ReSilence

Retune the Soundscape of future cities through art and science collaboration

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D2.1 Design needs and challenges in orchestrating the future sounds and experiences of cities

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Abstract

This deliverable presents the first version of the pilot use cases (PUCs) documented in the project proposal and DoA. The PUC scenarios will be updated based on feedback from project partners, including architecture professionals and artists.

The document explores fostering trust and acceptance of AI and XR technologies by studying literature and trust-building frameworks. ReSilence aims to address societal challenges in European cities, such as social inclusion, sustainability, and resilience, through art-inspired technologies that enhance urban spaces through sound.

The deliverable outlines the Art-driven methodology used for developing the four pilot use cases, including musical experiences, car sounds, urban soundscapes, and full body sound experiences. It presents the core challenges, artistic vision, and sub-challenges for each PUC, along with ReSilence's approach to addressing these challenges.

This deliverable will report the societal needs that will be addressed in the pilot use cases, as well as the related user requirements and artistic work. It will also include a description of the workshops to empower artists in R&D projects as well as the design thinking and participatory design process that will facilitate the acceptance of digital technologies.

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Executive Summary

This deliverable is the first version of the pilot use cases (PUCs), as documented in the project proposal and the DoA. PUC scenarios are presented and will be further updated and elaborated based on extensive feedback provided by project partners, consisting of architecture professionals, artists, and artists from the open call.

The deliverable also discusses the means to foster trust and acceptance around AI and XR technologies, through a review of existing literature, frameworks on building trust are going to be studied to identify the main factors that determine the impact of art on acceptance issues. ReSilence will address challenges related to societal problems such as social inclusion, sustainability, and resilience of European cities, through art-inspired technologies. These technologies will aim at enhancing the way we experience and design urban spaces through sound. Additionally, the deliverable presents the Art driven methodology followed for the development and further elaboration of the four pilot use cases. Specifically, it discusses the four initially formulated PUCs that consist of cases related to the design of Musical experiences, design of interior/exterior car sounds, soundscape design in urban spaces and full body sound experience. For each PUC it presents the core challenges that concern each PUC followed by the artistic vision and sub-challenges created by each artist's interpretation of the core challenges. ReSilence's approach on addressing those aforementioned challenges is also presented along with the expected work from the open call artists and a story discussing how the PUCs will be realised in real life.

ReSilence proposes to present research results from a scientific field in an easy-to-understand engaging narrative. New tools created within ReSilence are expected to result in more humane living environments, improving the overall wellbeing of citizens. Moreover, software tools developed throughout the project will give opportunities to stakeholders within industry, municipalities, and civil society to co-create their environment. ReSilence will use new technologies (AI & XR) to 1) explore the borders between noise and music in a changing world by producing an acoustic awareness in urban spaces, 2) create new types of sonic urban experiences that expand possibilities for accessibility, active participation/engagement, sustainability, and social inclusion, and 3) involve and collaborate with artists in order to leverage multiple sources of inspiration, interdisciplinary collaboration, and build trust around AI & XR technologies.

Abbreviations and Acronyms

AI	Artificial Intelligence
DoA	Description of Action
EEG	Electroencephalography
PUC	Pilot Use Case
VR	Virtual Reality
XR	Extended Reality
FR	Fundamental Research
PUC	Pilot Use Case

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1 INTRODUCTION

ReSilence is addressing challenges mainly from the Urbanism/Mobility sector while exploring the borders between music and noise, and user experience. The project will address real-world problems in urban settings through the cooperation of artists, creatives, and scientists. These actors will co-create, co-operate and co-design AI & XR solutions to address social challenges. In total, core challenges that are described throughout this deliverable are present in a big part of contemporary urban societies and reflect on the role of art in the design procedure of related spaces and the way it can affect human behaviour and living conditions.

ReSilence aims to identify social challenges and build trust and acceptance of novel digital technologies through art. In Section 2 an extensive review of existing literature is presented and proposed frameworks on trust are being examined in order to understand and leverage the main factors that determine the impact of art on acceptance issues. The societal needs and challenges of each use case are going to be investigated to define the corresponding user requirements and ensure that ReSilence will be properly deployed in each scenario to be evaluated by the end-users. In Section 3 the deliverable presents the Art driven methodology followed for the development of the four pilot use cases and the focus groups that are being set up, consisting of people from consortium partners directly involved in the project and open call artists. The focus groups will contribute to the further elaboration of the PUC scenarios and the future development of user requirements.

Lastly, in Section 4 the initial four pilot use cases are presented, specifically the use cases are: 1) centred on the active participation of citizens in musical experiences 2) the new silence of mobility 3) the acoustic perception and experience of urban soundscapes and 4) the enhanced experiences for people with hearing and vision impairments. The initial pilot use cases, and a first outline of the evaluation plan have already been documented in the proposal and the DoA. This deliverable (D2.1) is the first version of pilot use cases, which will be complemented in the following months by deliverable (D2.2) that will present an updated version of the PUCs, the related user requirements, and artistic work.

2 FOSTER TRUST AND ACCEPTANCE AROUND AI AND XR TECHNOLOGIES

2.1 The Basic Idea: Using the Arts as Potent(ial) Mediators of Trust and Acceptance

Recent advancements in Artificial Intelligence (AI) and Extended Reality (XR) have opened up exciting possibilities in various domains. However, while some people are generally open to embrace new technologies, other people and societies at large may initially be reluctant to accept them due to concerns such as fear of job displacement, skepticism about AI's creative capabilities, or unease about the unknown implications of XR and the fear of misuse. Therefore, societies need to be given the chance to interact with, explore and experience these new technologies in order to come to a shared understanding of their potentials and challenges.

