



Design brief for the final project of the “Digital Heritage and Multimedia” module (Professors Simona Caraceni and Sofia Pescarin)

A.Y. 2021-2022

Chloe Papadopoulou – [chloi.papadopoulou@studio.unibo.it](mailto:chloi.papadopoulou@studio.unibo.it)

Loredana Salvatore – [loredana.salvatore@studio.unibo.it](mailto:loredana.salvatore@studio.unibo.it)

Digital Humanities and Digital Knowledge(DHDK) Master Degree

Alma Mater Studiorum – University of Bologna

## Table of Contents

Table of Contents .....	2
Abstract .....	3
Introduction .....	3
Institution .....	3
Location .....	4
Relevant CH assets .....	4
Star assets .....	5
Target audience .....	5
Institutional goals of the Museo Internazionale e Biblioteca Della Musica .....	6
Education .....	6
Marketing .....	6
Concept .....	8
Conceptual Map .....	8
Museological Approach .....	8
Experience design .....	9
CH Topic .....	9
Cognitive and Emotional Goals .....	9
Development .....	12
Narrative .....	12
Interaction between the project and the users .....	13
Development to reach the cognitive focus .....	13
Detailed design for the structure, content and development of MUSEscape .....	14
Requirements and foreseen workflow .....	16
Research on the main target audience .....	16
Choice of devices .....	17
Next steps .....	17
Further development and maintenance issues .....	18
Disrupting the design .....	18
Scenarios of vast diversity among groups .....	18
Possible disruption of other museum activities and visitors .....	19
Accessibility .....	19
Member roles .....	19
Additional material .....	19
Bibliography .....	19

# MUSEscape: an interactive experience inside the International Museum and Library of Music of Bologna

## Abstract

The design brief presents the development of an interactive on-site experience inside the permanent exhibition of the Museo Internazionale e Biblioteca Della Musica in Bologna. Our project has the structure of an escape room using mainly Augmented Reality and 3D modelling, based on the principles of engagement and collaboration. The experience has **two main goals** for our primary audience of children and teenagers: firstly, to provide a deeper understanding of the exhibition and induce feelings of care and empathy about musical heritage, and secondly, to support their psychological and sociological development.

## Introduction

The importance of music in everyday life is manifold; It can be simply a leisure, a hobby or a full-time job. In its core, however, it is one of the purest forms of self-expression: a channel to convey one's feelings, a reenactment of the self. The complex practice of musical expression has always been a central component in constructing a region's cultural heritage and identity: UNESCO's list of intangible cultural heritage<sup>1</sup> contains 584 elements, of which 304 - an impressive 52 percent- are related to the terms music and song, referring to music alone or combined with other dimensions such as dance and poetry. The complexity of musical expression and its power as a "universal language", combined with Italy's high esteem as a center in European classical music, inspired us to design our project in order to propose a meaningful experience of musical culture implementing Human Computer Interaction methods.

## Institution and goals

The Museo Internazionale e Biblioteca Della Musica, a part of the Bologna Museum Institution, is dedicated to promoting musical culture in the city of Bologna, by means of artistic and bibliographic heritage. Besides the museum exhibition, the institution includes a music library, an events hall, multimedia facilities and educational workshops, serving tourists, music enthusiasts and scholars.

The first nucleus of the museum's collection was contributed by Padre Giambattista Martini, a great scholar, theorist and composer of the 18th century. Martini wrote theoretical papers about music and cultivated relationships with many musicians of the period; Most importantly, he donated an impressively vast collection of music treatises and scores to the

---

<sup>1</sup> The list was first established in 2008, and as of August 2021 corresponds to 131 countries. According to the UNESCO's 2003 Convention (2018a), intangible cultural refers to "the oral traditions and expressions, performing arts, social practices, rituals and festive events" that are transmitted from generation to generation.

municipality of Bologna, which was later enriched with the archives of the Liceo Musicale in 1827.

After researching the museum and exploring its exhibitions, we identified its main institutional goals: education and marketing. Therefore, we started designing an alternative, interactive experience with the aim to enhance the visitor's understanding of the exhibition, and increase the popularity of both the museum and the role of musical heritage in Bologna.

## Location

The museum first opened on May 11th 2004 in the 16th century Palazzo Sanguinetti, which has undergone a series of restorations. The museum itinerary comprises a total of 9 rooms, as shown in the figure below. The rooms are mostly divided thematically but also historically:

Room 1's central showcase is intended as a Prologue to the exhibition.

Room 2 and Room 3 are dedicated to Padre Giambattista Martini and his relations to prominent musicians of 18<sup>th</sup> Century Europe (among which young Mozart and J. Christian Bach).

Room 4 is dedicated to music theorists from the 15<sup>th</sup> to the 17<sup>th</sup> century, and mentions theoretical principles of the universal music treatise and its application to the practice of composing.

Room 5 hosts a collection of some of the most important printed books and instruments of the 16<sup>th</sup> and 17<sup>th</sup> century.

Rooms 6 and 7 are dedicated to the Italian Opera of the 18<sup>th</sup> and 19<sup>th</sup> century respectively, featuring prominent artists and related instruments, paintings and other artefacts.

Lastly, room 8 and 9 provide another series of rare and impressive instruments and music scores.



## Relevant CH assets

In the nine frescoed rooms, the exhibition itinerary traces six centuries of the history of European music, with paintings of illustrious musical figures from Padre Martini's collection, and more than eighty ancient musical instruments which are unique exemplars of their period. There is also a wide selection of documents: treatises and volumes on musical theory-harmony and history, theatrical opera scripts, letters, manuscripts, autograph scores.

In the institution's public website, one can read details about its founding and its most interesting exhibits, browse dedicated catalogs for the whole collection and access a virtual 3D tour of the museum which also provides related information and related classical pieces.

