EBU
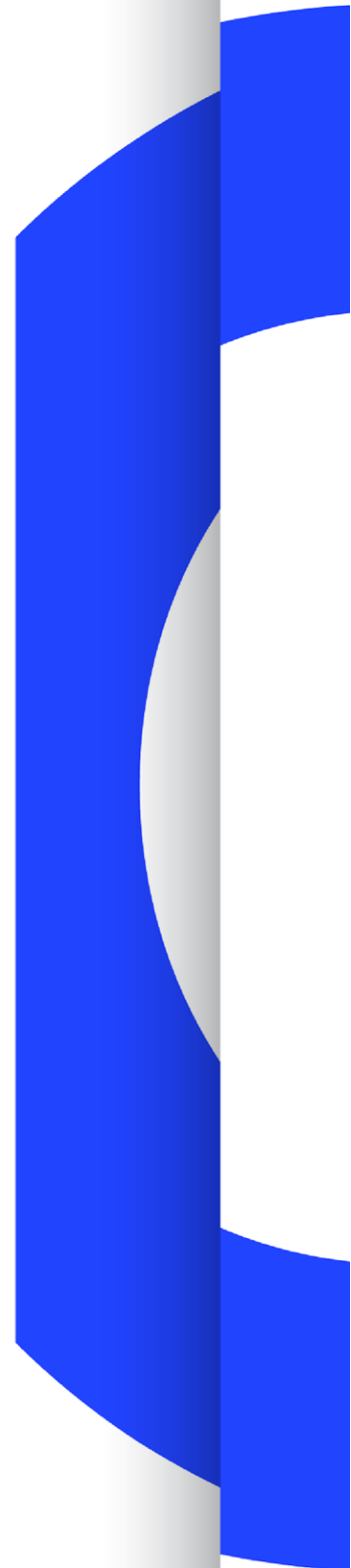## OPERATING EUROVISION AND EURORADIO

TR 061

USER EXPERIENCE AND INTERFACE IDEATION FOR NEXT GENERATION AUDIO (NGA)

TECHNICAL REPORT

Geneva
April 2021

Abstract

In this document, we report on an exercise conducted with EBU Members in which Interaction Design methods of persona design, scenarios of use, bodystorming and interface mock-ups were used to ideate[1] possible directions for the Next Generation Audio (NGA) user experience on mobile devices and televisions, and its resulting user interface design.

We begin by introducing the benefits of an interaction design approach, and the methods used during this exercise. The NGA concept and previous works carried out by Members in defining use cases are then described, followed by an account of the activities performed with Members in ideating the NGA user experience and user interface.

Finally, we list relevant design ideas that have emerged during these exercises - including single-gesture interaction, curated settings, and multi-modal interaction - and reflect on the success of these exercises.

---

[1] Ideate – verb, *to form an idea of; imagine or conceive*.

Contents

User Experience and Interface ideation for NGA

EBU Committee	First Issued	Revised	Re-issued
TC	2021		

Keywords: NGA, ADM, User Interface, User Experience, UI, UX, Interaction Design, Personas, Cultural Probes, Scenario Building, Experience Prototyping, Bodystorming, Wireframing.

1.   Introduction

Next Generation Audio (NGA) allows audiences to personalise their sound experience - wherever and however they consume it, thanks to metadata embedded in the audio data.

Instead of creating multiple audio mixes, audio producers can deliver a single, multi-purpose audio package, which can then be rendered and played back appropriately on anything from mono devices to sophisticated and fully immersive audio setups.

Accessibility features are also enabled by this format, such as the ability for users to control the relative playback volume of voice commentaries over the rest of the programme audio.

The EBU Audio Systems (AS) Group is heavily involved in promoting NGA adoption using the Audio Definition Model (ADM) [1] to describe the sound scene metadata.

During a discussion among AS members in the Spring of 2020, the EBU suggested revisiting the discussion on the definition of the user experience (UX) and user interface (UI), targeting both television receivers and mobile apps.

