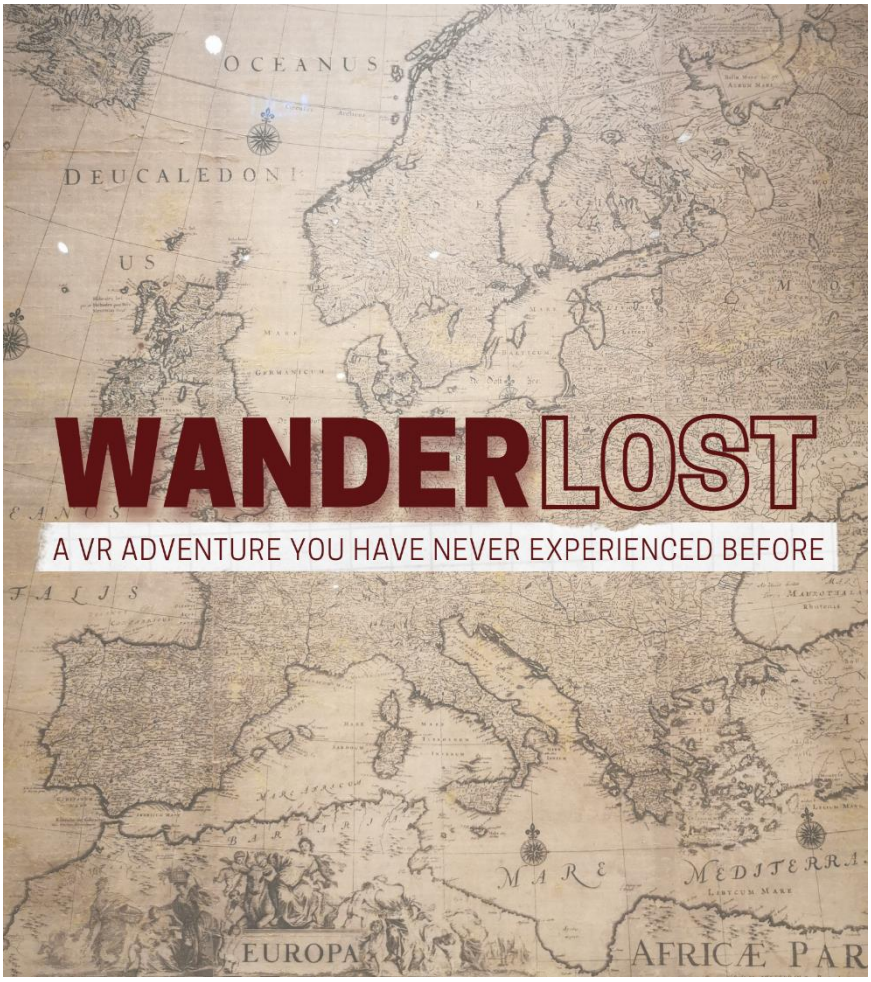

WanderLOST

A VR EXPERIENCE INSIDE PALAZZO POGGI'S MAPS

Final project for the "Digital Heritage and multimedia" course
held by Simona Caraceni and Sofia Pescarin

Orsola Maria Borrini –
orsolamaria.borrini@studio.unibo.it
Ginevra Botto –
ginevra.botto@studio.unibo.it

"Digital Humanities and Digital Knowledge" Master Degree
Alma Mater Studiorum –
University of Bologna

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Contents

Acknowledgments

We would like to thank the Museo/Collezione di Palazzo Poggi, Sistema Museale di Ateneo – Alma Mater Studiorum Università di Bologna for granting us permission to take pictures of the objects of their collection (specifically, the artefacts of the “Chamber of Geography and Nautics”). Unauthorized use, reproduction or duplication of all pictures is prohibited.

Abstract

This design brief regards the development of a **single-user Virtual Reality on-site application** about **climate change** within **Palazzo Poggi** Museum's permanent exhibition "Chamber of Geography and Nautics". The VR experience is based on the idea of travelling on the ancient maps displayed in the museum with the possibility to witness first-hand the changes fragile locations have endured and will face as a result of climate change and extreme polluting. The aim of our application is to instill a **sense of care** in the visitors and to raise **awareness** about the current situation of the planet, directing them towards a **behavioral change** in their lifestyle.

Introduction

The Context

The **Museum of Palazzo Poggi** belongs to SMA (Sistema Museale di Ateneo): a network of museums, collections and a digital museum belonging to the University of Bologna and aiming at **"encouraging curiosity and inspire learning"**[1], a mission that is pursued by organizing activities for school groups and interactive laboratories and events, as stated in the SMA website.

Palazzo Poggi was built during the 16th century and soon became the House of the Academy of Sciences of the Institute of Bologna. It developed into the seat of the university and now houses various university museums, one of them being the precious **collection of the Institute of Sciences**, founded in 1711 by Luigi Ferdinando Marsili and made of many interesting sections such as the "Military Architecture Chamber", the "Human Anatomy Museum" and several others. Among them, we have decided to focus on the **"Chamber of Geography and Nautics"**, containing not only naval models from the 17th and 18th centuries, but also nautical and geographical maps from the same period.

Our goal is to **enhance** this section of the museum by developing *WanderLOST*, a **Virtual Reality experience** that will enable the visitors to experience first-hand the world portrayed in the maps and to have a glimpse of how familiar places could be in the future.

The museum itself already makes available some relevant **Cultural Heritage assets**. Among the more traditional ones, such as the possibility to experience guided tours and playful interactive activities (still only available in Italian), there have been some **virtual exhibitions** that bear particular significance for our goals. One of these, *Di Terra, di Cielo e di Mare*[2], was promoted and organized by the SMA, the University of Bologna and the Vatican Museums and specifically concerned some of the assets displayed in the "Chamber of Geography and Nautics". In the event of an actual implementation of the project we could have access to **High Quality photographs** of some geographical maps. Nevertheless, the rest of the technology required for our application needs to be developed.

---

[1] Sistema Museale di Ateneo (SMA), *Schools, families, and children*, https://sma.unibo.it/en/visit/visit, last accessed May 26th, 2022.