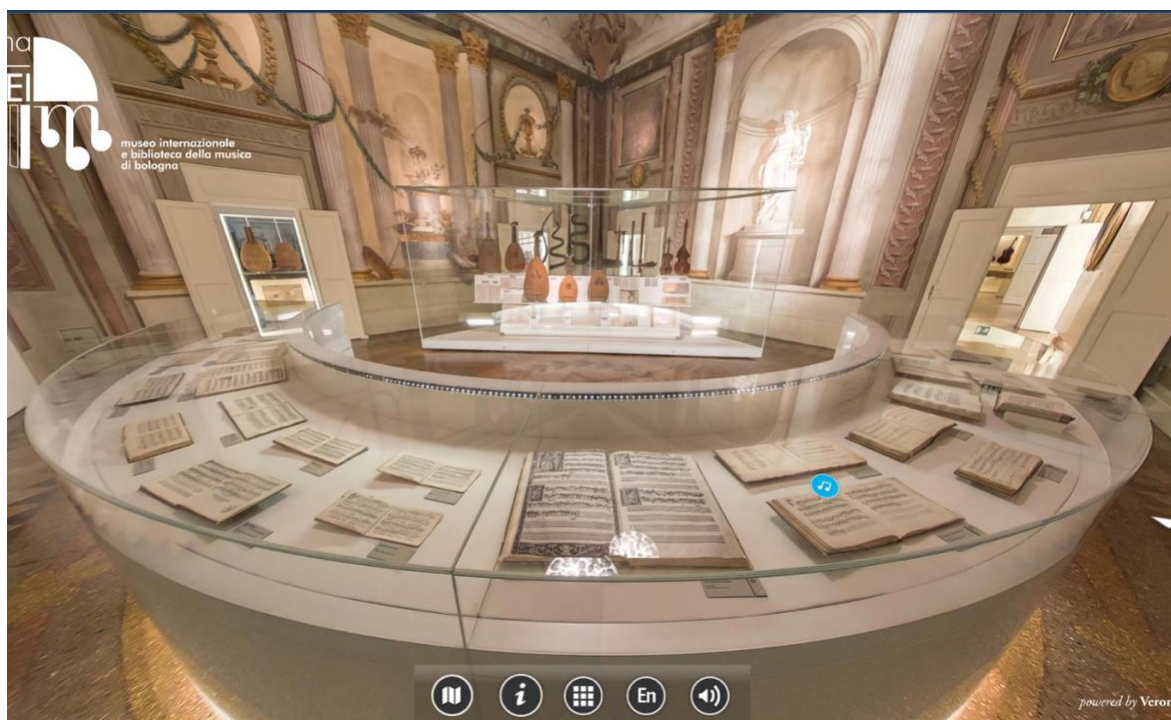


Figure 1. Room 5 of the permanent exhibition.

### Star assets

In the museum's collection, the most notable documents would be the first ever printed music score, produced in Venice by Ottaviano Petrucci in 1501, and young Mozart's own autographs, intended for the review of his musical skills by Martini himself. Lastly, amongst the rare and impressive instruments exhibited, the most unique one (also highlighted in the museum's brochure guide) is the original Clavemusicum Omnitonum of 1606, the only surviving specimen of the "perfect keyboard", equipped with 33 keys per octave, able to reproduce all the possible sounds according to the three genres of antique greek music (diatonic, chromatic, enharmonic).

### Target audience

Given the universal nature of our topic, and the fact that music is enjoyed by almost all people regardless of age and background, defining a target audience for our project was challenging. Therefore, we further investigated the benefits of music with regards to the physical, cognitive, and social-emotional development, and found that since childhood years are central in those domains, the ideal target group for our experience is children and teenagers aged 8 to 16, without however excluding older age groups.

# Institutional goals of the Museo Internazionale e Biblioteca Della Musica

## Education

Education is the primary goal for our proposed experience, which was formed with the following question: how can a museum that hosts only *tangible* cultural heritage objects—books, instruments, and figure paintings, provide a meaningful and interactive experience on the complex *intangible* cultural heritage that is music? How can one convey music as means of self expression, of finding purpose, as a form of identity? It is our vision that MUSEscape can effectively introduce these more complex and deep understanding aspects of musical culture to the visitor, so that the exhibition can gain an alternative, more profound meaning.

## Marketing

As for our second institutional goal, we would like to highlight and increase the value of the connection of this museum with another institution, the **Teatro Comunale di Bologna**. We chose to take advantage of the existing alliance between these institutions by making the theater present in the visitor experience, with the aim to support their mutual sustainment and collaboration in the divulging of the history of **Opera in the city of Bologna**, especially for young individuals who are often skeptical about this art domain. The museum itself has dedicated two of its rooms to the Opera in the 18<sup>th</sup> and 19<sup>th</sup> century and holds the autograph manuscript of “Il Barbiere di Siviglia” by Rossini.

Thus, as a way of enhancing the cooperation between the two institutions, we have imagined to give as a prize for winning the game a discount on the opera tickets for a play of the opera season. It would represent the possibility of approaching this kind of spectacle for kids and also a desirable prize for anyone interested in this fascinating world.

Our second goal involves the obtainment of a larger audience also within the city: Bologna is a place full of different cultural stimuli that could overshadow the little cultural treasures present in this museum, like the first printed partiture which is the oldest exemplar, valued at 13 million euros, or the written examination of Mozart for the Accademia, together with many other important objects, like the rare and beautiful musical instruments. Therefore, as a secondary aspect of this goal, the experience we have projected wants to catch the attention not only of the tourists, but of the citizens and inhabitants themselves who still are not fully aware of this particular shade of their city.

