

UnlockArt: Cultural Mediation at the Museum Through an Augmented Reality Escape Room

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Abstract: In the context of a museum, cultural mediation facilitates access to the works of art for the visitors which not always share the culture the pieces of art come from. Tools and resources such as catalogs, guided tours, or the work of the curators are all part of the museum's cultural mediation, which highlights and informs the visitors of the works on display. In this case study we present the game design process and results of UnlockArt, a project developed as a cultural mediation tool at the Museo delle Culture (MUSEC) in Lugano, Switzerland. The project studied and applied the educational escape room format to enhance the museum experience for visitors, and to encourage the younger ones to approach the collection through a ludic activity. By the means of the Star Model (Botturi and Babazadeh, 2020), the project designed an educational escape room for the "JAPAN. Arts and Life. The Montgomery Collection" exhibition, a collection of Japanese objects from the period between the 12th and the 20th century. Educational escape rooms are a format that works well in class, but may be burdensome to apply in a museum, which intrinsically imposes many constraints. Players should be silent, the escape room should always be ready to be played and easy to be rebooted, and it should not impact the exhibition for visitors that wish not to engage in the experience. For this reason, we opted for an augmented reality educational escape room (AR EER) which can be played on tablets. Such approach only requires QR codes placed around the exhibition, which hide puzzles and hints tied to the works exhibited in the museum, and does not need any rebooting phase as the puzzles are to be solved in augmented reality.

Keywords: Cultural mediation, Museum escape room, Augmented reality, Game design

1. Introduction and Background

UnlockArt is a project at the intersection of cultural mediation and game-based learning through Educational Escape Rooms (EER).

Cultural mediation is the act of mediating the access by people from a culture (e.g., Western European) to a different culture (e.g., Japanese). In the case of a museum, cultural mediation takes the form of catalogues and brochures, guided tours, and the work of the curators while preparing an exhibition.

The concept of EER has been broadly studied in the past, with a vast body of research ranging from kindergarten to higher or adult education (Fotaris and Mastoras, 2019). EERs are usually played in class, with medium-to-large groups of players, with well-defined educational objectives and with the teacher/lecturer acting as game master.

In this project we tried to adapt the EER format to the museum context. Such context poses many constraints and differs from both the classroom experience of EERs and the entertaining experience of commercial escape rooms from the point of view of players (number, age, skill level), play areas, locks, learning goals, and entertainment. UnlockArt has been developed to be played throughout an entire exhibition, as the puzzles refer to different works exposed, and had two main objectives:

- Promoting the exhibition through a novel entertaining activity that can be experienced while visiting the museum;
- Providing visitors with more insight on some of the works on display while playing.

Researchers have explored the idea of using technology and augmented reality (AR) within EER experiences to gamify the museum experience in different ways. Koenig et al. (2022) presented a similar work on creating an escape room for cultural mediation in order to foster curiosity in arts and culture by the visitors in a museum. Antoniou et al. (2019) proposed a digital escape room recreating (some of) the museum environments to attract visitors to a peripheral museum which can be played on a Web browser. McFadden and Porter (2018) proposed an AR ER pilot for the Minneapolis Institute of Art, while Vicari (2020) proposed an AR ER designed by the students to be played at the American Museum of Natural History to support astronomy learning using HoloLens.

UnlockArt was developed for the Museo delle Culture (MUSEC) in Lugano, Switzerland from 2021 to 2022, targeting the "JAPAN. Arts and Life. The Montgomery Collection" exhibition, a collection of Japanese objects

and memorabilia from the period between the 12th and the 20th century. The application was developed for tablets that were distributed when visitors entered the exhibition. Through QR codes scattered around the exhibition, visitors could solve riddles to save Mr. Montgomery from a curse. Quizzes and riddles were tied to the objects exhibited in the museum, requiring visitors to discover and use basic information about what they were observing in order to solve the riddles.

2. The UnlockArt Design and Development

UnlockArt was born as a cultural mediation project with *Museo in erba*¹, a museum in Lugano, Switzerland, which offers interactive exhibitions and laboratories for kids and young adults. The project aimed to develop an AR EER for the Museo delle Culture (MUSEC) in Lugano, one of the most important museums of the city, as a cultural mediation tool. The main idea was to develop an entertaining and exciting activity in a novel format in order to attract new, and – especially – young visitors, which so far represented only a minor share of the museum's visitors. The escape room format was found to be an exciting and fun way to live the museum experience through an overarching narrative and riddles related to a specific exhibition. Yet, this format is not really suited to be played in a museum: hiding riddles, locks, and hints among expensive pieces of art may be difficult as participants may mistake a piece of art for a part of the ER. Moreover, the experience should not tamper the exhibition itself, and more importantly other visitors that may want to enjoy the experience without playing the ER. Locks may be opened and never closed, thus other participants may arrive and find open locks and already solved riddles, or hints could be moved or taken away, making it impossible by other players to finish the experience and cause frustration.