A plan emerged to arrange "interaction design sessions" every two weeks to explore possible directions for the UX and interface design of NGA, based on use-cases previously provided by some EBU Members.

The goal was to list essential design rationale for the interfaces, sketch out user interfaces based on Members' use cases then develop scenarios around these UIs and test and derive a set of general guidelines.

This preliminary work will form the basis for potential future development aimed at providing UI design guidelines to TV manufacturers and app designers.

2.   Interaction design methods

Previous work on the user experience and interface design of NGA had a predominently technical focus, with the resulting guidelines also having a technical focus.

To provide additional experientally richer and more user-centred design perspectives, an interaction design approach was introduced.

2.1   *What is interaction design?*

Interaction design is an approach to the design of digital technologies that originates from the fields of human-computer interaction, usability/ergonomics, and industrial design. The approach focus is on designing for user interactions, rather than designing devices *per se*. The user and their life are put at the centre of design over any technical considerations.

When designing for a user's interactions in daily life, "soft" variables such as context, physicality, culture and personalities are taken into account. Design methods, such as acting-out, scenario-building and iterative prototyping are interdisciplinary and originate from fields as varied as theatre, permaculture[2] and industrial design.

2.2   *Methods*

To explore the NGA user experience and define its resulting user interface design in depth, a series of methods were deployed during sessions with Members.

2.2.1   Personas

A persona is a rich description of a (fictional) character who would be using a design.

Name	Clara Nunes
Location	Lyon, France
Age	12
Gender	Female
Occupation	School student

(Stock image: 123rf.com)

Background	Moved to France last month from Portugal after her mother's job relocated. A half-sibling is still in Portugal.
Personality	Bubbly, when she knows people well, can get shy in new situations.
Motivation & dreams	Isn't really into what her classmates like, but wants to fit in.
Quirks	Has memorised all the past 5 years Eurovision scores and winning song lyrics but doesn't tell anyone at school about it, in fear of not being "cool". Has no musical talent whatsoever.
Technical knowledge	Proficient with digital technology use. Learned some basic coding at school.
Needs	Something to impress her classmates with and sharing common interests.

Figure 1: 'Clara' persona – a rich yet realistic character

---

[2] Permaculture is an approach to designing human habitats according to ethical and ecological principles.

The aim of this method is to get a better understanding of the type of users who would be interacting with the design, avoiding potential clichés. A persona should not be based on a generic imaginary user, on oneself or someone the designer knows, but on a set of unexpected yet relevant personality traits.

A persona's description can include straightforward characteristics such as name, location, age, gender, occupation and background, but more interestingly should also include social background, personality traits, motivations and dreams, quirks, needs, values, lifestyle and more.

A persona can based on real people and user interviews if the design has a specific target group, but in the case of NGA, users can be anyone! As the idea with personas is to stretch the design space outside its default boundaries and to make room for unpredictability, personas can be realistic but can also be extreme or be based on celebrities or famous fictional characters [2]. In defining them, one should let go of preconcevied ideas and reach a high level of rich detail.

Name	Robin	
Photo Location	Nottingham, UK	
Age	Unknown	
Gender	Male	
Occupation	Professional archer, social worker, influencer	
		(Stock image: unsplash.com)
Background	Unknown	
Personality	Not a very social person but very influencial, has trust issues, small group of like-minded close friends, strong sense of right & wrong, slightly rebellious and confrontational	
Motivation & dreams	Social justice, love, challenges, possibly revenge	
Quirks	Famous for his sense of humour, and love of the great outdoors	
Technical knowledge	Tends to stick to tried-and-tested mobile tools that he has learned to master and that he carries everywhere with him, but also tends to lose devices quite regularly because he's always in a rush.	
Needs	To share content online to his followers in an accessible way	

Figure 2: 'Robin' persona – based on an extreme character from popular culture

2.2.2   Understanding the context of 'use'

Interactions in real life do not happen in a vacuum, but inside physical and social spaces as well as in cultural contexts, in real time. It is therefore important to understand where, how and why people use or do things in order to design for interactions that work within this context.