Furthermore, offering experiences that match the interests of its target audience, the Museo could better take advantage of its potential. A successful museum can indeed be described as “one that integrates marketing fully into the strategic planning and budgeting process. All audience oriented efforts are then done with the visitor in mind, and visitors’ wants, needs and behaviors are regularly researched and new programmes developed in accordance to them”.

An experience like the one we propose would be a way for the museum to focus on the audience proposing an entertaining and unique activity, capable of increasing its popularity



between kids and teenagers as well as music passionates, but not necessarily only among them. The dimension of the game would indeed capture the curiosity of whoever searches for new amusing activities.

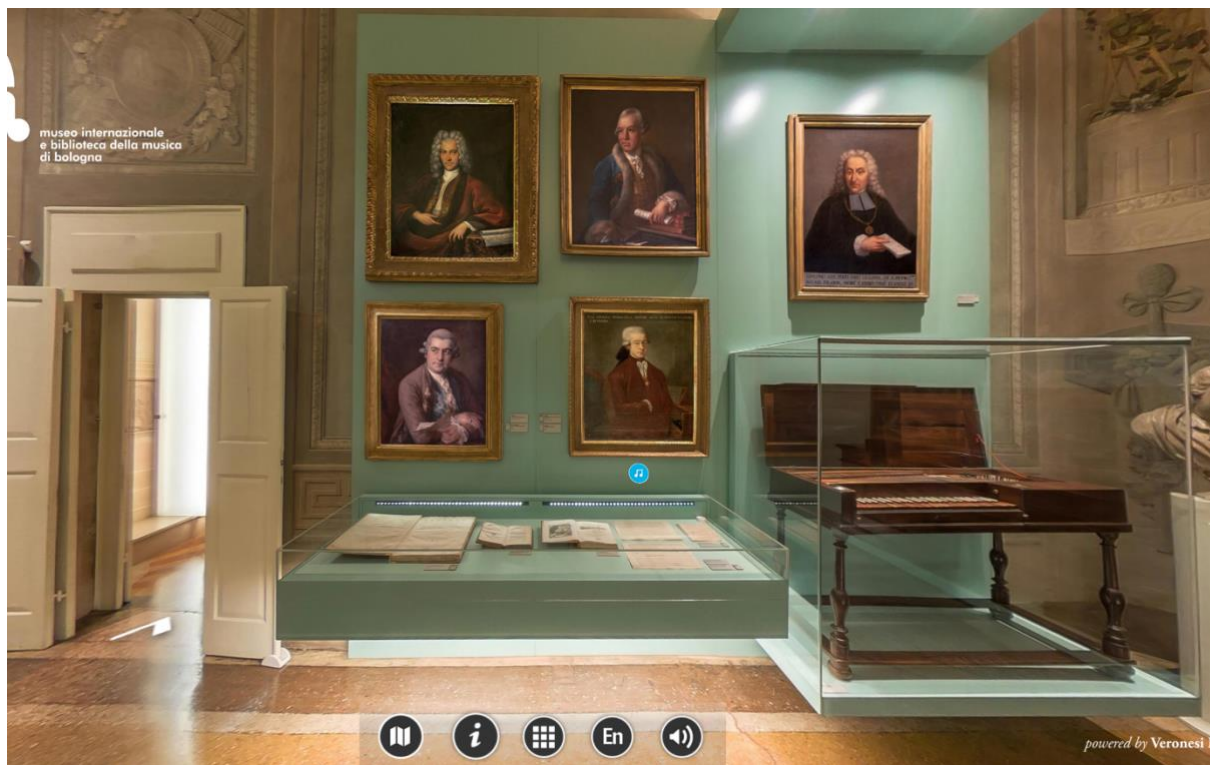


Figure 2. Room 2 of the permanent exhibition.