For these reasons we opted to design an AR EER using a software that was developed during a Master thesis at our university (Geronzi 2020). The first part of the project (May-November 2021), aimed to design the EER given the constraints and the software capabilities. During the second part of the project (November 2021-June 2022) the software was updated and new puzzles were added as a support for the designed EER. The museum EER finally launched in September 2022 and was kept available until January 2023 at the museum.

2.1 The Design Phase

The design of the experience was based on the Star Model (Botturi and Babazadeh, 2020) (Figure 1) and was developed from May 2021 to November 2021. The learning and the narrative were designed by the Museo in erba, which was given the theme of the exhibition with images of the object that would be displayed. We then helped integrating the puzzles, to be sure to produce effective puzzles that stimulated the learning of facts and anecdotes regarding the exhibited objects. The game-flow and the equipment were part of the constraints of playing an EER in a museum.

Before starting with the design of the actual elements, we performed an analysis of the context elements of the escape room: players, constraints, debriefing, and evaluation.

2.1.1 Context elements

Players. Our aim was to build an accessible activity for cultural mediation that would be exciting for kids and adults and that would attract more visitors to MUSEC. For this reason, we decided to aim for a fun narrative, which would not result boring for young adults and adults, and have puzzles that could be tricky to solve. To help less skilled players we decided to implement a hint system (which was not yet implemented in the AR ER platform) within each puzzle. Given the fact that multiple players would be playing the escape room in series, we decided not to have puzzles that required to move QR codes around: each puzzle was tied to a single QR code, which was hanged to the walls of the exhibition.

Constraints. Given the nature of the museum, we had many constraints to keep into account before starting the actual design. The main constraints revolved around the fact that we wanted an experience that could be *lived* while visiting the museum. For this reason, we could not aim for a standard escape room with padlocks and locked doors because that would tamper the experience for other players if there was no Game Master ready to reset all the locks. This could create bottlenecks and frustration for the standard museum visitors. The AR nature of the chosen solution allowed us to design an experience that does not need a Game Master to reset the room, because all the puzzles would be solved on a portable device. Moreover, we decided not to have a timer in order to avoid players running around the exhibition to find clues and missing pieces of

¹ <https://www.lugano.ch/vivere-lugano/cultura-e-tempo-libero/musei/museo-erba/>

information, ruining the experience for themselves and possibly to other visitors that decided not to play the game.

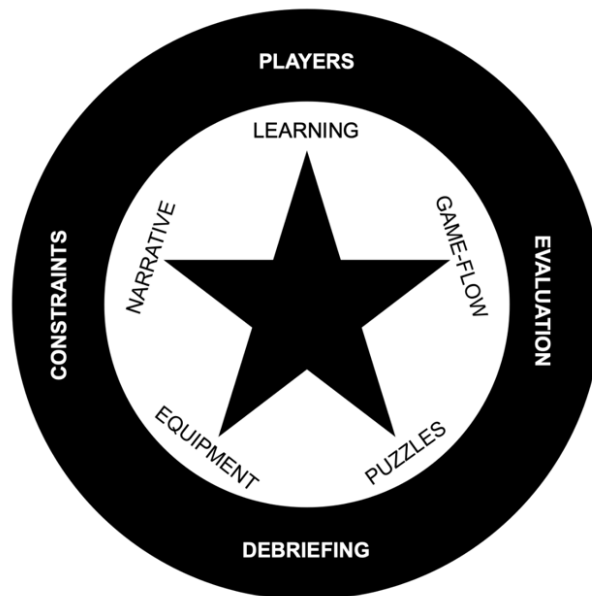


Figure 1: The Star Model for educational escape room design (from Botturi & Babazadeh, 2020).

For this reason, we also refrained from designing and integrating sounds in the experience. To avoid problems with application compatibility we decided to distribute the application on ten tablets available at the university and lend them to the museum. The number of tablets turned out to be sufficient as not more than 7-8 (groups of) visitors per round requested to play the experience. Once the visit was over, it was sufficient to close and reopen the app for the next players.