There are a wide variety of methods to achieve this, including ethnographic field studies, video observations, interviews or questionnaires.

Cultural Probes is a method developed by Bill Gaver, Dunne and Pacenti at the Royal College of Arts in 1999 [3] for understanding unknown contexts and communities of use. The probes are small packages that can include any sort of artifact (maps, postcards, cameras and other materials). They are provided to users as a means of provoking inspirational responses, in order to better understand their culture, thoughts and values, and thus stimulate designers' imaginations.

Users typically map their usual routes, take pictures of everyday environments and tell stories about their everyday lives and even sometimes their dreams and moments surrounding possible uses of the design.

Scenario Building is a technique originating from theatre and audiovisual productions, where the designer creates a storyboard or a description, of a user interacting with the design, in context. These scenarios benefit from a high level of detail, and focus on behaviours in context. Again, it is important to avoid clichés.

2.2.3 Prototyping

According to interaction designers Buchenau & Fulton Suri, "prototypes are representations of a design made before final artifacts exist. They are created to inform both design process and design decisions.

They range from sketches and different kind of models at various levels - "looks like," "behaves like," "works like" - to explore and communicate propositions about the design and its context" [4].

A useful representation of "what prototypes prototype" by Houlde and Hill [5], is a triangle with "role", "look and feel" and "implementation" corners. In this illustration of the prototyping space, one can focus on one or more specific aspects of what a final design could be, without necessarily trying to cover all of them. A prototype for a laptop for instance can be a pizza box prototyping its shape and form factor and situating itself in the "look and feel" corner of the triangle.

Experience Prototyping [4] (or its cousin *Bodystorming* [6]) is a method in which the designers themselves 'theatrically' act out the user interaction, within a physical setting representing the context of use (e.g., in a crowded place) or in the actual setting for use (e.g., in the train station they are designing for) and with the same constraints that a user would be facing (e.g., during a snow storm, wearing gloves and carrying groceries).

This method allows the design idea testing to be done in a realistic manner, to get a first-person perspective and understanding of interaction with the design, and to easily communicate design concepts and issues to peers, users and clients.

Finally, the last interaction method used in this project – also for prototyping – is *Wireframing*.

This method consists of making low-fidelity, yet functional, visual mock-ups of a screen-based user interface, to mimic the way that the user would be navigating the different functions of the interface.
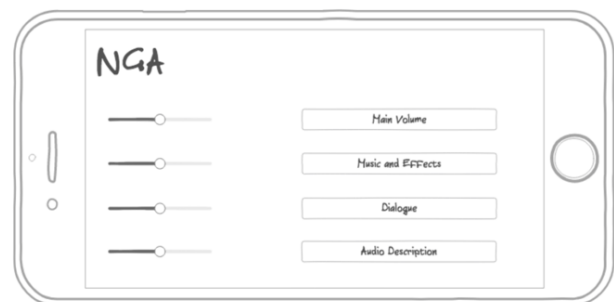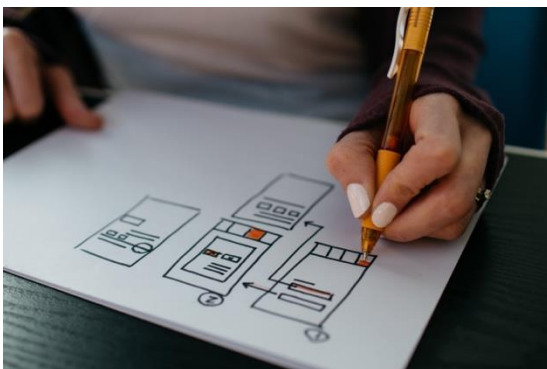
"Pen and paper" wireframing (stock image: unsplash.com)   simple mock-up for a mobile NGA UI using ninjamock.com

Figure 3: Wireframing examples

3.   Use case used to base the work on

The following use case proposed by the RAI was selected to build this work on.