## Concept

### Conceptual Map

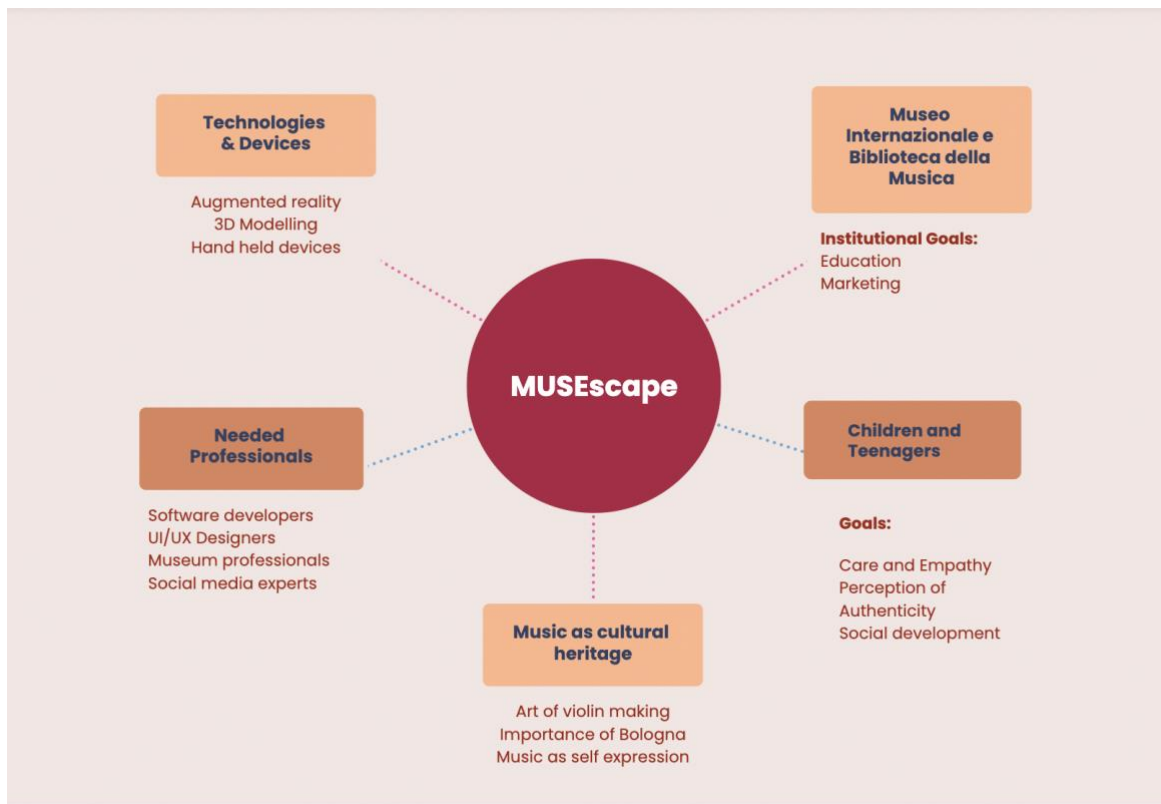


Figure 3. MUSEscape Conceptual Map.

## Museological Approach

To better define our application, we have tried classifying it on the basis of an established **taxonomy**. Following the *Taxonomy for virtual museums for the use of AVICOM professionals* by Simona Caraceni, we have identified the B category as the most appropriate for describing our virtual museum. Therefore we have a virtual museum enhancing museum **education** with **closed interaction** in a **closed space**, showing **selected objects** from the museum collection and **not allowing visitor contribution**.

The relationship between virtual and real is used to represent in a digitized form and space real objects. Within our application, the user will experience the addition of a virtual dimension to the existing and perceivable real one. Therefore we would define this interaction as a “**virtual on real**”.



CATEGORY	NEED TO BE ENHANCED	INTERACTION (open/closed)	SPACE (open/closed)	CONTENT	VIRTUAL/ REAL	VISITOR CONTRIBUTIONS (allowed/not allowed)
A	MARKETING	Open	Closed	Selected objects	Virtual on real, virtual with real	Not allowed
B	EDUCATION	Closed	Closed	Selected objects	Virtual on real	Not allowed
C	EXHIBITION	Open	Closed	Selected objects	Real with virtual	Not allowed
D	COLLECTIONS	Open	Open	All collection	Virtual with real	Not allowed/Allowed (*)
E	INTERPRETATION	Open	Open	Selected works/ all collection	Virtual with virtual	Allowed
F	EXPERIMENTATION/ COMPLEX MUSEUM IDENTITIES	Open	Open	Selected works/ all collection	Virtual with real	Allowed

Figure 4. Taxonomy of Virtual Museums -Caraceni, S. (2015). *Designing a taxonomy for virtual museums for the use of AVICOMM professionals*, Plymouth: Plymouth University.

## Experience design

### CH Topic focus

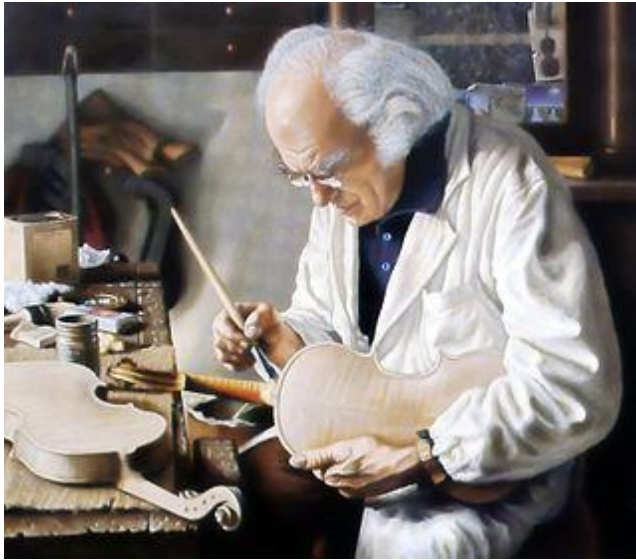
Starting from the -somewhat- underrated musical history of the city of Bologna, our project's main focal point is Italy's tradition in the art of creating bowed string instruments; a unique process requiring impeccable technique that is transferred from teacher to apprentice, which includes the assembly of more than 70 pieces of wood around an inner mould by hand, without the use any industrial materials. Around the country, the *maestri liutai (master luthiers)* produced some of the finest lutes and violins ever made, amongst which the world-famous Stradivari violins. Indeed, UNESCO, in 2012, included the ancient tradition of Cremonese violin making in the list of the **Intangible Cultural Heritage**, with the aim of safeguarding the craftsmanship skills and knowledge of these worldwide famous violin makers. Even though the art of violin making is still being handed down over time, the advent of the rival industrial production, faster and cheaper, is a very real danger for this historic cultural practice.

Although not as renowned as Cremona, starting from the fifteenth century the city of Bologna was known as a center of production of good quality musical instruments. This tradition was brought back up in the twentieth century thanks to Gaetano Pollastri and **Otello Bignami**. Mr. Bignami (1914-1989), who distinguished himself in the production of musical instruments, became the director of the "Scuola di Liuteria Bolognese", and was the teacher and point of reference of all the lute makers in the city in that period. Fortunately, its artist studio (previously located in Via Guerrazzi, 10) was not lost: it has been fully reconstructed by the **Museo Internazionale della Musica** di Bologna and plays a key role in our interactive experience.

### Cognitive and Emotional Goals

MUSEscape's primary cognitive focus concerns meaningfulness, **emotions** and **empathy**, and secondarily, **attention and perception of authenticity**. As we can read in "Key Concepts of Museology", "*The museal object is made to be seen, with its whole mass of implicit connotations, because we can display it in order to stir emotions, to entertain, or to teach.*" The interaction with real and AR objects and figures in our application is finalized to generate feelings of care and empathy in the visitor, but can furtherly invoke the visitor's engagement

and change of mindset regarding musical heritage. This project is carefully designed primarily based on the traits of young children and teenagers, both as individuals and as museum visitors, and aspires to achieve cognitive and emotional goals striving for a meaningful perception of musical cultural heritage, and also to support their further education and multi-faceted development.



