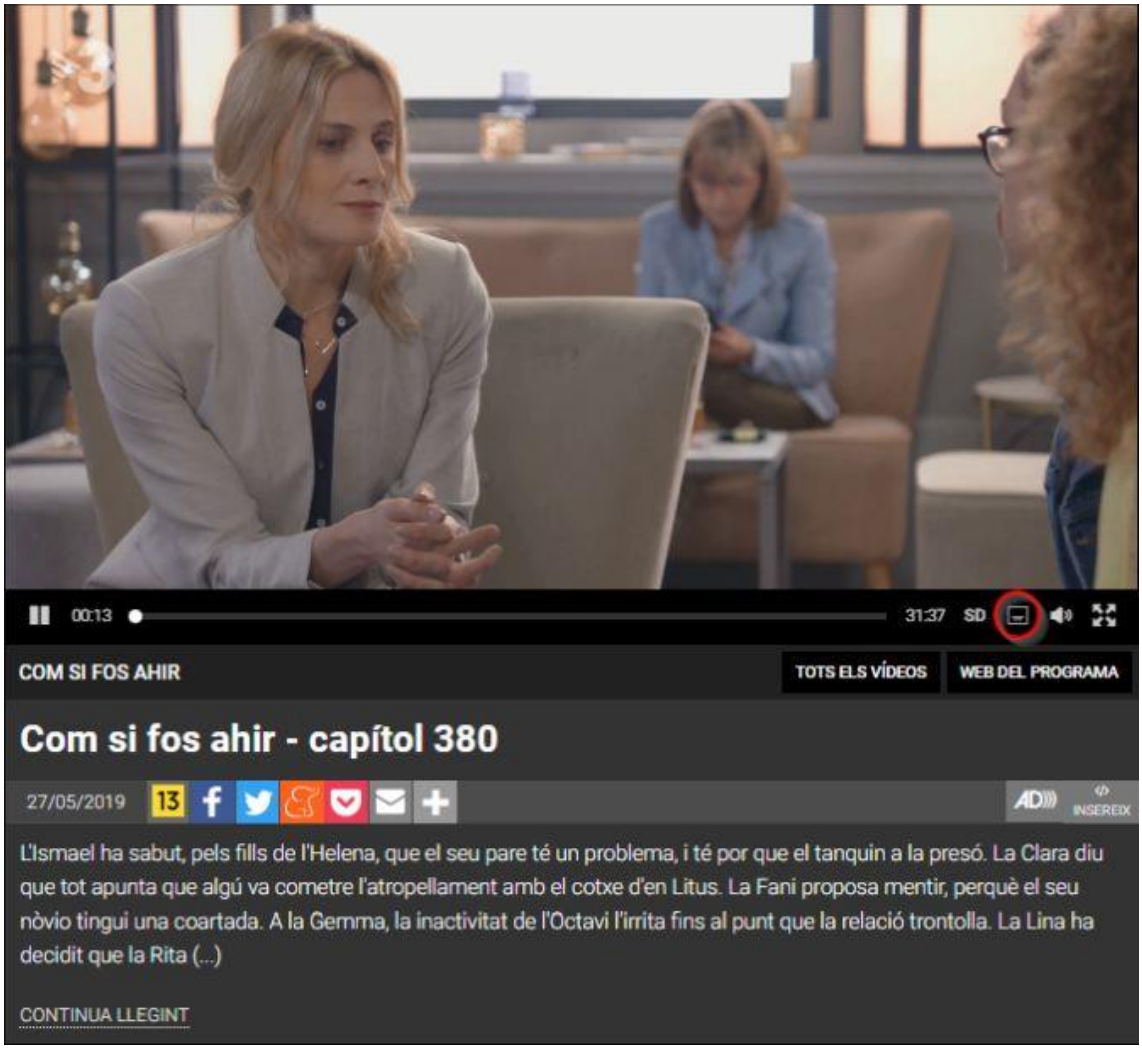
Steps

Step 1 - Open the menu moving the mouse pointer over the video area

Before: the menu is hidden and the subtitles are disabled. The user shall move the mouse pointer over the video area and then the menu is shown.



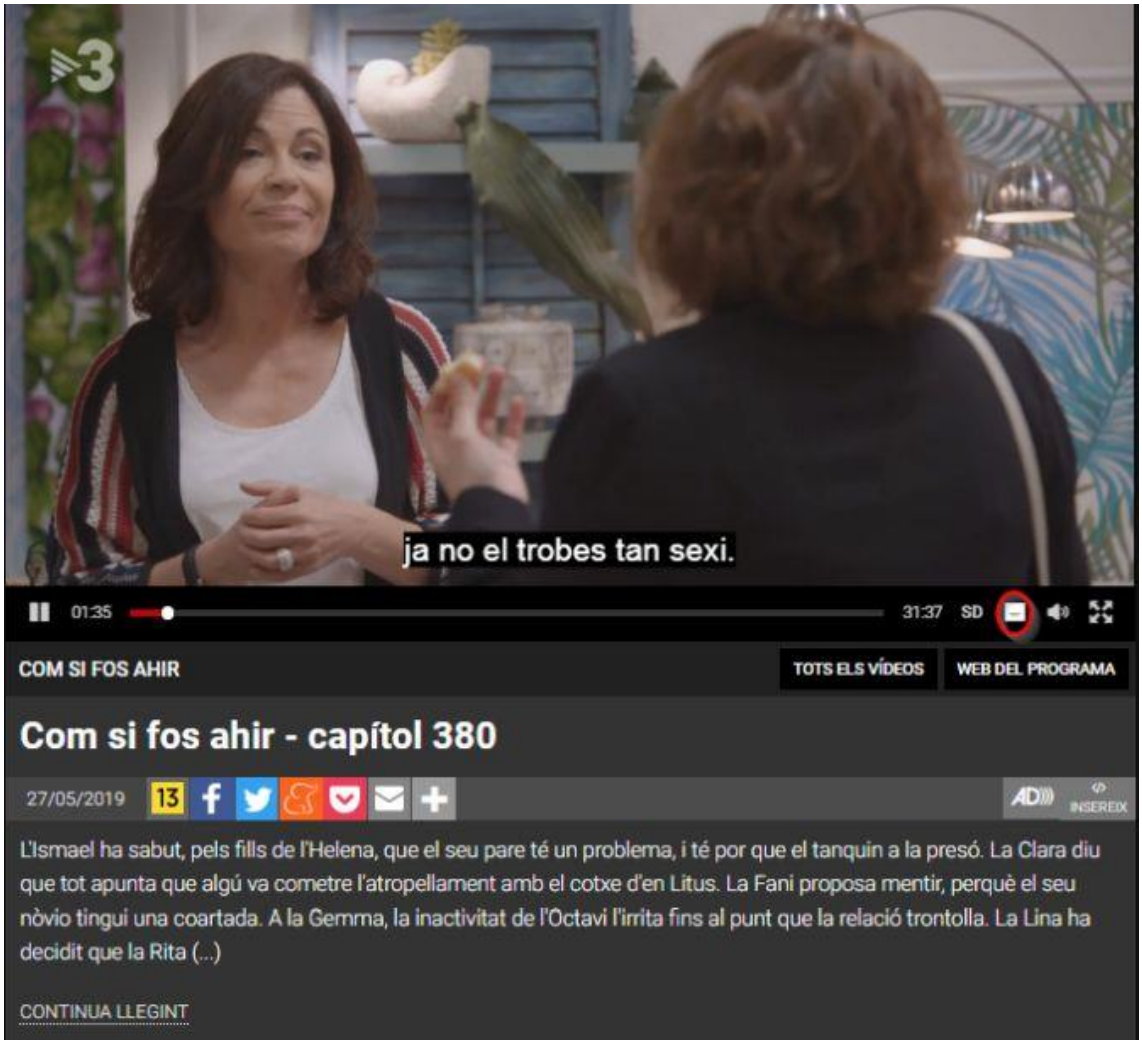
After: the menu is shown at the bottom of the video area. When there are subtitles available for the current asset, a subtitles icon with a dark shape is shown to indicate that subtitles are not activated (no icon is shown if the asset do not have subtitles).



Step 2 - Tap on the subtitles icon

Before: the menu is shown at the bottom of the video area and the subtitles icon is shown with the disabled shape. The user shall tap on the subtitles icon to activate them.

After: subtitles are activated, and now the subtitles icon is shown with a light shape to indicate the that subtitles are activated. The subtitle menu disappears after few seconds.



2.3.2. Switching Audio Description on/off

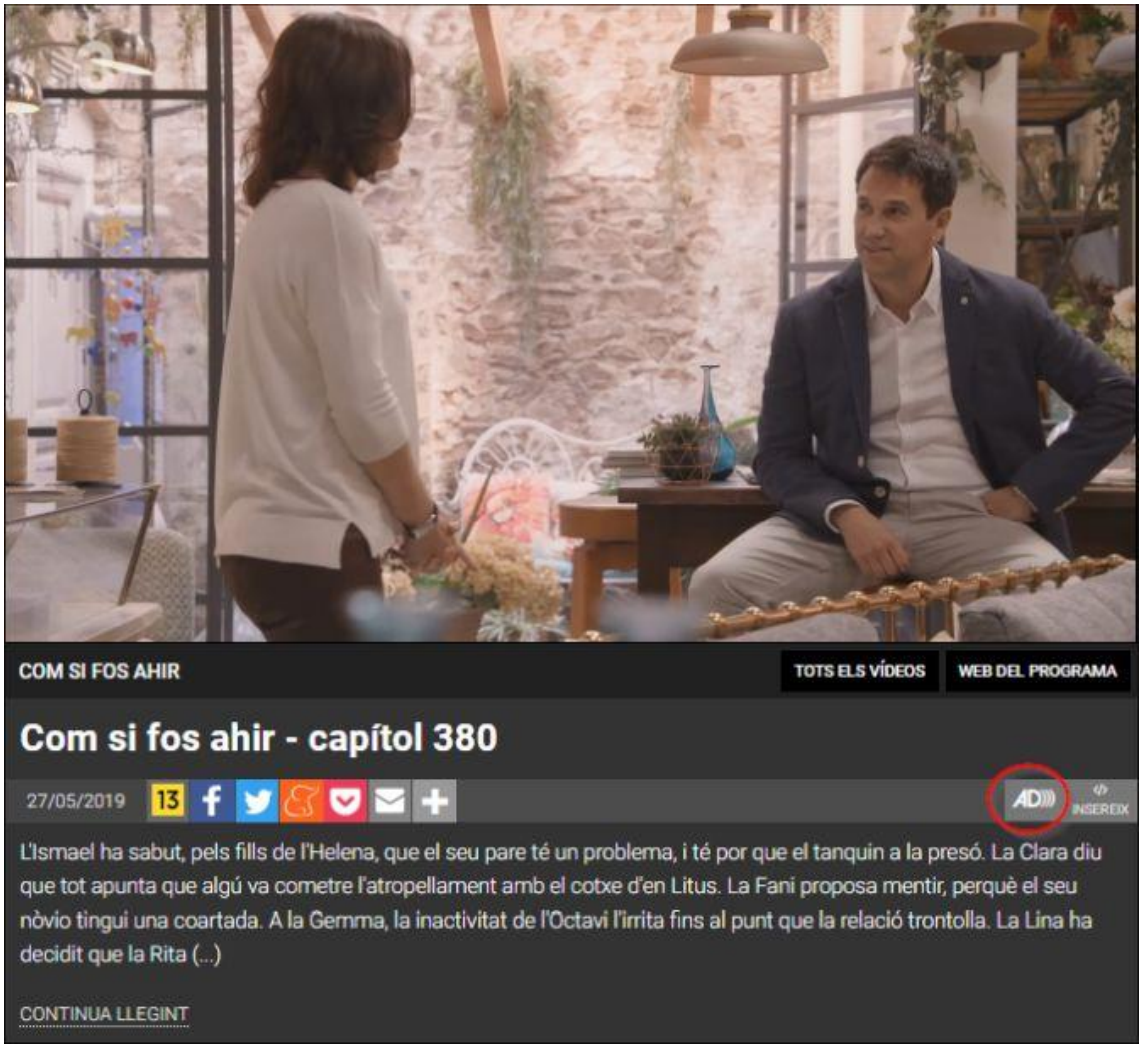
Target (Goal of the interaction)

- Name: Activation of Audio Description
- Type: Activation of Service

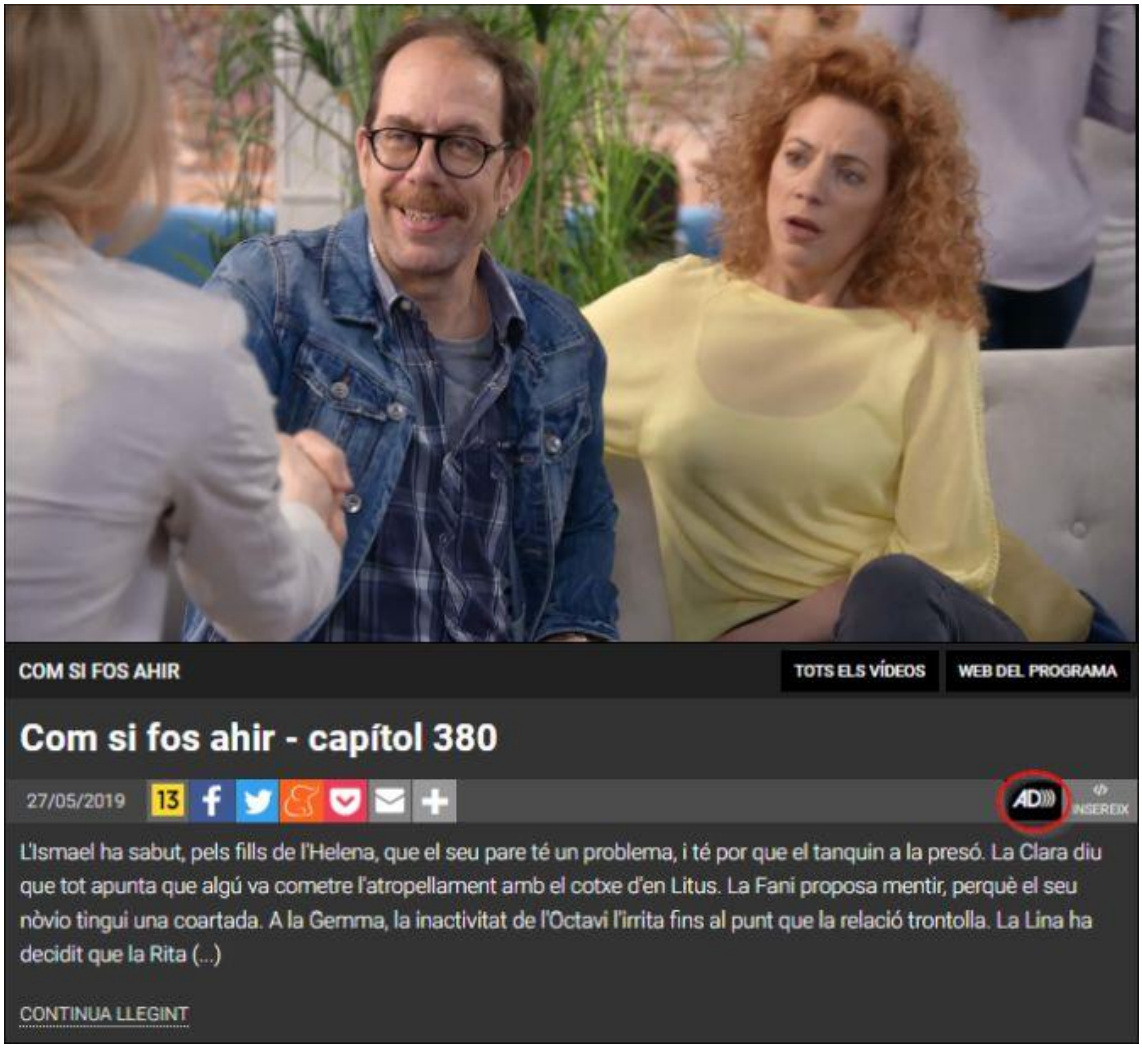
Steps

Step 1 - tap on the AD icon

Before: An asset with normal audio is playing. The Audio Description is distributed with an independent video asset; when an AD asset version is available for a specific asset, an icon is shown in the description area under the player. The grey background of this icon also indicates that the AD is currently not being played. The user can tap on this icon to jump to the AD asset.



After: the page is reloaded with the AD Version of the asset and the AD track is playing. Now the AD icon has black background to indicate that the AD is being played.



2.3.3. Switching Sign Language on/off

Target (Goal of the interaction)

- Name: Activation of Sign Language
- Type: Activation of Service

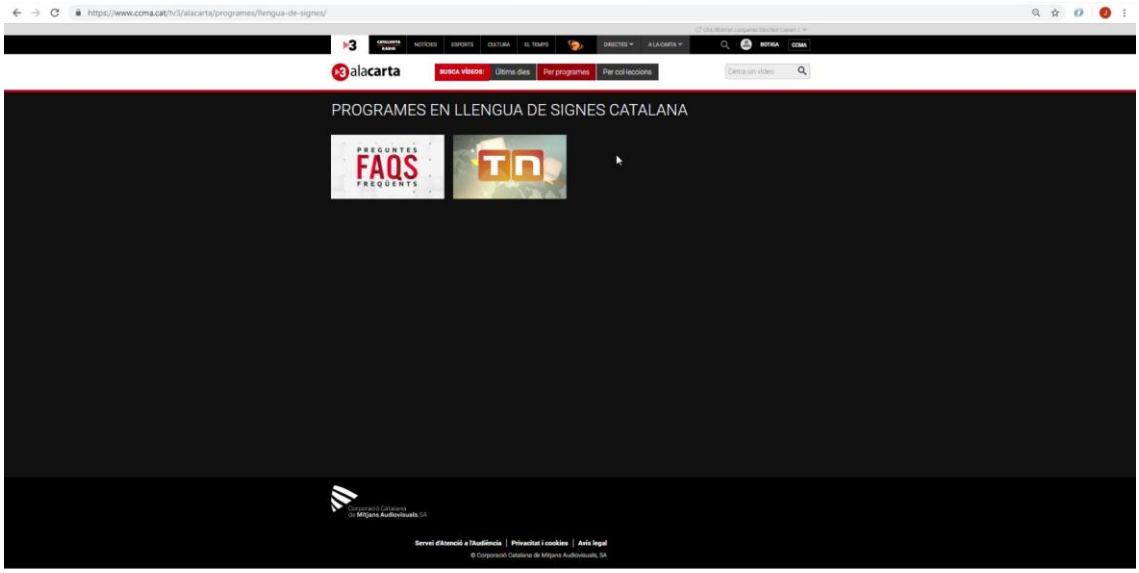
Steps

Step 1 - Locate the desired Sign Language asset

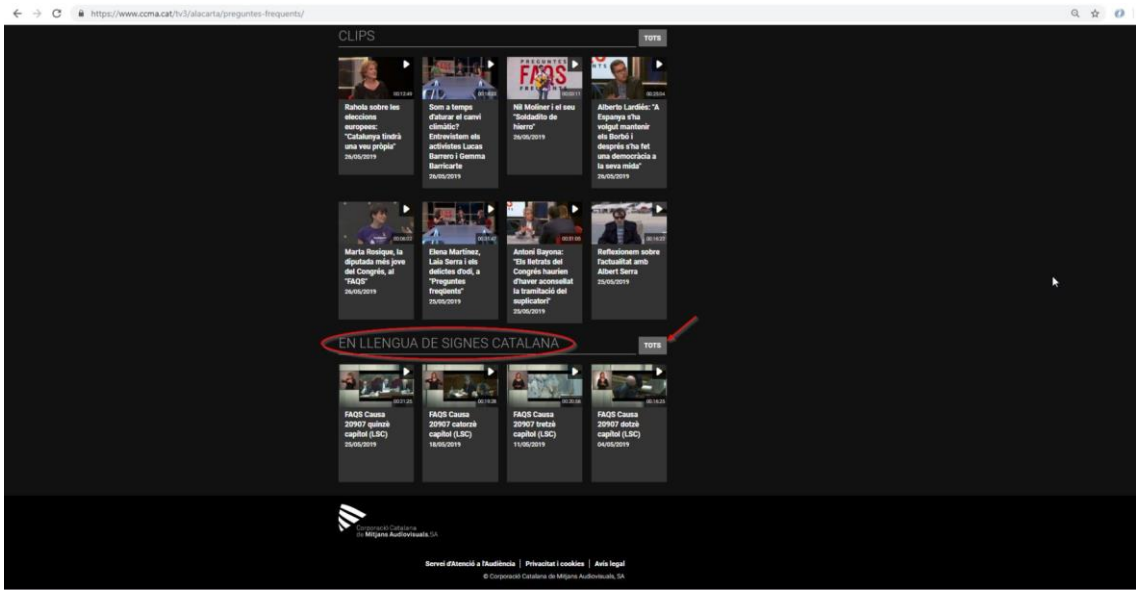
The Sign Language is distributed like an independent video asset and the user must locate and play it as a normal asset. There are two ways of locating content with Sign Language in the CCMA website.

Before - Method 1: The first way to access Sign Language contents is navigating through the page https://www.ccma.cat/tv3/alacarta/programes/llengua-de-signes/ which is accessible from CCMA home page in three clicks (Accessibility → Catalan Sign Language → Watch SL Videos).

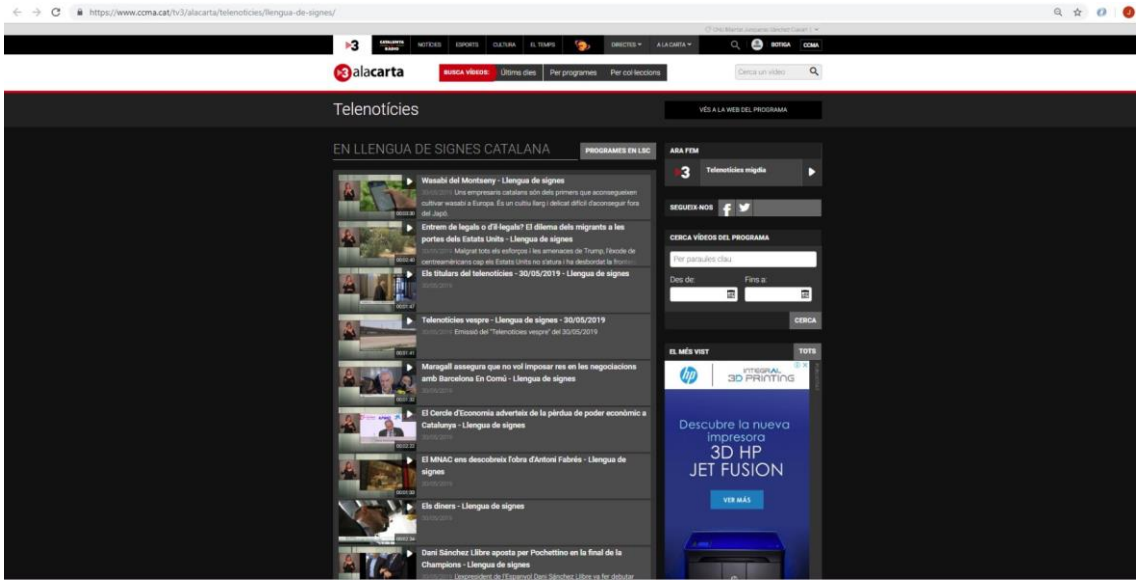
This web page lists all the programs produced with Sign Language, and the user can directly select the desired program to jump to a new page that lists all the assets with Sign Language that are available for this program:



Before - Method 2: The second way to locate content with Sign Language is accessing a specific TV program page in “TV3alacarta” section: if the TV program includes Versions of the assets with sign language, then a short selection of clips are listed under the sub-section “EN LLENGUA DE SIGNES CATALANA” shown at the bottom of the page. The user can just click on one of the proposed assets or click on “TOTS” button to jump to a new page that lists all the assets with Sign Language that are available for this program:



After: a new page is shown listing all the assets with Sign Language that are available for the desired program:



Step 2 - Play the desired video

Before: The user is placed on a page that lists all the assets with Sign Language that are available for a concrete program. The user then taps on one of the proposed assets to play it.

After: An asset is played with Sign Language burned (PiP) on screen.

2.3.4. Show current accessibility services settings

Target (Goal of the interaction)

- Name: Show current AS settings
- Type: Show settings

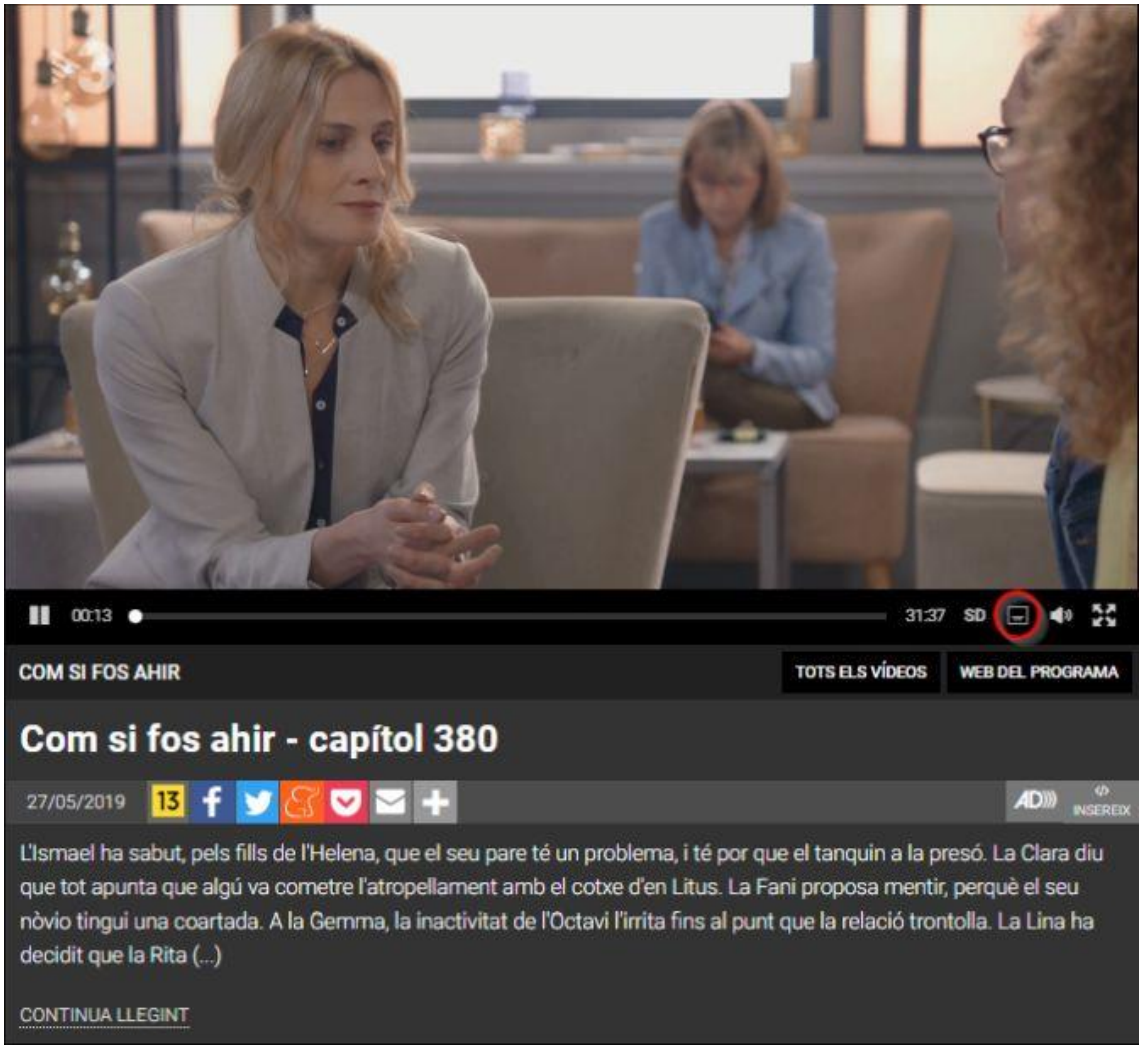
Show current AS settings for Subtitling Service

Step 1 - Open the menu moving the mouse pointer over the video area

Before: the menu is hidden and the subtitles are disabled. The user shall move the mouse pointer over the video area and then the menu is shown.

After: the menu is shown at the bottom of the video area. When there are subtitles available for the current asset, a subtitles icon is shown with different shapes to indicate the state of the service (no icon is shown if the asset does not have subtitles):

- A dark shape indicates that subtitles are not activated.
- A light shape indicates that subtitles are activated.



Show current AS settings for AudioDescription Service

Step 1 - The State of AudioDescription Service is shown with no action

The Audio Description is distributed like an independent video asset, but when the AD asset Version is available for a specific asset, an icon is shown in the description area under the player:

- The grey background of the AD icon indicates that the AD is not being played.
- The black background of the AD icon indicates that the AD is being played.