> A service contains the following audio elements and the presentation information for the combinations of elements defined as valid by the broadcaster. They are sent as a single elementary stream.
>
> - Music and Effects
> - Dialogue A + Dialogue B + Dialogue C
>   (i.e., up to three dialogue languages as three separate elements)
> - Audio Description
>
> The interface shall allow:
>
> - In the case of movies, documentaries, and entertainment shows: the selection and mixing of the Music and Effects element together with at least one of the Dialogue elements and the Audio Description element (if Audio Description is required by the user) according to a valid presentation sent in the stream, or,
> - In the case of sports or international events: the selection and mixing of the Music and Effects element together with at least two of the Dialogue elements according to a valid presentation sent in the stream
> - Independent level adjustment for the Dialogue element and Audio Description element
>
> Targeting both television receivers and mobile applications.

3.1   UX / UI status

Figures 4 & 5 represent the UX/UI prototypes developed by some of the NGA technology providers and used by the EBU during past trials.

These were designed with the goal of being adaptive, interactive and thereby, personalised and accessible. Characteristics included:

- A partially transparent navigation bar overlay at the bottom of screen with a menu system.
- Colour and transparency change on hovering and selection.
- Different commentary modes such as "Default", "Dialog+", and "Commentary off".
- Language, audio prominence, left - right, and up - down as default settings.
- Different system settings such as "Immersive mix" or "Venue".

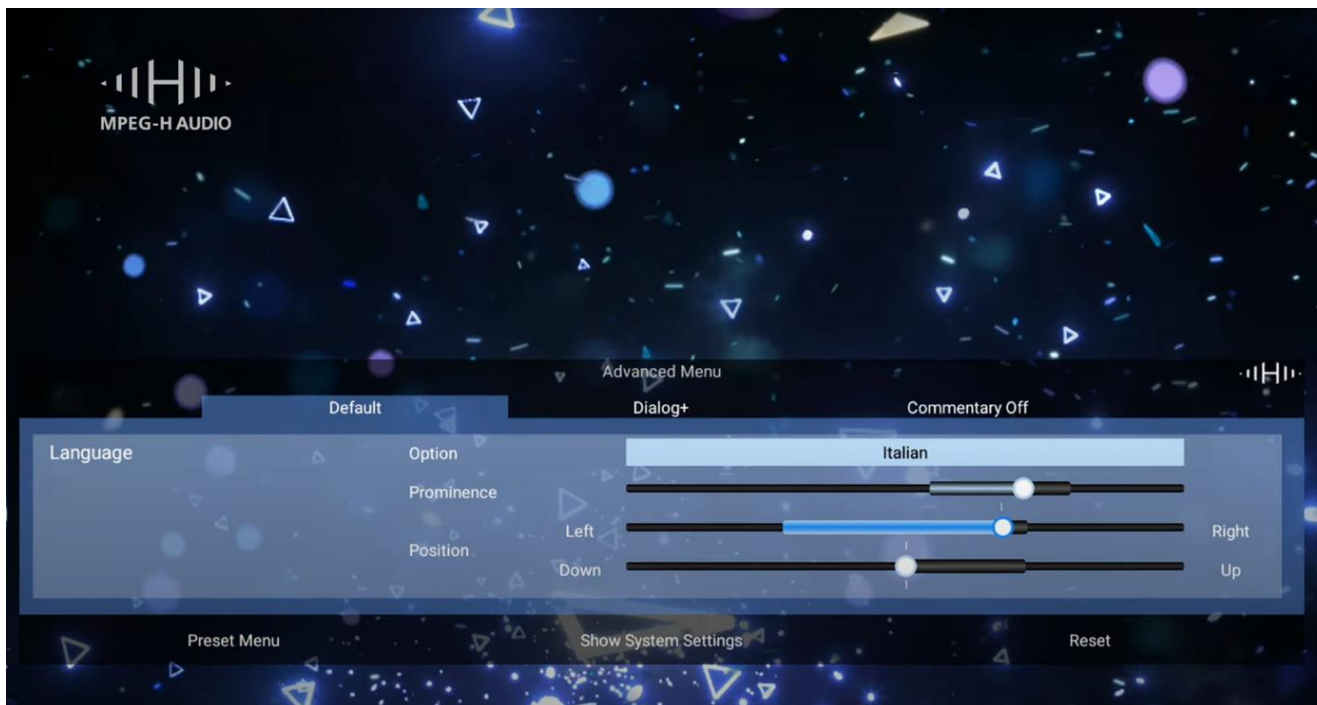The prototypes can also adapt the audio spatialisation to speaker layout or to headphones use.