A fundamental goal of our application is to increase the visitor's care and empathy for the profession of music artisans and especially for the “**maestri liutai**”, the luthiers belonging to the ancient and now endangered “Scuola di Liuteria” in Bologna. We hope to inspire the visitors' awareness of the risk of losing these precious cultural jobs and of the importance of preserving the ancient tradition of string-instrument making, with all the heritage of techniques and methods that have been transmitted from generation to generation.

Figure 5. **Otello Bignami** portrait by Gioacchino Passini in his Bolognese atelier in 1983.

The experience we propose is a way to introduce visitors to Otello Bignami and his colleagues' profession and its meaning in the cultural heritage domain. The presence of the reconstruction of a laboratory of this important “liutaio” gives a relevant chance to gain attention on this topic and generate a sense of care and interest in the visitors by making them closer to this reality.



Figure 6. Replica of Bignami's studio inside the Museum.

Another aim is to make the visitor develop a sense of **historical empathy** for the famous **musicians** connected to the city of Bologna, whose history is documented by the objects exposed in the museum. Taking in consideration the link they have with the city would enhance

the audience's awareness of the importance of Bologna in the development of musical art and a sense of genuine curiosity for the artists and composers and consequently for their works and music. Museo della Musica helps us in discovering that many composers, among which Mozart, have been students at the **Accademia Musicale di Bologna** or have lived part of their life in this city and in the surrounding environment, like Rossini and Verdi.

According to “Key Concepts of Museology”, *the purpose of informal education is thus to develop the senses and awareness; it is a development process which presupposes change and transformation rather than conditioning and inculcation, notions it tends to oppose.* Our proposed experience presents music from different points of view: firstly, as a practice which contributes to creating the elements composing our cultural heritage. All the work Martini did devoting himself to music, studying and teaching it, but also collecting the material exposed has not only been guided by passion, but also by the awareness of the importance of this field of studies and of its practical execution. The musicians presented in the Museum and Martini himself, can be **figures of inspiration** for the visitor to reflect upon the meaning of the musical activity, whose presence in human culture is very deep-rooted and ancient, and has never lost its ancestral attempt of expressing emotions.



Figure 7. Some of the portraits of musicians inside the exhibition.

## Development

### Narrative

#### Starting point

The start of the game is at the reproduced studio of Otello Bignami, located on the ground floor and separate from the rest of the exhibition. It is there where the teams will be formed and introduced to the game: an escape room that can be solved with small tasks, with the aim to find a hidden treasure inside the museum: the lost treatise of the luthier, containing a very detailed manual of the art and secrets of violin making; the one manual that can help restore this ancient craftsmanship before it goes extinct. Therefore, the game's starting place serves as a space to **immerse** the visitors in the final quest, and further induce their **empathy** after having a first-hand experience with Bignami's environment.

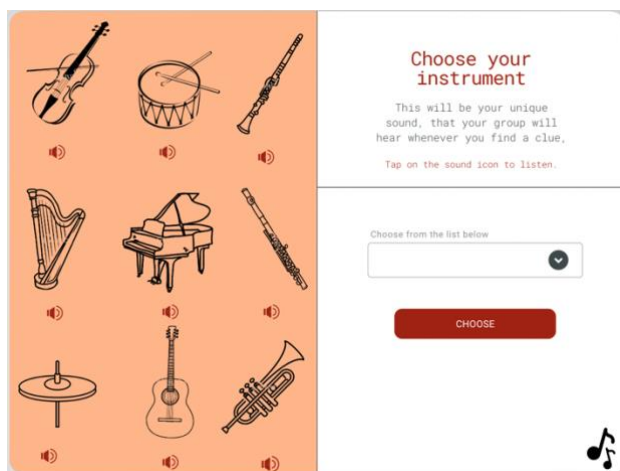


Figure 8. A graphic representation of the application's initial tasks.

#### Personalization

Before the game begins, each team member will customize their character. This process also includes their choosing an instrument that they like or feel that it best describes them, assigning them a **unique sound** that will be transmitted to all the member's devices when someone completes a task.

#### Solving tasks

Once the team is formed, they move on to the first floor where the music exhibition is hosted, and the closed-interaction experience begins: every time they enter a room, they hear a short description of the historical era, related figures, and the room's most important objects. After the description they are prompted to solve a small task which will allow them to unlock the next room and proceed with the storytelling. Using a handheld device, they can all point to specific objects inside the exhibition and tap on the screen to select them as clues. For each task, specific information is revealed to each team member which points them to a clue they have to find inside the room. This choice is meant to **make the members more dependent on each other**, which will maintain team communication and collaboration in spite of the device-based nature of the game.

A simplified twine story of our project can be accessed [here](#).