The ReSilence team firmly believes that incorporating AI and XR thoughtfully and transparently into artworks and artistic performances offers one such pathway for societies to engage with these technologies exploratively. By doing so, we can address concerns, alleviate scepticism, further develop and transform these technologies and ultimately foster trust. Throughout human history, the arts have served as vital platforms for individuals and communities to reflect on pressing societal issues and challenges. They have provided spaces for experimentation with alternative realities and solutions. In many ways, the arts can be viewed as safe spaces where ideas can be explored in a playful and hypothetical manner, without immediate consequences affecting people's lives. Besides meaning making, engagement with the arts can engender intense, deep and rewarding experiences. We therefore expect that when people will have a fulfilling experience with artworks or performances that use AI and XR technologies this will also lead to a more positive attitude towards these technologies.

By incorporating AI and XR into music experiences, for example, they may foster comfort and trust by offering familiar and relatable experiences. For instance, virtual reality (VR) concerts can recreate some of the atmosphere of traditional live performances, allowing individuals to enjoy the magic of a music event without physical constraints. By using AI algorithms, these virtual concerts could even tailor the experience to individual preferences, adapting the set list, lighting, and ambience to match personal taste. This personalization can help build a sense of familiarity and comfort, mitigating the potential anxiety that may arise from the adoption of new technologies.

Moreover, AI and XR technologies can empower individuals to actively participate in the creative process, strengthening their trust in these tools through the experience of control,

agency, and aesthetic satisfaction. With AI-powered music composition and generation algorithms, both professional musicians and amateurs can explore new avenues of creativity. This collaborative and co-creative approach may encourage individuals to embrace AI and XR as tools that enhance their artistic expression rather than replace it.

Another aspect that may contribute to trust-building is transparency in AI and XR systems. Artists can use XR to visualise the inner workings of AI algorithms, making them accessible and tangible. This transparency not only helps users feel more comfortable with the technology but also allows them to actively engage and contribute to the evolution of these tools. By incorporating user feedback and involving them in the decision-making process, the trust in AI and XR systems can be strengthened, fostering a collaborative relationship between humans and machines.

In conclusion, the integration of AI and XR in the arts, specifically in music, holds immense potential to help people feel more comfortable and increase their trust in these transformative technologies more generally. By creating familiar and relatable experiences, encouraging active participation, promoting transparency, and embracing inclusivity, artists and technologists can foster a deeper connection between individuals and these emerging technologies.

2.2 Pitfalls and Criticism

Incorporating AI and XR in the arts to build trust in these technologies is not without potential pitfalls and criticisms. The overwhelming quality of aesthetic experiences can sometimes blind individuals to justified criticism and real problems. Captivating visuals and immersive soundscapes may distract from ethical concerns and algorithmic biases. Additionally, there is a risk of overshadowing human creativity and craftsmanship, reducing these technologies to mere replication tools rather than catalysts for innovation and collaboration.

Moreover, the accessibility divide poses a challenge, as limited resources and technical barriers can exclude marginalised communities from these experiences. To overcome these challenges, a balanced approach that addresses ethical implications, preserves human agency, and promotes inclusivity is crucial. Efforts must be made to ensure that the adoption of AI and XR in the arts is accompanied by responsible use and a focus on representation and accessibility, bridging the gap and fostering trust among diverse communities.

3 METHODOLOGY

3.1 Pilot Use Case Creation Methodology

The PUC scenarios, which have been initially outlined in the proposal phase, are further elaborated based on extensive feedback and experience provided by partners during discussion sessions in regular teleconferences taking place on a bi-weekly basis and the contribution of artists from the open call. The starting point of the ReSilence PUC scenarios was the descriptions during the proposal phase. The main criteria, considered for the use case creation at that phase, were: a) Musical Experience Design, b) The New Silence (Sound and Mobility), c) Sound of Urban Spaces and d) Full-body sound experience. A detailed exchange of ideas and expertise of ReSilence partners of the initial general topics of the proposed PUCs has been performed, before coming to conclusion about the selected cases. Eventually, partners have agreed upon one scenario for each of the 4 PUCs.

3.2 Art Driven Methodology

As described in the STARTS toolkit[1] [ref], Art Driven Technology revolves around the idea of assessing technology based on its capabilities. It places a strong emphasis on the proactive identification and resolution of unintended consequences, regarding them as novel challenges that require solutions. ReSilence revolves around the notion of sound and the way it is perceived in a changing reality.

In the midst of a time characterised by ground-breaking technologies, the proposed methodology calls for a new breed of radical technologists who operate at the convergence of science, technology, and art, aiming to expand our comprehension and sensory experiences. Progress serves as a prominent guiding principle, and the methodology manifests through the creation of tangible prototypes that demonstrate feasibility and potential.

ReSilence is a project that aims to create art-driven technologies for shaping the future soundscape of cities. It brings together a diverse group of collaborators, including artists, architects, urban designers, scientists, engineers, and researchers, with a specific focus on utilising AI and XR tools. The project primarily tackles challenges within the Urbanism/Mobility sector, exploring the boundary between music and noise and assessing user experience in the context of sound environments. The roadmap for achieving this goal is illustrated in Figure 1. The methodology employed in this project begins with identifying specific challenges (Vision - the "what?" question) that are further refined and addressed through a series of Pilot Use Cases (PUCs) (Interpret - the "how?" question). Through extensive experimentation, prototypes are developed based on the requirements established in the previous phase, and

[1] Collaboration toolkit, STARTS Ecosystem (H2020 CSA, GA No. 824950) Publication date: July, 2020 retrieved June 19th 2023 https://starts.eu/wp-content/uploads/starts-toolkit-13july2020.pdf

these prototypes are subsequently tested in exhibitions and workshops to gather feedback and insights.