Figure 4: Current NGA prototype – MPEG-H Audio
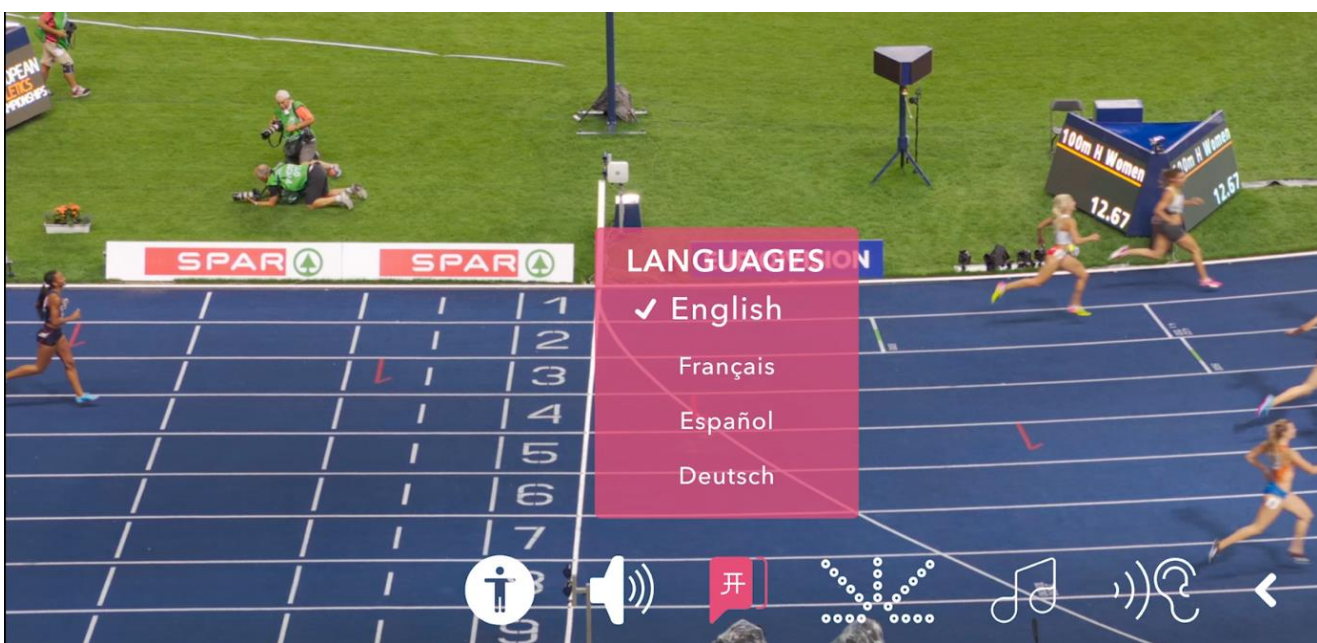

Figure 5: Current NGA prototype – AC-4

4.   The design sessions

A series of brief, fortnighly design sessions with members of the Audio Systems group were held online (in view of the COVID crisis), and members were encouraged to actively participate in the process.