Show current AS settings for Sign Language Service

Step 1 - The State of Sign Language Service is shown with no action

The Sign Language is distributed like an independent video asset which has SL burned as PiP, and the user must locate and play it as a normal asset. The Sign Language assets are indicated in its title with a piece of text like “amb llengua de signes” or “(LSC)”, also the signer is easily located in the video.

2.3.5. Player controls in the UI

Target (Goal of the interaction)

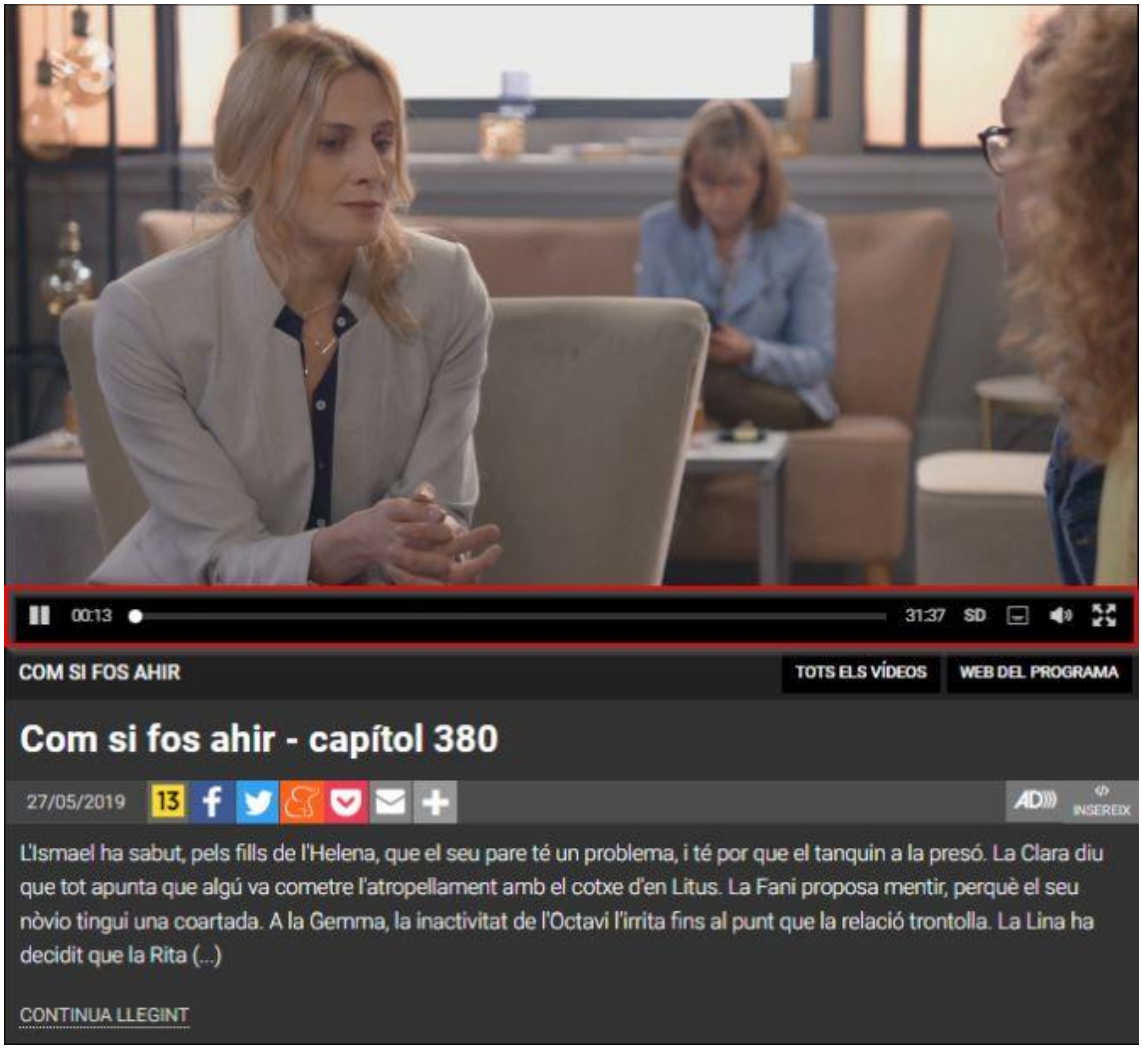
- Name: Player Controls
- Type: Use Player Controls

Display the player controls

Step 1 - Open the menu moving the mouse pointer over the video area

Before: the menu with the player controls is hidden. The user shall move the mouse pointer over the video area and then the menu with the player controls is shown.

After: the menu with the player controls is shown at the bottom of the video area.



Layout of the player controls

1. Play / Pause .
2. Current time position.
3. Position scroll bar (seekable).
4. Duration (remaining)
5. HD/SD video quality selector.
6. Subtitle activation control.
7. Volume control.

8. Full Screen control.

2.4. CCMA HbbTV App

The following sections contains the analysis of CCMA HbbTV app player[1].

Client

- Manufacturer: CCMA
- Name: CCMA HbbTV App Player
- Version: ---
- Type: HbbTV App

Hardware

- Manufacturer: LG
- Model: 32LB650V
- Version: HbbTV1.5
- Type: TV

Operating System

- Name: Webos
- Version: 2.0
- Version Name: ---

Content

- Media Channel: CCMA Catch Up
- Content Provider: CCMA

2.4.1. Switching Subtitles on/off

Target (Goal of the interaction)

- Name: Activation of Subtitles

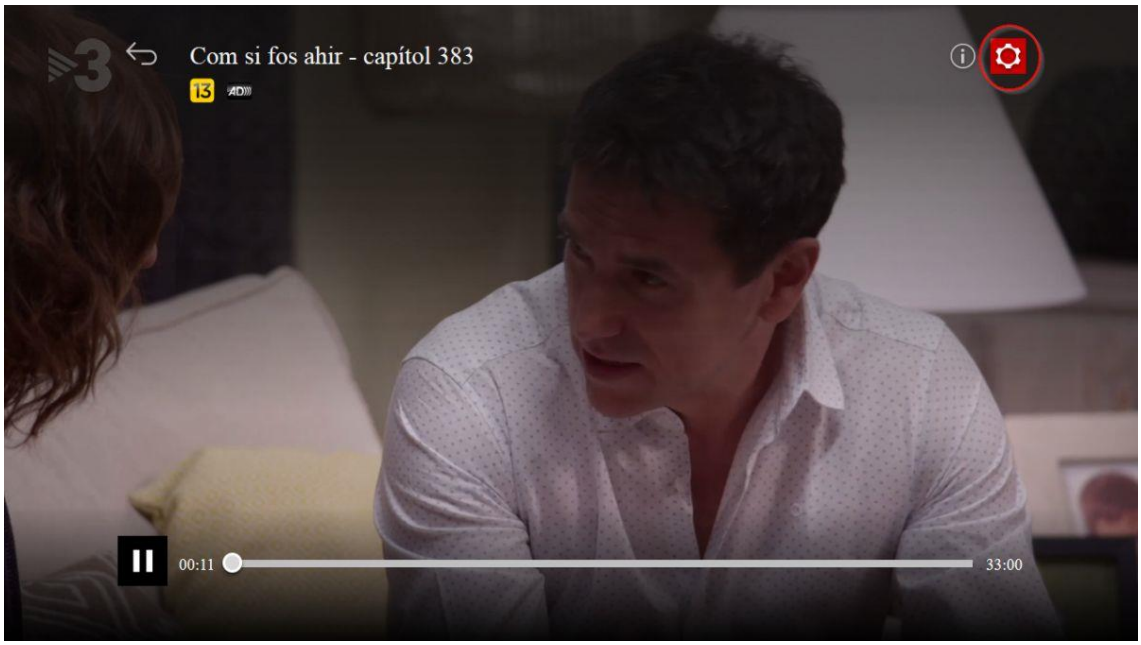
[1] The main difference with other applications being analysed here is, that the HbbTV app is being used with a remote control. Hence the way of controlling is fundamentally different.

- Type: Activation of Service

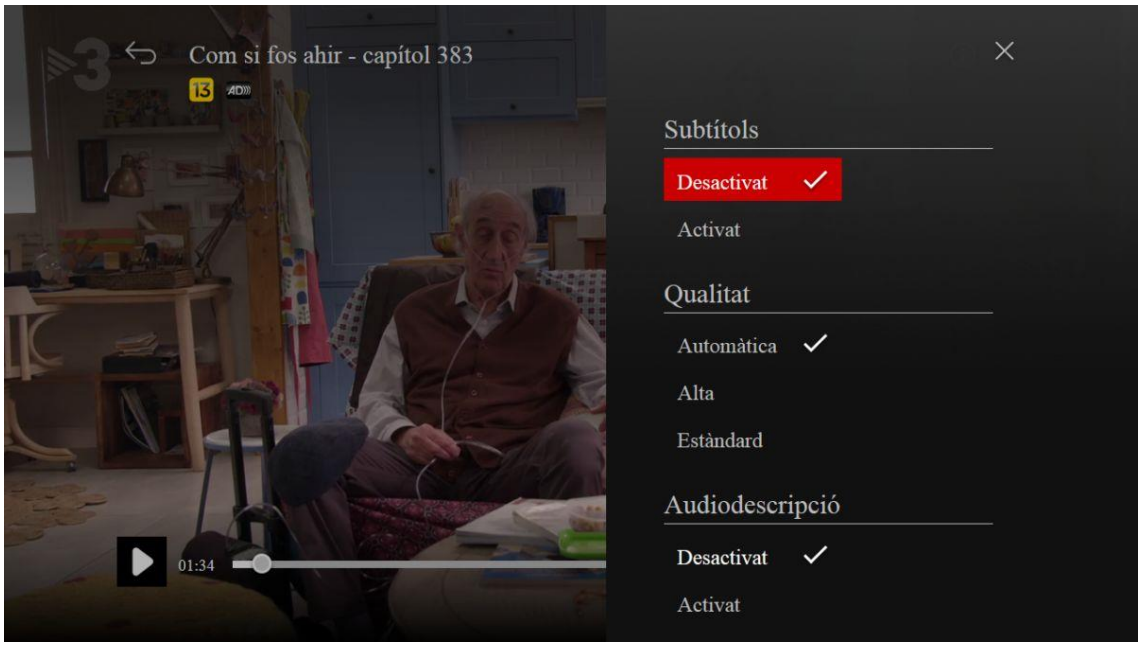
Steps

Step 1 - Open the menu with any key and select de configuration icon

Before: a video is being played, by default the menu is hidden and the subtitles are disabled. The user shall press any navigation key in the TV remote control, navigate to the configuration icon with the arrow keys and press ‘ok’ to open the options menu. This action would require a maximum of three key presses.



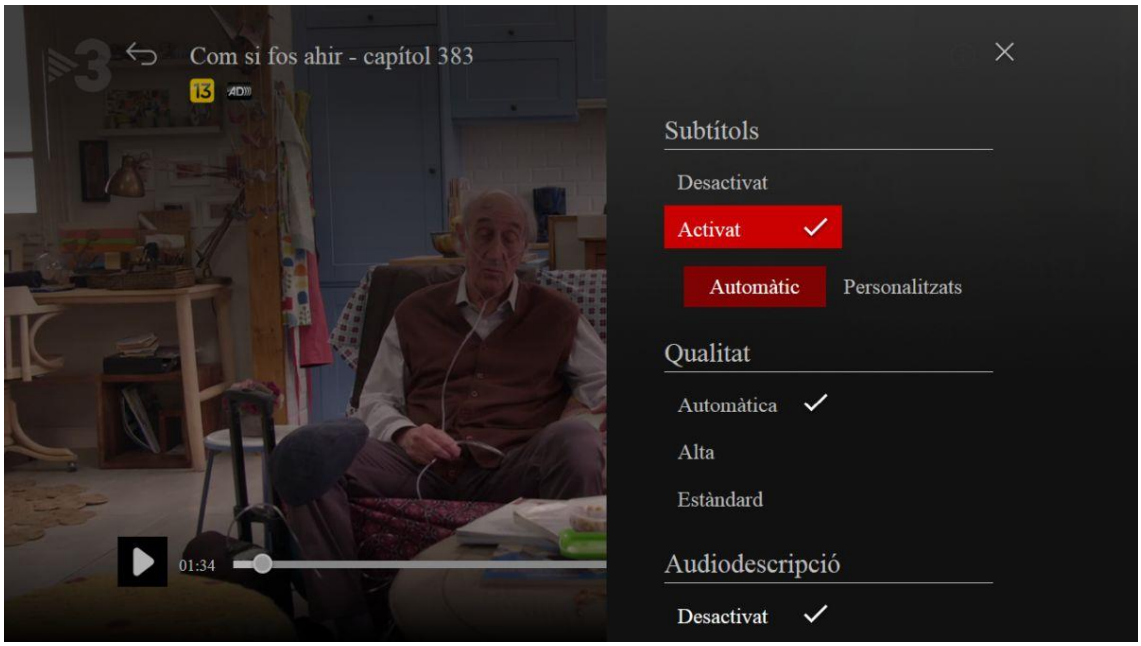
After: the menu is shown and the video is paused. The menu indicates that subtitles are not activated by means of a check sign beside the ‘deactivated’ option.



Step 2 - Activate the subtitles option in the menu

Before: The displayed menu indicates that subtitles are not activated by means of a check sign beside the ‘deactivated’ option. The user shall navigate to the ‘activate’ option with the arrow keys (one click) and press ‘ok’ on the TV remote control to validate the selection.

After: subtitles are shown now as active by means of a check sign beside the ‘activated’ option.



Step 3 - Close the menu and watch the subtitling

Before: A displayed menu indicates that subtitles are activated. The user shall navigate to the ‘X’ button with the arrow keys (2 clicks) and press ‘ok’ in the remote control to close the menu.

After: the menu is hidden, the video recovers the playing state and the subtitles are on screen.

2.4.2. Switching Audio Description on/off

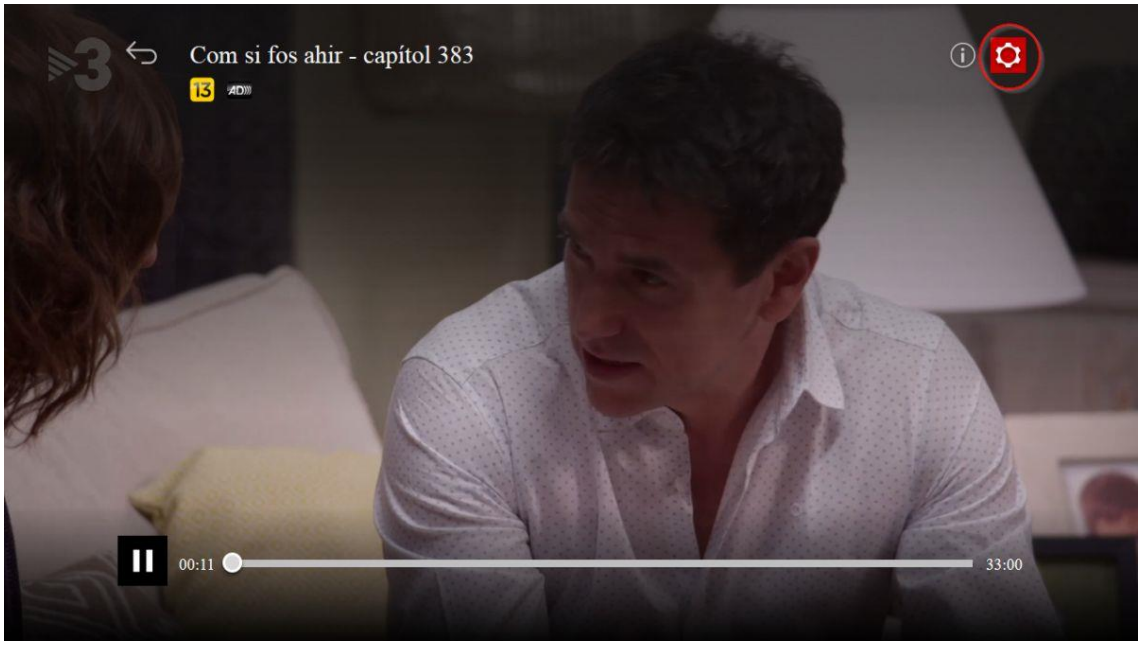
Target (Goal of the interaction)

- Name: Activation of Audio Description
- Type: Activation of Service

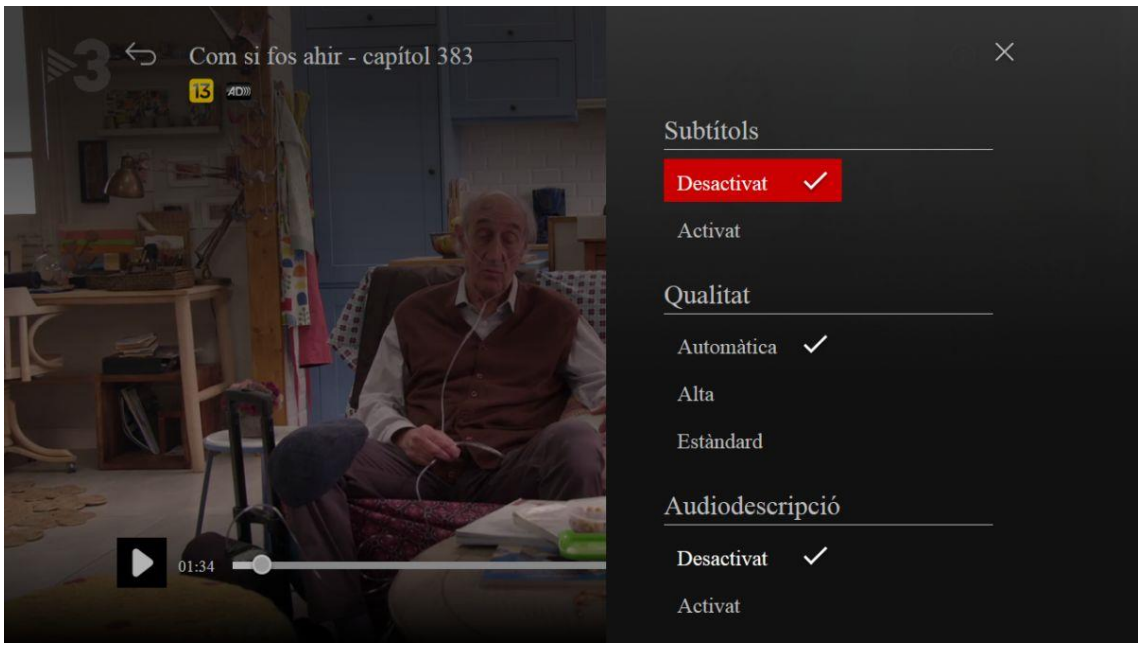
Steps

Step 1 - Open the menu with any key and select de configuration icon

Before: a video is being played, by default the menu is hidden and the Audio Description is disabled. The user shall press any navigation key in the TV remote control, navigate to the configuration icon with the arrow keys and press ‘ok’ to open the options menu. This action would require a maximum of three key presses.



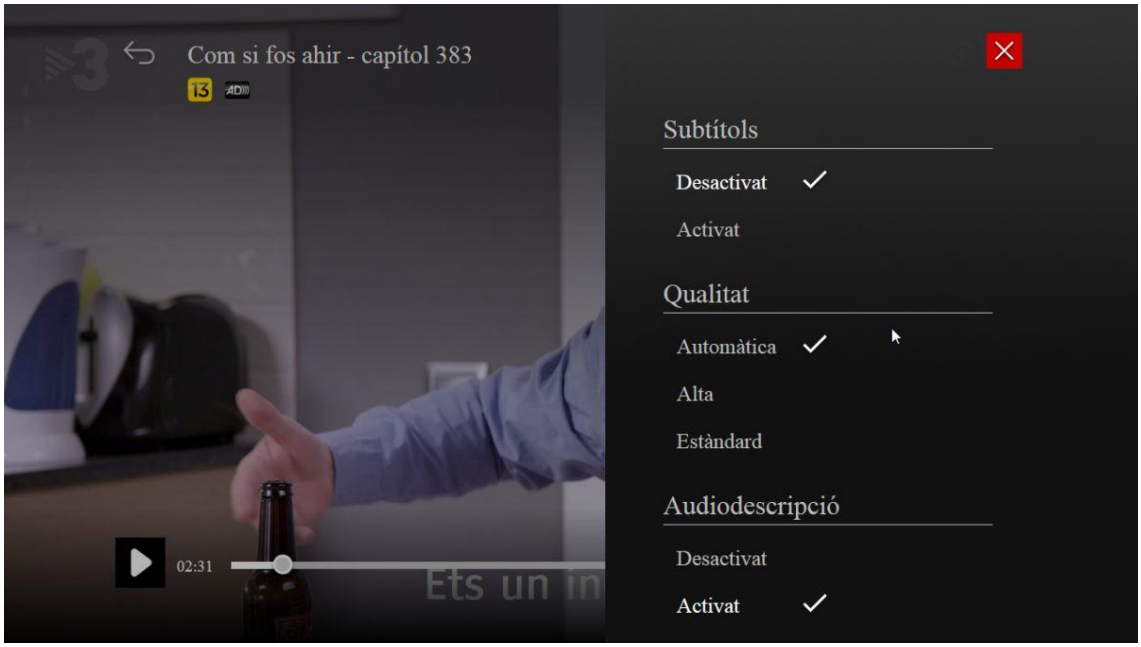
After: the menu is shown and the video is paused. The menu indicates that Audio Description is not activate by means of a check sign beside the ‘deactivated’ option.



Step 2 - Activate the Audio Description option in the menu

Before: The displayed menu indicates that Audio Description is not active by means of a check sign beside the ‘deactivated’ option under the ‘AudioDescription’ section. The user shall navigate to the ‘activate’ option using the arrow keys (6 key presses) and press ‘ok’ in the TV remote control to validate the selection.

After: Audio Description is shown now as active by means of a check sign beside the ‘activated’ option.



Step 3 - Close the menu and listen to the Audio Description

Before: A displayed menu indicates that subtitles are activated. The user shall navigate to the 'X' button with the arrow keys (7 key presses) and press 'ok' on the TV remote control to close the menu.

After: the menu is hidden, the video starts to play since the beginning (because in fact it is a different asset) with the Audio Description SoundTrack.

2.4.3. Switching Sign Language on/off

Target (Goal of the interaction)

- Name: Activation of Sign Language
- Type: Activation of Service

Steps

Step 1 - Locate the desired Sign Language asset

The Sign Language is distributed like an independent video asset and the user must locate and play it as a normal asset.

Before: The way to locate content with Sign Language is first to access a specific program page. If this program includes versions of its assets with sign language, then a short selection of clips is listed under the section "AMB LLENGUATGE DE SIGNES" placed at the bottom of the page. The user navigates to one of the proposed assets and press 'ok' with the remote control to play the content:

After: An asset is played with Sign Language burned on screen. The menu elements are kept on screen for few seconds before they disappear.

A minimum of two clicks is required to navigate to an asset and another one to play. More clicks may be required depending on the selected asset.

2.4.4. Show current accessibility services settings

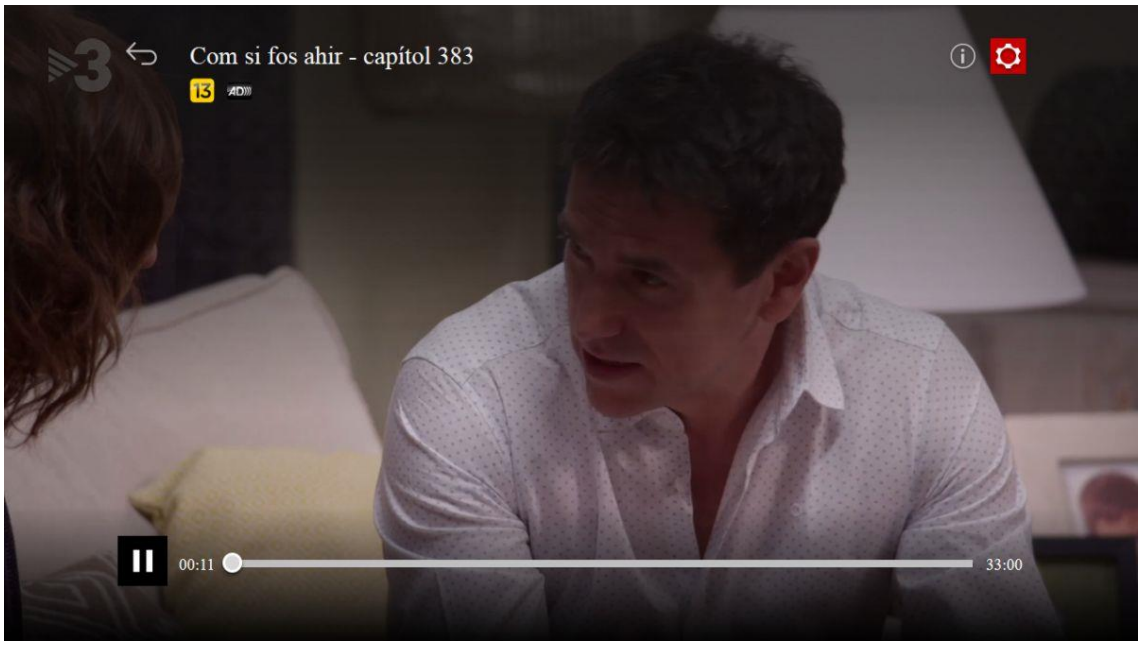
Target (Goal of the interaction)

- Name: Show current AS settings
- Type: Show settings

Show current AS settings for Subtitling Service

Step 1 - Open the menu with any key and select de configuration icon

Before: a video is being played, the menu is hidden. The user shall press any navigation key in the remote control, navigate to the configuration icon and press ‘ok’ to open the options menu. This action would require a maximum of three key presses.



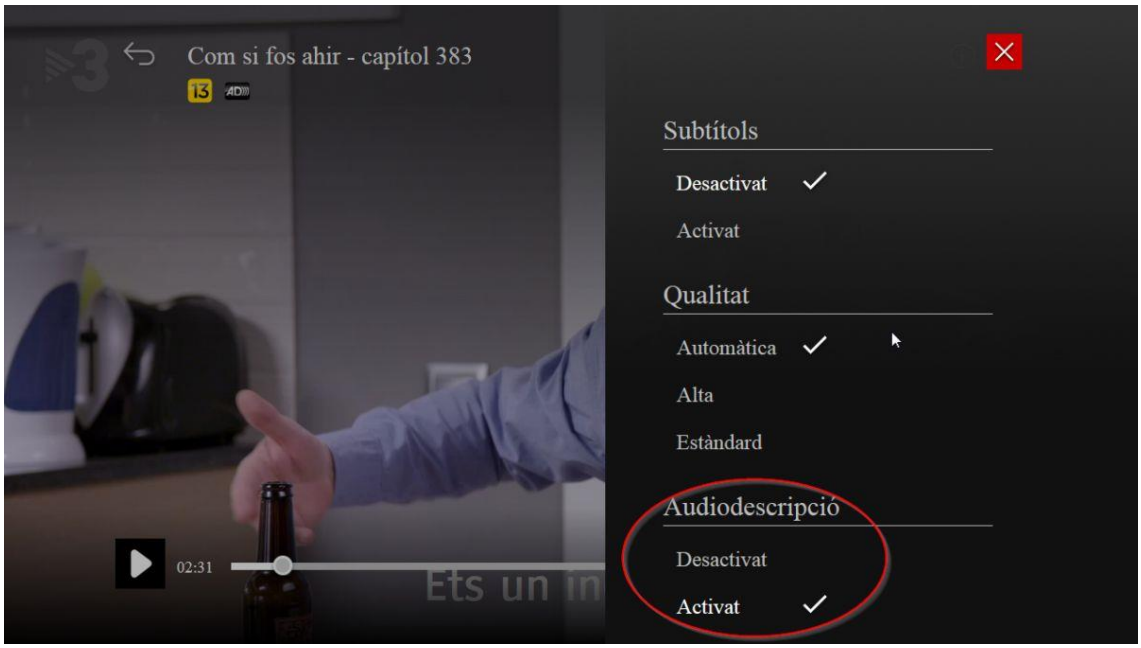
After: the menu is shown and the video is paused. The menu indicates that subtitles are activated or not by means of a check sign beside the ‘activated’ or ‘deactivated’ option (here “deactivated”:

Show current AS settings for Audio Description Service

Step 1 - Open the menu with any key and select de configuration icon

Before: a video is being played, the menu is hidden. The user shall press any navigation key in the remote control, navigate to the configuration icon and press ‘ok’ to open the options menu. This action would require a maximum of three key presses.