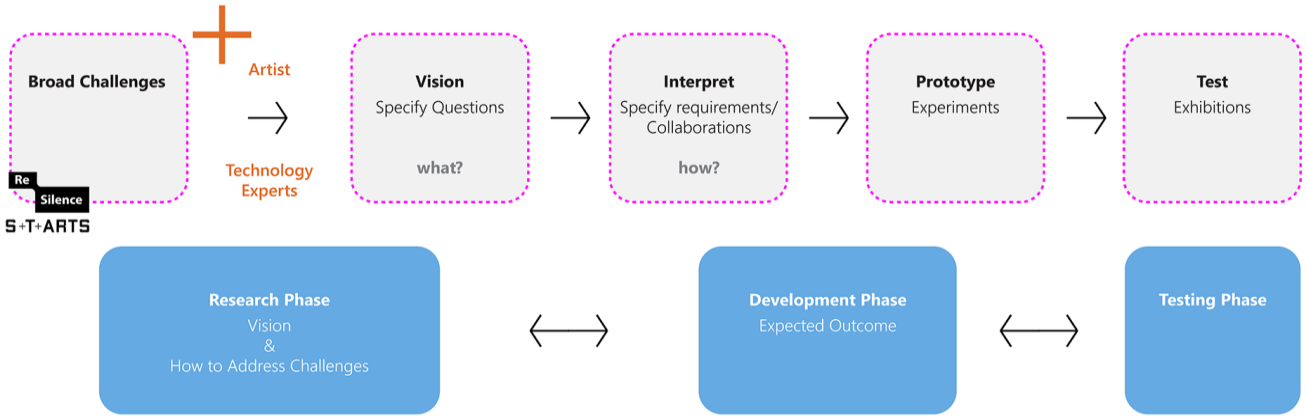

Figure 1: ReSilence methodology diagram

Figure 2: Detailed mapping of the methodology phases regarding Figure 1

Figure 3: Detailed ReSilence methodology with PUCs

Figures 2 and 3 provide a more detailed representation of the development methodology roadmap for ReSilence. These figures illustrate the progression of the methodology following the outcomes of the first project open call. The open call led to the selection of several artists and research proposals, which have been translated into specific implementation steps within the roadmap. Each PUC is thoroughly described under Section 4.

3.3 Focus Group Creation Methodology

Focus groups are widely used in many research fields to investigate new ideas. In respect to software engineering, the focus group method is a cost-effective and quick empirical research approach for obtaining qualitative insights and feedback from practitioners that can be used in several phases and types of research. In ReSilence, we use this method to distil the needs related to architecture and urban space design in order to elaborate the initial PUC scenarios, to formulate the prior user experience which will be furtherly incorporated in the elaborated list of user requirements and to evaluate the system prototypes. Specifically, three focus groups have been created consisting of: a) Architecture professionals, b) Performing art curators c) Artists and art residents (Open Call). The first focus group, mainly related to all PUCs, consists of architecture professionals from the academic environment.

At this stage, the involvement of the focus groups is mostly revolved around the first articulation of the use cases, and the user requirements that will be elaborated in deliverable (D6.1). Members of the focus groups are going to be involved in all stages of the project to enrich the implementation of use cases and ensure that they reflect the current needs of the end users.

3.3.1 Architecture professionals

The architecture-related focus group involves architects from AUTH's academic community, ranging from various fields of architectural design. The focus group consists of architects utilising several design workflows and tools and is related to architectural and urban design mainly in PUC3 and is also involved in use cases 1 and 2. This focus group includes a wide spectrum of expertise in the creative industry, ranging from architecture design, to design of ephemeral installations, indoor and outdoor urban design. More specifically, from the architecture professionals focus group a broad spectrum of users is involved, ranging from teaching staff specialised in advanced design technologies, academic staff related to architectural, urban and landscape design, as well as students of all levels, undergraduate, postgraduate, PhD candidates and members of broader communities related to architecture and design.

This focus group will collaborate together with artists and researchers and will investigate technologies for the analysis of city sounds in relation to outdoor urban design. This collaboration will result in the development of innovative solutions that promote societal issues concerning urban soundscapes taking into consideration the way urban sound affects society and its application in city planning and the arts.

3.3.2 Performing arts curators

In ReSilence artists, creatives, architects and urban designers work in close collaboration to create augmented experiences for audiences and citizens participating in cultural events.

Thessaloniki Concert Hall will support a testing ground for the indoors and outdoors use case studies, by hosting events in its premises.

The performing arts curators focus group will support artistic innovative performances to define known cases of environmental noise interference in musical experience (indoor and outdoor performances), as well as to explore new fields of enriching the audience's emotive experience of music.

3.3.3 Artists and art residents (open call)

ReSilence is a rich and complex project where artists and creatives are meant to collaborate at all levels with partners and leverage different methodologies and techniques. Additionally, an open call, as shown in (Figure 4), for Artists and creatives has offered cross-disciplinary residencies of a collaborative nature. Selected artists in collaboration with project partners are being involved in the initial phase of the PUC elaboration. The group contributes to the project goals by introducing their own ideas, aiming to address the societal challenges in the project's targeted pilot use case scenarios and their own. Artists are also involved, along with consortium partners, through an interdisciplinary collaboration to build trust around AI & XR technologies.