Five sessions were held, each exploring different aspects of the user experience and interface design.

4.1   Design sessions

4.1.1   Session 1: Introduction and persona design

This session introduced participants to the design process, the previous work done on the topic, and delved into the first method: personas.

Each participant was asked to developed two personas – a realistic one and an extreme one – then share their creations and preliminary design ideas with others.

As preparation for the next session (which would focus on studying the context of use), the participants were given a home assignement to take pictures of all the digital and AV technology they have at home, and if possible, of family members using it. They were also given the following questions to ask while the equipment was being used:

- why they're using the equipment
- what they were doing just before using the equipment and,
- what mood they were in at the time they started using it

then to note the answers against the relevant picture. People living alone could take selfies.

4.1.2   Session 2: Studying the context of 'use'

After a quick recap and review of the home assignement results, this session looked into how to study and understand the context in which a design or device is used.

Participants developed short scenarios using their pictures and previous personas, placing them in context. The results and emerging design ideas were then shared within the group.

Participants were asked to have paper, coloured pens and a camera available for the next session, which would continue looking into scenarios, but would be testing them with bodystorming.

4.1.3   Session 3: Scenario building and bodystorming

The third session was about prototypes and experience prototyping, in particular bodystorming. The group discussed what the role of a prototype actually is, how to prototype experiences, specifically looking at the current NGA prototype as a basis for redesign.

Certain features of the NGA prototype were looked at in detail, namely:

- Navigation.
- Usability, positioning on the screen, colour scheme, and interaction mode;
  in particular, investigation of potential ambiguities.
- The physical means of using the UI in real life:
  ◦ How the interface design changes from one device to another (size, input mechanism).
  ◦ How users are impacted by their context of use (multiple users, multiple changing physical contexts, setting time during live events that can't be paused).
- Extra features needed.

Using the scenario building method explored in the previous session and experience prototyping / bodystorming introduced in this session, participants developed simple scenarios of use of this prototype by a persona placed in a context of use, such as "*Carola uses NGA while commuting to work wearing headphones on the bus*".

Physical constraints, such as "*it is raining heavily*" were added. Each participant then acted out their scenario to the rest of the group, using pen and paper, and derived a set of design rationale about how effective the current design was and what could be changed or improved.

4.1.4   Session 4: Applying methods to the RAI use case

This session focused on the RAI use case developed in previous work (see [§ 3](#)) and potential changes to its preliminary UI considerations:

- Selection of a few "curated presentations" rather than infinitely-variable sliders on the screen?
- Single "smart" volume control (including dynamic range control application beyond maximum level to boost quiet sounds)?
- Common shortcut to activate audio-description?
- Independent routing of headphone output (binaural rendering on/off + preferred source if different from main)?
- Pop-up fader that allow the adjustment of dialogue intelligibility?
- Menu to adjust the Receiver Mix audio-description relative loudness, and the position of the commentary in space?
- Icons instead of text to better represent the choice of available presets (such as a flag to identify the stream's language, a stadium for a purely ambient sound version)?

Each participant picked one of these considerations and tested them using the methods learned at the previous session.

As preparation for the 5th and final session, participants were given a tutorial on how to do wireframing and were asked to work on more of these design considerations as home assignements.

4.1.5   Session 5: Wireframing and finalising design ideas

After looking into more design considerations, participants developed simple wireframe prototypes of the NGA user interface on a mobile device and a TV screen, using the tool Mockflow (www.mockflow.com).