[2] SMA, *Di Terra, di cielo, di mare: esplorazioni virtuali e scoperte tra Musei Vaticani, MOdE e Museo della Specola di Bologna*, https://sma.unibo.it/it/agenda/diterradicielodimare, last accessed May 26th, 2022.

However, **direct contact with the physical assets** is fundamental for our project to reinforce the connection between the visitor and the heritage and to spark the former's curiosity and interest in a so far-yet-so-close world. Therefore, our proposal is to install an **on-site application** at the end of the "Chamber of Geography and Nautics", exploiting the "chain" exhibition technique[3] followed by the Palazzo Poggi Museum. Additionally, the application would be in a room that itself intensifies the idea of crossing countries' borders: the **"Magna Charta Universitatum" Room**.

The target audience for our project is both Italian and foreign **tourists**. They don't need to be knowledgeable about the subject of the experience (that is, climate change), but they should be familiar with **game mechanics and dynamics** and, ideally, have some **previous knowledge on mixed reality devices**, specifically virtual reality ones. However, we do not need them to use their own devices as we will provide them with the VR station and tools: a head-mounted display and wireless touch controllers (such as the Oculus Quest system).

Figure 1. The context map.

[3] C. Celli, *Un percorso fra natura e storia: Il museo della città di Cesena lungo il fiume Savio*, Tesi in Composizione Architettonica, Alma Mater Studiorum – Università di Bologna, a.a. 2009-2010, relatore Arch. Francesco Saverio Fera.

The Concept

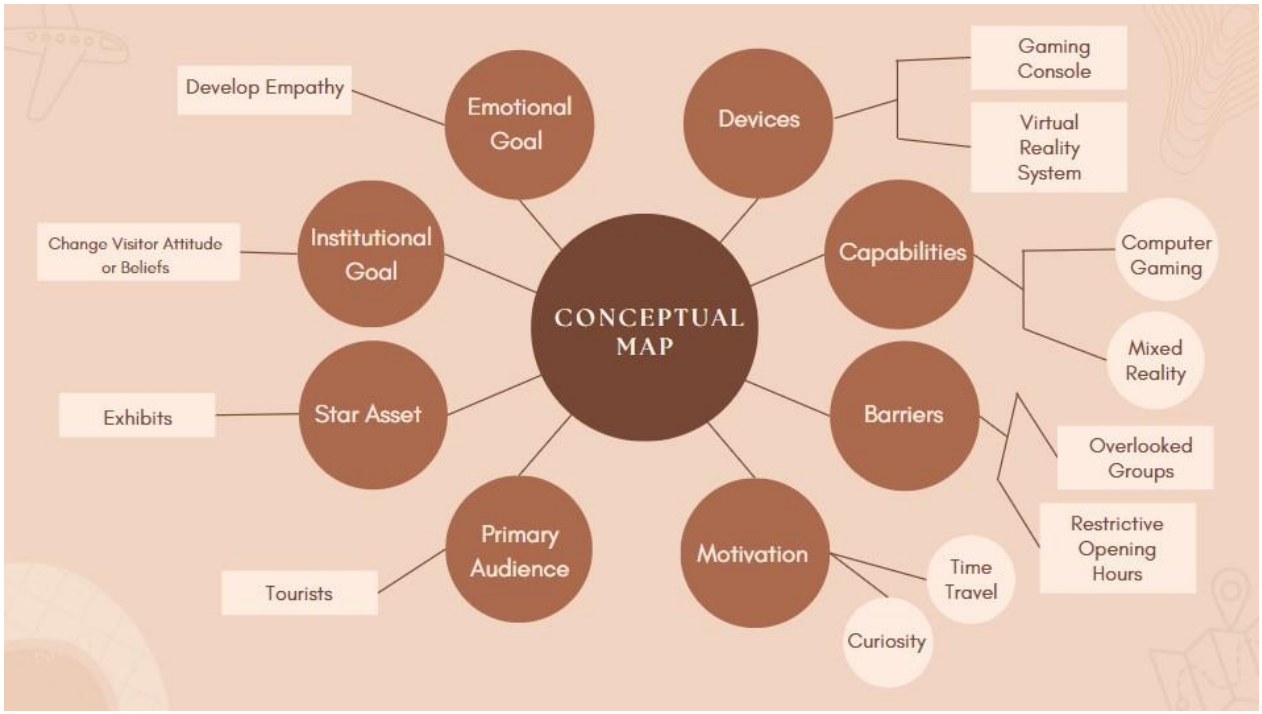

Figure 2. The conceptual map of WanderLOST*, built by using the VisitorBox Ideation Cards.*

From a museological point of view, we believe that *WanderLOST* can be described as a virtual museum **enhancing education** with very **little interaction** allowed to the visitor and in a sort of **"guided tour"** in which only a **selection of objects** from the museum collection are displayed. This definition refers to Caraceni's taxonomy of virtual museums and specifically corresponds to category "B"[4].

NEED	EDUCATION
INTERACTION	Closed
SPACE	Closed
CONTENT	Selected objects
VIRTUAL/REAL	Virtual on real
VISITORS CONTRIBUTIONS	Not allowed

Table 1. Category "B" of Virtual Museums, from Caraceni (2014).

[4] S. Caraceni, *Designing a taxonomy for virtual museums for the use of AVICOM professionals*, University of Plymouth, 2015.

In our VR experience, the interaction will be restricted to a set of **simple gestures** directed at strengthening **immersion**, **authenticity**[5], and **sense of presence**[6] within the visitor, who will be able to select items and destinations but will always be accompanied by a **voice** forwarding the story step-by-step. The narration is built on top of a **selection of geographical maps** (rendered with **HQ photographs**), **3D reproductions** of the naval models and of Coronelli's globe: just a part of the large collection kept in Palazzo Poggi.

A fundamental feature of the experience is the element of **surprise**. We aim at capturing even casual visitors' attention by emphasizing the journey aspect of the application: the possibility of travelling to familiar and maybe distant places from a museum room in Bologna will increase the **interest** for an experience that will then become something unexpected.