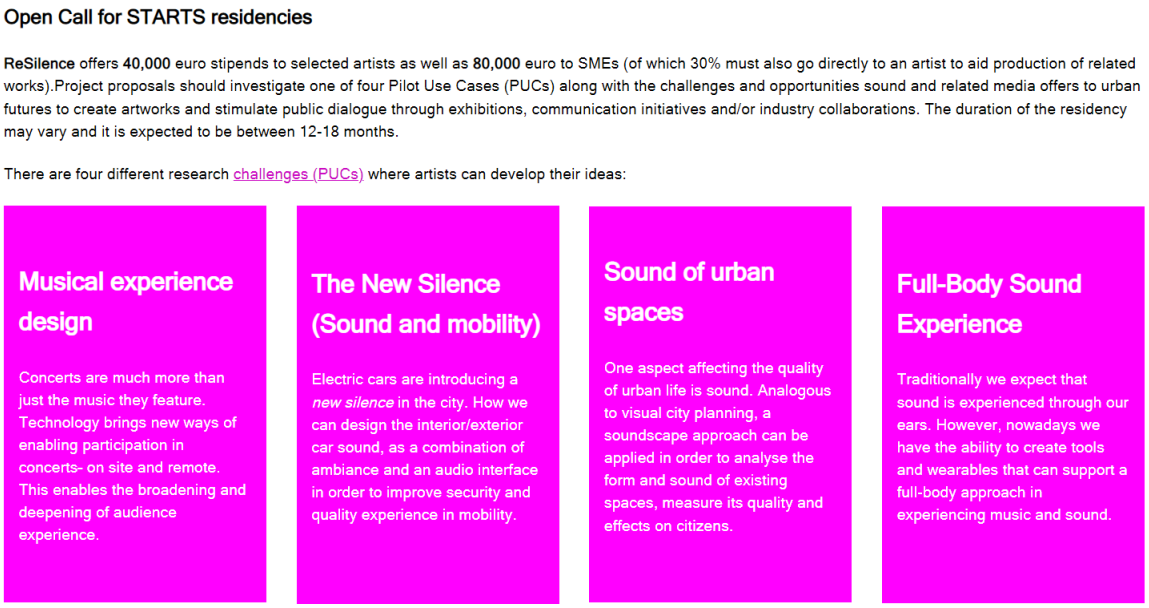

Figure 4: Overview of open call webpage

3.4 Workshops and Webinars

ReSilence will bring together artists, scientific and technological experts. A series of webinars and workshops are going to take place involving both the artists and technology providers in an exercise of knowledge transfer and understanding of the way each side thinks and works.

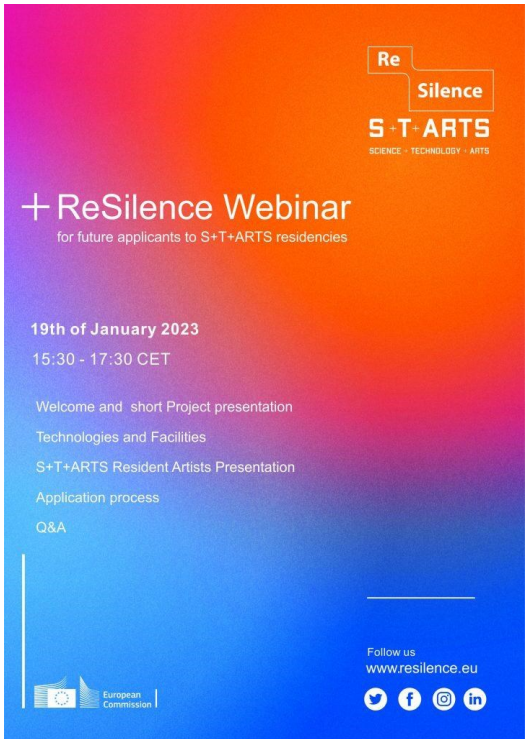

Figure 5. (a) Webinar announcement

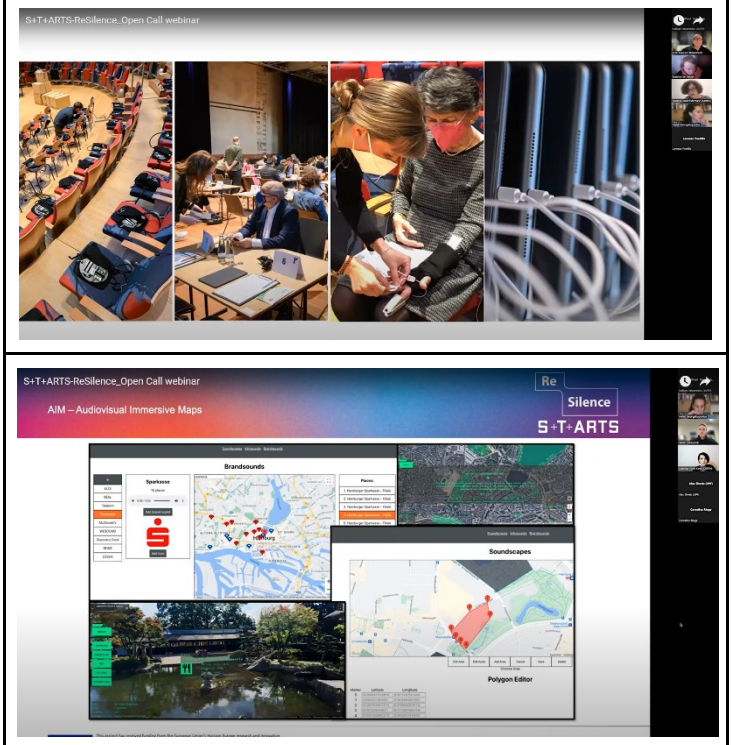

Figure 5. (b) screenshots from the ongoing process

3.4.1 Open call webinar

Artists and pairs of artists-SMEs from all over the world were invited to submit their proposals. In order to support the artists and SMEs in the application procedure, CERTH organised an online seminar, which was held via Zoom. The webinar was announced on the official ReSilence website on January 16th(Figure 5(a)) and was held on January 19th (Figure(b)) .

During the webinar a short introduction of the project was presented as well as the technologies and facilities offered by the ReSilence partners. All partners presented their teams and fields of expertise. The webinar concluded with details on the application process and a Q&A session. The number of participants exceeded 50 artists and the whole procedure, which lasted around 120 minutes, is available online and can either be reached through the

ReSilence project official website and YouTube channel (t.ly/11qR) or the official STARTS website (https://starts.eu/resilence-online-webinar).