After: the menu is shown and the video is paused. The menu indicates that Audio Description is activated or not by means of a check sign beside the ‘activated’ or ‘deactivated’ option:



Show current AS settings for Sign Language Service

Step 1 - The State of Sign Language Service is shown with no action

The Sign Language content is distributed like an independent video asset with SL burned in video as PiP, and the user must locate and play it as a normal asset. The Sign Language assets are indicated in its title with piece of text like “llengua de signes” or “(LSC)”, and also the signer is easily located in the video.

2.4.5. Player controls in the UI

Target (Goal of the interaction)

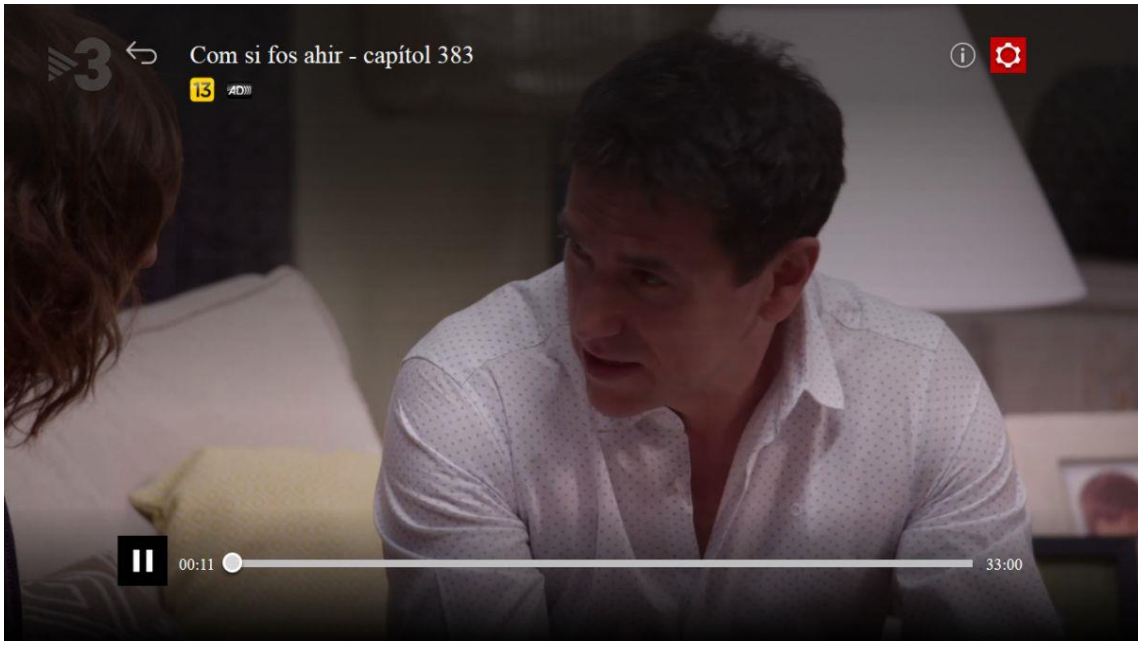
- Name: Player Controls
- Type: Use Player Controls

Display the player controls

Step 1 - Open the menu with any key and select the configuration icon

Before: a video is being played, by default the menu is hidden. The user shall press any navigation key (arrow or 'ok') in the TV remote control to make the player controls to appear.

After: the player controls are shown.

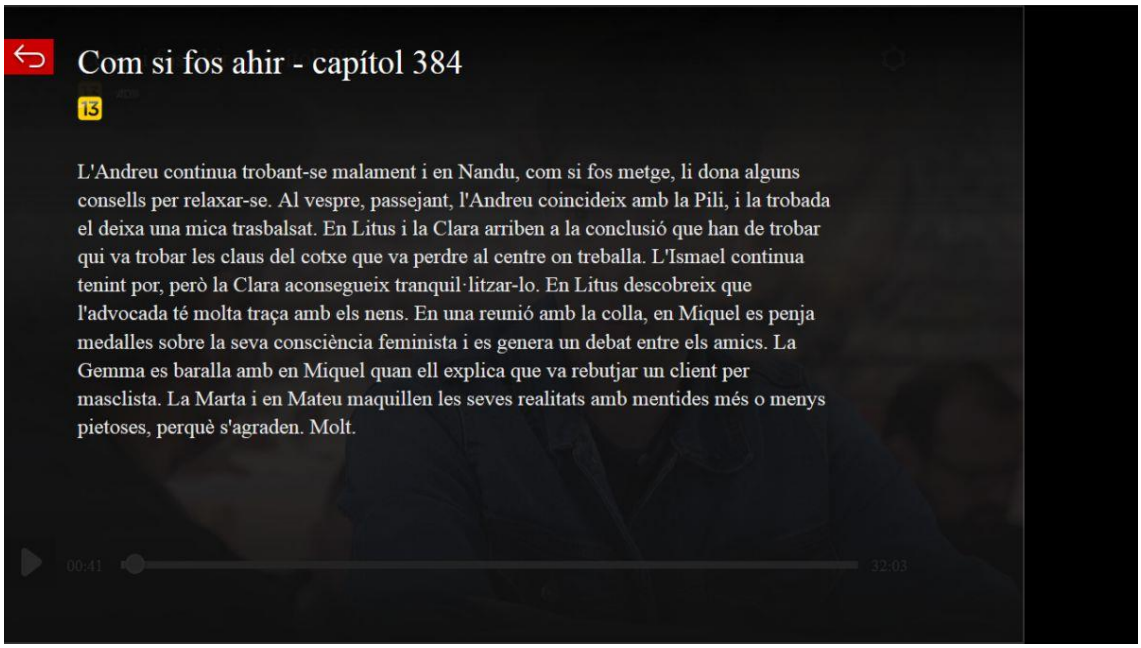


Layout of the player controls

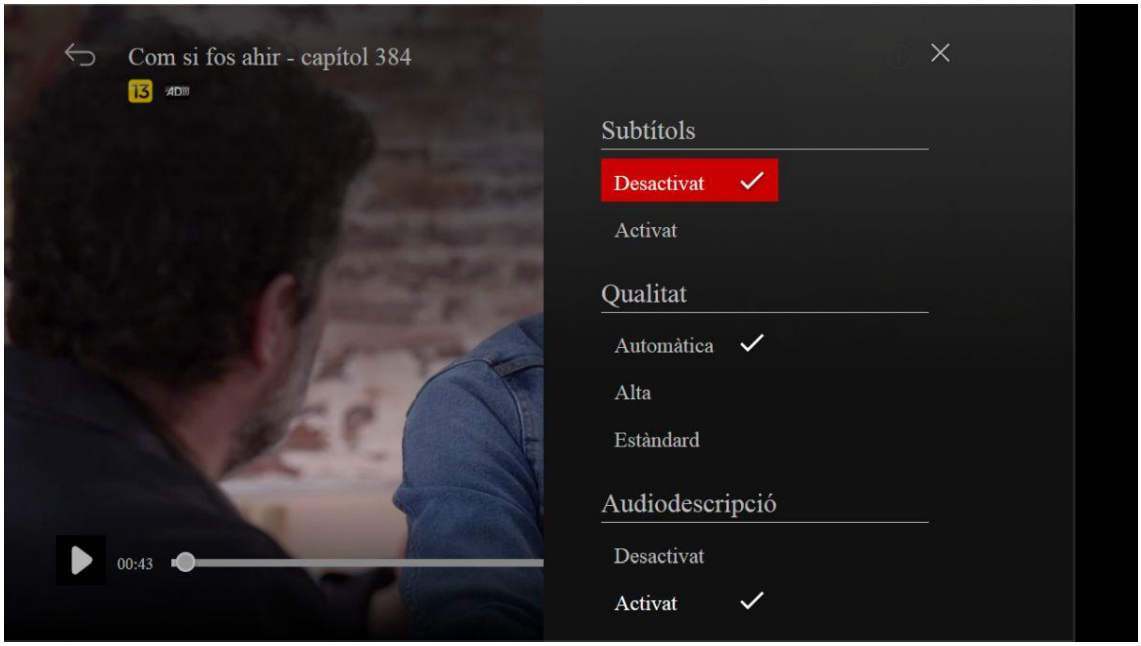
1. Play  /Pause  : Toggles between play and pause modes by positioning the focus on the icon with the arrow keys and pressing ‘Ok’ on the remote control.
2. Current time position.
3. Position scroll bar (seekable).
4. Duration (remaining).
5. Return to previous menu.

6. Content Title.

7. Information button: opens an overlay with the program's synopsis.



8. Configuration button: Opens a menu for activation and personalisation of subtitles, video quality selection, and Audio Description activation.



2.5. Netflix Web Player

Client

- Manufacturer: Netflix

- Name: -
- Version: 6.0015.861.051
- Type: Browser player – tested on Mozilla Firefox 67.0 (64 bit)

Hardware

- Manufacturer: Lenovo
- Model: ThinkCentre M900 Signature Edition
- Version: -
- Type: PC

Operating System

- Name: Windows
- Version: 10 Pro
- Version Name: Version 1809

Content

- Media Channel: Netflix
- Content Provider: many, here: Norddeutscher Rundfunk (NDR)

2.5.1. Switching Subtitles on/off

Target (Goal of the interaction)

- Name: Activation of Subtitles
- Type: Activation of Service

Steps

Step 1 – Hover mouse over player

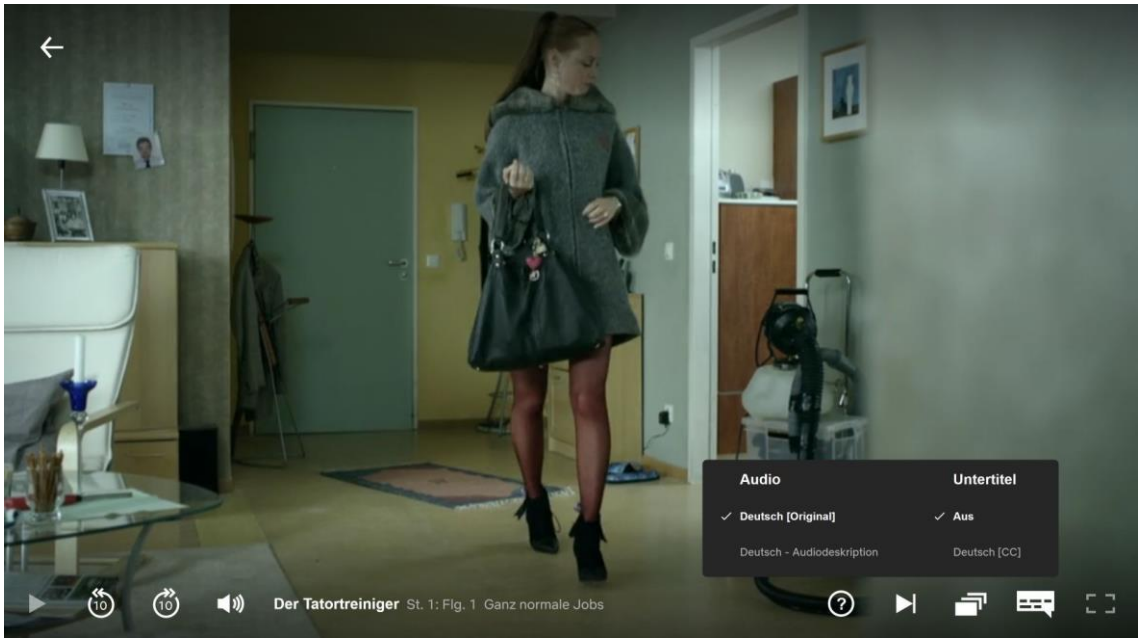
Before: Menu with player controls not visible

After: Menu with player controls visible

Step 2 – Hover mouse over icon "Audio and Subtitles"

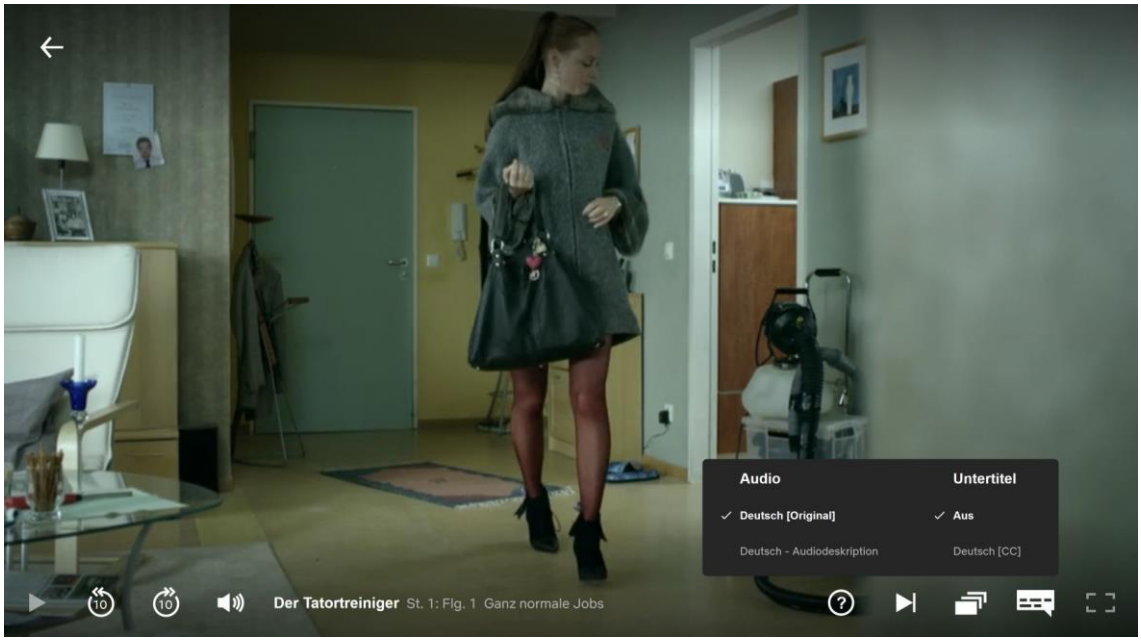
Before: Submenu with accessibility settings not visible ("Audio and Subtitles" icon indicated for clarity)

After: Submenu with accessibility settings visible

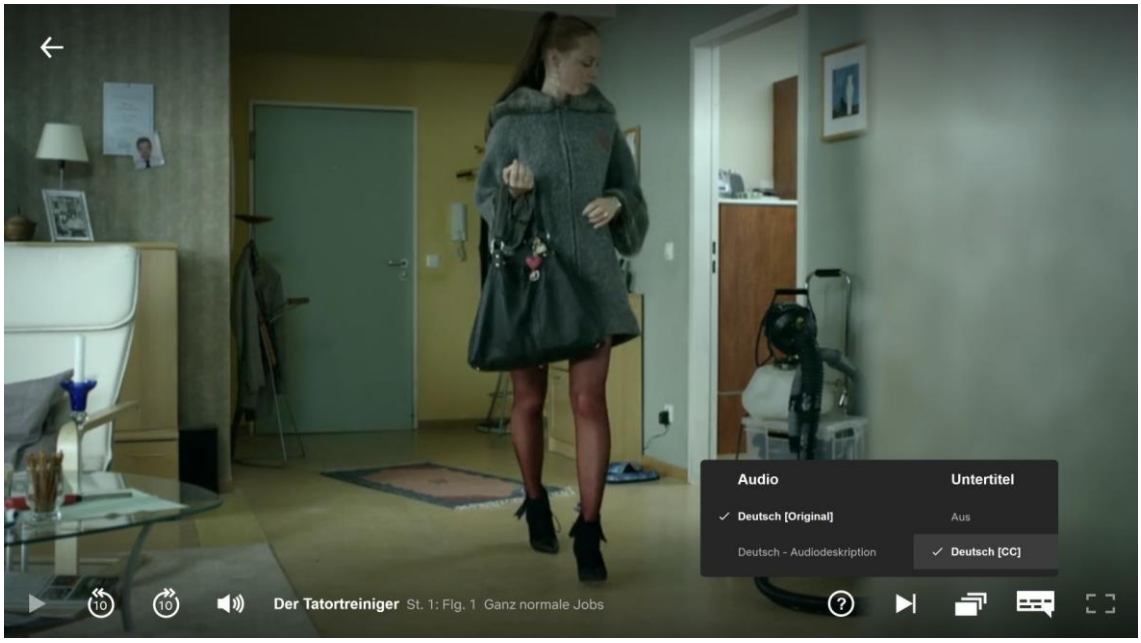


Step 3 - Click on desired subtitles

Before: subtitles not activated (“Aus” (English: “off”))



After: subtitles activated (“Deutsch [CC]”)



2.5.2. Switching Audio Description on/off

Target (Goal of the interaction)

- Name: Activation of Subtitles
- Type: Activation of Service

Steps

Step 1 – Hover mouse over player

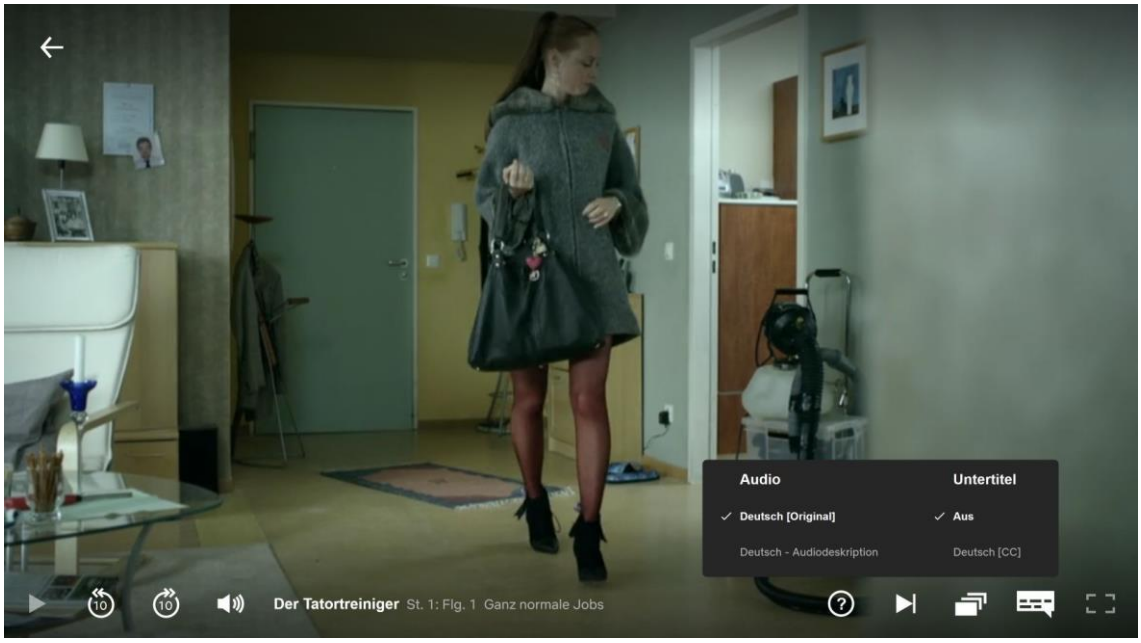
Before: Menu with player controls not visible

After: Menu with player controls visible

Step 2 – Hover mouse over icon “Audio and Subtitles”

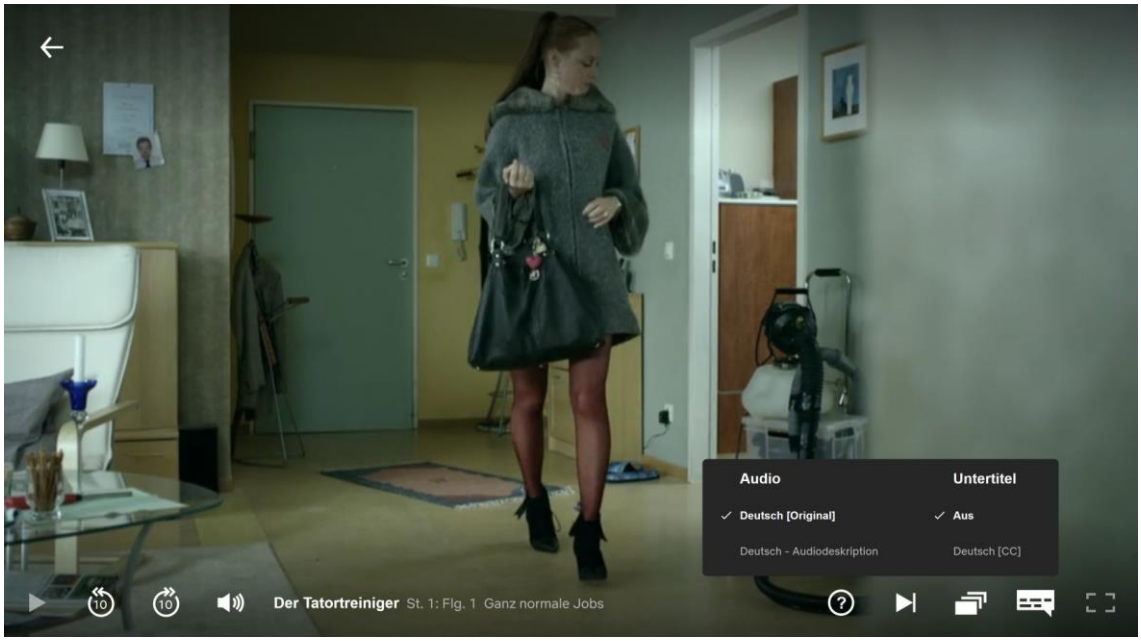
Before: Submenu with accessibility settings not visible (“Audio and Subtitles” icon indicated for clarity)

After: Submenu with accessibility settings visible; if the asset has Audio Description, it is listed here.

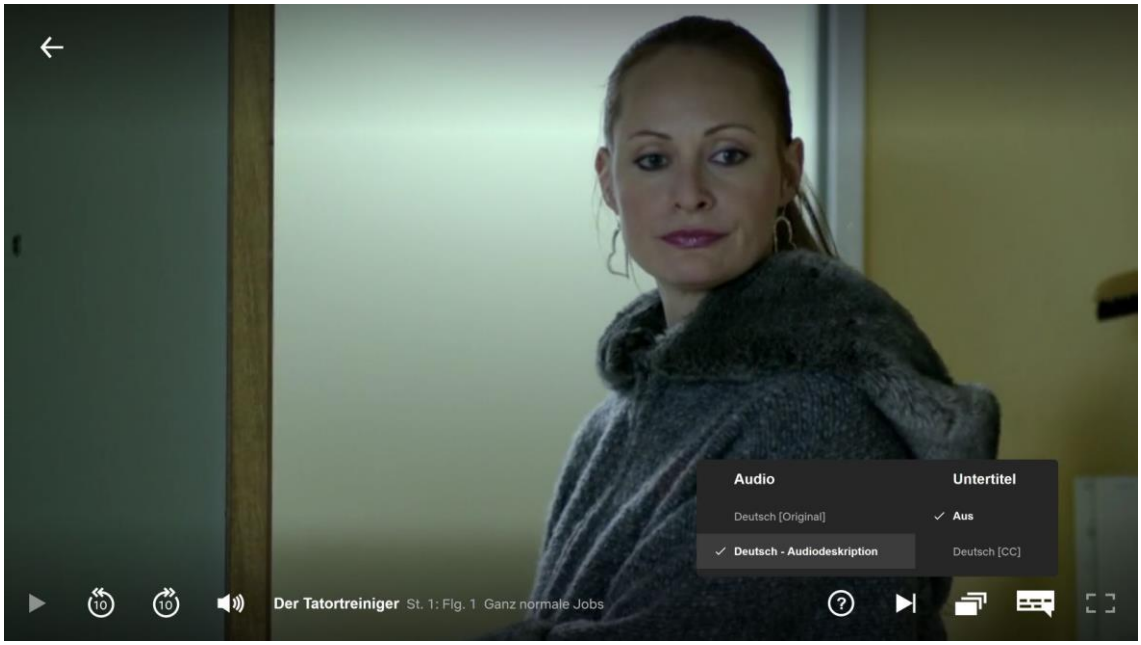


Step 3 - Click on desired Audio track

Before: The original sound track is activated (“Deutsch [Original]”)



After: The sound track with Audio Description is activated(“Deutsch-Audiodeskription”)



2.5.3. Switching Sign Language on/off

Not Applicable. (If Sign Language is offered for a media asset via NetFlix, it is contained in an additional asset for a piece of media, where the SL is burned-in with the main video.)

2.5.4. Show current accessibility services settings

Target (Goal of the interaction)

- Name: Show current AS settings
- Type: Show settings

Steps

Step 1 – Hover mouse over player

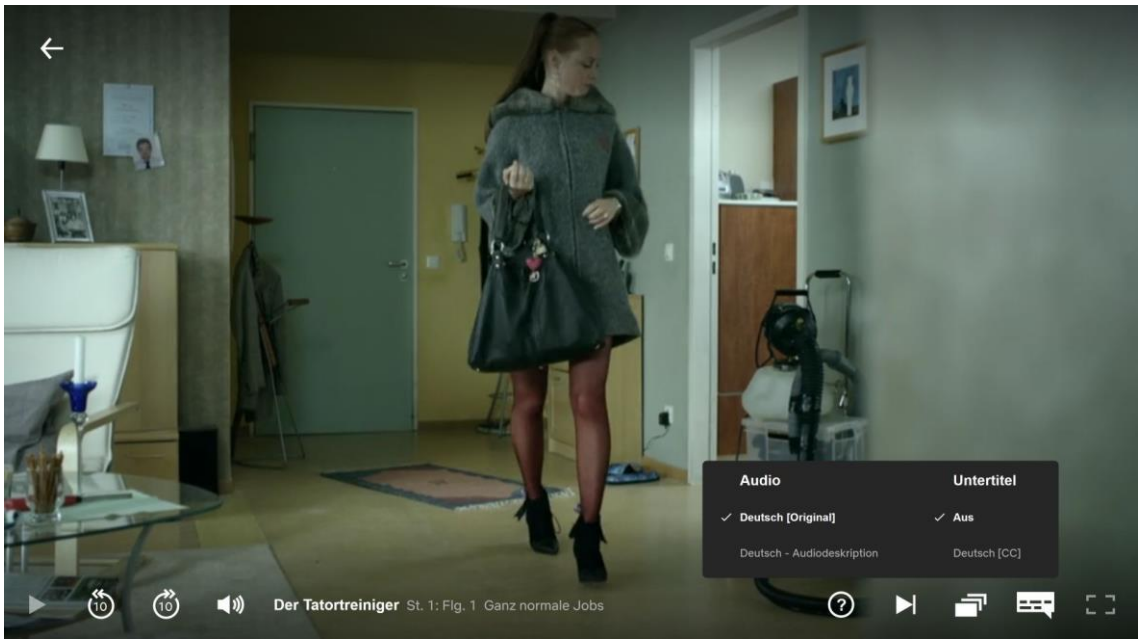
Before: Menu with player controls not visible

After: Menu with player controls visible

Step 2 – Hover mouse over icon “Audio and Subtitles”

Before: Submenu with accessibility settings not visible (“Audio and Subtitles” icon indicated for clarity)

After: Submenu with accessibility settings visible



2.5.5. Player controls in the UI

Target (Goal of the interaction)

- Name: Player Controls
- Type: Use Player Controls

Display the player controls

Steps

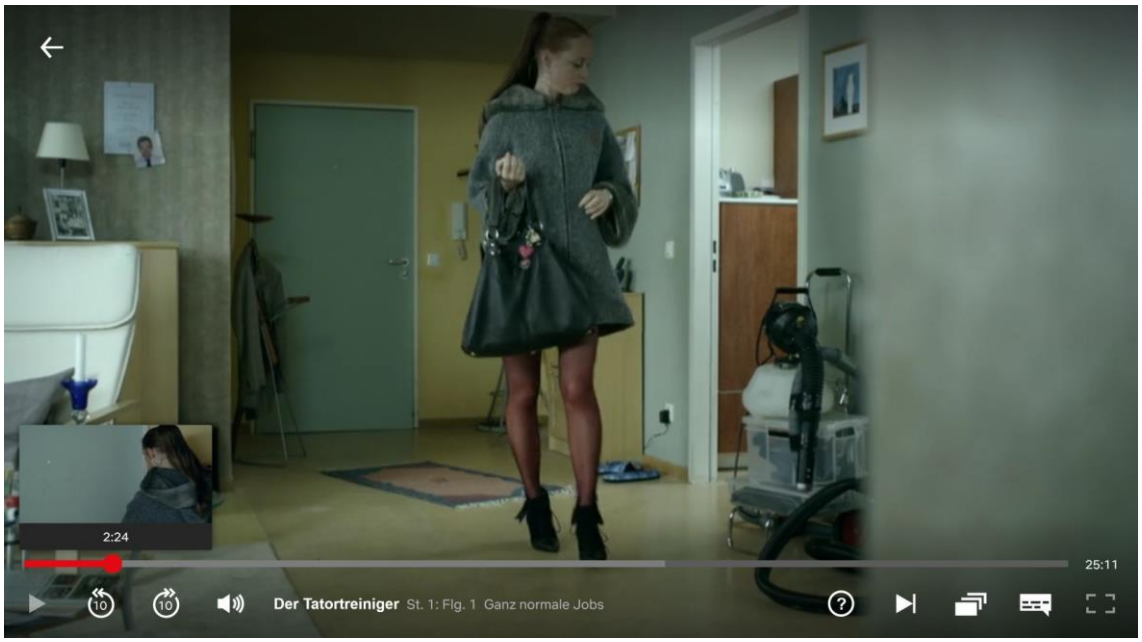
Step 1 – Hover mouse over player

Before: Menu with player controls not visible

After: Menu with player controls visible

Layout and function of the player controls

1. Position scroll bar (seekbar; to seek, hover mouse over icon, then click and drag the red dot in the scroll bar)



2. Play/Pause (hover mouse over icon and click to toggle)

Steps

Step 1 – Hover mouse over player and move mouse to play icon

Before: Menu with player controls not visible

After: Menu with player controls visible

Step 2 – Click on “Play”

Before: Video is paused.