NEED	EDUCATION
EXAMPLE	Guided browsing within a potential learning environment
TECHNOLOGY	Virtual Reality experience based on HQ images, 360 interactive panoramas and 3D reproductions
CONTENT	Digital images, texts, audio (soundtrack and guiding artificial voice), 3D models. The digital objects are reproductions of the maps, the naval models and the globe displayed in the physical exhibition
VIRTUAL/REAL	Virtual on real
VISITORS EXPERIENCE	Surprising and provocative for both the casual and the greedy visitor

Table 2. The VR Experience according to Caraceni's taxonomy (2014).

WanderLOST gives the visitor the unique opportunity to get a closer look at Palazzo Poggi's "Chamber of Geography and Nautics" and to have a **different** and **educational experience**, suitable and accessible to all kinds of users, even the least knowledgeable and up-to-date ones. Through a **dramatic** and effective **narrative**, the application aims at leaving a permanent mark in the visitor, pushing him to a **behavioural change** towards the care for the Planet. The HQ and 3D reproductions, moreover, allow for a different **connection with the Cultural Heritage objects** preserved in the museum, traditionally perceived as far and aseptic. In doing so, we hope to contribute to changing the conventional perception of museums.

[5] S. B. Gilbert, *Perceived Realism of Virtual Environments Depends on Authenticity*, from *Presence Teleoperators and Virtual Environment*, June 2017.

[6] C. Coelho, J. Tichon, T. J. Hine, G. Wallis, G. Riva, *Media Presence and Inner Presence: The Sense of Presence in Virtual Reality Technologies*, from *Communication to Presence: Cognition, Emotions and Culture Towards the Ultimate Communicative Experience*, IOS Press, Amsterdam, 2006, pp. 25-45.

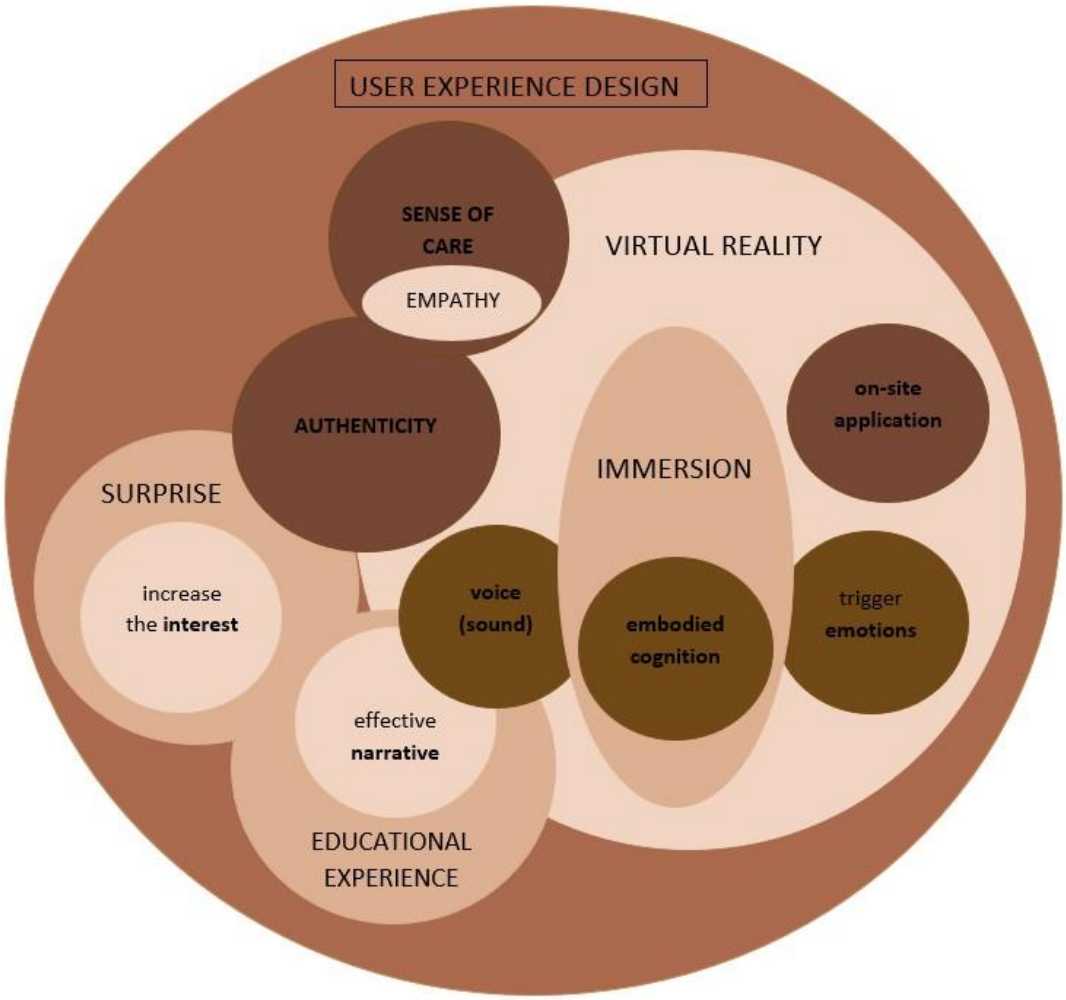

Figure 3. The User Experience Design graph.

The *WanderLOST* experience focuses on the Cultural Heritage topic of **climate change**. Many important institutions have highlighted the extent of climate change's effects both on the environment and on humankind throughout the years, and it is now a generally known fact that **raising awareness** among common people is **fundamental** to attempt reversing this terrible chain of events[7]. The importance of common people's involvement in addressing the issue has even been stated by UNEP (United Nations Environment Programme) in its "Raising awareness of climate change" handbook, specifically devised to help governments develop and implement educational and public awareness initiatives, and by UNESCO, that stresses on the importance of education and training to address climate change, encouraging innovative approaches and non-formal education programmes through media[8]. We believe that developing an interactive and immersive application such as *WanderLOST* play an important role in this direction: by using a **dramatic** and **intimate**

[7] Climate ADAPT, *Awareness campaigns for behavioural change*, 2015, https://climate-adapt.eea.europa.eu/metadata/adaptation-options/awareness-campaigns-for-behavioural-change, last accessed May 30th, 2022.