3.4.2 First online meeting with the artists

The first online meeting with the selected artists of the 1st Resilience Open Call was held on Friday, June 9th 2023 at 12:00 pm CET. The warm welcome was extended to all participants by CERTH, the coordinator of the consortium. Introductions were made and the members of the consortium were presented, fostering a sense of unity and collaboration among the participants. The agenda outlined the schedule for the meeting, ensuring an organised and productive discussion. Each artist had the opportunity to present their project within a brief timeframe, followed by a short discussion period for further exploration and clarification. The presentations included Andrea Cera, Tim Otto Roth, Caroline Claus, Gustavo Maggio, Wendy Chua, Joyce Koh and Players Journey, as well as Loukia Tsafoulia, Severino Alfonso and Up2metric. The meeting concluded with a discussion about the next steps and scheduling the next meeting to continue the progress.

3.4.3 Fundamental Research engages artists for project development

Fundamental Research (FR) will organise personal meetings with the artists. The purpose of these meetings is to create smaller clusters and facilitate discussions between the artists and selected project partners, in order to seek the appropriate collaborations with the consortium members. Through these personal interactions, FR will engage in dialogues with the artists to gain a deeper understanding of their projects, provide guidance and offer significant insights. That way, the artists will have the opportunity to receive valuable input to further develop their projects. These meetings will create a platform for meaningful dialogue and collaboration.

3.4.4 First plenary meeting

The first plenary meeting, scheduled to take place in Genova on July 20-21 2023, marks an important milestone in the Resilience Open Call project. This in-person gathering aims to bring together all the selected artists and consortium members to delve deeper into the next steps of the process. The plenary meeting will provide a forum for discussions, brainstorming and sharing of ideas, nurturing a space conducive to creativity and innovation. The participants will have the opportunity to present their progress since the initial online meeting and receive valuable feedback from their peers and experts. Through workshops, breakout sessions and networking opportunities, the meeting aims to enhance the overall development of each project. The first plenary meeting in Genova promises to be an exciting event that will pave the way for additional partnerships and contribute to the realisation of the Resilience Open Call's objectives.

4 USE CASE SCENARIOS

This section will elaborate on the four pilot use cases, which were defined during proposal phase and have been further enriched with input from consortium partners and artists in residence. The PUCs are presented and described starting with the core challenges concerning each use case, followed by the sub-challenges that encapsulate artistic vision related to each PUC. Next, a section describing how Resilience aims to address those challenges utilising state-of-the-art technologies is presented. Finally, two parts, the expected work and a story, are discussed. These parts elaborate on the artistic creations and the real life implementation of each PUC respectively. The elaboration of PUCs will finally assist in identifying the needs of the end users.

Each PUC is analysed under the terms of:

- **Core Challenges:** Which contains the main challenges concerning the use case
- **Sub-challenges / Vision:** Which refer to the artist's proactive approach of closely studying the details of the project's main challenges and breaking them down into smaller, more manageable components.
- **Addressing the challenges / Interpret:** Which describes how the PUC will approach the challenges in question
- **Expected artwork / Prototype:** Which entails the realisation of an artistic creation or prototype that captures the essence of the artist's vision, showcasing their imaginative exploration and expressive pursuit within the project.
- **Story / Test:** Which elaborates on how the PUCs can be implemented in real-life environments and defines the actors that are involved and the use of ReSilence components. In version 2 of the deliverable, the story will be further developed.

4.1 PUC1 – Musical Experience Design

4.1.1 Core challenges

This use case explores how new digital technologies can redefine conventional roles in music and performance. Integrating audience interactivity and leveraging emerging technologies, artists have been invited to disrupt the dynamics of musical experiences. They should aim to seek to create innovative music performances, dance shows and participatory spaces that break free from traditional constraints. Collaboration between artists, technologists, scientists, architects and designers is crucial in order to bring to life innovative artistic expressions. Through this quest, the goal is to reimagine the relationship between performers, audiences and their surroundings, offering fresh perspectives in both physical and virtual realms. Related to this is the idea that a creative and aesthetically satisfying use of AI and XR technologies will positively affect people’s general views of these technologies.

4.1.2 Artistic approach: Tim Otto Roth

4.1.2.1. Sub-challenges / vision

The project "Theatre of Memory'' presents distinctive challenges in the examination of interplay and perception within an immersive sound environment. The primary objective is to unfold an innovative and dynamic acoustic network that reflects the fundamental neuronal processes associated with memory. In an effort to review established approaches, this project sets out to institute a new model for composition and interaction with musicians, using neurobiological feedback as a foundation. Key points of research include the translation of nervous activity into acoustic signals and the creation of interconnected networks of audioneurons. With a strong focus on microtonal relationships and individual tone assignments, the project delves into the creation of complex and dynamic spatio-temporal tonal sequences. Additionally, it raises questions about the impact of sound runtime and the acoustic environment on the compositional process. The artist's motivation stems from the desire to design a novel musical experience that facilitates spatial participation and provides an intuitive understanding of neurobiological processes.

4.1.2.2. Addressing the challenges / interpret

To address the challenges, the ''Theatre of Memory'' employs custom-designed speakers that function as audioneurons, creating a dynamic acoustic network. Incorporating parameters for neurobiological plasticity, the system can "learn" and adapt, turning into a “Theatre of Memory ''. The changing lights and colours provide a complementary representation of the sonic activity, while the flexible arrangement of audioneurons enables various levels of immersion and interaction for both the audience and musicians. The expertise of the Max Planck Institute will be instrumental.