After: Video plays. Play button toggled to Pause button.

Alternatively: hover mouse over any part of the player and click to toggle play/pause status. The player briefly shows the new status by fading in the appropriate icon in the centre of the player.

3. Jump back 10 seconds

4. Jump forward 10 seconds

5. Volume control (to change volume, hover mouse over icon, then click and drag the red dot in the control bar)

Steps

Step 1 – Hover mouse over player and move mouse to volume control

Before: Menu with player controls not visible

After: Menu with player controls visible

Step 2 – Click and drag the red dot in the control bar

Before: Volume is low.

After: Volume is higher.

6. Series title, series season and episode information, episode title

7. Help function

8. Jump to next episode
9. Series / episode information
10. Audio and Subtitles settings (see above)
11. Full screen option (to select full screen mode, hover mouse over icon, then click)

2.6. YouTube Web Player

Client

- Manufacturer: YouTube
- Name: -
- Version: 2.20190810.05.01
- Type: Browser player, tested on Mozilla Firefox 67.0 (64 bit)

Hardware

- Manufacturer: Lenovo
- Model: ThinkCentre M900 Signature Edition
- Version: -
- Type: PC

Operating System

- Name: Windows
- Version: 10 Pro
- Version Name: Version 1809

Content

- Media Channel: YouTube
- Content Provider: many, here: Norddeutscher Rundfunk (NDR)

2.6.1. Switching Subtitles on/off

Target (Goal of the interaction)

- Name: Activation of Subtitles
- Type: Activation of Service

Steps

Step 1 Hover mouse over player

Before: Menu with player controls not visible

After: Menu with player controls visible

Step 2 Click subtitle icon

Before: subtitles not activated (subtitle icon has no red line under it)

After: subtitles activated (subtitle icon has red line under it)

2.6.2. Switching Audio Description on/off

Whereas it is technically possible to add AD to a YouTube video (e.g. by means of an external plugin[2]), this functionality is not included in the mainstream videos on the YouTube portal.

Typically, if Audio Description is offered for a media asset, it is contained in an additional asset for a piece of media, where the main audio is being replaced by an audio mix containing Audio

[2] For example 3Play Media: https://www.3playmedia.com/2018/07/23/how-to-add-audio-description-to-youtube-videos/

Description. One has to search the YouTube portal for such media assets. At playback time in such cases the AD is “always on”. There is no further indication to the user.

2.6.3. Switching Sign Language on/off

If Sign Language is offered for a media asset via YouTube, it is contained in an additional asset for a piece of media, where the SL is burned-in with the main video.

2.6.4. Show current accessibility services settings

Target (Goal of the interaction)

- Name: Show current AS settings
- Type: Show settings

Steps

Step 1 Hover mouse over player

Before: Menu with player controls not visible

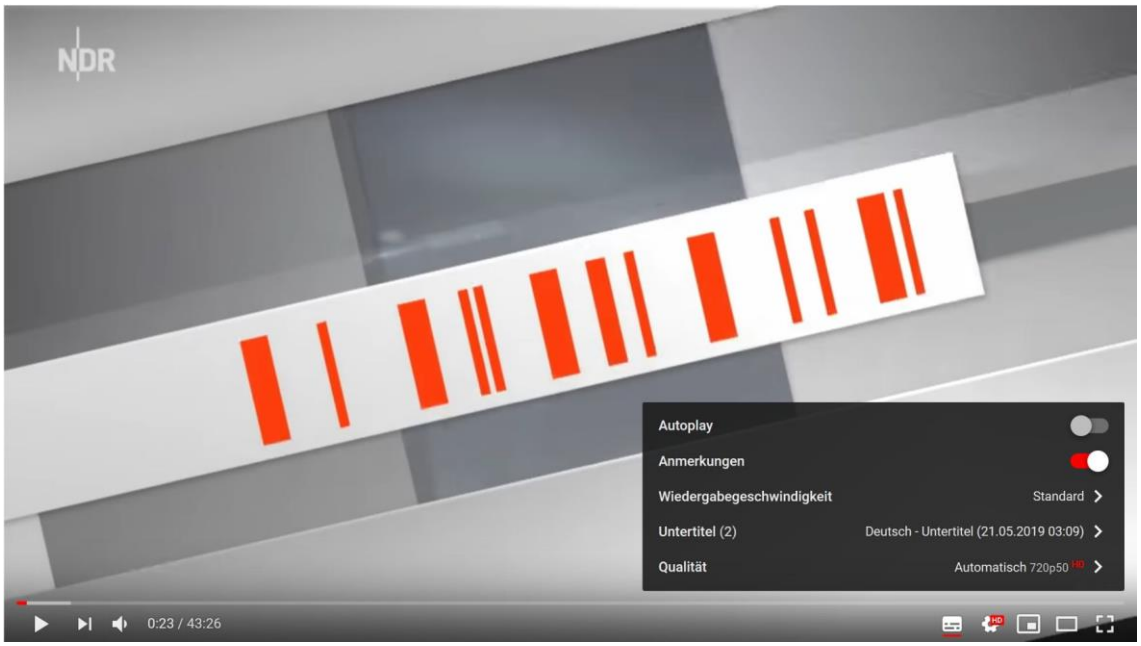
After: Menu with player controls visible

From the player controls is clear whether subtitles are switched on or off (see above).

Step 2 Click settings icon

Before: Settings menu not visible

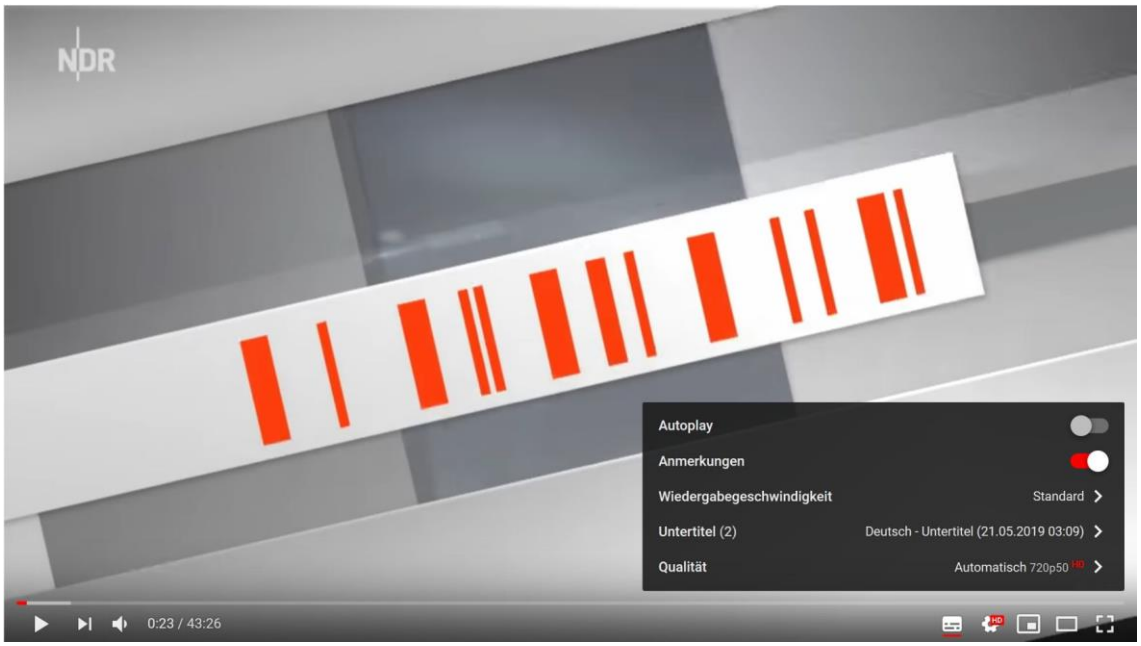
After: General settings menu visible



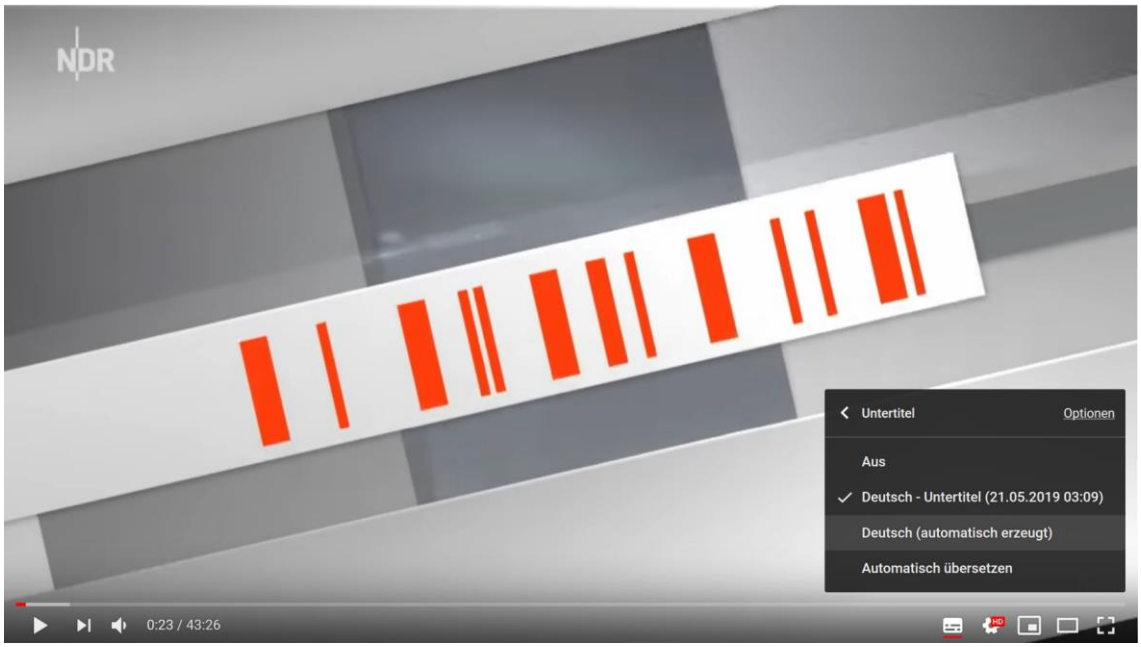
The general settings menu for subtitles shows the currently selected option (here “Deutsch - Untertitel”).

Step 3 - Click “subtitles” (here “Untertitel”)

Before: General settings menu visible



After: Settings menu with subtitles options visible



From this submenu, alternative options / versions of subtitles can be selected by clicking on them. Also, subtitles can be switched off (“Aus”).

For Audio Description and Sign Language, no specific indications are included in the settings menu. For these AS, in YouTube additional assets need to be included for a certain piece of media, respectively including a pre-mixed Audio Description or a burned-in signer. At playback time in such cases the AD or SL respectively are “always on”.

2.6.5. Player controls in the UI

Target (Goal of the interaction)

- Name: Player Controls
- Type: Use Player Controls

Display the player controls

Steps

Step 1 Hover mouse over player

Before: Menu with player controls not visible

After: Menu with player controls visible

Layout and function of the player controls

1. Position scroll bar (seekbar; to seek, hover mouse over icon, then click and drag the red dot in the scroll bar)

2. Play/Pause (hover mouse over icon and click to toggle)

Step 1 – Hover mouse over player and move mouse to play icon

Before: Menu with player controls not visible

After: Menu with player controls visible

Step 2 – Click on “Play”

Before: Video is paused.

After: Video plays. Play button toggled to Pause button.

Alternatively: hover mouse over any part of the player and click to toggle play/pause status. The player briefly shows the new status by fading in the appropriate icon in the centre of the player.

3. Jump to next video in this series

4. Volume control (to change volume, hover mouse over icon, then click and drag the white dot in the volume control bar)

Steps

Step 1 – Hover mouse over player and move mouse to volume control

Before: Menu with player controls not visible

After: Menu with player controls visible

Step 2 – Click and drag the white dot in the control bar

Before: Volume is low.

After: Volume is higher.

5. Time of player position / total length of the video

6. Subtitle on/off (see above)

7. Settings menu (see above)

8. Mini Player

9. Cinematic view (hover mouse over icon and click to toggle between cinematic and standard view)

10. Full screen option (to select full screen mode, hover mouse over icon, then click)

2.7. RTVE VR Web Player

Unlike the VoD players of RTVE, the VR player of RTVE does not integrate any Accessibility Service. Therefore, many parts of our analysis template do not apply.

Interestingly, RTVE has shown interest in ImAc, offered their contents and the possibility of integrating the ImAc player in their websites is being discussed.

Client

- Manufacturer: RTVE
- Name: -
- Version: -
- Type: Browser player, tested on Google Chrome :75.0.3770.80 / Mozilla Firefox 64.0.1
- URL: http://www.rtve.es/lab/realidad-virtual/

Hardware

- Manufacturer: -
- Model: -
- Version: -
- Type: PC / Laptop

Operating System

- Name: Windows
- Version: 10 (64 bits)
- Version Name: Windows 7 Professional

Content

- Media Channel: RTVE (URL: http://www.rtve.es/lab/realidad-virtual/)
- Content Provider: RTVE

2.7.1. Switching Subtitles on/off

Not applicable.

This feature is not available in the majority of the offered contents through this player. However, RTVE also provides some 360º demos for the possibility of switching on/off subtitles is offered, e.g.: http://lab.rtve.es/teatro-real/es/orquesta-360/ .

The figures below indicate how this option is included in the menu (bottom region: SUBTITULOS), the visual notification that is shown when subtitles are switched on/off, and how a strikethrough text is added to that menu item when the subtitles have been switched on.

However, no subtitles are shown when switching them on in some of them (probably a software bug).

2.7.2. Switching Audio Description on/off

Not applicable

2.7.3. Switching Sign Language on/off

Not applicable

2.7.4. Show current accessibility services settings

Not applicable

2.7.5. Browse the available videos

Target (Goal of the interaction)

- Check how videos can be browsed, searched and selected

Step 1. Browse the Catalogue and Search for Videos

Videos are shown in a mosaic on the website. No list and searching features are available.

2.7.6. Player controls in the UI

Target (Goal of the interaction)

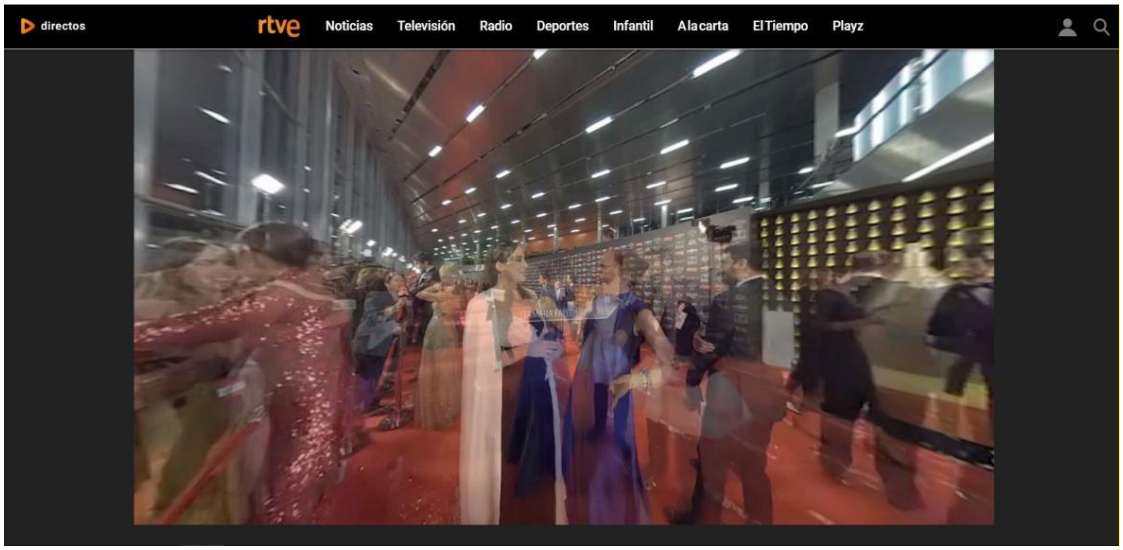
- Name: Player Controls
- Type: Use Player Controls

Display the player controls

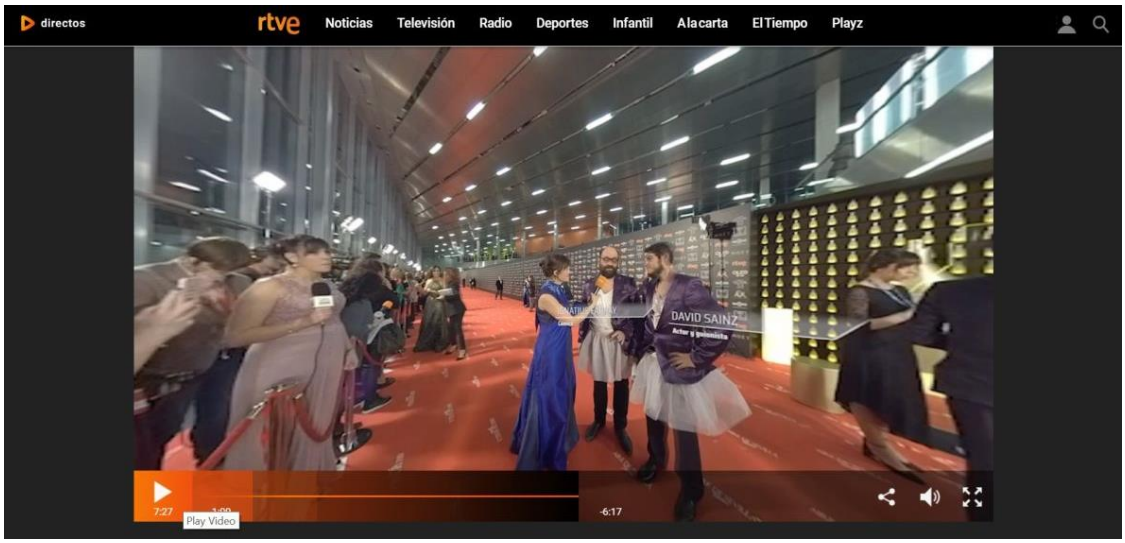
Steps

Step 1 Hover mouse over player

Before: Menu with player controls not visible



After: Menu with player controls visible



Layout and function of the player controls

The figure above shows the layout of the player controls

1. Scroll bar or seekbar (to seek, hover mouse over icon, then click on the target position or drag from the current position and drop in the target one). The orange area will be updated accordingly.

2. Play/Pause (hover mouse over icon and click to toggle)

Step 1 – Hover mouse over player and move mouse to play icon

Before: Menu with player controls not visible

After: Menu with player controls visible

Step 2 – Click on "Play"

Before: Video is paused.

After: Video plays. Play button toggled to Pause button.

Alternatively, by clicking on any part of the video, the player pauses / restarts playbacks.

3. Volume control (to change volume, hover mouse over icon, then click / drag the white bar in the volume control bar).

Steps

Step 1 – Hover mouse over player and move mouse to volume control

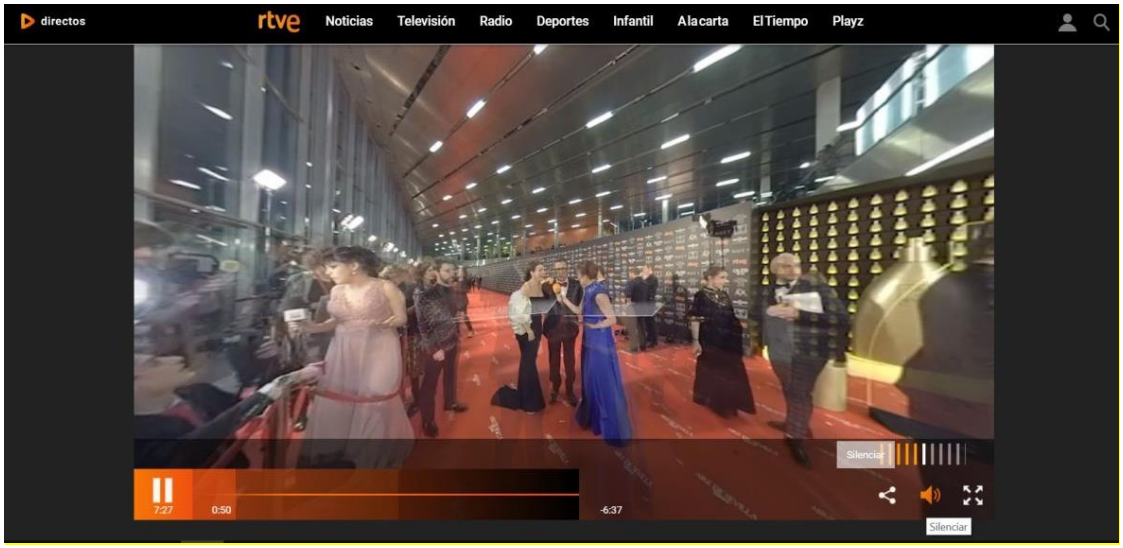
Before: Menu with player controls not visible

After: Menu with player controls visible

Step 2 – Click and drag the white bar in the control bar

Before: Previous volume level.

After: Desired volume level.



4. Mute: is also possible by clicking on the volume icon. Another click will active the audio again

Before: Previous volume level.

After: Mute (and icon of mute is shown).

5. Time of player position / total length of the video.

This is shown in the player controls.

6. Full screen option (to select full screen mode, hover mouse over icon, then click)

2.8. RTVE VR Android App

Unlike the VoD players of RTVE, the VR player of RTVE does not integrate any Accessibility Service. Therefore, the next steps do not apply.

Interestingly, RTVE has shown interest in ImAc, offered their contents and the possibility of integrating the ImAc player in their websites is being discussed.

Client

- Manufacturer: RTVE
- Name: RTVE VR (Android App)
- Version: -
- Type: Android App

Hardware

- Manufacturer: Samsung
- Model: Galaxy
- Version: S7 and S9
- Type: Smartphone

Operating System

- Name: Android
- Version: 8.0 / 9.0
- Version Name: Oreo / Pie

Content

- Media Channel: RTVE
- Content Provider: RTVE

2.8.1. Switching Subtitles on/off

Not applicable

2.8.2. Switching Audio Description on/off

Not applicable

2.8.3. Switching Sign Language on/off

Not applicable

2.8.4. Show current accessibility services settings

Not applicable

2.8.5. Browse the available videos

Target (Goal of the interaction)

- Check how videos can be browsed, searched and selected

Step 1. Browse the Catalogue and Search for Videos

Videos are shown in a mosaic in the app. No list and searching features are available.

Once clicking on the Setting control, just basic Instructions (see below, in Spanish) and the list of downloaded videos are shown.

Once clicking on a specific video, the cover and basic info about the video is shown (but nothing about accessibility). The users are also given the possibility of watching the video online (streaming) or downloading it.

2.8.6. Player controls in the UI

Target

- Name: Player Controls
- Type: Use Player Controls

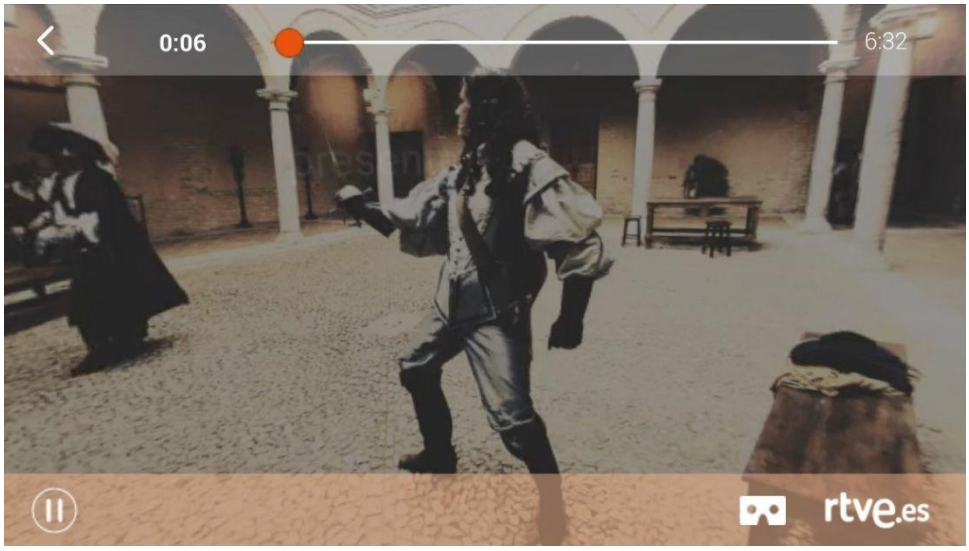
Display the player controls

Steps

Step 1 Hover mouse over player

Before: Menu with player controls not visible

After: Menu with player controls visible



Layout and function of the player controls

The figure above shows the layout of the player controls.

1. Scroll bar or seekbar (to seek, hover mouse over orange circle, and drag & drop / click to the target position. The position of the orange circle will be updated accordingly.

2. Play/Pause (hover mouse over icon and click to toggle)

Step 1 – Hover mouse over player and move mouse to play icon

Before: Menu with player controls not visible

After: Menu with player controls visible

Step 2 – Click on "Play"

Before: Video is paused.

After: Video plays. Play button toggled to Pause button.

3. Volume control: no menu controls to set volume levels are provided. The controls of the device being used should be instead.

4. Time of player position / total length of the video.

This is shown in the player controls.

6. VR Mode (bottom right: hover mouse over icon, then click. Then an exit control "X" is added to exit from VR mode).

2.9. WebVR

Client

- Manufacturer: WDR
- Name: WebVR
- Version: -
- Type: Browser application, tested on Firefox 67.0 (64-bit)

Hardware

- Manufacturer: Lenovo
- Model: ThinkCentre M900 Signature Edition
- Version: -
- Type: PC

Operating System

- Name: Windows
- Version: 10 Pro
- Version Name: Version 1809

Content

- Media Channel: VR Production “Glueck auf! [3]”
- Content Provider: Westdeutscher Rundfunk (WDR)

2.9.1. Switching Subtitles on/off

Target (Goal of the interaction)

- Name: Activation of Subtitles
- Type: Activation of Service

Steps

Step 1 Click subtitle icon

Before: subtitles not activated (subtitle icon has no gray background)

[3] https://glueckauf.wdr.de/de/

After: subtitles activated (subtitle icon has gray background)

2.9.2. Switching Audio Description on/off

Not applicable.

2.9.3. Switching Sign Language on/off

Not applicable.

2.9.4. Show current accessibility services settings

Status of the subtitles (switched on or off) is directly visible from the player control bar (see above).

2.9.5. Player controls in the UI

Display the player controls

The player control bar is always visible.

Layout and function of the player controls

1. Language selection (DE, EN, TR) (click any language to change the menu language in the application)
2. Legal information
3. Privacy policy
4. Link to copyright information
5. Link for further contact
6. Link to barrier-free version of the application (HTML webpages)
7. HMD info
8. Subtitle toggle (see above)
9. Full screen option (to select full screen mode, hover mouse over icon, then click)
10. Audio toggle (to toggle on / off, hover mouse over icon, then click)

Steps

Step 1 – Hover mouse over volume control

Before: Audio icon white on transparent background

After: Audio icon white on red background

Step 2 – Click volume control

Before: Volume is ”on”

After: Volume is “off”

2.10. Analysis and best practices

General findings

Regarding access to accessibility services in general, SoA media web players quite well support the provision of subtitles. Audio description and sign language are very often not integrated for access by the player menu directly – rather, the user needs to search for an appropriate media asset in the respective portal (note: for sign language hardly any "closed signing" services are being offered). Depending on the metadata and search functionality provided by the media provider, this is more or less irritating to the user.