[8] United Nations Environment Programme (UNEP), *Raising awareness of climate change: a handbook for government focal points*, October 2006, pp. 2-3; United Nations Educational, Scientific and Cultural Organisation (UNESCO), *Education for Sustainable Development: a roadmap*, 2020 (more specifically section 1.2 "What needs to be done", pp. 8-9).

narrative and embodied cognition, it will trigger emotions, strengthening the attachment of the user to our CH topic and leading to a transformation of the user's behaviour beyond the experience itself[9].

Our chosen cognitive focus for *WanderLOST* is stimulating Meaningfulness by triggering strong Emotions and increase Empathy.

All the elements of the application contribute to meaning-making in different ways: the possibility to choose not only the naval ship to travel with but also the specific destination is an important personal component that, as such, brings out the user's emotions. Ideally, a high-end development of this project would involve the addition of many different places all over the world, giving the possibility to everyone to travel back to their native countries and so to be more strongly involved in the adventure. Meaningfulness is also amplified by using a dramatic narrative: the sight of familiar places inevitably corrupted through the years by climate change will reinforce the enchantment already emerged from the employment of immersive technology such as VR and the idea of experiencing the crossing of spatial and temporal boundaries (underlying our project from the very beginning and a possible attraction for casual visitors). By triggering these strong emotions, we intend to change the user's empathy and, more specifically, his empathic concern and caring attitude[10] towards the planet, pushing towards a personal transformation: the acquisition of a more sustainable lifestyle.[11]

Goal and Requirements

The goal of *WanderLOST* is not only to enhance a section of Palazzo Poggi's Museum, the "Chamber of Geography and Nautics", improving its learning experience, but also to prompt an analysis of climate change.

However, we are aiming at something more extensive than just better a museum exhibition and making the visitor aware of the Planet's condition: we want to trigger a behavioural change, to make the visitors *want to be* an active part in the restless fight against climate change and pollution, and we aspire to do so by directly touching their roots.

To reach this goal, we need to develop an immersive, authentic, and engaging experience: a single-user Virtual Reality one, "a computer-generated digital environment that can be experienced and interacted with as if it were real"[12], in which the concepts of Human Computer Interaction (HCI) and immersivity are fundamental to achieve our goal of Meaningfulness-Emotion-Empathy. The engagement of the experience, as stated by Lazzaro[13], is amplified by emotions, one of the main aspects of our application.

---

[9] J. Bennett, *The Enchantment of Modern Life: Attachments, Crossings, and Ethics*, Princeton University Press, 2001; Y. Poria, R. Butler, D. Airey, *The core of heritage tourism. Annals of Tourism Research*, 2003.

[10] N. Noddings, *Educating moral people: A caring alternative to character education*, 2002; N. E. Soto, *Caring and Relationships: Developing a Pedagogy of Caring*, 50 Vill. L. Rev. 859, 2005.

[11] Many of these concepts are dealt with in the sources referenced to in the previous footnotes.

[12] J. Jerald, *The VR Book*, Springer, 2014, pp. 9-15.

[13] Lazzaro identifies five ways that emotions impact the gaming experience: enjoy, focus, decide, perform, and learn. In our case, we would say that the most relevant are "focus" and "learn": emotions are important for motivation and attention, and they can help users to focus effort and attention (N. Lazzaro, *Why we play - Affect and the fun of games: designing emotions for games, entertainment interfaces and interactive products*, in *The Human-Computer Interaction Handbook*, CRC Press, 2012).

Development

The development process started with a brainstorming stage, in which the focus was to select one of the many museums of Bologna that would interest us the most and that would have an interesting collection that could act as the source of some reflection. We then determined our main concepts and approaches and proceeded with research on what was already available on the Web[14] and how we could add something to it.

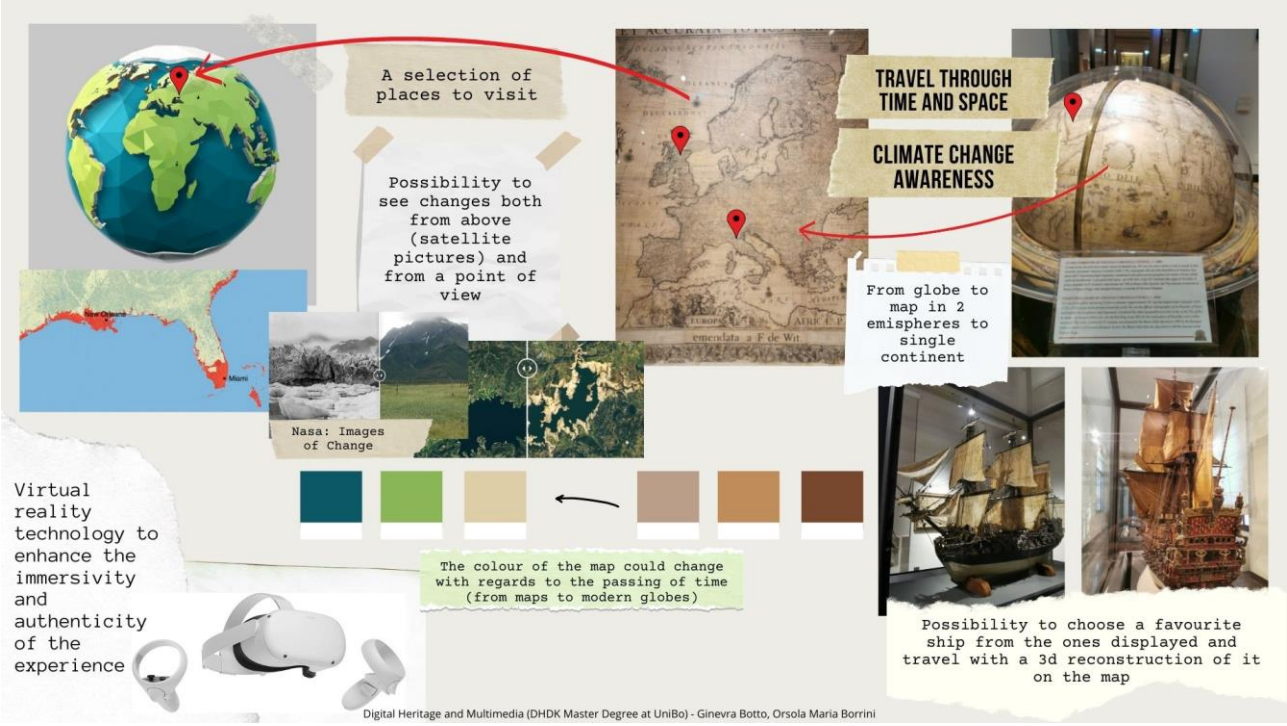

Figure 5. The moodboard developed to give the "feeling" of the WanderLOST *VR Experience.*