Comment: invert sides so default is on the left, and changes to the right

Bottom-right button to go back to menu

Comment: ENTER button is familiar, might remember it. Idea of using existing main buttons on remote
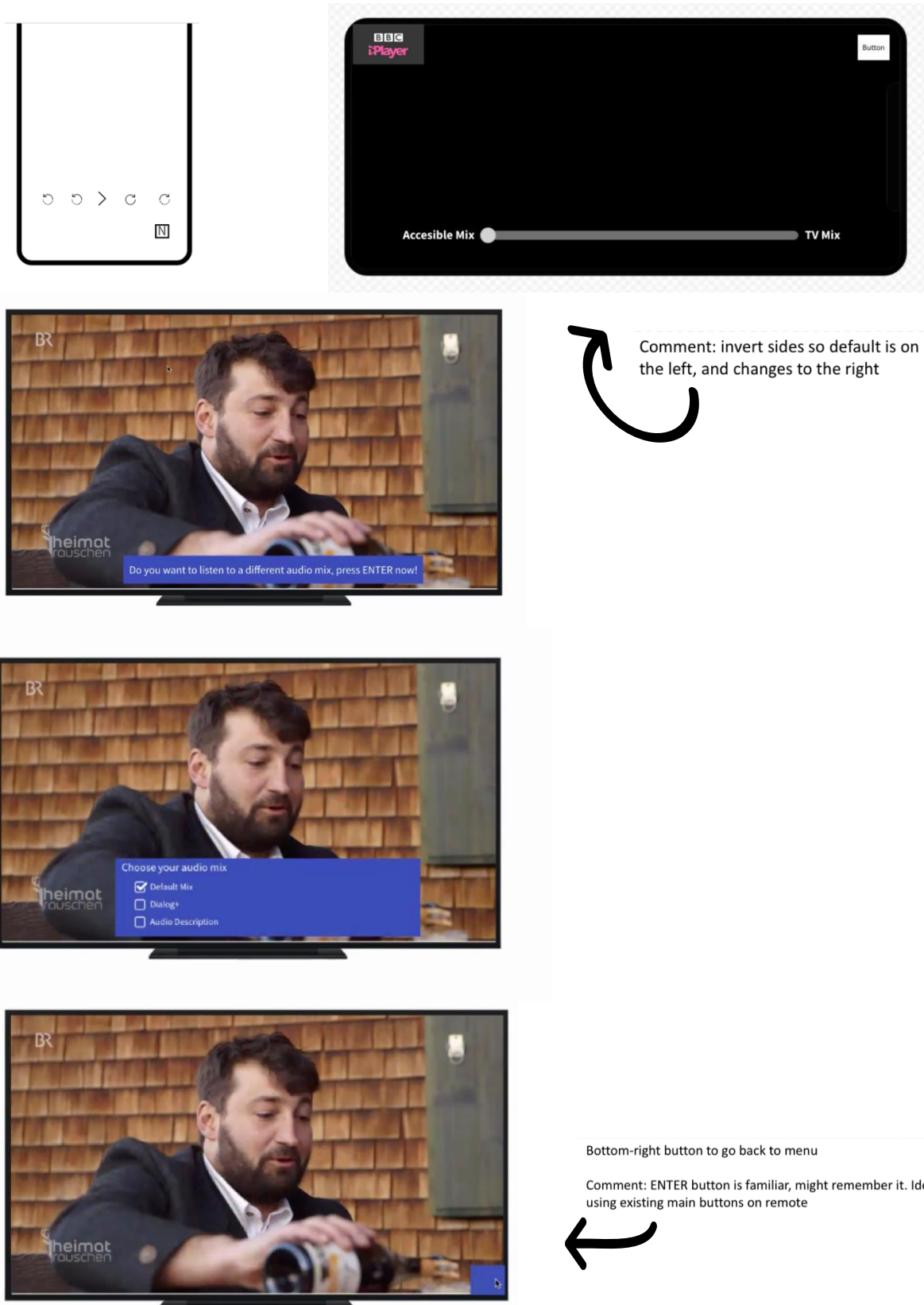
Figure 6: Participants' mock-ups

5. Emerging design ideas

Each of the design sessions brought new design ideas and re-designs of the current prototype, with iterative refinements of previous ideas and novel ones. Several design concepts emerged, which are summarised below as three main emerging categories.