For on-demand streaming media services (e.g. based on DASH) it is technically possible the provide audio description as an additional audio track inside the media player. However, the asset production / generation / packaging must be set up to support this. CCMA has implemented this for its catch-up service – the player supports selection of AD when available and thus makes access to that accessibility service easier and more transparent to the user.

Although some SoA VR-players support the provision of subtitles, they have no focus on accessibility services in general.

Activating / de-activating accessibility services

Assuming the player is running and content is loaded, *subtitles* in the majority of the web players that were documented can be activated in 1 "smooth" step – only a single click with the mouse / pointing device is involved, being preceded by one or two "mouse-over" steps. In our experience, other web players may need one or more additional steps / clicks, especially when subtitles are being provided in multiple languages. The CCMA HbbTV App requires 3 steps with a maximum total of 7 key presses on the remote control[4]. Few VR players support subtitles.

As already mentioned, with respect to *audio description*, several media portals require the user to specifically search for an extra media asset. The tested webplayers that support audio description allow activation in 1 "smooth" step – only a single click with the mouse / pointing device is involved, potentially being preceded by two "mouse-over" steps. The CCMA HbbTV App requires 3 steps with a maximum total of 16 key presses on the remote control. Audio description is not in focus of VR players.

For *sign language*, hardly any "closed signing" services (with separately activatable sign language interpreter) are currently being offered, hence this option is typically also not available in current players. Rather, the user needs to specifically search for an appropriate media asset in the respective media portal. The amount of media assets being provided with sign language, vary widely. Sign language is not in focus of VR players.

Show current settings for accessibility services

The majority of the web players we documented allow showing the current *subtitle* settings in a single step (typically mouse over). The CCMA HbbTV App requires a maximum of 3 keypresses

[4] In our experience, for other HbbTV apps the amount of key presses lies in the same order of magnitude. A large advantage is that, once set, the app remembers the user's preference, so subtitles once activated, remain activated for the future.

on the remote control to show settings[5]. YouTube also supports showing further details on the current subtitles, e.g. language.

Several players integrate settings for accessibility services in a general “settings” menu.

Information on the status of *audio description* settings is sometimes implicit, in case of an extra media asset for audio description, e.g. via the asset title or simply because “it is there” (without further feedback). CCMA in its web player always indicates the status of audio description. The Netflix web player requires “one smooth step” (mouse over). The CCMA HbbTV App requires a maximum of 3 keypresses on the remote control to show settings[6].

Information on the status of *sign language* settings is mostly implicit, in case of an extra media asset for sign language, either indicated in the asset title or simply because “it is there” in media assets provided with “open signing” (without further feedback).

Use of player controls and icons

All documented web players provide access to play/pause and volume controls by hovering mouse over the video or have controls always visible. The CCMA HbbTV app displays the player controls by one keypress on the remote control; to access the controls, focus must be positioned on respective icons with the arrow keys (number of key presses varies).

All documented players use the typical SoA icons to represent play/pause (as a toggle button), as well as a control bar for in-/decreasing volume. The play/pause status can be toggled by hovering the mouse over the icon and clicking once. The icon shows the action carried out when clicking (e.g. icon showing “pause” causes the video to pause when clicked). Some players allow a shortcut: hover mouse over video and click to toggle play/pause status. The volume control bar requires one click and dragging the settings knob on the bar.

In a few applications the player icons are really small and hard to identify.

Representation of accessibility services

The representations of subtitles, audio description and sign language vary widely. Graphic representations from the documented web players are summarised below.

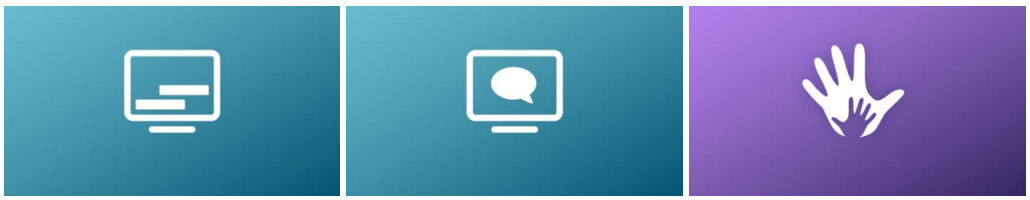
	ST activated	ST not activated
ARD Mediathek		
CCMA Webplayer		
WebVR		
YouTube		

[5] Our experience with other HbbTV apps shows that 3 key presses for this action is a good number (at the lower end of the scale).

[6] Our experience with other HbbTV apps shows that 3 key presses for this action is a good number (at the lower end of the scale).

	AD activated	AD not activated
CCMA Webplayer		

For reference we also include here the graphical representations used in the ARD Mediathek to search for / filter media assets by the accessibility services they provide, Subtitles Audio description Sign language: respectively:



For *subtitles* some players use icon graphic only – but the icon used differs widely. The ARD player uses text only: UT – being a text short form for subtitles ("Untertitel") and the CCMA HbbTV app uses only text (in the settings menu "Subtitols").

For *audio description* also both icon graphics and text are used. Either icon graphic only, text shortform and full text (in settings menu) are used.

As sign language is mostly only offered as part of extra assets from the media portal, there are no player icons used.

Icons are used in several ways to indicate the status of the respective accessibility service. In the tested version of the ARD player, "UT" with a strikethrough means subtitles are currently disabled. The CCMA web player uses highlighting of the subtitle and audio description icons to indicate whether they are switched on or off. YouTube adds a red line under its subtitle icon to indicate that subtitles are switched on. Web VR does so by adding a grey background to the icon.

Size of icons: in some applications the icons are really small which makes it hard to identify if an icon is representing subtitles or something else.

Summary

The availability of accessibility services for online media is still quite low, specifically for audio description and sign language (as a "closed signer" service). Support for subtitles in the documented web players is good; most players however do not have direct means to select audio description or sign language from the player UI – often the user needs to load an extra asset from the respective media portal. VR players do not seem to have focus on accessibility services – at most subtitles are supported.

In the web players under test the number of steps (clicks) to activate accessibility services (when that option is available) is small (very often just one step). This is a clear target for all media players.

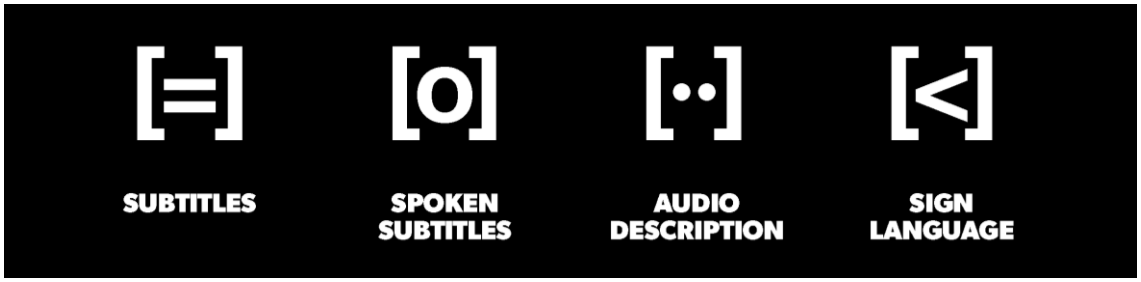
There seems to be a large gap between UIs based on a pointing device like a mouse and a UI based on a remote (TV) control – in the latter case the activation of accessibility services potentially can require many more steps / key presses. However, this also strongly depends on the implementation: in our experience, whereas activation of subtitles in an HbbTV app may take 3 or more key presses on the remote control, some manufacturers have a dedicated button

for toggling (DVB) subtitles on their remote. This clearly suggests that specifically for TV applications, solutions for easier access to accessibility services (e.g. by means of a dedicated button for accessibility services) and potentially harmonisation thereof should be considered.

Feedback to the user about the current settings of accessibility services is also open for improvement. For subtitles all documented players give good feedback, with only one step action; for audio description and sign language in many cases only implicit feedback is given, and the way in which it is done is not consistent. Also, the number of steps required to show settings should be a small as possible.

The player controls (pause/play, volume control) show a large overlap in their design – using SoA icons; the size of the icons should be large enough for easy control.

There is no overall convention for icons / representations used for accessibility services. Some UIs use graphics, some text and the icons used vary widely. In our experience, for subtitles there seems to be a trend to use a text box with indicated lines of text. Generally speaking, it seems sensible to harmonise the representation, specifically for an international audience, to increase the recognisability. The ImAc consortium decided to use a proposal from Danish Radio (Figure 1) to have a harmonised icon set in all countries where user pilots are carried out. See https://www.dr.dk/om-dr/about-dr/smart-icons-design-common-european-standardization .



(Foto: DR Design)

Figure 1 – Icons designed by Danish Radio to illustrate accessibility services

Care should be taken, due to the number of documented players in this UI analysis in the scope of ImAc, with generalisation of our findings. Nevertheless and generally speaking, a lot can still be done to improve “access to accessibility services”; it is a topic that clearly requires additional research, specifically also regarding the realisation of UIs (whether for web players on PC/tablets, apps running on TV or other devices). Easy access solutions also for TV application (via remote control) would be ideal but need a support from involved market players.

3. USER INTERFACE DESIGN AND IMPLEMENTATION

This chapter addresses the UI design for ImAc, how it was developed for Pilot phase 1 (initial design, iterations, need for an enhanced UI), how feedback was included and taken aboard in the player development, ending up with the implementation of the ImAc player UI that is planned to be used for Pilot phase 2.

3.1. Traditional User Interface – initial design

This chapter briefly describes the basis for the first UI design for the ImAc player. The very first version for a UI design was based on research on legacy players from catch up TV services, webplayer for video-on-demand and streaming services as well as VR players. The focus of this research was on the aspects of accessing and controlling the accessibility services, i.e. the first four functionalities described in section 2.1.

The result of the research was the basis for two design proposals:

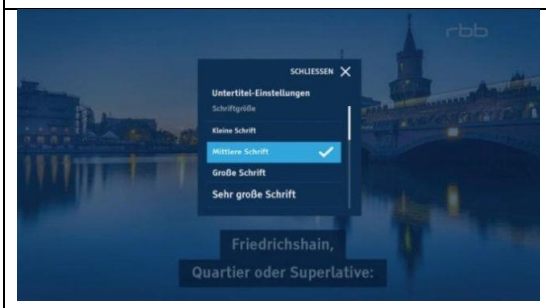
1) webplayer for desktop PCs / tablets and

2) player for HMD or smartphone plugged to VR headset.

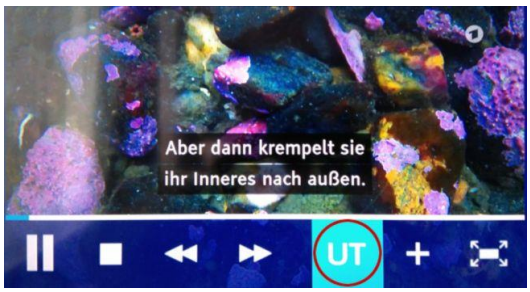
The ARD catch-up TV player for HbbTV devices were the pillar for the design concept; it contains a basic set for one accessibility service (subtitles), which can be easily adapted to further accessibility services, see Figure 2. It enables to activate and deactivate the subtitles (German: "Untertitel" – UT) and to personalise the subtitle presentation ("Einstellungen").

step1: tap on icon UT (status subtitles deactivated, the UT icon has a strike)

step 2: subtitle menu opens - activate subtitles ("Untertitel an")



step 3: personalise presentation of subtitles (one menu divided in categories, here: font size ("Schriftgröße")



step 4: Subtitle menu disappears, subtitles are activated, the UT icon has no strike

Figure 2 – ARD catch-up TV player for HbbTV devices as basis for initial UI design

The design of the ImAc player was adapted to enable activation / deactivation of all accessibility services (subtitles, sign language, audio description and audio subtitles) and to make it possible to offer a wide range of personalisation settings clustered in categories. The aim was to have a

concept that is flexible enough to extend the settings later on based on the results of user testing. The main challenge was to integrate four services with a large number of settings while avoiding a long and complex menu.

Initially, two different designs were foreseen: one for the web player and one for the VR headset player (see Figure 3 and Figure 4). In a later step, the two designs were combined because the differentiation appeared unnecessary. As shown in the figures, the player contains the main functionalities to control the video such as play / pause, rewind and forward as well as volume control and progress bar. The accessibility services menus contain categories (first level) and options (second level). For guidance purposes, both levels are visible while the options are being explored, showing the user which category is currently selected (see Figure 3). The selected setting is highlighted in dark grey. The cardboard symbol allows to switch between the tablet mode (desktop PCs, tablet, smartphone) and the mode for VR headsets / smartphones plugged in VR headset.

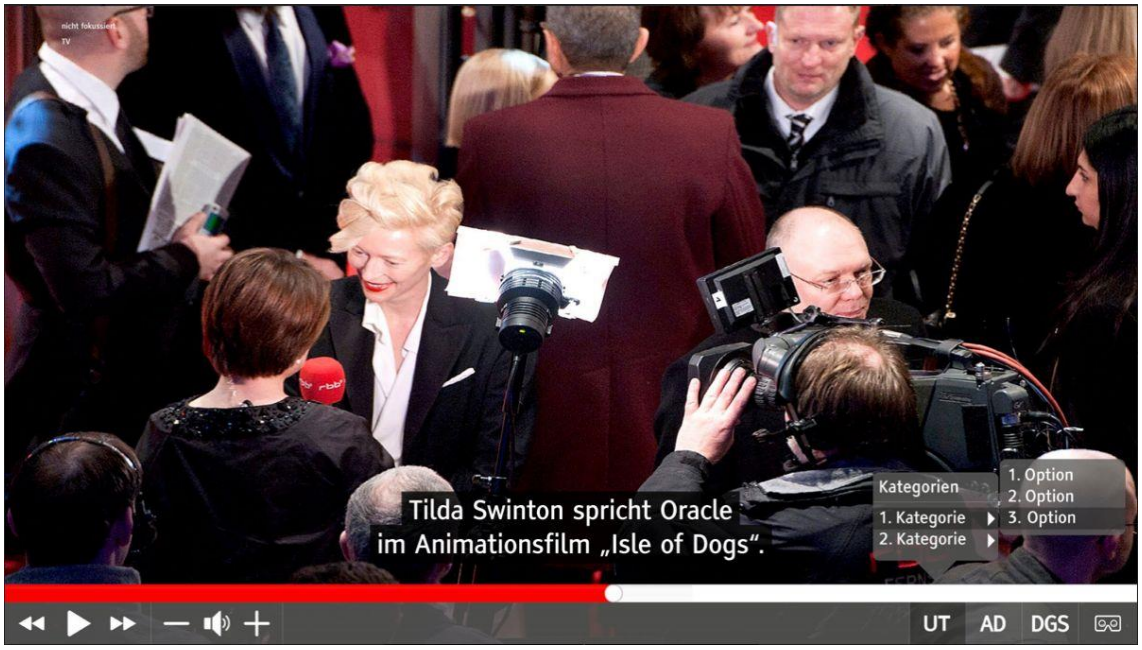


Figure 3 – Initial UI design for web player for desktop PCs / tablets (UT=subtitles, AD= audio description, DGS= sign language)

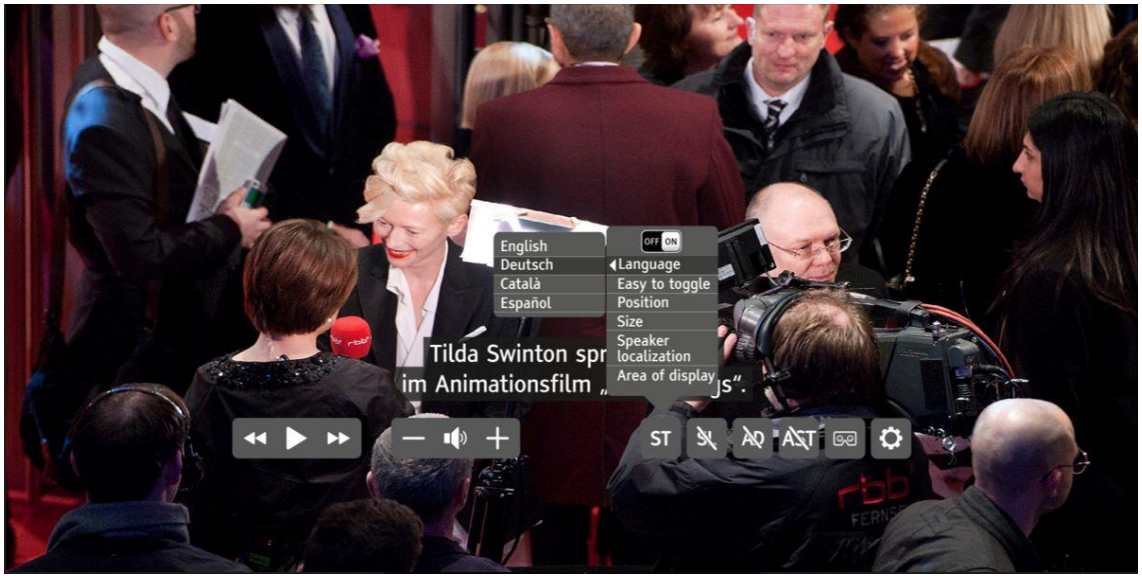


Figure 4 – Initial UI design for player for VR headsets

In the menu for VR headsets a concept to open the menu needed to be considered. Furthermore, the menu should not obscure too much of the video content. In a first version, a settings wheel was chosen, as shown in Figure 5, which is always visible in the field of view and is the access point to open the menu. It was agreed later in the consortium to open the menu with looking down instead of having a permanent disturbance in the field of view which might reduce the level of immersion. This concept is also used by other VR players and enables the user to open the menu without the usage of a button on the VR headset or a controller.

Figure 5 – Settings wheel to open and close menu

An important issue was to decide on the way to activate and deactivate the accessibility services. Following the ARD catch-up TV player for HbbTV, shown in Figure 6), the initial aim was to allow activation / deactivation in the same menu level as the personalisation settings, to reduce the number of steps needed. Therefore, a first approach was the usage of the toggle on / off concept which is also used by the ARD settings app to personalize the HbbTV subtitles (see Figure 6).

Figure 6 – Activation of subtitles in ARD HbbTV settings app

The result can be seen in Figure 4 which shows the menu with the opened submenu to activate / deactivate and personalise the subtitles. The same approach was used for all accessibility services.

3.2. Enhanced accessibility UI – initial design

The definition of the Enhanced Accessibility User Interface (EA-UI) has followed a collaborative process in its definition and implementation from the beginning of the project until its current state in the ImAc player. As part of the activities preparing phase 1 of the pilots, the broadcaster partners proposed a design for the player UI that takes in account the needs of the people with disabilities such as sight loss.

As described in section 3.1, RBB initially had proposed two solutions for the design of the traditional menu, which were combined because the differentiation appeared unnecessary. In addition, CCMA proposed a design for an EA-UI consisting of a carousel menu with large menu items and high contrast to address the needs of people with sight loss, which was adapted later to have the same functionalities as the traditional menu (see section 3.1). This carousel menu was implemented in a preliminary version of the ImAc Player, see Figure 7.

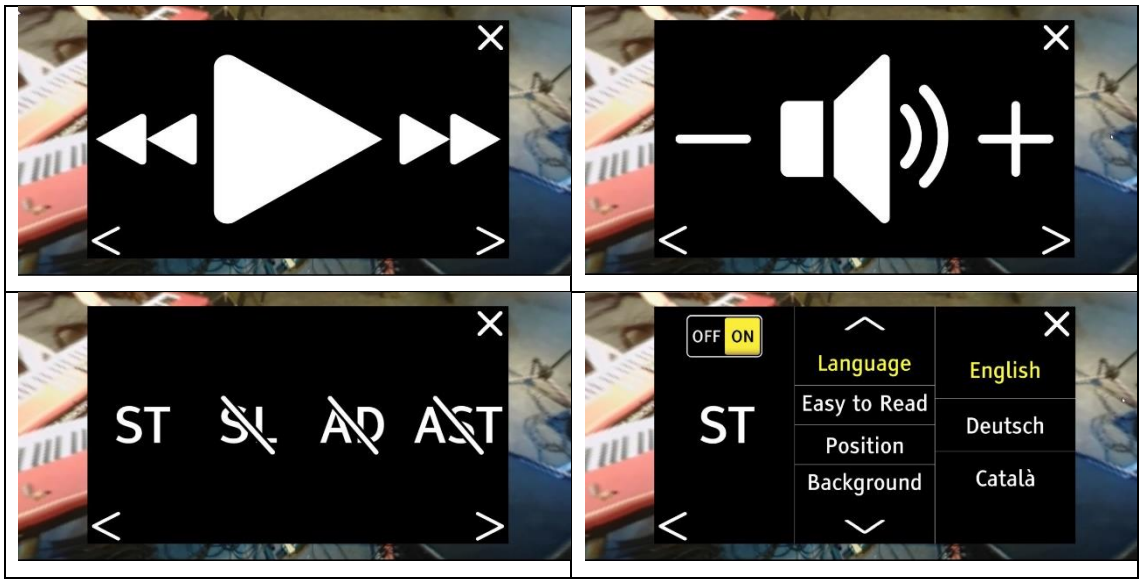


Figure 7 – Initial version of Enhanced Usability UI

During pilot phase 1, only the traditional UI was tested. It was agreed by the consortium that it was desirable to have a single UI design for all user groups, so the enhanced accessibility UI in this design was not included in the test. Rather, the traditional and the Enhanced Accessibility designs were combined in a single UI design, see section 3.5.

3.3. Final design for pilot phase 1

In pilot phase 1, the usability of the menu was tested on a tablet and in a VR headset. The focus was on the activation and deactivation of the service, the usage of the player controls, volume control and the personalisation of the subtitle presentation. Consequently, the emphasis was put on the implementation of all available functionalities for subtitles.

The menu could be opened by moving the head down with the VR headset or swipe down on the tablet. A loading animation informed the user that the menu would be opened soon.

Figure 8 – Loading animation to indicate opening menu

In addition to the standard functionalities for media players like playback / volume controls and a progress bar, the buttons on the right side of the menu enable the access to the submenus for each accessibility service. By clicking on the settings wheel, the user can change global settings. The menu can be closed by clicking the cross (x).

Figure 9 – Menu bar

Figure 10 – Subtitle menu with toggle on / off - First level of the accessibility service menu

E.g. clicking on ST opens the first level menu with subtitle settings, see Figure 10.

Once the user selects a category in the first level menu (e.g “Size”), the submenu opens at the same place with the available options (see Figure 11). The selected option is highlighted in yellow. The user can return to the first level of the menu by selecting the arrow shown next to the category title (“Size”).

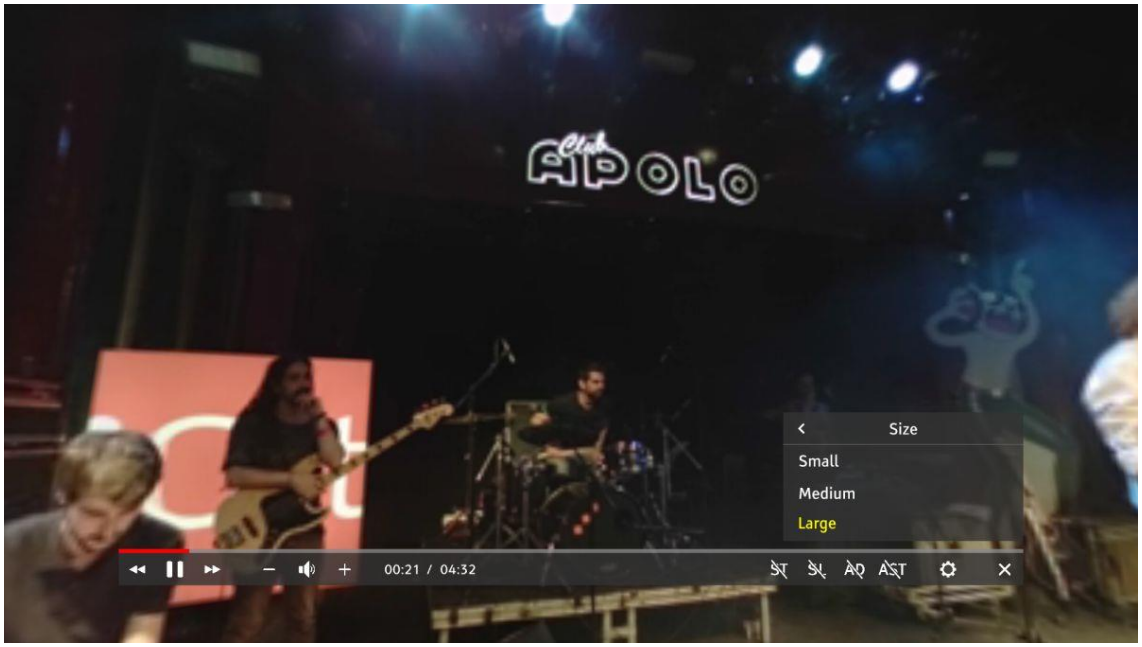


Figure 11 – Second level of the accessibility service menu subtitle

3.4. Results from pilot phase 1 UI test – traditional menu

According to the results of the UI tests in pilot phase 1 (details can be found in D5.4 – Pilot Evaluation Report [1]), two main issues were identified that needed to be improved in a new version of the player UI.

Mainly, most users did not recognize the toggle on/off button to activate the service as an active element. Therefore, the concept to activate and deactivate the accessibility services needed to be reconsidered to achieve a clear navigation and reduce the number of clicks. Additionally, the results of pilot phase 1 showed that the menu was displayed too small on tablets, making it impossible for some users to select certain items, especially the toggle on/off button.

3.5. UI design for pilot phase 2

As mentioned, two menu variants were designed and implemented for pilot phase 1: a traditional and an enhanced-accessibility / low-sighted (i.e. larger) UI. Only the traditional UI was evaluated in pilot phase 1 because only users with hearing impairments participated in the tests. Based on the lessons learned and the gathered feedback, it was decided to design and adopt evolved and refined versions of both UI variants, following the same approach.

There were multiple reasons for this:

1) the number of clicks to activate / deactivate accessibility services (issue in both menus) should be minimized;
2) the toggle button to activate / deactivate accessibility services was not found to be intuitive by users (tested in the traditional, but also applying to the enhanced-accessibility menu);
3) the usability of the traditional UI was not good on small screens (e.g. smartphones);
4) the traditional UI expanded the limits of the tested “safe area” or “comfortable Field of View”;

5) settings common to multiple accessibility services (e.g. language, indicators, safe area...) could be clustered to enhance simplicity in usage;

6) it was suggested and agreed to combine the traditional and enhanced-accessibility menu: the differentiation appeared unnecessary and having just one single menu with a bigger size variant would make it more simple and intuitive.

Therefore, efforts were devoted to not only enhancing the design of the player UIs, but also the design of the ImAc portal. This included an analysis about the most adequate menus, colors, fonts and practices in VR for a good usability and accessibility.

3.5.1. Evolved ImAc portal

When typing the URL of the ImAc player, an initial page listing the available contents is shown, as can be seen in Figure 12. This landing page has a modern, intuitive and accessible UI. It includes the list of available videos and information about them, such as their title, cover, thumbnail, duration, language of the main audio and the available accessibility services. All this information is retrieved via the metadata generated at the production side, when creating and preparing the contents, as described in D3.5 [3]. Information about the project is also provided in the footer (e.g. logo, webpage, partners, Social Media channels…). This initial page has been called the "ImAc portal".

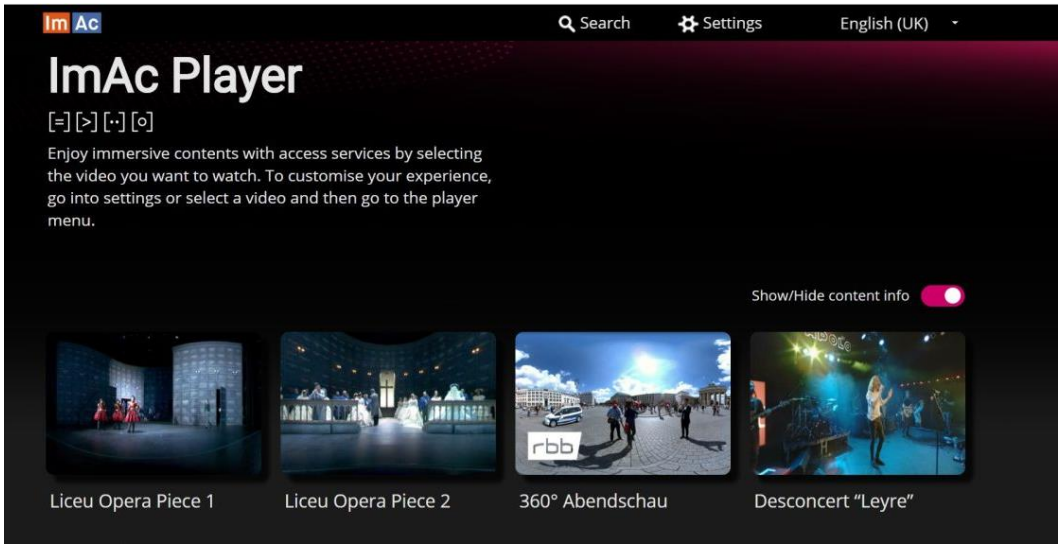


Figure 12 - ImAc portal: initial Screen listing the contents and with initial settings

Through the initial screen of the ImAc portal, the users can select the desired language for the UI, as well as some initial settings that can be changed afterwards in the player menu during media consumption.