For the proper development stage, we widely made use of the **VisitorBox Ideation Cards**, that allows to clearly identify the different steps to follow to cover all the important aspects of interactive systems useful and enjoyable to use, and we were guided by the **ten rules of Interactive Media Design applied to Cultural Heritage**[15]. We also reasoned consistently with the **PACT framework** (People, Activities, Context, Technologies) to select our scopes and requirements for *WanderLOST*.

PACT

People

Defining a target audience was one of the most challenging steps of the design process: a Museum like Palazzo Poggi certainly can interest a wide variety of visitors with its particular and varied collection, from school groups to researchers and tourists (both Italian and foreign). Considering the CH topic we wanted to focus on, we preferred to address a category that could symbolize, in a way,

[14] In this stage we have observed how there are many important institutions that already dealt with climate change effects on the environment from a "distant" point of view, by making use of satellite pictures: some examples could be both Nasa's *Images of Change* and Google Earth.

[15] S. Pescarin, *Esperienze interattive nei musei: dieci regole d'oro*, in *Videogames, Ricerca, Patrimonio Culturale* (a cura di S. Pescarin), Franco Angeli, 2020, pp. 89-127.

"common people": tourists, who don't necessarily have previous knowledge about the topic and may not be interested in addressing it directly.

More specifically, we have crafted two Personas to gather some more insight on the target audience's expectations and possible reactions to our idea.

Figure 6. Marcelo Foster Persona. This character is the one around which the Twine interactive story revolves.

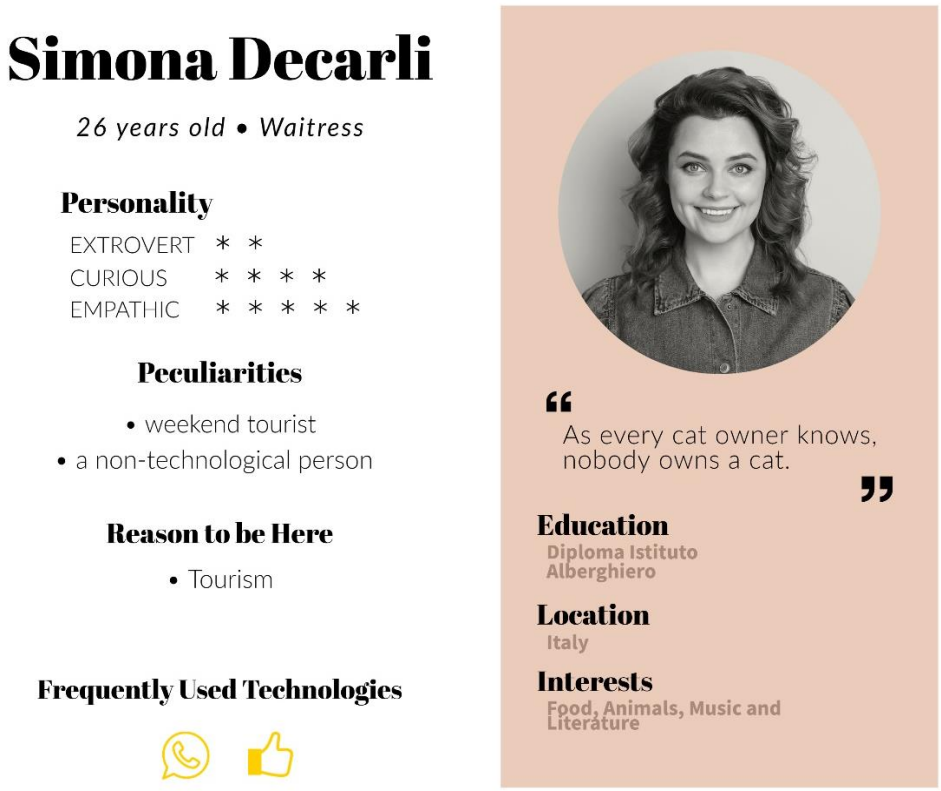

Figure 7. Simona Decarli Persona.

While disrupting our design (the fifth stage of the VisitorBox Ideation Cards) we have found a **shortcoming** in our project for what concerns the target audience: a project such as ours, that makes use of VR technologies, unfortunately is **inoperable by people with vision impairment**, as it widely relies on visual stimuli to foster strong emotions. Such a deficiency can be partially eliminated by implementing a **crossroad decision** at the beginning of the application: either access the experience with the **whole VR device** or with **headphones** and a **mic** (in the latter case the whole experience will be replicated by means of suggestive and effective sound effects accompanied by a "more invasive" narrative voice and a speech-based interaction).

Activities

After defining the target audience, we have worked on the activities that *WanderLOST* includes: its scope and goal, as already stated, is mainly to **trigger a behavioural change** in the visitor by **surprising** and **enchanting** him with **strong emotions** connected to **familiar places**.

To maintain a more intimate atmosphere and to have a more effective impact on the visitor, the experience will be a **single-user activity**, with **simple interactions** and set in a **known environment** (the "Chamber of Geography and Nautics" just visited in the traditional museum). As the VR stations will be positioned in the "Magna Charta Universitatum" Room, a branch of the museum route which is more "isolated" compared to the rest of the rooms, we imagine the **surroundings** to be **peaceful** (and therefore not negatively affecting the experience).