THE BUTTON / SLIDER

Sometimes a toggle between options to find the correct setting is all that is required. This could mean triggering a pop-up fader or toggling on-and-off a chosen or curated NGA function. Not having to fiddle with settings could be especially useful for hard-of-hearing viewers in busy environments. Importantly, this feature should not cover the page and must only be placed in non-intrusive corners of the screen or be a narrow slider at the bottom, or even a physical button or steering wheel.

- A button to allow toggling on & off an automatic, single "smart" volume control.
- A single pop-up fader to allow the adjustment of dialogue intelligibility, balancing the predominance of the standard TV mix versus an improved dialogue mix where less important things are attenuated.

CURATED PRE-DETERMINED SETTINGS

To ensure that users do not have to dive into deep menus with a large number of sliders, the idea of pre-determined settings was proposed, with the following versions:

- Navigation by swiping through options instead of clicking into deeper menus.
- Clicking on various graphical buttons to select curated settings.

MULTI-MODAL INTERACTION

This includes voice command and gesture command, such as scrolling a physical wheel.

Building on scenarios of personas with degraded eyesight using NGA in busy environments and where easy access to settings is more important than visuals, particular emphasis was put on voice and physical buttons as optional main modes of interaction. Possibilities include:

- Voice-activated audio description.
- Tilting a phone to adjust volume.
- A "general setting" physical button to switch voice command on/off or select predetermined audio settings.
- Large icons instead of text to represent the choice of available presets in a more accessible way (such as a flag to identify the stream's language, a stadium for a purely ambient sound version, etc.)

6. Conclusions

Despite the limited number of sessions and the constraints of being conducted online, the design sessions and the use of interaction design methods, proved to be useful in the ideation of user experience and user interface design for NGA.

Several new design ideas anchored in their relevance for users, and in their realistic use in the context of being used in real-life, were developed and could be built upon.

More design ideas could be produced in a face-to-face setting, and formed into guidelines. A new version of the prototype based on the design ideas developed in this exercise could be implemented, followed by guidelines to be provided to manufacturers.

7.   References

[1]
Audio Definition Model – ITU-R Recommendation **BS.2076-2**
https://www.itu.int/dms_pubrec/itu-r/rec/bs/R-REC-BS.2076-2-201910-I!!PDF-E.pdf

[2]
Interaction Relabelling and Extreme Characters: Methods for Exploring Aesthetic Interactions. J. P. Djajadiningrat, W. W. Gaver, and J. W. Fres. 2000. In Proceedings of the 3rd conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques (DIS '00). Association for Computing Machinery, New York, NY, USA, 66–71. DOI: https://doi.org/10.1145/347642.347664

[3]
Design: Cultural Probes. Bill Gaver, Tony Dunne, and Elena Pacenti. 1999. Interactions 6, 1 (Jan./Feb. 1999), 21–29. DOI: https://doi.org/10.1145/291224.291235

[4]
Experience Prototyping. Marion Buchenau and Jane Fulton Suri. 2000. In Proceedings of the 3rd conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques (DIS '00). Association for Computing Machinery, New York, NY, USA, 424–433. DOI: https://doi.org/10.1145/347642.347802

[5]
What do Prototypes Prototype? Stephanie Houde, Charles Hill, 1997. Chapter 16 - Handbook of Human-Computer Interaction (Second Edition), pages 367-381. Editor(s): Marting G. Helander, Thomas K. Landauer, Prasad V. Prabhu. ISBN 9780444818621. DOI: https://doi.org/10.1016/B978-044481862-1.50082-0.

[6]
Understanding Contexts by Being There: Case Studies in Bodystorming. Antti Oulasvirta, Esko Kurvinen, and Tomi Kankainen. 2003. Personal Ubiquitous Computing. 7, 2 (July 2003), 125–134. DOI: https://doi.org/10.1007/s00779-003-0238-7