## Interaction between the project and the users

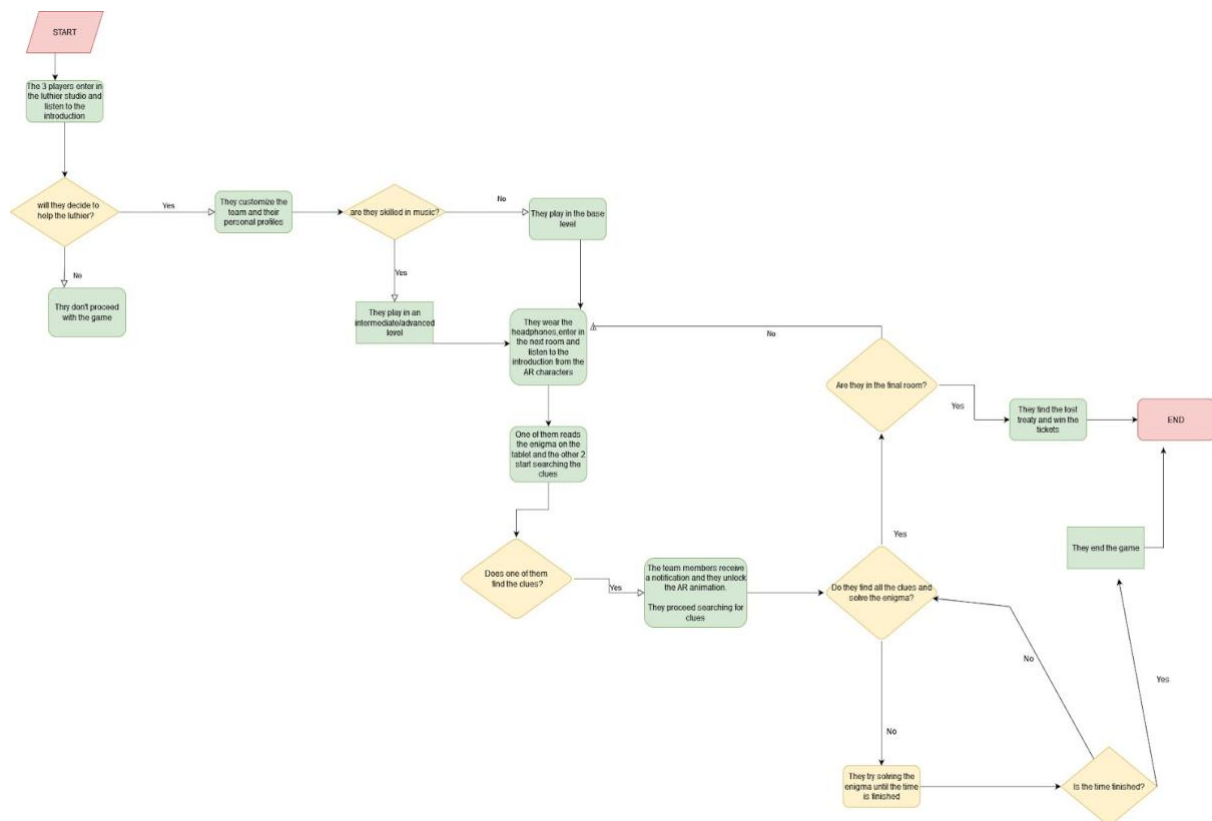


Figure 9. Interaction diagram in flowchart form.

## Development to reach the cognitive focus

As a most appropriate technology for our application we chose Augmented Reality, for the animating the portraits and the sculptures representing the artists, and the objects that will serve as clues. The musicians would directly call on the participants of the game, revealing them some details about their personal history, aiding to their perception them as close, real people with their own stories. This would make it possible to concentrate on historical and cultural aspects through **informal learning** thanks to the aid of **Human Computer Interaction**.

The technological component of this AR experience would indeed mix with the emotive one and generate a sense of presence, while still maintaining contact with the physical space. This way of “meeting” the paintings is meant to be capable of involving the emotions of the visitors, adding meaningfulness to their activity and evoking empathy feelings in them.



## Detailed design for the structure, content and development of MUSEscape according to goals

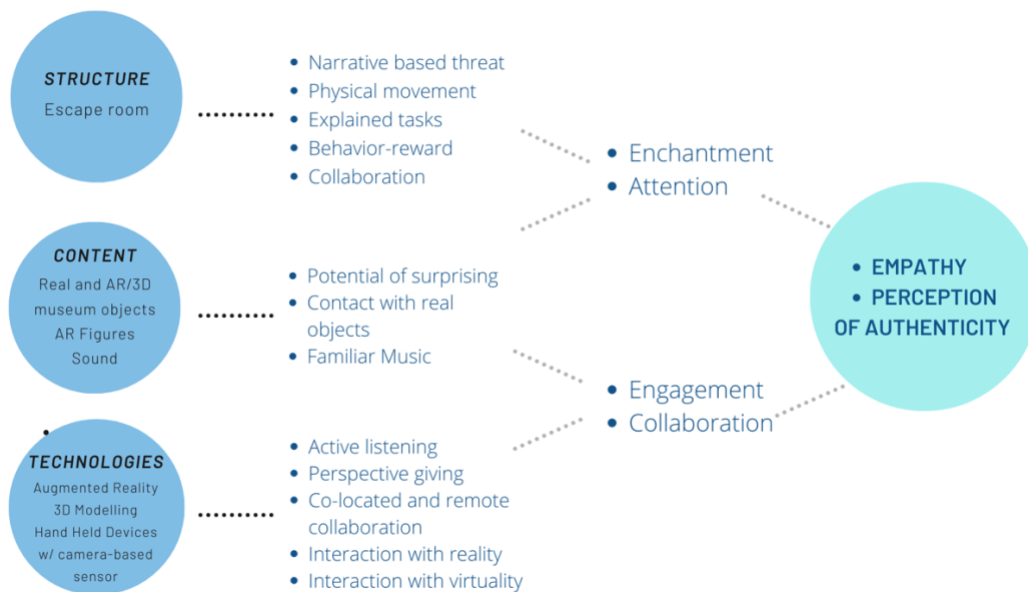


Figure 10. Map of the development to reach the cognitive focus.