Furthermore, the activity is thought of as an **occasional** one, with a maximum of **repetitions** set to **three**: at the end of the first experience (one travel to one destination), the user will have the possibility to choose to either continue or to interrupt it. However, the impact of *WanderLOST* goes beyond the museum visit: within the supplied **brochure** there will be a list of simple but effective sustainable activities to realise in day-to-day life. Here is where the effectiveness of the application will really be tested.

Context

The physical context of our application is a museum room: the "Magna Charta Universitatum" one. As it has already been the setting of a virtual exhibition in the past, we believe it is sufficiently **spacious** and **quiet** for our concept. After an inspection in loco we observed enough electric plugs (of course essential to the charging of the VR headset and controllers) and, overall, a relaxing lighting of the room (there are no harsh lights). In conclusion, an appropriate environment for *WanderLOST*.

We believe to have developed a concept as **accessible** as possible for all kinds of people, regardless of race, national origin, religion, sex, and age. As afore mentioned, one of the shortcomings we have encountered is the fruition of the experience by **visually impaired people**[16]. Another possible **obstacle** for the access to our application are the **restrictive opening hours** of the museum, that also affected us during the development of our project. Then again, this is something we cannot really influence and therefore cannot be considered a flaw of *WanderLOST*.

[16] A possible but partial solution is addressed in the previous section PACT-People.

Before and after the experience the museum staff and technicians will be present to assist the visitors: helping them in handling the VR devices (and, if necessary, explaining how to use them) and providing them with the final brochure summarizing the experience and the further steps to take.

Technologies

Our project involves mainly **VR technologies** which allow for the development of an **immersive** application with **restricted interaction** from the user and that can work also **offline**. We have thought of using an **Oculus Quest** headset, that does not require an external PC and makes use of two 6DOF (Six Degrees of Freedom) controllers, able to track the user orientation and position.

In the prototype here presented, we have used **360 panoramas** (developed with **PTGui** and then made interactive with **Pano2VR**) to give the feeling of being immersed in a virtual environment (in the final implementation of the project, these will be replaced by a proper immersive environment). For what concerns our application, the "virtual" environment first starts off as a reproduction of the "Chamber of Geography and Nautics" but then transforms into immersive reproductions of at-risk places all over the world. Our idea needs, to start, **research** to create such environment not only for the present time, but also for the past and the future (in which case we would need expert professionals). Moreover, we would also need **3D reproductions** of some of the objects from the museum's collection: the naval models and Coronelli's globe.

Figure 8. One of the four 360 panoramas made with the PTGui software (free trial version).

The experience

WanderLOST is supposed to be experienced at the end of the visit to the "Chamber of Geography and Nautics": in the "Magna Charta Universitatum" Room there will be two VR stations and one explanatory board *partially* describing the experience.

When the tourists decide to get involved and wear the VR devices, they will find themselves in a **virtual reconstruction** of the third section of the exhibition just visited. They are greeted by a warm **voice** that welcomes them and explains the circumstances: they are now able to make a very special journey through space and time, but first they need to **choose their vessel**. By looking around, they can see some of the naval models displayed, each promptly illustrated by the voice, that instructs on its name and purposes and asks to the visitors to "touch and invite" their favourite vessel on their palm with a simple gesture. With this choice, a small 3D reproduction of the chosen naval model can be now held in hand.

The visitors are then invited to get closer to **Coronelli's globe**, that awaits them under the light in the next room. By pointing at it, their virtual bodies walk towards it until they're right in front of it. Again, the voice gives some instructions: the small chosen vessel can be now "thrown" onto the globe,

positioning itself right off Italy's coasts, the starting point of the journey, and then the visitors can decide to either choose a destination (point at the globe) or to let fate decide (spin the globe).

In the first case, the globe "unscrolls" into a two-hemispheres map. By hovering over the continents with their hands, the visitors can see their borders highlight and can choose one by simply clicking on it. The map of the corresponding continent then opens: pinned on it there are some placeholders, each denoting a specific place which is briefly described by a scroll popping up when hovering over it. After choosing which place to visit, the small vessel on the map travels all the way to the destination, accompanied by an exciting background music. The travelers find themselves immersed in a digital reproduction of the selected location in the past. They are able to look around and appreciate the world as it was and as they never experienced it. The voice makes some remarks about small but important details while time starts passing, a ticking sound stressing the passage of each year, and the environment rapidly transforms, deteriorating as a consequence of climate change. The sight of possibly familiar places quickly getting corrupted and the guidance of the voice spark a reflection in the helpless visitors, who cannot intervene in any way (in this section of the experience no interaction is allowed).

In 2022 time finally stops and the visitors find themselves in a known world, to which they are accustomed. This time, however, they see it in a different way: they now know how it was before and what has changed. The small details they noticed are barely recognizable and a few seconds of silence are left to the travelers to reflect on what was just witnessed. Suddenly, time starts moving forward again, getting faster by the second. The background music is now pressing and dramatic, while the voice comments the negative changes that rapidly succeed one another in a tragic timelapse climaxing in a silent future environment, devastated by the effects of climate change never handled by humankind. After some disheartened seconds of silence, the voice intervenes once more, calmingly reflecting on what could have been done and addressing the visitors with some provocative questions about their accountability. The whole environment slowly fades to black.

At this point, the voice comes back and asks, accompanied by a fluctuating text, whether the visitors want to repeat the experience or not. They can now interact again with the application and either nod (accepting to continue the experience for another round) or scroll their heads (refusing to continue and finishing the experience). If they decide to continue, they'll find themselves again in front of the globe, otherwise the end credits will show up and they'll be instructed to take off the VR device.

In case they decide to take a random journey, the globe will start spinning and a random destination will be selected. The small vessel will travel straight away to the selected continent and location. From this point onwards, the experience will have the exact same structure of the "personal" journey.