4.1.2.3. Expected artwork / prototype

The expected outcome of the residency is an installation that will feature a light augmented sound laboratory with an expanded number of audioneurons. Studying perception and experimenting with different auditory and visual experiences, the project seeks to enhance the concept of immersion. The interactive mode will foster feedback from the audience or musicians, creating complex spatio-temporal tonal sequences. The principal ambition is to push the boundaries of music experiences and offer visitors a unique and engaging journey into neurobiological processes.

4.1.2.4. Story / test

Developing a premiere version of "Theatre of Memory'' in Berlin, the project envisions creating a captivating narrative that unfolds within the domain of memory. The historic

Tieranatomisches Theater, a captivating venue located in the heart of Berlin, has been confirmed as the first exhibition space. Built in 1789/1790, this anatomy hall at Humboldt University provides an exceptional setting for the project. The anticipated presentation in January 2024 will be a highlight in the accompanying program of the renowned brain exhibition at the Charité Medical History Museum,supported by the Charité Foundation. In addition to this, discussions with national and international neuroscientists are underway to explore further exhibition opportunities.

4.2 PUC2 – The New Silence (Sound and Mobility)

4.2.1 Core challenges

The rise of the industrial revolution ushered in a new era of machinery, marking a kinetic revolution, characterised by the movement of mechanics. In this transformative landscape, sound design emerges as a user-focused experience, where utilitarian sounds can evolve into sources of artistic innovation. Electric cars, for instance, offer an unexplored territory for composers to craft unheard auditory landscapes, while also presenting an opportunity for the vehicle itself to become a dynamic performance art installation, where the driver takes on the roles of composer and performer. Moreover, the reflective properties of surfaces play a significant role in reimagining urban spaces and determine the choice of construction materials. Architects and artists explore the domain of indoor acoustic design, investigating the resonance of sound and the way our bodies engage with space, resulting in the creation of distinct sounds. Expanding on this knowledge, it is essential to apply it to public spaces like restaurants, subway stations and train stations, treating them as musical instruments that can be enhanced through intentional design interventions. The sound absorption and reflection qualities in these environments will shape the total impact for individuals.

4.2.2 Artistic approach

4.2.2.1. Sub-challenges / vision

Designing sounds for electric cars presents a dual challenge of balancing safety and functionality. It entails careful consideration of sound composition and placement within the vehicle to ensure that the sounds effectively alert pedestrians and other drivers without being intrusive or distracting. Furthermore, collaborative efforts between sound designers, engineers and user experience experts can enhance the driving journey through well-integrated sound elements. Another aspect to address is creating distinctive auditory sensations that align with the brand identity and recognition of each electric car manufacturer. Developing sounds that reflect the unique characteristics of the brand, electric car manufacturers can establish a sonic signature. In addition, the assimilation of sound design into electric cars has a profound impact on the urban space. These soundscapes can contribute

to the character of urban environments, creating a harmonious atmosphere for both drivers and pedestrians.

4.2.2.2. Addressing challenges / interpret

Collaboration between sound designers, engineers and automotive experts is essential to develop progressive strategies. Research and development can focus on creating advanced sound systems that pursue dynamic sound generation and modulation, based on driving conditions and user preferences. Similarly, engaging with urban planners and architects can optimise the soundscape of urban environments. Understanding the interaction between electric cars and the surrounding acoustic environment, solutions can be proposed to mitigate noise pollution and enhance the sonic experience.

4.2.2.3. Expected artwork / prototype

A potential artwork or prototype resulting from addressing these challenges could be a sound installation that simulates the sonic experience of driving an electric car. This would include a customizable system that responds to user interaction, providing a personalised experience. The installation would allow visitors to navigate through different auditory landscapes, showcasing the creative possibilities in sound design for electric vehicles. Additionally, it could incorporate elements of urban design, demonstrating how sound interventions can transform public spaces into engaging environments.

4.2.2.4. Story / test

Dissemination strategies for designing sounds in electric cars could include workshops, conferences and online platforms. Publishing research papers and forming partnerships with automotive manufacturers and industry associations would contribute to knowledge sharing. Public demonstrations and exhibitions would showcase the impact of sound design.

4.3 PUC3 – Sound of Urban Spaces

4.3.1 Core challenges

Noise pollution presents a significant issue in urban areas, and consequently, incorporating soundscape design into city planning has gained attention in recent years. However, there is still a need for effective methods to shape the soundscapes of spaces, ensuring the well-being of the public. The core challenge is to develop tools and techniques that enable architects and urban designers to address noise pollution, with an emphasis on revolutionary ideas from sound artists. This process will involve simulations and prototypes implemented in smaller sections of the urban environment, initially involving a limited number of individuals and gradually expanding to larger areas of cities and communities.

4.3.2 Artistic approach: Andrea Cerra

4.3.2.1. Sub-challenges / vision

This project centres around the development of an interactive environment driven by sound, which aims to investigate the connection between movement, soundscapes and the perception of intrusiveness. The main goal is to create a space where participants have the ability to shape a virtual city soundscape through their movements and raise awareness regarding the negative impact of polluted urban soundscapes and foster active engagement in mitigating these issues. A number of sub-challenges are given special attention by the project, such as examining the degree of intrusiveness in urban soundscapes, exploring innovative techniques to counteract it and utilising movement qualities and physiological signals to analyse how soundscapes influence participants' behaviour. The artist concentrates on investigating expressive movement qualities at a mid-level and understanding their variations in relation to different levels of intrusiveness, in order to comprehend how sound impacts both movement and overall quality of life.

4.3.2.2. Addressing the challenges / interpret

The project proposes two scientific experiments in collaboration with UNIGE and Maastricht University. The first experiment focuses on an individual immersed in different soundscapes, measuring movement qualities and physiological signals while performing a movement task. The second experiment involves small groups of people performing a joint action, analysing their movement features and physiological signals. These experiments intend to investigate the impact of soundscape intrusiveness on movement qualities and group dynamics.