By clicking on the Settings menu, the user can select / activate general settings for the player, settings common for the accessibility services, and specific settings for each accessibility service (see Figure 13). A brief text is added to indicate the effect / purpose of each settings option.

In the General Settings sub-menu, the users can set / select:

- The menu type (Figure 14): This settings option allows the user to select their preferred menu type, whose features and controls will be discussed later.
- The pointer size: In VR environments, the UI controls can be typically selected / set via a pointer. One requirement was the possibility of personalizing the size of this pointer,

and this can be done in this settings option, by choosing between three pre-defined sizes: Small, Medium, and Large.

- Voice Control (Figure 15): through this settings option the voice control feature can be activated / deactivated. The Voice Control features are explained in D3.5 [3].
- Save and Erase the User's Profile: This settings option allows the users to save the selected / activated settings, so they can be loaded in future usage of the player. It also allows erasing these settings.

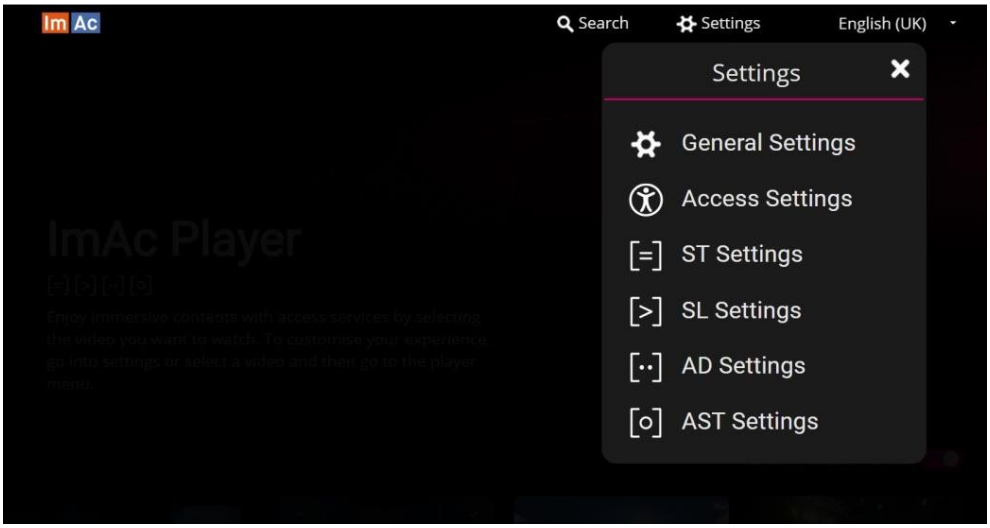


Figure 13 - ImAc portal: Settings menu

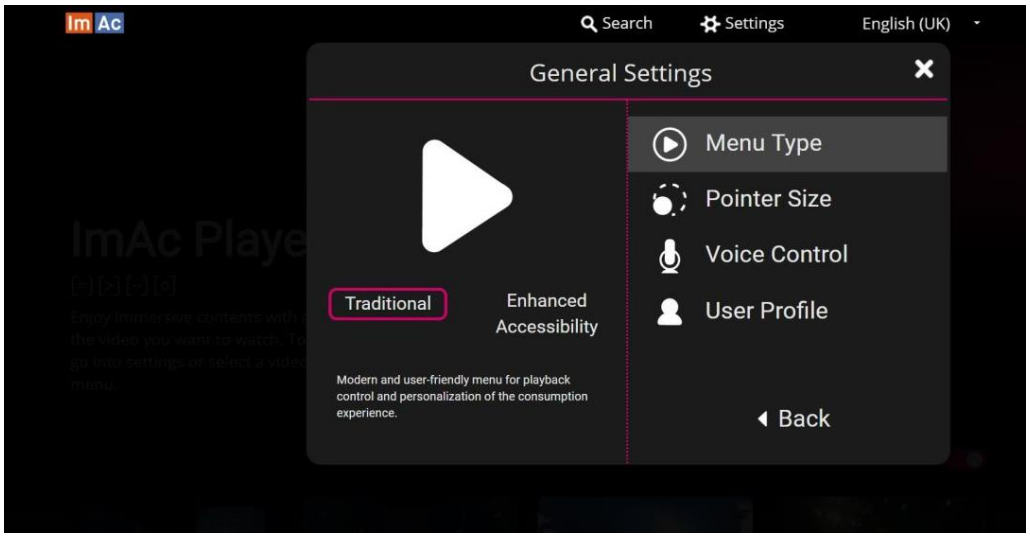


Figure 14 - ImAc portal: General Settings Sub-Menu

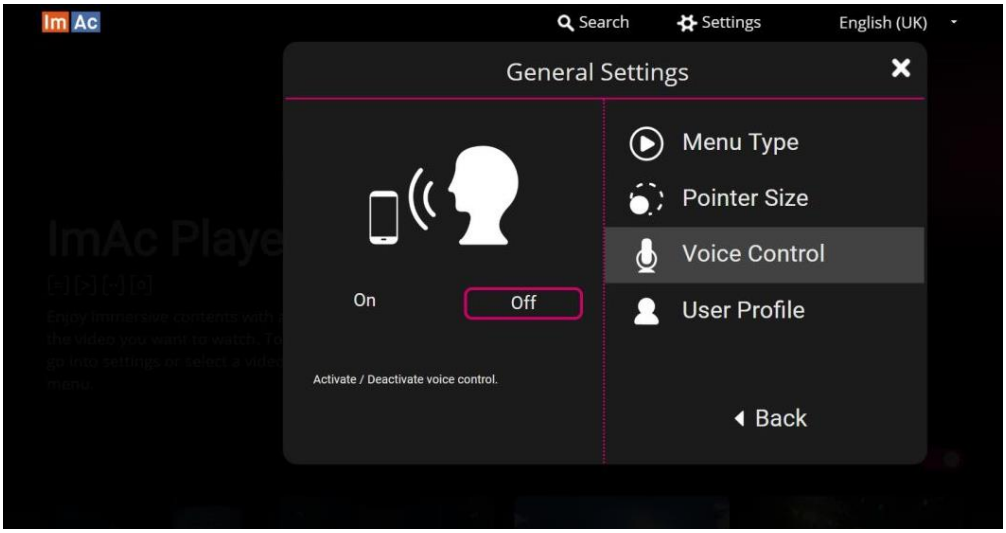


Figure 15 - ImAc portal: Voice Control Settings

The specific settings for each accessibility service are explained in detail in D3.5 [3].

Once clicking on the thumbnail of a specific clip (Figure 12), its video cover is shown together with more information about this selected clip (duration, synopsis, available accessibility services…), as shown in Figure 16. If the user wishes to consume the selected content, it can be loaded by clicking on any of the two available Play buttons (next to the synopsis and as an overlay to the thumbnail).

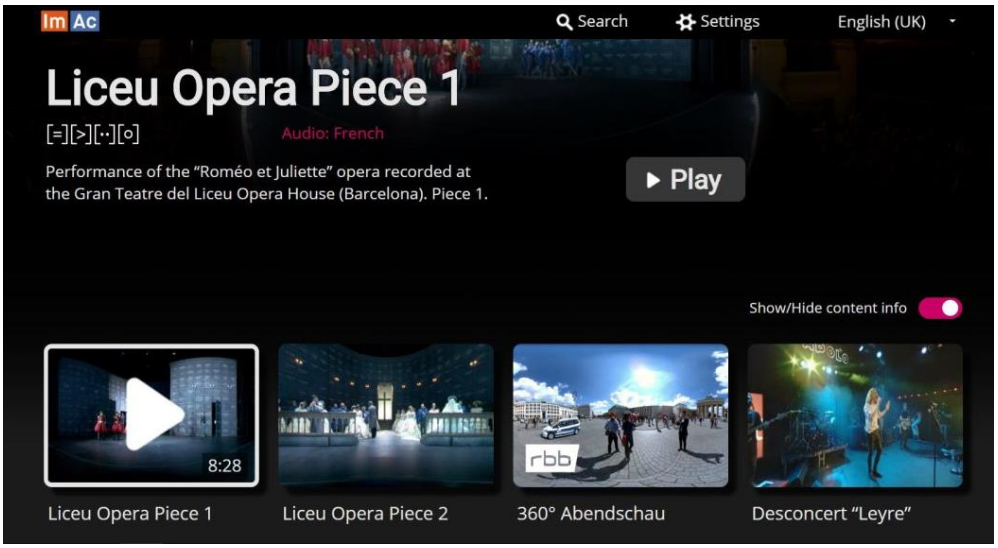


Figure 16 - ImAc portal: Selected content

The colour palette and fonts being used, together with the designed and adopted icons, are presented below:

	#CC0066
	#000000
	#1B1B1B
	#363636
	#E6E6E6

Thin
Thin Italic
Light
Light Italic
Regular
Regular Italic
Medium
Medium Italic
Bold
Bold Italic
Black
Black Italic

Light
Light Italic
Regular
Regular Italic
Semi-Bold
Semi-Bold Italic
Bold
Bold Italic
Extra-Bold
Extra-Bold Italic

Figure 17- Roboto and Open Sans fonts and colour palette used in the UIs

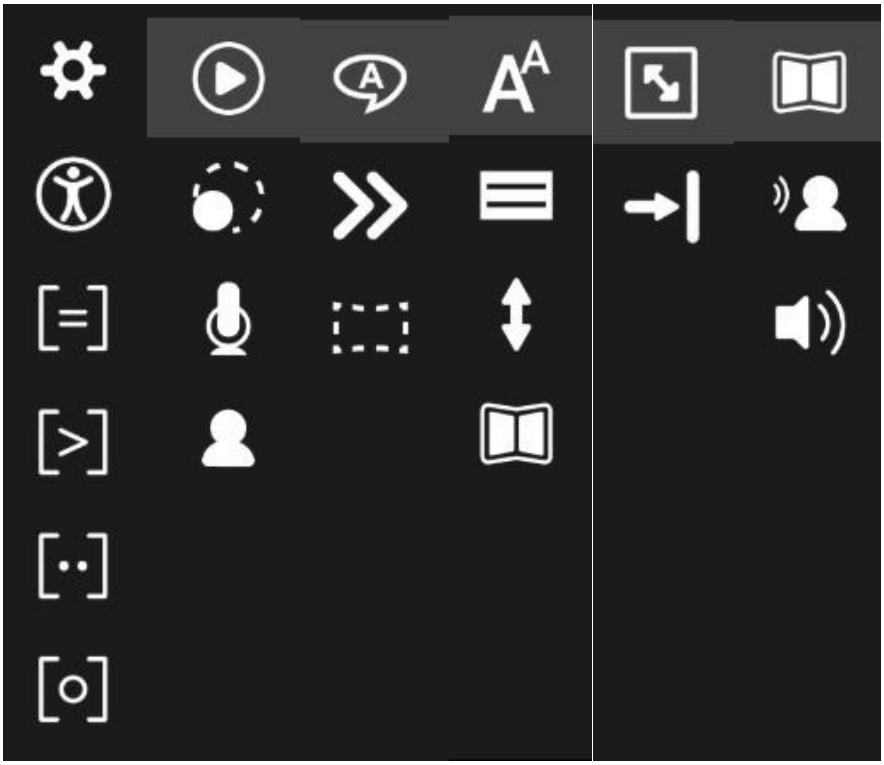


Figure 18- Designed and adopted icons in the UIs

3.5.2. Evolved Traditional UI

Two proposals addressing the lessons learned were designed and shared with the consortium.

Proposal 1

Proposal 2


A votation was made by the consortium during a General Assembly (March 2019), and the decision was to go for Proposal 1, with some suggested improvements on color contrast and clustering the sub-menus windows in a single one. The result can be seen in Figure 19.

While watching the video, the menu can be opened by looking down for a period of time, by performing clicks via the mouse/keyboard/touchpad or the VR controllers. This allows having a clean screen without any visual element while watching VR contents, to prevent any negative impact on the user's immersion. The menu can be closed by clicking on the exit control (top right "X" in the menu), as in typical menus and screens.

Figure 19 shows the newly designed player menu. It includes the necessary controls to activate / deactivate the required accessibility services (with just one click) and to set the different options and features to meet the requirements gathered in WP2. The icons proposed by the DR (Danish Broadcaster) for the accessibility services have been adopted[7].

[7] See: https://www.dr.dk/om-dr/about-dr/smart-icons-design-common-european-standardization

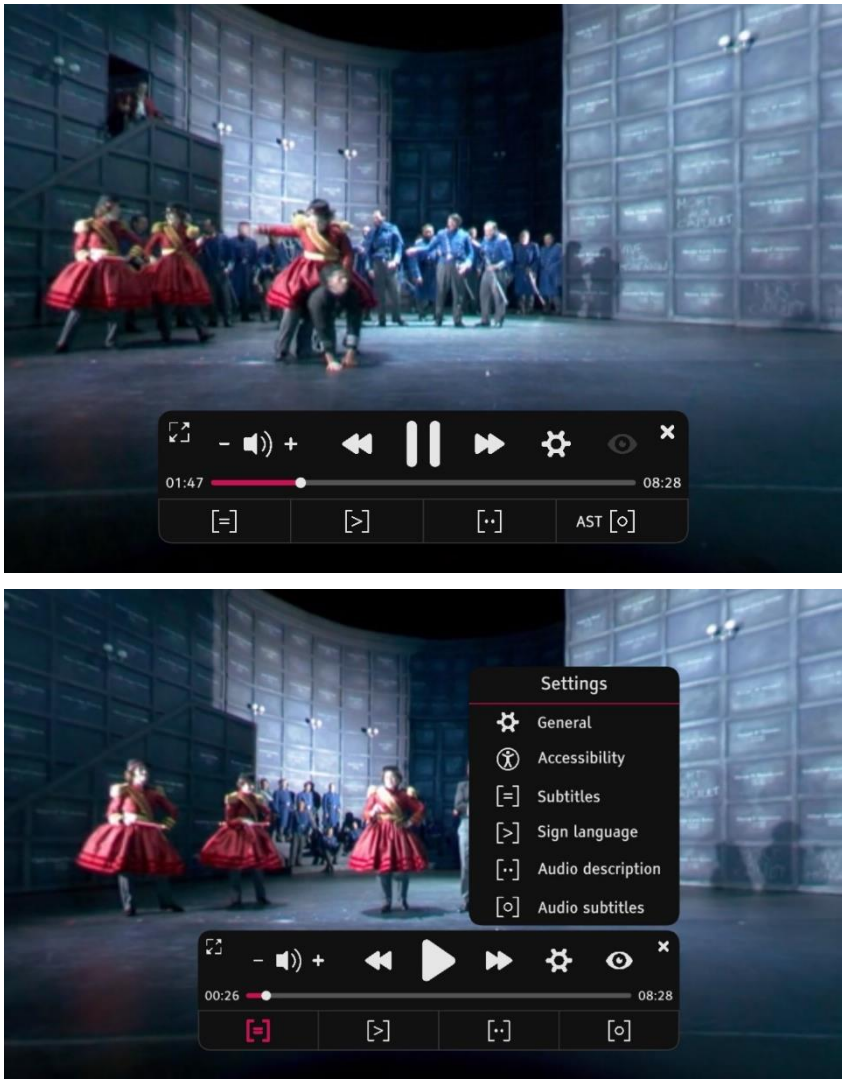


Figure 19- Player menu

The menu provides visual feedback when clicking any of the controls, changing momentarily their colour to yellow and size for playback control commands, and changing their colour to magenta and its format to bold when activating the accessibility services (see Figure 20). When placing the pointer over the icons for the accessibility services, their acronyms are displaced in case users are not yet familiar for these icons. Likewise, the menu is displayed at the bottom centre of the Field of View, in the same position of subtitles. This means that when activating subtitles, the menu is dynamically placed at the top centred position to not obscure them and, if the subtitles position is changed to the top, the menu is positioned at the bottom centre.

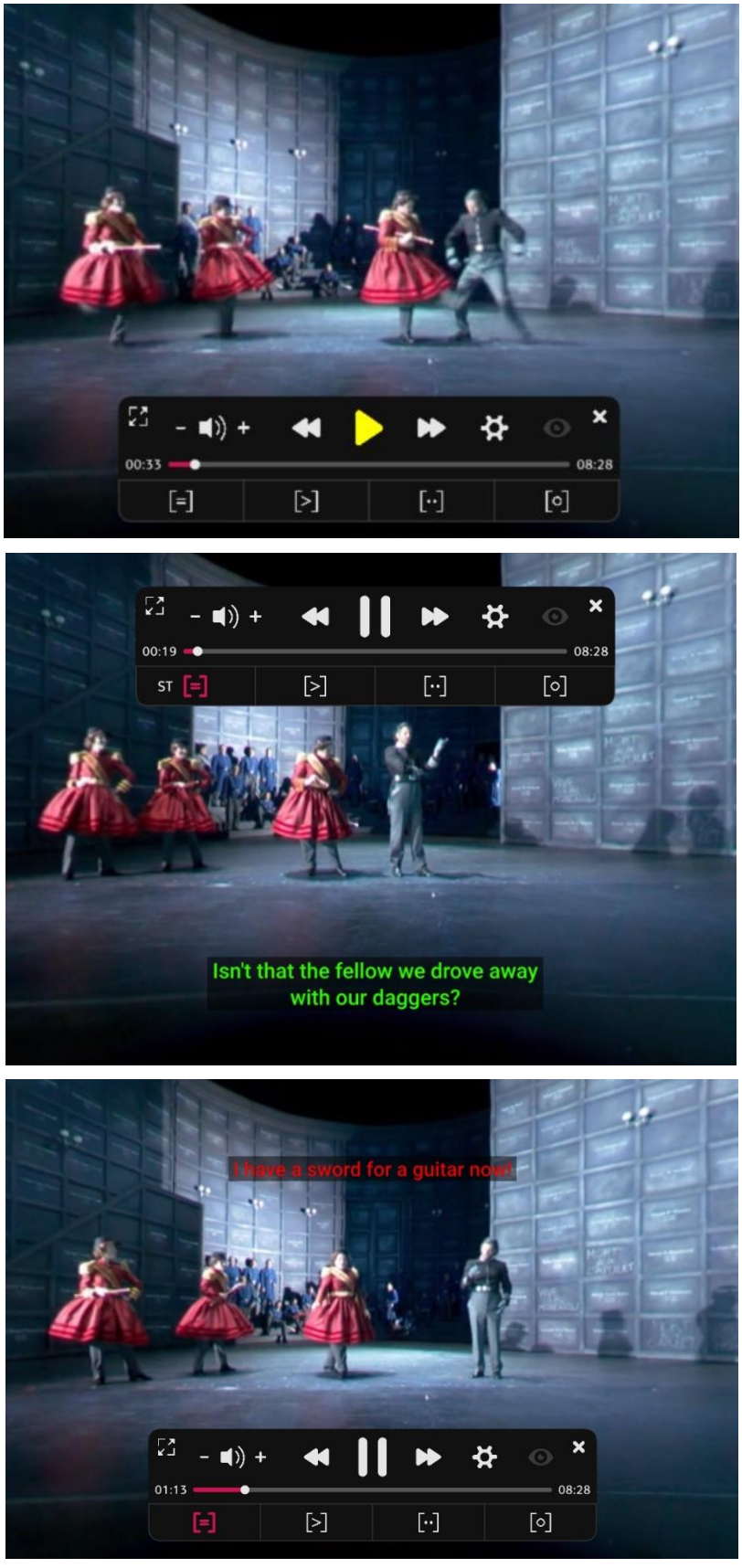


Figure 20- Visual Feedback on the Execution of Commands

Further details and the specific setting options for the player and each accessibility service are described in D3.5 [3].

3.5.3. Evolved Enhanced accessibility UI

As already mentioned, the goal of the Enhanced accessibility UI is to address the needs of people with sight loss: enlargement of menu, high contrast and easy access to settings. The initially designed Enhanced accessibility UI was combined with the “traditional UI” into one single design.

Alternatively to selecting the Enhanced accessibility UI in the initial screen of the ImAc portal, the user can also activate the *Enhanced Accessibility UI mode* at any time during the consumption of a video by clicking the top-left icon of the menu bar (showing an “enlargement” icon, and return in the same way to the *Traditional UI mode* (Figure 21).

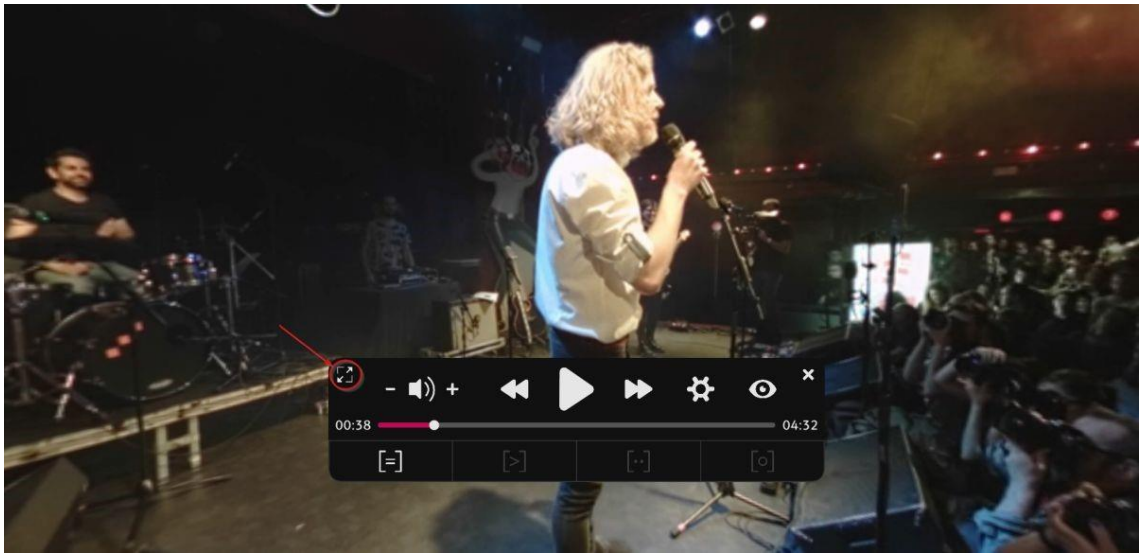


Figure 21 – Returning to the Traditional UI mode

After the *Enhanced Accessibility UI mode* activation, an enlarged version of the menu is shown which keeps the graphical design and behaviour, so the user can navigate in the same way in both UI modes (Figure 22).

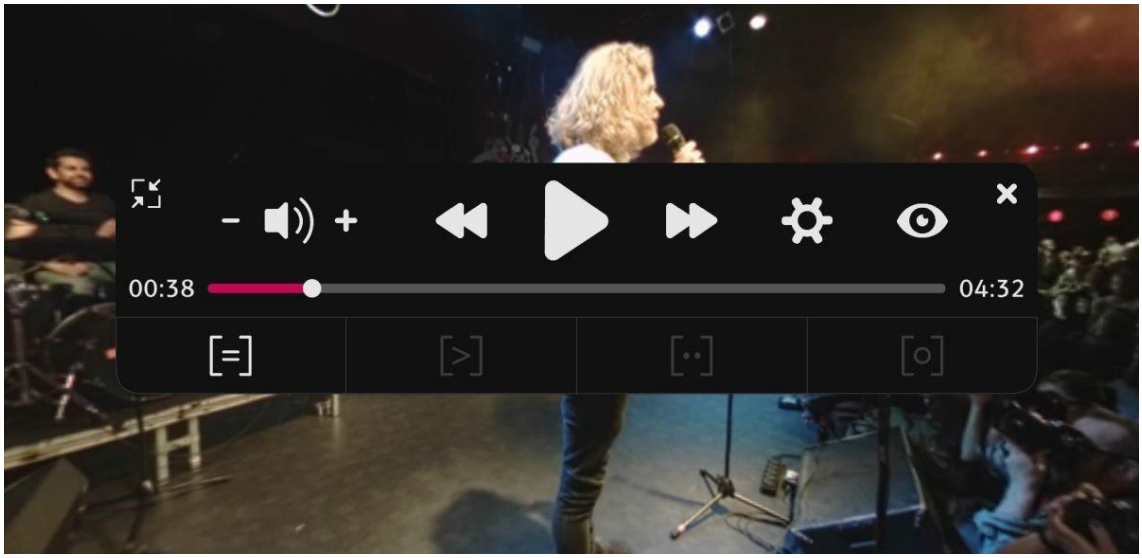


Figure 22 – Menu in Enhanced Accessibility UI mode

When the user opens a submenu using the *Traditional UI mode*, it is unfolded on top of the main menu as shown in Figure 23.

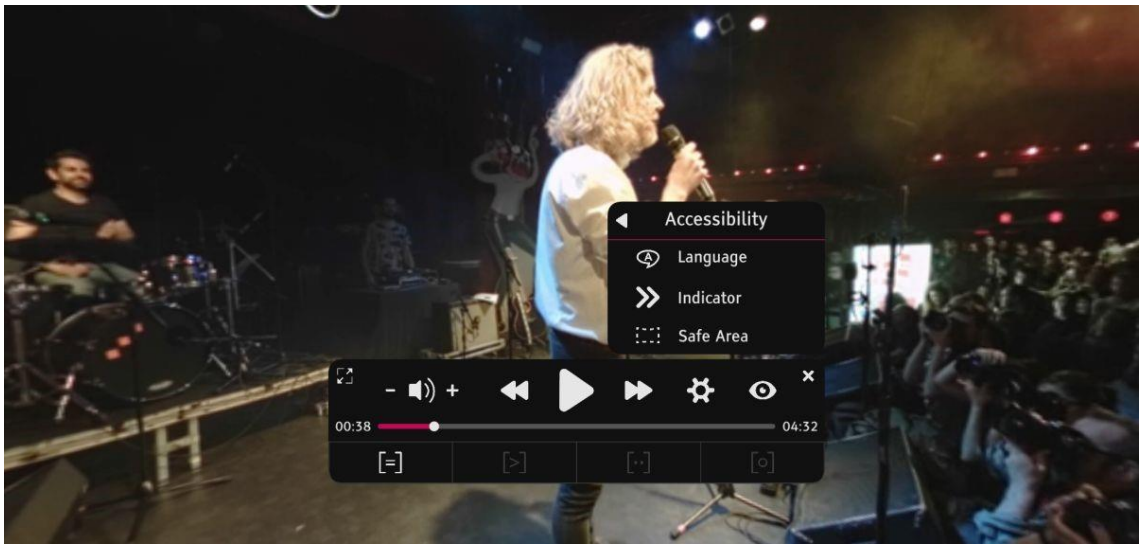


Figure 23 – Submenu in the Traditional UI mode

In contrast, in the *Enhanced Accessibility UI mode* a submenu is opened isolated and enlarged in the middle of the screen as shown in Figure 24. In such a case, a preview control is added not only in the main menu (see previous figures), but also on those sub-menus in which visual features can be set.

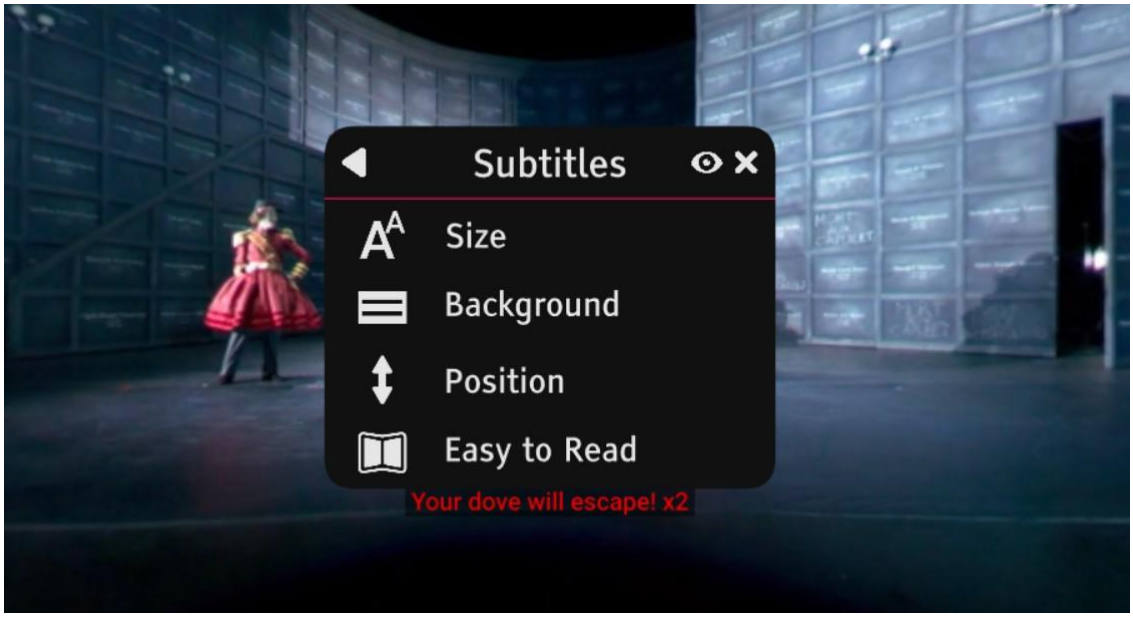


Figure 24 – Submenu in the Enhanced Accessibility UI mode

The goal of the *Enhanced Accessibility UI mode* is to match the needs of the low-sighted users regarding enlargement and contrast while it keeps the same navigation simplicity and behaviour of the *Traditional UI mode*. In fact, anyone can use the *Enhanced Accessibility UI mode* without the need to learn anything new with respect the *Traditional UI mode*.