After taking off the VR devices, the visitor will be handed an explanatory brochure with a recap of *WanderLOST* and its conclusions, a list of sustainable actions easy to implement in day-to-day life and the possibility to share the experience with others: by scanning a QR code, a dedicated webpage of the Museum's website will open. In this webpage we plan to use the assets already available on the web (such as satellite pictures showing climate change's proof[17]) and to give the possibility to share

[17] Such assets have already been addressed in the first part of the Development section: we intend to adopt either Google Maps' or Nasa's project, properly acknowledging them.

such images on social networks. Of course, this section of the project also aims at enhancing the **marketing** of the museum, other than giving a follow up to our experience.

A prototype of the experience has been produced by using **Twine**, an open-source tool for telling interactive, nonlinear stories[18]. By using Twine assets, it has been possible to showcase how the choices of the user affect, even if partially, the development of the story.

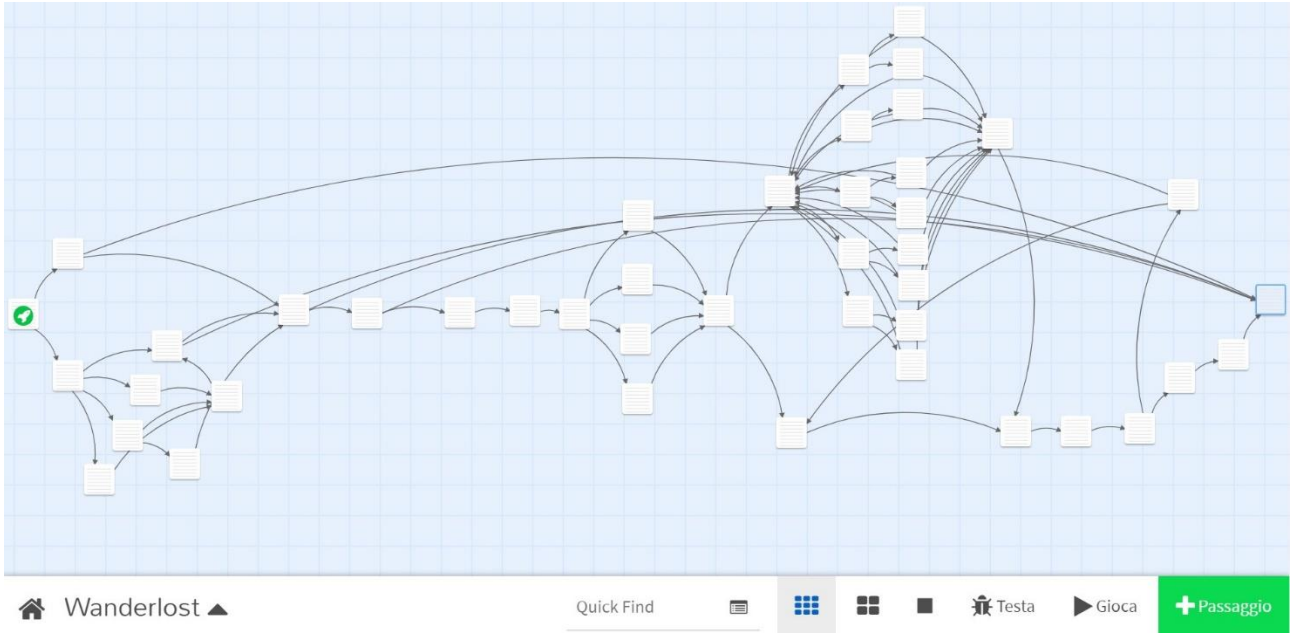

Figure 9. The structure of the experience in Twine. A more detailed picture can be viewed at this link, while the Twine interactive narrative can be experienced here.

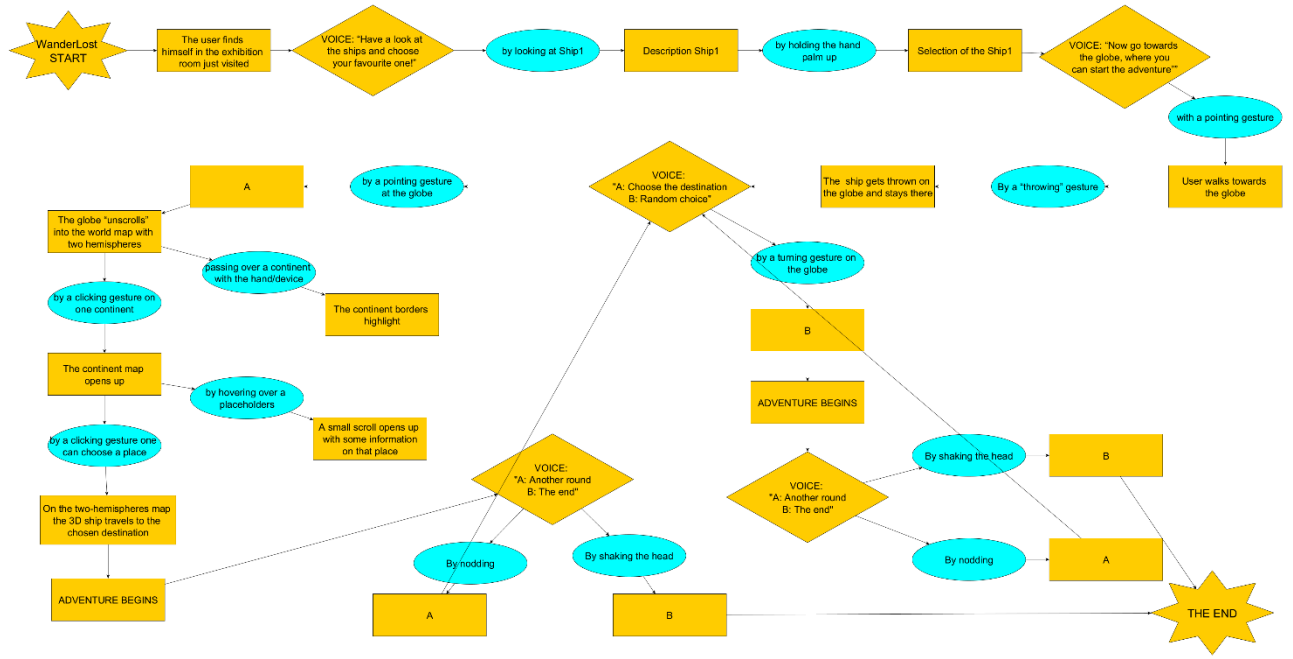

Figure 10. The Interaction Diagram for WanderLOST*: the blue parts are the interactions directly made by the user, the yellow parts represent the flow of the application.*

[18] The Twine interactive story can be found in the GitHub repository.