4.3.2.3. Expected artwork / prototype

As a result of the residency, an interactive installation is being developed. This installation will feature portable micro-installations and software modules that can be experienced individually or in various settings. It will provide opportunities for participants to engage with the soundscape and analyse counter-measures to intrusiveness. The objective is to create a collection of modules that can be used in different situations, such as walks in noisy streets, home environments, conferences, or educational workshops.

4.3.2.4. Story / test

The interactive installation, developed as a result of the residency, is potentially planned to be showcased in Genova, specifically during the EU STARTS event, as part of the Festival della Scienza.

4.3.3 Artistic approach: Caroline Claus

4.3.3.1. Sub-challenges / vision

The main emphasis of the project lies in the investigation of sonic space shifts that evoke physical and emotional responses in individuals, thereby expanding the scope of acoustic strategies beyond acoustic comfort. A key aspect involves developing a sonogeographical dérivé, a cartographical work on sonic space shifts that exposes the impact of regeneration processes on the sonic materiality of urban areas. Ethical considerations regarding audio logging in public spaces will be assessed, involving the implementation of experiments in the fields of architectural and urban design. Creating immersive AR/VR audio experiences through the synthesis of audio logging data and constructing a sonorous scale model, the artist seeks to transform our understanding of sonic environments and bring about innovative approaches.

4.3.3.2. Addressing the challenges / interpret

The proposed project aims to address the challenges by conducting research and experimentation in audio cartography, specifically focusing on sonic space shifts in Brussels Territory North. The development of an audio observatory and the production of an audio paper will facilitate the interpretation of urban sound spaces in planning, design and improvisation of urban sound space. Engaging with local communities and networks, public meetings and discussions will be organised to involve stakeholders and raise awareness of the sonic transformations in the area. The artist will collaborate with CERTH, AUTH and WESOUND to handle and resolve complex issues related to the project.

4.3.3.3. Expected artwork / prototype

The artist aspires to develop a sonogeographical dérivé, which serves as an audio observatory and an audio paper. The observatory will facilitate live streaming, collective discussions, long-term observation and the production, synthesis, mixing and sharing of recordings. It will provide insights into the sonic materiality of urban spaces and contribute to the understanding of the affective aspects of sonic geographies. Additionally, an AR/VR experience will be developed to present the sonorous scale model online, allowing users to submerge themselves in the transformed sonic environment. At the final stage, a book launch and a seminar on sonic urbanism will be organised, functioning as a platform to celebrate and disseminate the synthesised sonogeographical dérivé among the public.

4.3.3.4. Story / test

Public meetings are planned to be organised in the Territory North of Brussels, creating vibrant urban spaces that bring together diverse communities. These local engagement tactics are

complemented by international dissemination that will occur through participation in conferences, symposia and sound artistic events, striving to reach a wider audience interested in sonic and affective environmental aesthetics and promote exchanges within the context of sonic urban regeneration.

4.4 PUC4 – Full-Body Sound Experience

4.4.1 Core challenges

This use case emphasises the transformative power of vibration and tactile sensation in redefining our perception of sound and visual inputs. It highlights two key aspects:

a) The significance of a holistic approach to music and sound, involving the entire body rather than just the ears.

b) The conversion of physical objects into captivating soundscapes and vibrations, drawing inspiration from artists like Christine Sun Kim.

With specific attention directed towards individuals with hearing or visual impairments, the purpose of this exploration is to bring about a technological revolution by acting as a catalyst for enhancing our sensory capabilities. By bypassing the impaired areas (eyes, ears), we can redirect and distribute sound and visual information through alternative ways, enabling a more comprehensive and immersive spatial experience.

4.4.2 Artistic approach: Gustavo Maggio

4.4.2.1. Sub-challenges / vision

Enveloping themselves in the resonance of sound and the interplay with the human body across various spatial contexts, the artists embark on a creative project. Their goal is to uncover the complex connections between acoustics, the intricacies of human anatomy and the transformative power of haptic full-body sound experiences. Through this study, they expect to unlock new dimensions of sensory engagement, where the boundaries between sound, physical sensations and immersive environments blur, in order to create profound and captivating artistic encounters. A key focus is on reimagining the soundscape of silence for marginalised groups, particularly people with disabilities who often face exclusion from conventional auditory experiences. Furthermore, the artists set sights on addressing the potential disruption of the ocean's soundscape due to sonar ocean exploration. They want to portray the narratives of marine life and other planetary inhabitants, highlighting the interconnectedness of all beings. Through their venture, the artists strive to create interactions that challenge societal norms and expand the understanding of the world around us.

4.4.2.2. Addressing the challenges / interpret

A team of artists and experts will collaborate, bringing together their distinct skills and perspectives. This team comprises industrial designer Gustavo Maggio, design anthropologist Wendy Chua, composer and sound artist Joyce Koh and the SME partner Players Journey, which specialises in XR media experiences. Through their collective expertise in product and textile design, music composition, sound art and the intersection of art and technology, they will embark on research, prototyping and concept development. By harnessing advancements in sensor technology, bioacoustics and wearable design, the team intends to create an installation within an immersive exhibition space that showcases the transformative potential of haptic-sensory sound experiences. Their collaborative efforts will lead to an innovative showcase that stretches the limits of art, science and human perception.

4.4.2.3. Expected artwork / prototype

The result anticipated from this project is a multisensory installation that combines haptic soundscapes with virtual reality (VR) mediascapes. Participants will have the opportunity to wear sensory wearable suits and undergo the haptic-sensory compositions inspired by the scrutiny of sound and the ocean. The installation aims to be accessible to visitors of diverse abilities, with a focus on gathering feedback from persons with disabilities to enhance the inclusivity of the experience. Additionally, the artists envision the potential for the wearable technology to be adapted into concert theatre chairs, transforming the audience's passive listening process into an active, full-bodied musical participation.