4. STATE-OF-THE-ART SIGNALLING OF ACCESSIBILITY SERVICES

There are different concepts to ease the access to accessibility services. One concept is to have a central UI (e.g. a button) that brings up all accessibility services that are available for a specific media asset. To come closer to this vision, two areas need to be worked on:

- How could a harmonized user interface look like?
- How can accessibility services be accessed and then combined to a unique interface? How are they, their availability and their properties currently signalled?

Whereas ImAc activities on the graphical user interface have been described in the previous chapters 2 and 3, this chapter focuses on the second point.

4.1. Overview of supported accessibility services in different delivery paths

In an extensive overview all current ways of signalling accessibility services in different technical environments have been documented. The scope of this work is not only relevant for the ImAc project and its services but also follows the more general goal to harmonise access to accessibility services. As such, the overview addresses ALL appropriate standards / specifications – not only the standards used for the ImAc implementations.

The full overview describes the available signalling semantics together with the customizable properties for each service (covering the options that are relevant for accessibilty); this detailed overview will be included in D4.4 [2]. Table 1 summarises this overview and shows for each distribution path (broadcasting as well as web streaming media) which services are supported (fields marked green in the table) and based on which standard / specification.

Table 1 – Overview of supported accessibility services sorted by distribution path

		DVB	ATSC	DVB DASH	HLS	CMAF	HTML5	HbbTV (native)
Subtitles	Teletext subtitles	■						■
	608/708 subtitles		■	■		■		
	DVB bitmap subtitles	■						■
	TTML subtitles	■	■	■	■	■		■
	WebVTT subtitles			■	■	■	■	
	Open (in-vision) subtitles	■		■				
Audio Description	Broadcast-mix AD	■	■	■				
	Receiver-mix AD	■	■	■				
Sign Language	Open (in-vision) sign language interpreter	■		■				
	Closed sign language interpreter	■						

Note: If a service is not marked as supported for a specific distribution path in Table 1, it doesn't mean that there isn't a possibility to have such a service. Rather it means, there is no standardized way to signal such a service. This applies especially to web streaming formats.

In the following sections, the main properties of each accessibility service that can be signalized (subtitles for the hard of hearing/closed captions, audio description, sign language) are discussed / summarised and possible options for the signalisation are addressed.

4.2. Subtitles

Main properties with signalling support

- Presence – signalling that/if subtitle tracks are available
- Language – signalling the language of a subtitle track
- Target group (hard-of-hearing) – signalling if a subtitle track is for the hard of hearing

General

As a minimum, nearly all subtitling specifications provide the ability to signal the subtitle language and whether the subtitles are intended for the hard-of-hearing. The particular specifications usually define different locations and values for that purpose. When TTML subtitles are embedded into a DVB MPEG-TS, further characterization of the subtitles is possible e.g. regarding the typical change rate or the used position.

Some delivery paths support multiple subtitle formats, where the presence of different subtitle tracks is signalled, but not at one single location within the stream. A receiver may not look for all possible subtitle formats in a stream (and consequently doesn't show all available options to the user). Additionally, the user is mostly confronted with different access means to the different subtitle services. For instance, in DVB, Teletext subtitles are typically activated by navigating to the corresponding Teletext page while DVB subtitles are activated via a menu that is designed by the TV or Set Top Box manufacturer and opened via a dedicated button on the remote control.

Indication of the subtitle purpose

The indication of subtitles for the hard-of-hearing is basically a simple yes/no property and uses different values, depending on the actual specification. Consequently, other purposes cannot be signalled. It is often assumed that subtitles that are not for hard of hearing are considered to be subtitles for translation.

Only very few specifications explain the actual meaning of the values used for this flag, e.g. DVB TTML in MPEG-TS. Additionally, the default value for the subtitle purpose differs. Some specifications initially assume (translation) subtitles and define signalling to indicate subtitles for the hard of hearing. Others assume "hard of hearing" subtitles by default.

Different signalling on different levels

It is often possible to employ subtitle signalling as part of the subtitling format, as part of the container format and as part of the transport method at the same time. This has to be taken into account when subtitle signalling is used, in order to prevent inconsistent signalling on different abstraction levels and resulting differing decoder behaviour.

For example, when transmitting TTML subtitles encapsulated in ISOBMFF via MPEG DASH, there may be three different locations to signal a language code for subtitles. Depending on which level the language information is actually processed by a decoder / player, a different language will be indicated to the user. A detailed example is shown in section 6.1.

HbbTV application subtitles

HbbTV application subtitles are currently provided in form of a (proprietary) HbbTV application with an integrated renderer for EBU-TT-D subtitles, allowing the viewer to configure certain aspects like font size or position. The subtitles themselves are transmitted on a separate PID as part of DSM-CC stream events.

Such subtitles currently have no means to signal a subtitle language or to indicate subtitles for the hard-of-hearing. The reason is that these subtitles for now can only be signalled as a conventional HbbTV application, as no more detailed signalling involving accessibility services is available here so far.

4.3. Audio Description

Main properties with signalling support

- Presence – Signalling that/if Audio Description is available
- Language – Signalling the language of the Audio Description track
- Mode – Indicating receiver-mix or broadcast-mix

General

All specifications that affect audio description provide signalling for the language of the audio description. In most cases, it is also possible to signal that an audio description track contains a "receiver mix" i.e. contains only the audio description itself and has to be mixed with the broadcast audio track on the receiver side. The particular specifications usually define different locations and values for that purpose, but all resulting in a simple yes/no flag.

Different signalling on different levels

It is often possible to employ audio description signalling as part of the container format and as part of the transport method at the same time. This has to be taken into account when audio description signalling is used, in order to prevent inconsistent signalling on different abstraction levels and resulting differing decoder behaviour.

As an example, when transmitting audio description encapsulated in ISOBMFF via MPEG DASH, the language code may be signalled in three different locations. The language field of the ISOBMFF file's Media Header box could e.g. have the language “eng” for English. At the same time the extended_language field of the file's Extended language tag could signal “en-GB” for British English. The file could then be a segment of an MPEG-DASH stream. Hereby the @lang attribute of the related track within the DASH manifest (MPD) could specify even another language, e.g. “de” for German. Depending on which level the language information is actually processed by a decoder / player, a different language will be indicated to the user.

In addition to different signalling on different levels, it is in general also possible to specify different languages for the same audio track in case of a DVB MPEG-TS. The reason is that there are several descriptors that provide a language field.

More detailed information regarding language signalling in different layers is given in section 6.2.

4.4. Sign Language

Main properties with signalling support

- Presence – Signalling that/if sign language interpreter is available
- Language – Signalling the language of the sign language interpreter

General

In general, there are only very few specifications that provide signalling for sign language. One reason might be that production and transmission of sign language is more costly compared to subtitles or audio description.

While for a DVB MPEG-TS open (in-vision) sign language can be distinguished from closed sign language, the DASH-IF IOPs don't provide this distinction.

For a DVB MPEG-TS, it is possible to signal a language code (according to ISO 639-2). However, this standard is quite limited and only allows to signal the use of sign language in general (sgn) - but not the actual sign language used. In contrast, the DASH-IF IOPs allow the use of a language code supporting the signalling of the actual sign languages e.g. the German Sign Language (gsg).

5. SIGNALLING OF ACCESSIBILITY SERVICES IN IMAC

5.1. ImAc extensions

As described in D3.1 (chapter 2) [4], ImAc requires additional information to be provided with the content stream in order to provide the suggested accessibility services. Table 2 provides an overview of the gap analysis, identifying data that is required by ImAc but cannot be transported by currently standardized formats. At this stage, we will identify the gaps without suggesting concrete solutions; these will be given in D4.4 [2].

Note that these requirements are based on the ImAc features that were and will be tested with end users. Not all features may require standardisation actions. Either because a feature doesn't prove to be relevant enough to justify standardisation effort, or because proprietary solutions are sufficient to cover a feature in a closed environment. As mentioned, D4.4 will provide further information on this.

Table 2 - Overview of gap analysis regarding signalling of accessibility services in ImAc

Title	Description
Easy-to-read-subtitles	Easy-to-read subtitles are an alternative subtitle service / track that may be present in addition to the standard subtitle track (in the same language). Or, the (only) subtitle track for a language may meet the conditions of "easy-to-read" and may be labelled accordingly. The signalling must be available to the player, ideally without the need to decode each available subtitle track. Typically, a player would show the available subtitle services on a UI to the user, such that he can select the preferred option. This information cannot be provided by the current standards relevant for the ImAc services. To allow the above mentioned player functionality, the signalling must be provided on the MPEG DASH level.
Speaker position (subtitle)	ImAc feature – ImAc suggests adding visual indicators that show the position of the current speaker. In MPEG OMAF, a position within a 360° scene can be related to a subtitle. However, this position describes the position of the subtitle itself and not the position of the related speaker. There is currently no mechanism to express the related speaker position (or direction) in a standardized way. The subtitle format IMSC allows the usage of custom attributes and may be a candidate to store this information.
Audio description gain	ImAc feature – The user may choose between three different audio mixes, that differ regarding the AD gain in relation to the gain of the main audio. There is currently no mechanism in the standards used for ImAc content distribution to signal this information. By design, each mix

	results in a list of adaptation sets in the MPEG DASH manifest (at least one, more if several quality levels are provided). Thus, the adaptation set element is a candidate position to signal this information.
Audio description mode	ImAc feature – The user may choose between different treatments of the AD audio signal (AD modes). (same as for “AD Gain”): There is currently no mechanism in the standards used for ImAc content distribution to signal this information. By design, a different audio treatment results in an additional mix, which results in a list of adaptation sets in the MPEG DASH manifest (at least one, more if several quality levels are provided). Thus, the adaptation set element is a candidate position to signal this information.
Audio channel description	MPEG DASH supports signalling of the audio channel allocation through the AudioChannelConfiguration attribute and the @schemeIdUri attribute “urn:mpeg:dash:23003:3:audio_channel_configuration:2011”. For instance, this scheme allows to describe where the channel of the center speaker of a 5.1 system is located in the stream. For Dolby encoded streams, there’s another scheme defined using the schemeIdUri “tag:dolby.com,2014:dash:audio_channel_configuration:2011” However, it is not possible to indicate any format that is NOT loudspeaker-based. That means formats without a 1:1 mapping between an audio channel and a loudspeaker. This is for example the case for Ambisonics which is transported in four audio channels but need to be decoded properly before mixed for instance to a headphone signal.
Sign language track (closed)	Can be signalled in an upcoming version of MPEG-DASH (currently under draft). But by itself, the MPEG DASH specification is not enough for a harmonised implementation. Additional usage guidelines like the DVB DASH profile are required. Rendering information to combine a closed SL video with the main video in the player cannot be signalled (e.g. positioning information like location or size – needed to render the video from an additional adaptation set onto the main video – cannot be signalled in MPEG DASH).
Sign language track status indication	ImAc feature – Only show sign interpreter video, when sign interpreter is translating The feature can be realized by MPEG DASH using multi-period MPDs and separate tracks for the signer video segments, but the implementation seems more complex than required and is not supported in open libraries like dash.js.

	A status indication for the video, defining if the sign interpreter is currently translating or not is not supported.
Speaker position (signer)	ImAc feature – Speaker identification for signer videos are supported by adding a graphical element (e.g. arrow) to the scene that shows the position of the (current) speaker. Neither MPEG4 nor MPEG DASH support a mechanism to add such metadata to the signer video track.
Speaker identification (signer)	ImAc feature – Speaker identification for signer videos are supported by adding a speaker's name or an emoji under the signer video or a coloured frame around it. Neither MPEG4 nor MPEG DASH support a mechanism to add such metadata to the signer video track.
Audio Subtitles (AST) presence (delivered as audio)	Spoken subtitles can be realised either by a text-to-speech process in the client device (using a subtitle track), or alternatively, by delivering a pre-rendered audio track that contains spoken subtitles. When using the latter approach, the audio track must be signalled accordingly, such that the receiver knows the content of this stream. The content may be either AST only, or AST pre-mixed with main audio or even AD and main audio. In ImAc, AST is delivered as a separate audio track and mixed with the main audio at the player side, if selected. MPEG DASH supports the signalling of an additional complementary audio track (AST falls into this category) but doesn't support any means to identify the stream as AST.
AST mode	ImAc feature – The user may choose between different treatments of the AST audio signal (AST modes). There is currently no mechanism in the standards used for ImAc content distribution to signal this information. By design, a different audio treatment results in an additional mix, which results in a list of adaptation sets in the MPEG DASH manifest (at least one, more if several quality levels are provided). Thus, the Adaptation Set element is a candidate position to signal this information.

5.2. Overview of signalling in ImAc

This section provides a summarising overview of the signalling and metadata elements that are used in ImAc. A detailed description will be given in D4.4 [2]. The media distribution in ImAc is based on MPEG DASH and follows the standard as far as possible. Some of the metadata can be signalized in different layers (e.g. subtitle language), as described in chapter 4. The column "Data carried in" in the tables below, indicates the format/layer that is used by the ImAc player to retrieve the particular information.

More background information about handling presentation settings signalled in different layers is given in chapter 6.

Table 3 - Metadata required in ImAc for the subtitling service

Title	Short description	Data carried in
Subtitle presence	Indicate presence of a subtitle track	MPEG DASH
Language	Language of the subtitle track	MPEG DASH
Target (role)	Differ between subtitle types “hard of hearing” and "translation"	MPEG DASH
Easy-to-read	Indicate subtitle service as easy-to-read	MPEG DASH (custom extension)
Text colour	Colour of the subtitle text	IMSC
Style attributes	Style attributes of the subtitle (except colour), mainly: font family, font size, horizontal and vertical alignment, subtitle style (background box and outline)	Player implementation* & user preferences**
Region (safe area)	Part of the visual field where subtitles may be rendered	User preferences
Speaker identificator	Indicator to differ between the ImAc modes for speaker identification: "simple", "arrow", "positioned"	User preferences
Speaker position	Direction of subtitle’s speaker (or audio source) in 360° scene.	IMSC (custom extension)

* player implementation: No information from the content stream is used, instead, the ImAc player provides a default value that cannot be changed.

** user preferences: No information from the content stream is used, instead the value is set by the user through a settings menu.

Table 4 - Metadata required in ImAc for the audio description service

Title	Short description	Data carried in
AD presence	Indicate presence of an AD track	MPEG DASH
Audio Language	Language of the audio/AD track	MPEG DASH
Role	Indicate broadcast mix (track contains main audio plus AD)	MPEG DASH
AD mode	Indicate AD mode (ImAc feature) of the track	MPEG DASH (custom extension)
AD gain	Volume level of AD (in relation to main audio, ImAc feature)	MPEG DASH (custom extension)
Audio properties	Various information about audio stream (codec, bitrate, number of channels, etc.)	MPEG DASH
Audio channel description	Audio channels/format: Indicate binaural stereo or Ambisonics	MPEG DASH (custom extension)

Table 5 - Metadata required in ImAc for the audio subtitles service

Title	Short description	Data carried in
AST presence	Indicate the presence of an AST track	MPEG DASH (custom extension)
Language	Language of the AST track	MPEG DASH
Role	Indicate receiver side mix (track contains AST only)	MPEG DASH
Related main audio	Indicate the dependency of a main audio track and refers to it	MPEG DASH
AST mode	The audio mode that the track contains	MPEG DASH (custom extension)

Note: typically, audio (or "spoken") subtitles are created in the receiver device from a subtitle track using a synthetic speaker (by means of a text-to-speech engine). In ImAc the audio subtitles were pre-recorded for test purposes (in some tests real speakers recorded AST). The pre-recorded audio for the AST was delivered as a separate audio track that the player can mix to the main audio (receiver side mix).

Table 6 - Metadata required in ImAc for the signer service

Title	Short description	Data carried in
Signer presence	Indicate the presence of a signer video	MPEG DASH
Language	Indication of signer language	MPEG DASH
Stream parameters	Various information about signer stream (codec, bitrate, etc.)	MPEG DASH
Position on screen	Position of the signer video on the screen (i.e. in the current field of view)	User preferences*
Speaker position	Direction of the speaker (or audio source) in 360° scene	*Not defined yet **
Speaker identification	Indicate speaker or colour or emoji or non-speech info	*Not defined yet **

* User preferences: No information from the content stream is used, instead the data is set by the user through a settings menu.

** Not defined yet: For pilot actions in the project, a workaround solution has been implemented to support this metadata. But the solution is not in line with existing standards and not suggested as an implementation. A suggestion for an actual implementation will be given in D4.4 [2].

6. PRESENTATION SETTINGS SIGNALLED IN DIFFERENT LAYERS

With media being delivered and consumed over the web, the control over the user's screen has been shuffled and re-distributed to several players, larger and smaller ones. Broadcasters controlling every bit all the way from the camera lens to the display (from glass to glass) – that's the past. How content will be treated, manipulated, enriched and displayed is influenced along the signal path. Apart from the user device, the operating system (OS), the browser, web player or native application, it is also the user who can match the service to his taste by setting preferences. Which, of course, can be a fantastic chance for a custom-tailored user experience. Theoretically. Because all these options can – without being regulated – as well lead into unexpected behaviour where the only way to tell how content will be presented is by trial and error.

Web technologies evolve and change fast and are not such a closed ecosystem as the traditional broadcast world. That has a dramatic impact on the influence that content providers have regarding the presentation of their content. That is especially true for auditive or visual layers that are provided on top of the main media – such as accessibility services. Not at least because of the very trivial fact that these services often slip through when it comes to testing an application. How can we provide quality of service in such an environment?

The data affected here includes descriptive data like the language of a track as well as layout and styling information for visual accessibility services (ST, SL). Sections 4.2, 4.3 and 4.4 explain that there are several data field for language signalization for accessibility services. Which one is the master that a player application should rely on? Editors layout the subtitles precisely, considering aspects of readability, picture content (like graphics), save areas and speaker identification clues. How should a player handle this information in case there is a conflict with a user setting? Should a smart processing be applied or should user settings simply override the pre-styled layout?

This chapter cannot answer all these questions, but provides

- Description and documentation of the problem with redundant descriptive data from different layers (section 6.1);
- Analysis of specific descriptive data, in general as well as in the context of ImAc (sections 6.2 and 6.3).

6.1. Example: Conflict with metadata from different layers

This section describes the general conflict that arises from redundancy of information in different layers with the help of an example. The following figures illustrate this conflict based on the subtitle style attribute "subtitle color". As part of the content stream, we have an IMSC subtitle file that includes styling information for text and in this example sets the subtitle colour to red:

```
<?xml version="1.0" encoding="utf-8"?>
<tt:tt xmlns:tt="http://www.w3.org/ns/ttml"
    xmlns:ttp="http://www.w3.org/ns/ttml#parameter"
    xmlns:ttm="http://www.w3.org/ns/ttml#metadata"
    xmlns:tts="http://www.w3.org/ns/ttml#styling">
    <tt:head>
        <tt:styling>
            <tt:style xml:id="textRed"
                tts:color="#FF0000"/>
        </tt:styling>
        <tt:layout>
            <tt:region xml:id="bottom"
                tts:origin="10% 10%"
                tts:extent="80% 80%"
                tts:displayAlign="after" />
        </tt:layout>
    </tt:head>
    <tt:body>
        <tt:div>
            <tt:p xml:id="p1"
                region="bottom"
                style="textRed"
                begin="00:00:01.000"
                end="00:00:04.000">
                This subtitle was intended to be red.
            </tt:p>
        </tt:div>
    </tt:body>
</tt:tt>
```

Figure 25 – IMSC sample file styling the subtitle colour to “red”

Now we want to play this file in the VLC player, which is a native media player application that is available for various platforms. In the VLC menu under “simple Preferences” → “subtitles / OSD”, we find user preferences for subtitles, including one option to set the subtitle colour (”Text default colour”). We set it to yellow:

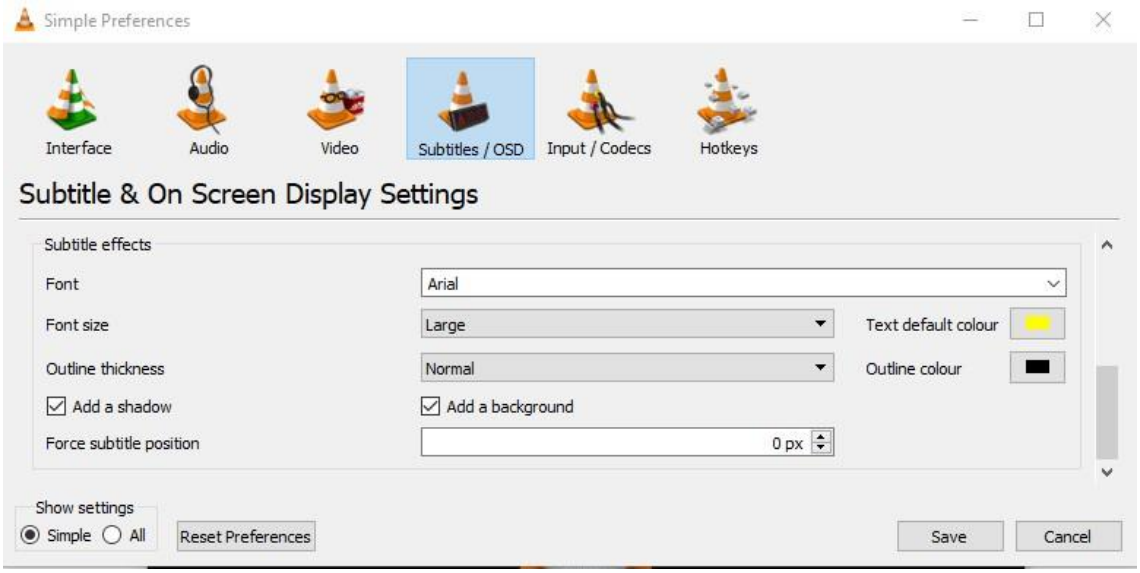


Figure 26 – Setting subtitle colour preference in the VLC player

In our example, we are running the VLC player on Windows, which, just like other operating systems, allows the user to set a few preferences regarding subtitles. Text colour ("Caption colour") is included as well and we set it to cyan:

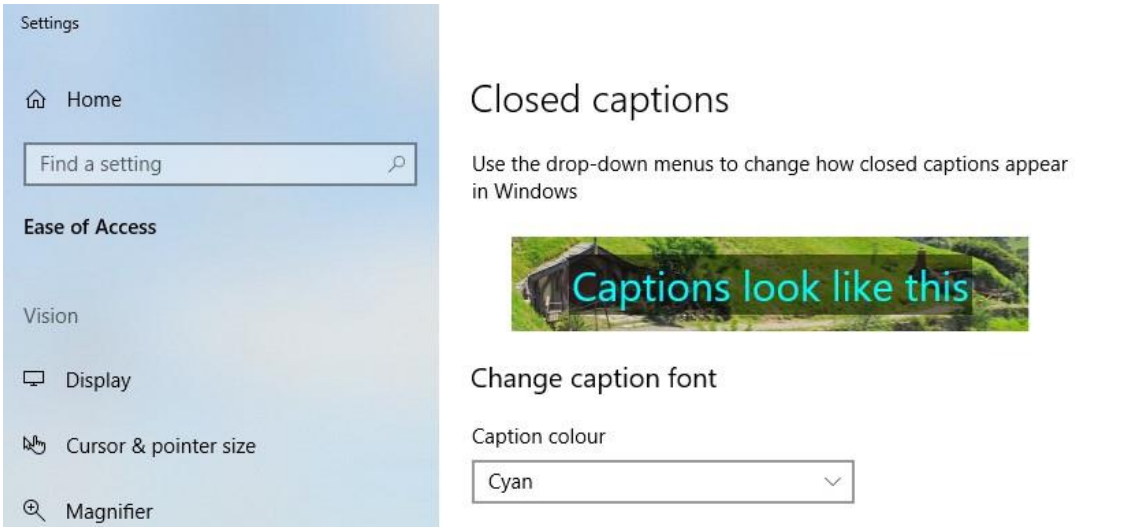


Figure 27 – Setting preferred caption colour in Windows

Now the question is, how will the subtitles provided by the IMSC file will be displayed by the VLC player? Red, yellow or cyan? The result is shown in Figure 28.

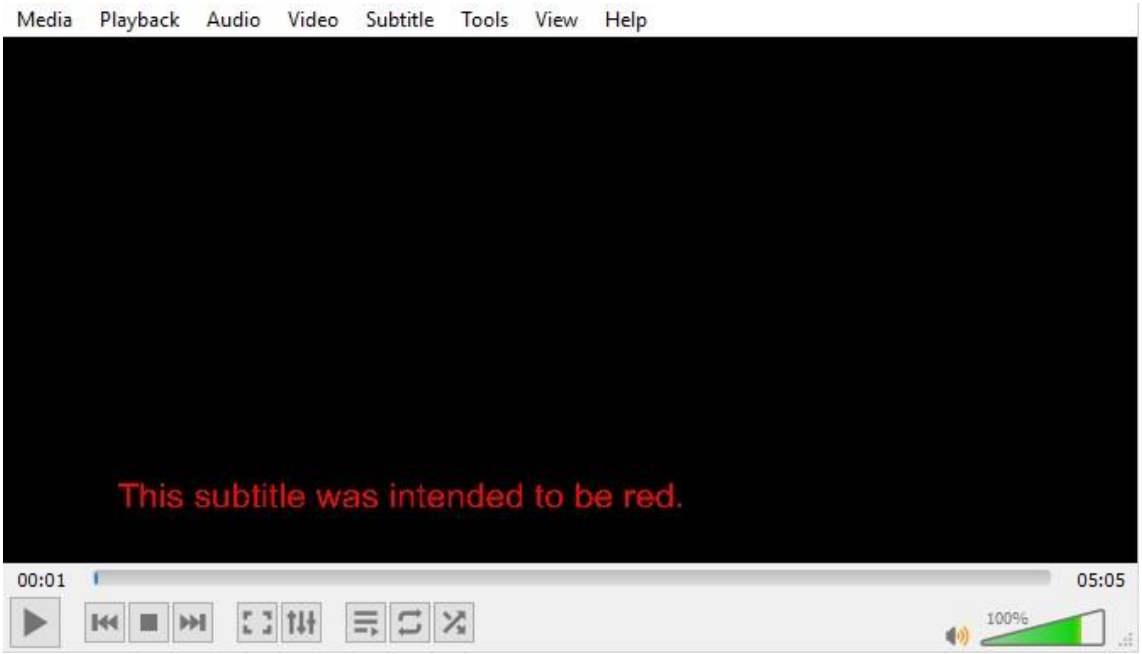


Figure 28 – IMSC file rendered by VLC player

In this case, VLC player uses the colour information as given in the IMSC subtitle file and overwrites the player and OS setting.

But if we load the same IMSC file into the Windows "Film & TV" player, the subtitles are rendered in cyan as specified in the Windows settings – the colour information in the IMSC file is ignored.