### 1. Attention:

The first thing we need for an emotional engagement is attention. Therefore, MUSEscape experience implements **Persuasive Technology** features, used with the goal of educating the visitors. Attention is indeed researched through the following features:

- **physical movement** – since the experience happens in the closed space of the museum, players can keep the contact with museum space, using their app for investigating the museum's objects by pointing at them. In order to unlock the AR features of exposed objects, visitors have to get close enough to them. This physical approach points to get closer also mentally to the objects.
- **explaining tasks** through the AR characters before the players start solving the enigmas- It starts catching their attention and making them concentrate on those tasks connected with CH without being distracted by other thoughts.
- **playing familiar music**- in the customization phase, each player will choose an instrument in which identifying himself. This will associate to him and his device a melody played with that instrument. The melody, which is the same for all the players, will be reproduced by their smartphones each time one of them finds a clue and frames it. This will make the music become familiar and catch the attention every time it is played.
- **behavior-reward mechanism** - the way the escape room works motivates the participants to concentrate on their tasks for unlocking the next step. Therefore, the finding of each clue makes them closer to their reward: managing to escape from that room. In addition to this, each clue found unlocks an AR animation, which acts as a little reward for having been able to discover the clue in the room.

## 2. Historical Empathy

By means of Augmented Reality technology, visitors will encounter prominent figures of musical history throughout the game, who will introduce the relevant features of the room and its tasks. This aims to generate a cognitive and affective engagement with historical figures, that will help in understanding and **contextualizing** their lives. This process of learning about the past by **taking the perspective** of the ones who populated it is connected with the development of a sense of **care** towards people and their activities.

The result of these coexisting factors (historical contextualization, perspective taking and affective connection) is meant to make visitors develop **Historical Empathy** towards the characters involved in the game.

A greater sense of **authenticity** should also be obtained from this activity, due to the induced emotion and perception through senses which gives a sense of real; we invite our visitors to experience music and instrument making as a form self expression, which involves real passion and dedication, personified in the legendary musicians of the past centuries.

## 3. Dialogue:

The goal of the adventure is to stimulate the mind, intuition and, last but not least, team building: collaboration between all participants is an indispensable factor in solving the puzzles and successfully completing the game. Therefore, **dialogue** is fundamental and powerful in experiences like this. Since the beginning in the laboratory of the violin maker, **team collaboration** is stimulated through the customization phase, which gives space both at the collective dimension and at the individual one, thus generating a conscious and positive sense of membership. Further on, the experience is built in a way that prompts for interaction between members themselves and with the 3D personas.

## 4. Enchantment approaches

### Potential of surprising:

The Escape-room visit to the museum is accompanied by a continuous **discovery** about Martini, his studies and the artists connected with him. His figure is indeed connected with interesting events and people, like for example Mozart himself, who came to Bologna to meet him and study with him as a teacher, in order to be admitted to Accademia Filarmonica, and his admission written proof is still held in the Museum. Making the visitors discover, through the clues present in the room, this little chapter of the history of a famous artist as W. A. Mozart has a **potential of surprising** them. Details will be revealed about the handwritten piece of paper which, although seems to have been written by one of the best musicians in history, contains the imperfections and mistakes of a young student who is still learning how to deal with composing, as happens with all individuals when learning music.

### Narrative based on threats:

Also, the red thread represented by the tale of the lost luthier's treatise and the initial depiction of the figure of luthiers in history are presented in connection with the risk of losing this ancient



craftsmanship. Perceiving the **threats** impending this activity lays the foundations of a will of **preservation**.

The dimension of the team and the limited time the players have for completing their mission will make them cooperate for reaching a final common goal, which consists of saving the lost treatise, the last chance to preserve the magic secrets behind the art of violin making, and of course to gain a sense of achievement.

#### **Lasting remembrance:**

Our choice of clues for the escape room is meant to draw more attention to specific objects that we deem both as star assets of the museum, but also items that can be often overlooked in an exhibition, such as books. Furthermore, using music to explore emotions can also affect episodic memory and help thus in transmitting the message more effectively, especially thanks to the auditory repeated stimuli conveyed by the app.

## **Requirements and foreseen workflow**

### **Research on the main target audience**

As previously mentioned, the focus of our project directly inspired the choice of our main target group: numerous studies on music education and music intervention have shown its beneficial effects in the educational, psychological, and sociological domain, and especially in learning ability and concentration skills, easing anxiety, and enhancing peer relationships and self-esteem. During the last decades there is an increasing interest in *music therapy*, an allied discipline that uses music-based experiences to address patient needs in one or more domains of human functioning, primarily in children. While the proposed interactive experience can be considered neither as a music course, nor as tool of music therapy, it inspired us to create an application that would strengthen teamwork, sense of belonging and self esteem.

During the design process, we tried to examine in depth the traits and motivations of our target group. On one hand, we consider the age group of children and young teenagers one of the most receptive to an interactive museum experience, given that they are intrinsically curious and for the most part, eager to engage in teamwork activities where they can feel entertained but also gain a sense of belonging.

On the other hand, we paid special attention to the fact that children have a much shorter attention span than adults and can be easily distracted, and our proposed museum experience would have to be tailored in a way that is both meaningful and entertaining. This was an important parameter for constructing our experience as an escape room: besides its function as potential threat narrative medium, a collaborative game is a very familiar concept for our target group; From a young age, engaging in games with other kids is a very common pastime activity, and simultaneously, a foundational active learning method leading to impactful knowledge through the involvement in complex activities. We believe that our proposed experience structured as an escape room integrating museum objects is an ideal balance between education and play, and the utilized technologies allow for this combination to be adequately meaningful and entertaining.

## Choice of devices

Given the structure of our design, our primary audience and the layout of the exhibition space, as an operational device we chose that of a **tablet**, that is a more natural form of interaction for our users and require only basic operational skills. Tablets, in addition to being small and light, can support all the necessary hardware for AR, including a display, camera, graphics, GPS compass, and accelerometer. The application will make use of the camera sensor in order to activate the AR figures.