4.4.2.4. Story / test

In their quest for a suitable venue for the final showcase, the team plans to leverage their extensive network of museums, galleries and performing theatres with whom they have previously collaborated. They plan to premiere the first installation in Europe, potentially in Berlin, and subsequently tour it in different cities. Drawing on their experience in curating immersive exhibitions, Gustavo, Wendy and Joyce are well-equipped to translate their work into tangible and interactive exhibition experiences for the public. With potential venue partners, such as the Red Dot Design Museums, the National Museum of Singapore, Esplanade theatres and the Humboldt Forum, they have a range of options to consider for staging their art piece. Additionally, being part of research clusters and networks like Matters of Activity and Game Lab Berlin provides them access to further exhibition opportunities and venues in Berlin, such as the Kunstgewerbemuseum and the Tieranatomisches Theater.

4.4.3 Artistic approach: Loukia Tsafoulia

4.4.3.1. Sub-challenges / vision

The project “Soft” deals with several challenges associated with the development of adaptive and therapeutic environments. One key challenge is to design a dynamic space that can intelligently respond to an individual's sympathetic nervous system activation. This requires a deep understanding of the physiological and psychological states of occupants and how they can be influenced by sensory aspects, such as sound and light. Another concern is to incorporate distant-to-the-body technology, with the intention of adapting the sonic and light characteristics of the environment in real-time. This involves creating biofeedback-mediated relaxation techniques and utilising body pressure pockets to modulate pressure intensity in relation to sound and light. Additionally, the team of artists seeks to confront the challenge of neurodiversity by creating an inclusive space that caters to the needs of both neurotypical and neurodivergent individuals.

4.4.3.2. Addressing challenges / interpret

In response to the challenges mentioned, the project team will apply their profound understanding in synesthetic research, design and immersive environments. They will collaborate with partners such as UM's 'Brain & Emotion lab, the Max Planck Institute, CERTH and UNIGE, who will respectively bring expertise in neuroimaging, aesthetic perception of sound, translating sound to tactility and body movement analysis. The involvement of up2metric, as an SME partner, specialising in computer vision and artificial intelligence, will provide valuable contributions to enhance the project's technological capabilities. The team will employ multimodal full-body analysis and distant-to-the-body technologies to visualise the relationships between the human body/mind states and spatial aspects. They will also integrate distant-to-the-body technology with the sonic and light environmental aspects, allowing for real-time adaptation based on biometric data. Conducting experiments and alpha-testing the ideas within the “Soft” prototype, the team plans to establish a proof of concept and gather feedback from both neurodivergent and neurotypical individuals to evaluate the effectiveness of the adaptive environment.

4.4.3.3. Expected artwork / prototype

The residency aims to achieve the desired outcome of creating a functional prototype for the "Soft" project. This prototype will be a deployable and adaptive therapeutic environment conceptualised as a spatial wearable. It will take the form of an encapsulated pod, where individuals can retreat to when overwhelmed or overstimulated. The prototype will incorporate various technologies and design elements to modify sensory aspects of the interior environment, with a particular emphasis on sound and light. It will utilise body-based

biometrics and closed-loop biofeedback to intelligently modify the sonic and light characteristics in real-time. The purpose of these modifications is to create a soothing and calming environment that assists the occupants in self-regulating their emotional and physiological states. The design will cater to various contexts, such as sensory-loaded lobbies, concert halls, exhibition venues and hospitals. Through its deployment, the team intends to further examine the therapeutic benefits of the adaptive environment and its potential in fostering the well-being of individuals, both neurotypical and neurodivergent.

4.4.3.4. Story / test

'Soft' is set to undergo testing and evaluation at Thessaloniki Concert Hall. The preliminary idea will be presented at the UIA 2023 CPH World Congress and published under Springer's Sustainable Development Goals series. The outcomes of the residency will be shared through publications, conferences and events, including the Venice Biennial and Ars Electronica festival. The 'Soft' prototype will be deployed at venues such as the MusiXLab space and Thessaloniki Concert Hall. Collaboration with neurodivergent communities, both in Europe and the US, is planned. Online platforms will be used for project updates and public engagement.

5 CONCLUSIONS

This deliverable describes an initial version of the pilot use cases and the pilot use case creation Artistic driven methodology. It reflects issues concerning new ways of enabling participation in concerts– on site and/or remote, sound design is perceived as a user-centric experience related to mobility, architectural and urban scales as well as individual full body experience of music and sound.

Additionally, the deliverable delves into addressing how utilising art can assist in alleviating scepticism and further develop and transform AI and XR technologies in order to build trust to the public. Art can be used as a means to offer a familiar experience to the audience, immersing people in a more fulfilling experience with artworks or performances that use AI and XR technologies, thus leading to a more positive attitude towards them.

This deliverable further discusses the creation of focus groups consisting, at this point, of members that come from user partners research team and associates, as well as open call artists who participated in the discussions throughout the procedure of the proposal phase as well as user meetings. Additionally, workshops organised between artists, architects and technologists are also incorporated. Finally, the deliverable elaborates on each PUC, its core challenges that concern the main objectives of each PUC followed by the artistic vision and sub-challenges created by each artist's interpretation of the core challenges. Furthermore, how each PUC will approach the challenges it is concerned with along with the expected work from the open call artists and a story discussing how the PUCs will be realised in real life are presented.

The use case scenarios will be further developed and enriched, from the online meeting as well as the physical plenary meetings, with first being in Genoa in July 20-21 2023, as well as the subsequent implementation phases of the project.

A. **APPENDIX**

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