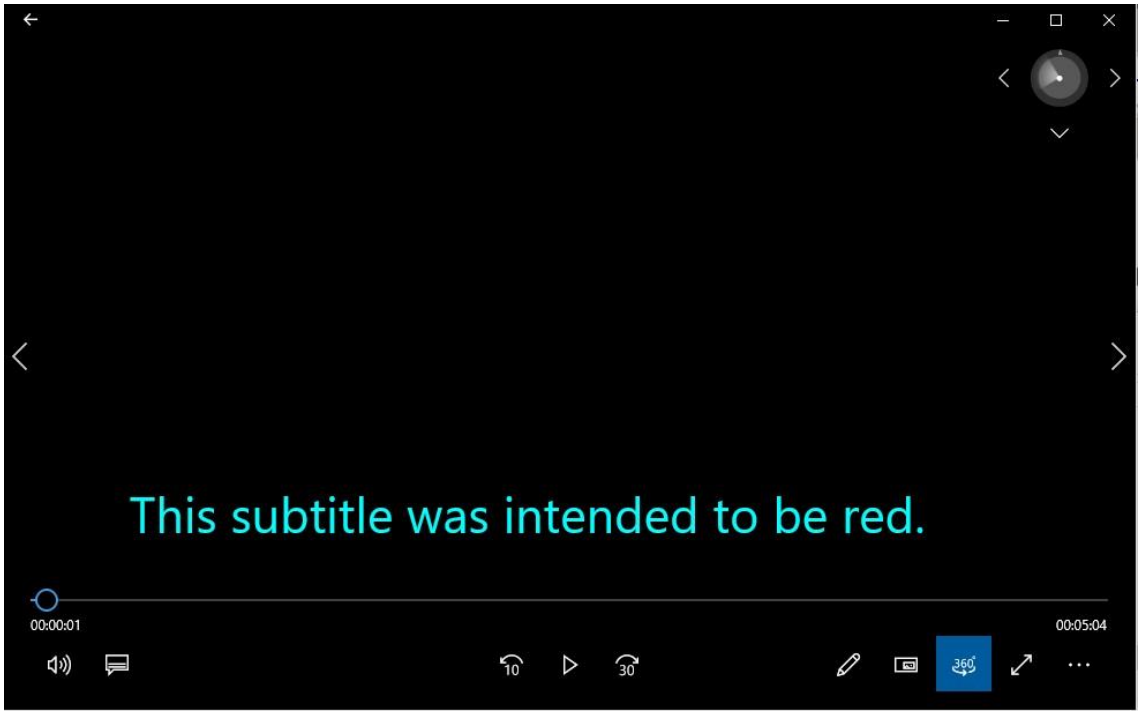


Figure 29 – IMSC file rendered by Windows "Film & TV" player

Only if we set the Windows setting for the subtitle colour to default, the subtitles will be rendered as specified in the IMSC file (see Figure 30).

Figure 30 – Setting preferred caption colour in Windows to default

The default colour setting will result in the rendering as specified in the IMSC subtitle file:

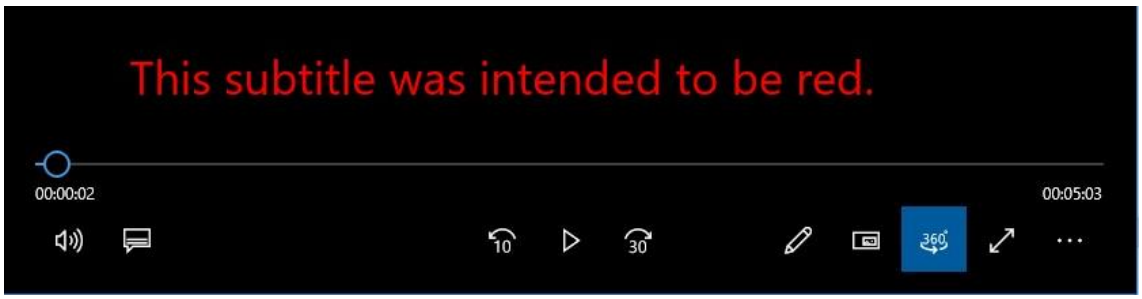


Figure 31 – IMSC file rendered by Windows "Film & TV" player, with Windows caption colour "default"

Now, we load a simple WebVTT subtitle file in the two players. In this example, no colour information for the subtitle is contained. The subtitle colour in the Windows settings back to "cyan".

The file we load is shown in Figure 32.

```
WEBVTT FILE


1

00:00:00.100 --> 00:00:05.000

This subtitle has no color information assigned
```

Figure 32 – Sample WebVTT file without colour information

And the result we get in the VLC player is shown in Figure 33.

Figure 33 – WebVTT file rendered by VLC player

As it can be seen, the text default colour set in the VLC player is used to render the subtitle. The Windows settings are ignored in this case.

If we open the same WebVTT subtitle file in the Windows "Film & TV" player, the subtitle is rendered as specified by the Windows settings (see Figure 34).

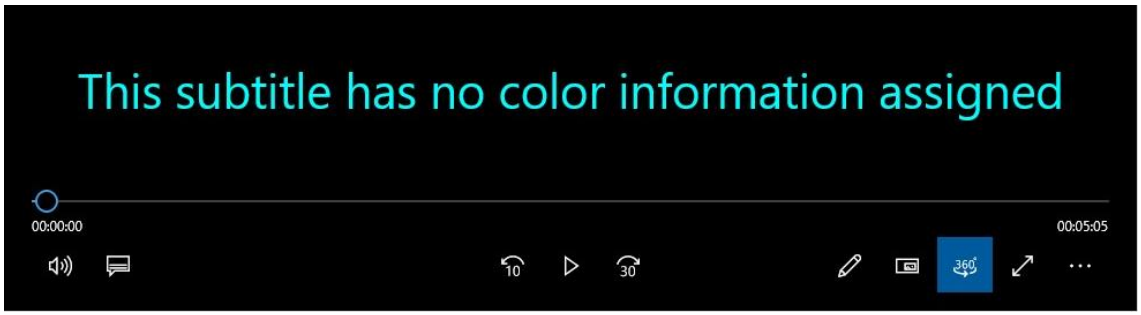


Figure 34 – WebVTT file rendered by the Windows "Film & TV" player

From this example it becomes clear that the conflicting colour information for subtitles is handled differently by various media players. Having said that, it does make sense to have the option to set a preference for the colour, e.g. in the case of the WebVTT file that doesn't contain any colour information, it is useful that users can choose a default subtitle colour.

Of course, there are many more metadata / attributes like font size or subtitle position where each player makes its own choice on how to handle the information available. In sections 6.2 and 6.3 we explain how ImAc handles language information and information on subtitle style and positioning, and we explain the reasoning behind it.

6.2. Concept for handling language settings

This section discusses the handling of language settings on the player side. This includes the UI, subtitles, sign language and audio services (AD and AST). We will focus on the following main aspects:

- Language signalling
- Structuring of language settings in the UI

6.2.1. Language signalling for accessibility services

As described in the sections 4.2, 4.3 and 4.4, the language of a service can be signalled on different layers of the transmitted media stream and for each accessibility service separately. This signalling is the basis for a player to identify which services are available in which language and to show the corresponding options to the user.

In principle, the player may use the information from any layer to determine the language of the contained service. There are no guidelines that suggest a preferred option for processing the available information.

Problem description

The information might be inconsistent in different layers by mistake. The following example shows how such inconsistency may be introduced: Especially during the production of accessibility services with segmented content (which is the case for nearly all accessibility services), the production effort may be reduced when re-using the production of one language and use it as basis to produce a second one. If the source file contains a language field and is simply duplicated, the language needs to be updated by the producer. This (additional) manual step may simply be forgotten by the producer or editor of the file. When this file comes to be distributed, it depends on the system properties what happens. For instance:

a) The language to be signalled by the streaming format may be retrieved from the file. In this case, the two layers (file layer and streaming format layer) are consistent but carry the wrong information.
b) The language to be signalled by the streaming format may alternatively be retrieved from the content management or planning system, where the language for the produced file was set before. In this case, the information in file and streaming format is not consistent. If a player application picks the wrong information (in this case, this is the one from the file) it will show the language of that service wrongly.

Solution used in ImAc

The signalling in the streaming format (e.g. MPEG DASH in ImAc) may be the most reliable information. Packaging the stream is the last process where such metadata information is set or modified. If a stream is labelled incorrect at this stage, the source of information is incorrect as well – either the accessibility service file, or a data field in the content management or planning system. It is rather unlikely (though not impossible), that the information is set wrongly despite a correct signalization within the file layer.

For a player application the streaming format layer is also a convenient location to retrieve the information from, since the DASH format holds the language information for all services within the same data field. Additionally, the available streams need to be parsed and identified anyway and the language is just one of several properties used for identification of a stream. If we assume that player applications typically use the streaming layer as source for language information, that also means that signalization errors in this layer will be detected more quickly, which also results in a higher reliability of the information in this layer.

Thus, the ImAc player implementation uses the language signalization indicated by the @lang attribute in the DASH MPD.

6.2.2. Structuring of language settings in the UI

The language is a property that

a) Affects various services as well as the UI and
b) May be set separately for each service and/or for the UI

The question arises on how these settings should be structured in such a way that the user may easily find his/her desired option.

Figure 35 and Figure 36 show two examples, how language settings could be nested within the menu for the UI. We assume a single access point for a main menu here, but of course there could be other options for a (direct) access from the player user interface.

The samples show that different entry points within the menu lead to the language settings. These are only two of many possible structures or groupings. The languages available in these examples were chosen randomly.

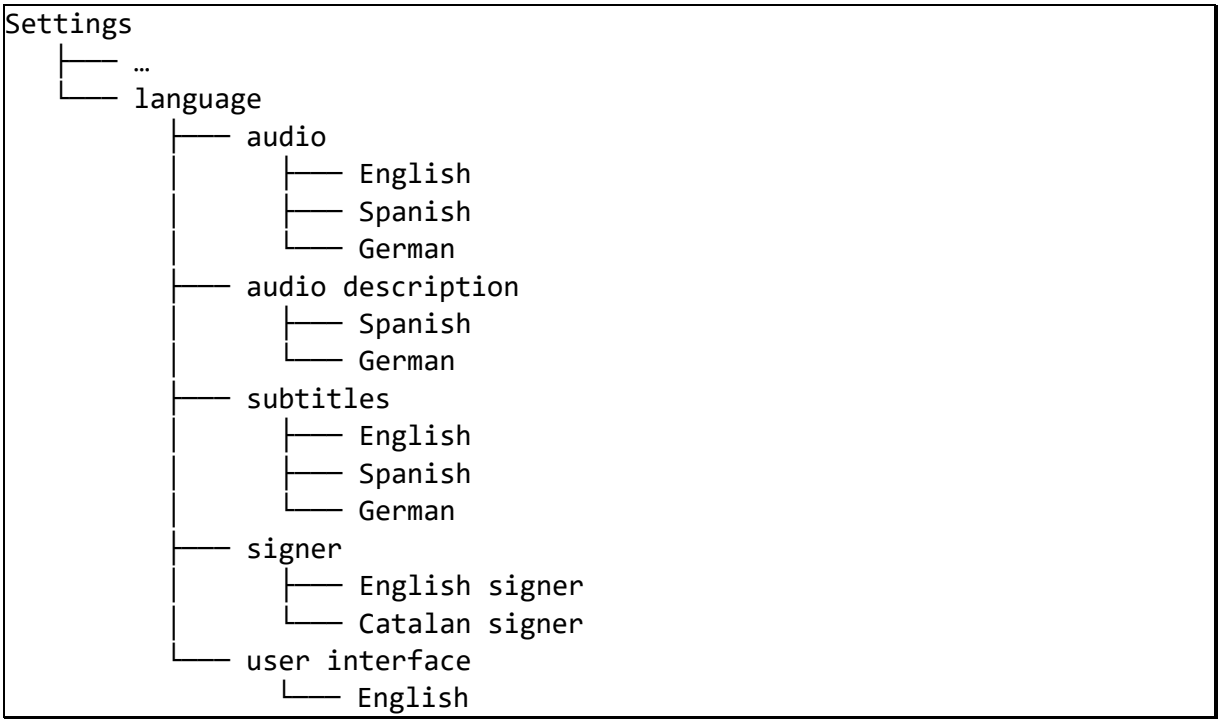


Figure 35 – Example 1 for structuring language settings

In this example, all language settings are grouped under one sub menu.

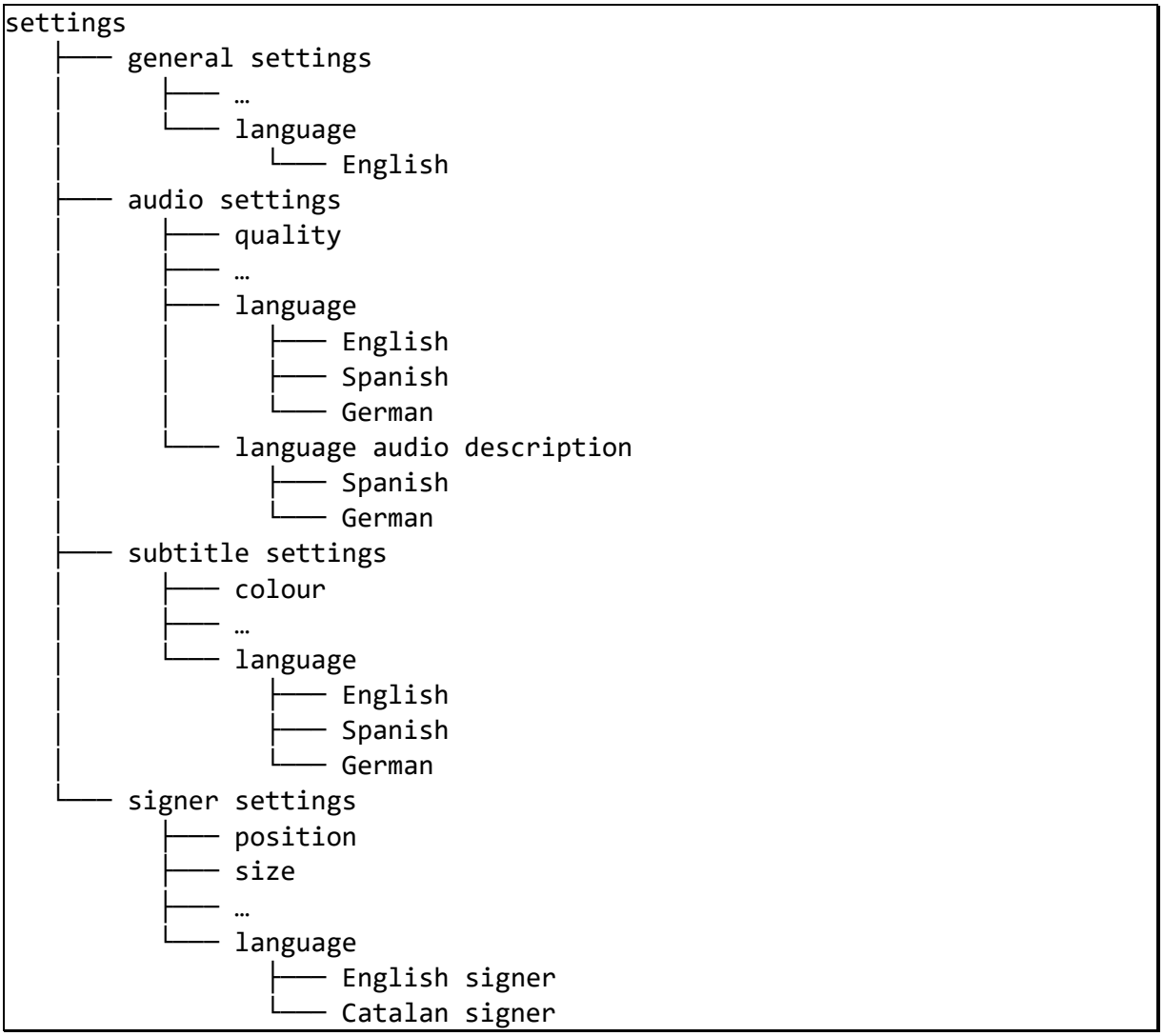


Figure 36 – Example 2 for structuring language settings

The second example is more “service-centric”, i.e. the user customizes his/her (accessibility) service. For instance, when the user wants to use the signer service, all settings for the signer video can be found in one place.

Another aspect that is shown in the above-mentioned examples is the availability of languages. It is often the case, that not all services are available in the same language(s). The main audio might be available only in English, but subtitles are available in other languages as well. This is important when we think about dependencies between language settings and if a (preferred) language for a particular service is changed automatically when a language setting is changed somewhere else. The player application has various options, for example:

- The player could select the UI language as default for all services, if they are available in this language.
- When the language of the main audio is changed by the user, the player could automatically set the language of accessibility services to the same language. However, this might cause issues when the user manually sets an accessibility language to a different one, prior to the main audio language. (Use case: subtitles for translation)
- The player could store user preferences chosen in the past (e.g. by using cookies or a user account) and use the previously selected languages as default or fallback language.

The ImAc player (refer to D3.5 [3]) uses the approach as shown in Figure 36. The language setting for each accessibility service is located in the respective accessibility service settings sub-menu. During the ImAc project, a third option was tested with users, where the language for all accessibility services could be set in a sub-menu dedicated to general accessibility service settings. Our tests showed that users find it difficult to find the language settings in this case. Consequently, the menu was restructured.

6.3. Concept for handling subtitle style and positioning attributes

In this section we describe the ImAc approach on handling styling and positioning attributes of a subtitle coming from different layers. Note, that IMSC specifies a 2D subtitle format (although the attribute tts:disparity allows to set depth information for stereoscopic content) and some decisions were taken with special regards to the 360° space. For each attribute, a short description of its typical usage and impact on subtitle rendering is provided. Thus, the section may contribute to discussions about general guidelines for subtitle style handling in web environments that go beyond the scope of ImAc.

6.3.1. Colour

In many countries, font colour in subtitles is used to differentiate between speakers. Even if not every speaker in a program can be assigned a dedicated colour, the main characters are typically identified. Additionally, groups or types of people have their own colour, like off-speakers for example. That means, that colour carries useful information that should support the user following the program / movie.

For that reason, the colour of the subtitle as set in the IMSC file, which will carry the colour information for speakers as decided by the content provider, will be used in the ImAc player. Since IMSC always provides this information, there is no need to decide on a default colour in the ImAc player. Thus, it is suggested here, that the text colour from the content stream should not be overwritten by the player application.

6.3.2. Font size

For the first TV subtitle service in Teletext, only two text sizes were possible: single line height and double line height. Later, with the introduction of DVB subtitles, the font size could be chosen freely by the broadcaster, but the rendered result had to stay within the title safe area of the picture resulting in an upper limit for font sizes. Since DVB subtitles mostly use non-monospace fonts, the upper limit for real subtitle lines cannot only be calculated exactly.

In some areas, user tests have been performed to decide on DVB subtitle parameters like background, font family, colours and also font size. Typically, the font size is chosen such that subtitles are comfortable to read. There's always a conflict between readability and not covering too much of the image. In the content stream, a provider can only estimate the best trade-off between these two things.

Many web players allow for setting the font size according to a personal taste. That way, the users' sight abilities as well as the devices properties can be taken into account. With very different screen sizes and resolutions, personalization of the font size can add a lot of value to a user.

Especially in VR glasses (or HMDs), this is of high relevance, due to the low resolution that most of these devices have. As a result, the font size must be larger compared to a sharp 2D display of the same size. Consequently, the ImAc player overrides the font size attribute in the content stream and offers the user three different font sizes to choose from.

6.3.3. Font family

The selected font family mostly serve readability and aesthetic purposes. However, recently there is a growing number of samples where font family is chosen to support a movies atmosphere or to differentiate between different types of subtitles in a video. An example is the usage of italic fonts for TV or radio speakers in a video. Another example is the font that was chosen for the aborigines of planet Pandora in the movie Avatar (2009). These creatures have their own language and open subtitles were used for translation in all language versions of the movie.

Font family also affects the font size, this has to be taken into account, when overwriting only one of these attributes in the player.

For the ImAc player a font family was chosen that provides a good readability in HMDs (and any font family information provided in a subtitle file is ignored by the player). The font was chosen by the project partners after collecting feedback on a small number of fonts, but without running a significant user test.

6.3.4. Positioning

Subtitles are often positioned at the bottom or top of the safe area (i.e. leaving a margin to the edges of the image). Subtitles are typically positioned in such a way that no other text elements in the image are obscured (e.g. in sport events where many graphical elements are included in the picture).

In a few cases, subtitles are positioned within the image to stand next to a speaker or to be placed within an area of the picture that contains less important, homogeneous background.

For positioning attributes, it usually is beneficial to keep the author's intention regarding the subtitle placement. As said before, this ensures that subtitles do not obscure any important region of the image. However, in some cases it might make sense to overwrite these attributes on the player side and to force subtitles to be always at the top or at the bottom or to place them below the picture in a separate box. The latter is a tempting option, especially if the video is not shown in full screen or if the aspect ratio of the video is larger than the one of the screen (i.e. displaying "letter box"). In case of a letter box format, the black areas could be used to display the subtitles.

In the ImAc player, there is another strong argument to override the position within a 2D frame. As explained in detail in D3.5 [3], the ImAc player offers different subtitle presentation modes. When the subtitle layer is rendered on top of the visible part of the image, it's actually a 2D plane the subtitles are rendered onto. If that plane spans over the entire screen, the IMSC positioning could be used. When using an HMD for playback, typical subtitles positions are however too far off the well perceived centre area of the picture.

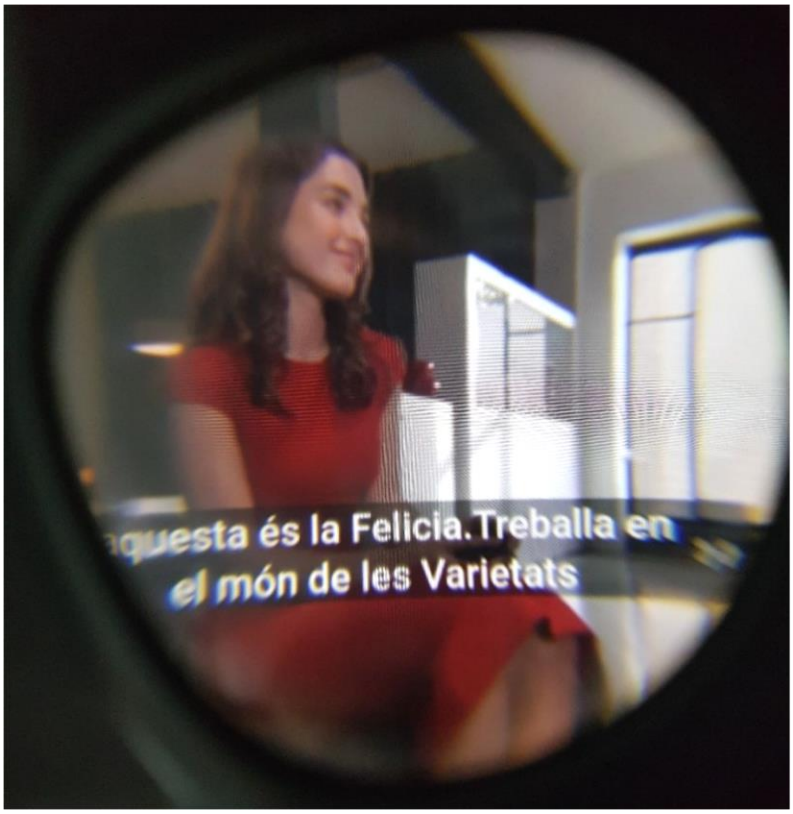


Figure 37 – Picture taken through the lens of an Oculus Go HMD

From Figure 37 it can be seen that the image quality falls off towards the edges[8]. This is another reason to avoid positioning of subtitles too far off the well perceived centre area of the picture.

The ImAc player overrides all positioning attributes and provides three so called “safe areas” the user can choose from. That way, the user can decide how close the subtitles are to the centre of the screen. Additionally, the user can choose between top or bottom aligned subtitles. The horizontal alignment is always set to “centre”, because a left or right alignment make no sense in a 360° environment where horizontal alignment doesn’t refer to a certain part of the picture.

[8] Although this photo shows the effect in general, it doesn’t represent the image quality correctly.

7. CONCLUSIONS

This document addresses the topic “access to accessibility services” by looking at the UI itself as well as the signalling of AS. It contains the experience from the ImAc consortium regarding UI / user guidance that has been collected so far and describes best practices for the UI as well as for the signalling of AS in the content stream and regarding handling redundant, potentially inconsistent signalling information from different abstraction levels in the UI.

Through a structured analysis of the UIs of State-of-the-Art media players, general insights and some recommendations have been provided to support users accessing AS. Hardly any media player currently provides access to the full set of AS (subtitles, audio description, sign language); VR players do not focus on AS at all. The documented media players that do support access to AS, allow a quick access to AS and their settings (one “step” of action via the UI). Having said that, the UIs have very diverse designs, and the way guidance is given to control the AS varies widely.

The UI design to access accessibility services in the ImAc player was based on existing players; taking these as a starting point, a design for a “traditional UI” was developed. An “enhanced accessibility UI”, which had been developed in parallel, was combined with it, and the resulting ImAc player UI offers both. The current implementation of the UI giving access to the accessibility services in the ImAc portal and player (implemented in T3.5) reflects the status after feedback from T3.4 as well as from user tests in pilot phase 1 (see D5.4 “Pilot evaluation report” [1]). This will be used for further user tests (specifically pilot phase 2).

User guidance on access to AS could be eased by harmonising the UI design. This is not an isolated issue for immersive media but rather a general issue and clearly goes beyond ImAc: this requires cooperation between media (portal) providers and implementors.

There is a plethora of standards and specifications describing how accessibility services can be signalled. The currently available standards on current ways of signalling accessibility services in different technical environments have been documented in an extensive overview for a selection of services offered by the project partners or their owners. The scope of this work is not only relevant for the ImAc project and its services but also follows the more general goal to harmonise access to accessibility services.

A multitude of specifications and standards describing signalling and metadata for subtitles is available in the market, both for broadcast as well as online streaming media distribution. For audio description also specifications are available; there are only very few specifications that provide signalling for sign language. A summary is presented in this document – the full overview will be part of deliverable D4.4 [2].

For application in 360^{o} video / XR environments, additional metadata / signalling information is required. An overview of the required ImAc extensions, comparing current standards with required ImAc features, is provided; technical details on the realisation thereof will be described in deliverable D4.4 [2].

The provision of redundant signalling of accessibility services on various layers simultaneously (e.g. the operating system, the browser, web player or native application and user settings) can cause conflicts in the UI. Potential conflicts in the UI are addressed. Specifically, this document describes how these conflicts are handled in ImAc in the case of language settings, as well as subtitle style and positioning attributes coming from different layers. As potentially various specifications / standards are involved, an additional harmonisation of implementation choices would be desirable.

The topic “access to accessibility services” clearly requires additional research, specifically also regarding the realisation of UIs (whether for webplayers on PC/tablets, apps running on TV or other devices). Easy access solutions also for TV applications (e.g. a “one button” solution to access accessibility services) would be ideal but need support from involved market players.

8. REFERENCES

[1] ImAc deliverable D5.4 – Pilot evaluation report (first iteration), Revision: 0.4, November 2018, http://www.imac-project.eu/documentation/deliverables/

[2] ImAc deliverable D4.4 – Report on new accessibility formats, delivery planned for August 2019

[3] ImAc deliverable D3.5 – Player, Revision 2.1, July 2019, http://www.imac-project.eu/documentation/deliverables/

[4] ImAc deliverable D3.1 – Architecture Design, Revision 2.1, January 2019, http://www.imac-project.eu/documentation/deliverables/

ANNEX I TAXONOMY FOR ANALYSIS OF ACCESS TO ACCESSIBILITY SERVICES IN PLAYER / APP

This taxonomy supports a step-by-step documentation of the player / app under analysis, the hardware and software environment for the test as well as the detailed description of each functional step being carried out (documented with screenshots and descriptive information). The information gathered can be used for later analysis and comparison, based on various parameters. This annex lists the "template" of the taxonomy as it was used for ImAc.

Title (Which player / app was tested)

Client

- Manufacturer: xxx
- Name: xxx
- Version: xxx
- Type: xxx (e.g. TV native App, HbbTV App, Android App, iOS App, Browser player, ….)

Hardware

- Manufacturer: xxx
- Model: xxx
- Version: xxx
- Type: xxx (e.g. TV, PC, Tablet, …)

Operating System

- Name: xxx
- Version: xxx
- Version Name: xxx

Content

- Media Channel: xxx (e.g. „Das Erste Mediathek", „TV3 Catch Up", …..)
- Content Provider: xxx (e.g. „Das Erste", „TV3",…

Target (Goal of the interaction)

- Name: xxx [possible values are: Activation of Subtitles / Activation of Audio Description / Activation of Sign Language / Show current AS settings / Player Controls]
- Type: xxx [possible are: Activation of Service / Show settings / Use Player Controls]

Steps

Step 1 – [description of step 1]

Before: Describe status before step 1 is taken.

And add a screenshot of "Before" status

After: Describe status after step 1 is taken.

And add a screenshot of “After” status

Step 2 – [description of step 2]

Before: Describe status before step 2 is taken.

And add a screenshot of “Before” status

After: Describe status after step 2 is taken.

And add a screenshot of “After” status

<END OF DOCUMENT>