This choice also aims to:

- Handle different capabilities that may occur in visitors within our main target group
- Support maximum engagement with the exhibition and maintain collaboration within the teams

## Next steps and needed professionals

### 1. Coordination with institutions

- Museum professionals, Marketing and communication experts

### 2. Creation of prototype

- UI/UX Designers
- Sound specialists for sound patterns
- Software developers proficient in AR integration for handheld devices

#### Hardware

- Tablets (HHD) with processor, display, camera and microelectromechanical systems (MEMS) sensors with an accelerometer and GPS.
- Headphones

#### Technologies

- Blender/Meshlab for the historical figures and augmented objects

### 3. Prototype testing – monitoring of behavior, interviews

### 4. Optimization through iterative development

### 5. Creation of dedicated page linked in the museum website.

### 6. Social media campaign

- Marketing and social media experts of both institutions

### 7. Deployment and publication

### 8. Museum personnel to monitor the experience and for safety and anti-theft measures.

## Further development and maintenance issues

A step further step to maximize the immersiveness of the experience would be the introduction of Spatial AR inside the replica of Bignami's studio and during the path from the entrance to the first floor using 3D projectors. The interaction could also be enriched with the use of **smartglasses and headsets**, hands free interaction via **gesture and voice recognition**. **However, we chose to not include them** in order to make the project more affordable and to favor the contact with the real exhibition of the museum which on its own shows a unique complexity and musical heritage wealth.

With regard to maintenance, we foresee that a hardware professional should be available when needed to control the operation of the devices, and that the social media of the institutions should continue to promote the experience on a semi-regular basis.

## Disrupting the design

### Scenarios of vast diversity among groups

Of course, we had to consider the diversity of our target group. Between the ages of 8 and 16, there is a vast difference in abilities like critical thinking, strategic response. Additionally, it is a fact that our interactive experience is designed in a way that will introduce basic things to the audience, whether they are fond of music or not. However, it is very possible that some of the individuals visiting the museum already have knowledge of musical history and theory, in which case the proposed experience would be of less interest to them. To deal with this, we propose that our escape room should have three levels of ascending difficulty, each corresponding to both the age range and the musical skills of our target audience.

In detail, the levels would be as below:

**Level one:** primarily aimed at: young children, individuals with no music skills (tasks will involve mainly the active recall of information from the narration, and the interaction with museum objects).

**Level two:** primarily aimed at: young children and individuals with basic music skills tasks (tasks will also include the identification of music notes and melody reproduction).

**Level three:** primarily aimed at: young children and individuals with more advanced music skills (tasks will include the writing of music notes and skills in melody and harmony).

The choice of each level will be unrestricted and the role of the museum guide is only to answer possible questions regarding the difficulty and provide suggestions to the group. Thus, in the event that a team has members of various ages and music abilities, they can freely decide which level to choose.

## Possible disruption of other museum activities and visitors

Our proposed idea inside the exhibition area of the museo could inadvertently lead to the disruption of other visitors' experiences. As a way to integrate the escape room inside the museum activities, without sacrificing its interactive nature, we propose to have the game displayed in dedicated hours.

## Accessibility

We have foreseen that participants with hearing or vision impairment will sadly not be able to enjoy the experience in its full capacity; to manage this, we propose an adaptation of the experience according to each case (implementing more visual text or audio descriptions), that will allow them to contribute equally, and follow the game's flow which is in every case based on collaboration. Regarding kinetic disabilities of other kind, we found that the exhibition space layout and the inclusion of personnel for monitoring is appropriate.

## Member roles

The workflow was shared to a great extent regarding the design of concept and interaction methods, the implementation of technologies and development of twine narrative. The following tasks were divided:

Chloe Papadopoulou – Research on target audience, cognitive and emotional goals, disruption of design, creation of conceptual maps.

Loredana Salvatore – Research on Institutional goals, description of the specific development techniques applied obtaining the cognitive focus, and user – experience interaction.

## Additional material

A sample of the experience developed as a [Twine narrative](#).

## Bibliography

Caraceni, S. (2015). Designing a taxonomy for virtual museums for the use of AVICOMM professionals, Plymouth: Plymouth University.

Liddiard, E. and Rose, D. (2021). A Pilot Study of an Intervention for Children Using Music Listening and Music Making to Explore Core Emotions and Support Wellbeing. *Open Journal of Social Sciences*, **9**, 329-364. doi: [10.4236/jss.2021.93022](https://doi.org/10.4236/jss.2021.93022).

L. Turchet, R. Hamilton and A. Çamci(2021). Music in Extended Realities. *IEEE Access*, vol. 9, pp. 15810-15832, 2021, doi: [10.1109/ACCESS.2021.3052931](https://doi.org/10.1109/ACCESS.2021.3052931).

Li K, Weng L and Wang X (2021) The State of Music Therapy Studies in the Past 20 Years: A Bibliometric Analysis. *Front. Psychol.* 12:697726. doi: 10.3389/fpsyg.2021.697726

Desvallées, André, and François Mairesse(2009). *Key Concepts of Museology*. Paris, Armand Colin.

Bekele MK, Champion E.(2019). A Comparison of Immersive Realities and Interaction Methods: Cultural Learning in Virtual Heritage. *Front Robot AI*. doi:10.3389/frobt.2019.00091

L. Vygotsky(1976). *Play: Its Role in Development and Evolution*, Chapter Play and its Role in the Mental Development of the Child. Penguin Books, New York. pp. 537–554

Wikipedia contributors. (2022, July 2). Luthier. In *Wikipedia, The Free Encyclopedia*. Retrieved 19:01, July 5, 2022, from <https://en.wikipedia.org/w/index.php?title=Luthier&oldid=1096194592>

All images of the museum exhibition and the Virtual Tour belong to the Institution Bologna Musei and the Museo Internazionale e Biblioteca della Musica.