Reaching the cognitive focus

To reach our cognitive focus (that is, triggering a behavioural change) we aim at **stimulate the visitors' feelings**. The setting of the application in variously familiar places (where the **familiarity** has different degrees: the native country will feel, of course, more familiar than the "Chamber of Geography and Nautics") has the goal of triggering some **positive emotions** in the user, who is also drawn to the experience by the **excitement** anticipated by the possibility of travelling through space *and* time all over the world. But these emotions quickly change when the true topic of *WanderLOST* emerges: seeing familiar places getting corrupted certainly triggers some sort of **emotional response** within the user, who is then **drawn to play an active role** in the fight against climate change. We hope that, by handing to the user the explanatory **brochure**, these strong emotions will transform into a **real behavioural change**: we do not suggest difficult and demanding activities, but easy and practical ones that give back a quick and positive feedback.

Foreseen workflow, further development, and maintenance

1. **Historical** and **scientific research** (Knowledge Organisation step)
    a. Because of the structure and scope of our project (a travel through space and time with a focus on environments' transformation caused by climate change), we both need historical and scientific experts: the former to properly reconstruct the immersive reproductions of past places, the latter to correctly point out and explain the alterations due to climate change that have happened and that could happen in the future
2. **UX/UI Design** development
3. **Non-interactive Computer Graphics** development (using softwares such as Blender and Meshlab)
    a. Our project needs the implementation of some **3D models**: the 3D model of Coronelli's globe and of the four ships available for the initial choice (namely the Sant'Antonio da Padova, the Galley of the Order of Knights of Saint Stephen, the Bien Aimé and the Vainqueur)
    b. We also need to implement some **HQ 2D images** of the two-hemispheres map and the continental maps
4. **Interactive Computer Graphics** development (using softwares such as Unity or Unreal)
    a. More specifically, the **virtual reconstruction** of the "Chamber of Geography and Nautics" with the possibility to interact with it (as we said before) as well as the past, present and future reconstructions of the visitable places
5. Creation of the specific **webpage** in the Museum's website
6. **Software testing** for feedback and possible revisions
7. **Deployment** and publication

For all these development steps, of course, there is the need of **professionals** (such as UX/UI designers, graphic designers, 3D modelers, web and game developers), **softwares** (Blender/Meshlab, Unity/Unreal), and **hardware** (Oculus Quest 2, starting from €349).

When the application is installed in place, we would also need some **tech professionals** to handle the VR devices and the possible malfunctions that could emerge during the prolonged use (in case they need to be charged, there are numerous sockets in the "Magna Charta Universitatum" Room, but

the purchase of at least 3 devices is advised) and some **museum staff** to overview the visit and distribute the brochures.

For what concerns **maintenance**, from a technical point of view we want it to be **periodical**. As far as the content, we would like *WanderLOST* to **follow the development of the planet's climate change** even in the future. As many of these variations can be perceived only after a certain time span, a good idea would be to **update the application every 5 years or so**. In this way, also future generations could be aware of such issues and feel more directly involved.

Supporting Materials

- Interactive story (TWINE)
- 360 interactive panorama (PANO2VR) as a hi-fi prototype of the VR application
    - This interactive panorama has been developed starting from four 360 non-interactive panoramas realized with PTGui

All the supporting materials can be found in the GitHub Repository.

Team Roles

Orsola Maria Borrini – Development of the 360 interactive panorama, Shooting of the HQ pictures inside the museum, Media Research.

Ginevra Botto – Development of the Twine Interactive Story, Media Research, Marketing Development and Management of the relations with the Institution.

Bibliography and Sitography

- J. Bennett, *The Enchantment of Modern Life: Attachments, Crossings, and Ethics*, Princeton University Press, 2001
- S. Caraceni, *Designing a taxonomy for virtual museums for the use of AVICOM professionals*, University of Plymouth, 2015
- C. Celli, *Un percorso fra natura e storia: il museo della città di Cesena lungo il fiume Savio*, Tesi in Composizione Architettonica, Alma Mater Studiorum – Università di Bologna, a.a. 2009-2010, relatore Arch. Francesco Saverio Fera
- Climate ADAPT: https://climate-adapt.eea.europa.eu/
- C. Coelho, J. Tichon, T. J. Hine, G. Wallis, G. Riva, *Media Presence and Inner Presence: The Sense of Presence in Virtual Reality Technologies*, from *Communication to Presence: Cognition, Emotions and Culture Towards the Ultimate Communicative Experience*, IOS Press, Amsterdam, 2006
- S. B. Gilbert, *Perceived Realism of Virtual Environments Depends on Authenticity*, from *Presence Teleoperators and Virtual Environment*, June 2017
- J. Jerald, *The VR Book*, Springer, 2014

- N. Lazzaro, *Why we play - Affect and the fun of games: designing emotions for games, entertainment interfaces and interactive products*, in *The Human-Computer Interaction Handbook*, CRC Press, 2012
- N. Noddings, *Educating moral people: A caring alternative to character education*, 2002
- S. Pescarin (a cura di), *Videogames, Ricerca, Patrimonio Culturale*, Franco Angeli, 2020
- Y. Poria, R. Butler, D. Airey, *The core of heritage tourism. Annals of Tourism Research*, 2003
- Sistema Museale di Ateneo (SMA): https://sma.unibo.it/it
- N. E. Soto, *Caring and Relationships: Developing a Pedagogy of Caring*, 50 Vill. L. Rev. 859, 2005
- United Nations Environment Programme (UNEP), *Raising awareness of climate change: a handbook for government focal points*, October 2006
- United Nations Educational, Scientific and Cultural Organisation (UNESCO), *Education for Sustainable Development: a roadmap*, 2020