Evaluation. In order not to further inquire the visitors, it was decided not to prepare a post-experience survey for the participants. The players were informally asked about their experience by the museum staff at the end of the visit and some informal feedback was gathered and shared with the researchers and the Museo in erba staff.

Debriefing. We planned no debriefing for the activity, as that would have been unnatural in the museum setting. The debriefing was implicit in the application, which included an in-depth description of the solutions with respect to the associated pieces of art.

2.1.2 Design elements

Narrative. The narrative describes how the owner of the collection, Jeffrey Montgomery, has been possessed by a *tanuki*, a Japanese supernatural being. The only way to save Jeffrey Montgomery is to find all the pieces of a kimono that, once wore, will free him from the tanuki. The pieces of the kimono will be unlocked as the puzzles are solved and stored within a virtual backpack. The last puzzle will require the players to have collected all five pieces of the kimono that will be used to solve the puzzle. The kimono puzzle is tied to a real kimono displayed in the exhibition, as other puzzles in the EER with respect to other pieces of art.

Learning. By tying the puzzles to elements of the exhibition, players needed to understand what they were looking at during their visit in order to solve the puzzles. For example, the kimono puzzle needed the players to closely look at the real kimono shown in the exhibition in order to put its pieces together (Figure 6). Visitors were given a brochure at the beginning of the visit: this brochure also contained helpful information to solve some of the puzzles. Players were invited to play while visiting, but also taking into account the information in the brochure. At the end of every puzzle, an in-depth description of the related piece of art was offered for participants that were curious to know more.

Puzzles. The puzzles were all related to the art exhibited in the museum. For example, besides the final kimono puzzle, one puzzle asked to find the differences between a piece of art shown in the exhibition and a version that has been modified by the tanuki on the app. The player had to look closely in order to find the differences

from the original (Figure 2). One puzzle required to decipher a *haiku* (a Japanese form of poem), another asked to discover the materials an exhibited backpack was made of. Other puzzles were related to counting a certain number of elements within exposed art, or assign the correct object to its everyday usage. To solve the puzzles, it was sufficient to carefully read the label description, or the brochure information. The puzzles fit in the narrative through the tanuki gimmick: the tanuki was making a mess in the collection of Jeffrey Montgomery, and players were tasked to fix the mess while looking for the pieces of the precious kimono.



Figure 2: The piece of art showing horses with some errors to be found

Game-flow. We opted not to have a complex branching or open game-flow (Nicholson 2018). The museum exhibition was linear, thus we decided to opt for a linear and straightforward game-flow, aligned with the exhibition flow.

Equipment. The only equipment needed for the EER to be played were QR codes which were hanging on the walls of the exhibition, nearby the pieces of art which the puzzles were associated to (Figure 4). The exact position of the QR codes was decided with the curator of the exhibition, in order not to interfere with non-playing visitors.

Once the design phase was done, in November 2021 we started the development of the missing features in the AR ER application.

2.2 The Development Phase

The starting application, developed within a Master thesis in 2020 (Geronzi 2020), presented a simple subset of puzzles which could be used in a Web application which helps users develop their own AR (E)ERs. The application offered multiple-choice puzzles, password input, but also puzzles related to the order or position of QR codes, which we decided not to use. The required features analyzed during the design phase included:

- A new graphic skin for the application, Japanese-themed (Figure 3, Figure 4);
- a drag-and-drop puzzle (Figure 4);
- a "find the differences" puzzle (Figure 2);
- an "in-depth" button that let players know more about the puzzle they just solved;
- save-state of the game (if players would mistakenly close the application);
- hints system;
- English translation (Figure 3).

The development of the functionalities was done during Fall semester 2021 within the context of a Bachelor thesis and one semester project, and during Spring semester 2022 within a semester project done by two students. A total of four students worked on the above-mentioned improvements needed for the application to be used within the museum.

The application was originally developed using the Unity real-time development platform for the application side, and PHP for the Web application where users can generate their own (E)ERs. The Web app has been revamped in a recent Bachelor thesis, and now runs on Node.js. The AR EER for the museum has been deployed on Samsung Galaxy Tab A tablets which were distributed at the museum entrance. Visitors could borrow the tablets to play the escape room and return it at the end of the tour.

3. UnlockArt in Action

Upon starting, the application shows a splash screen with the possibility to change language and start the game, shown in Figure 3. Upon clicking on the start button, the narrative starts with a series of text boxes. Players are introduced to the AR system by scanning a first marker available at the entrance of the museum, which continues with the narrative and only requires the players to press a button. This was done in order for the players to gain familiarity with the system.

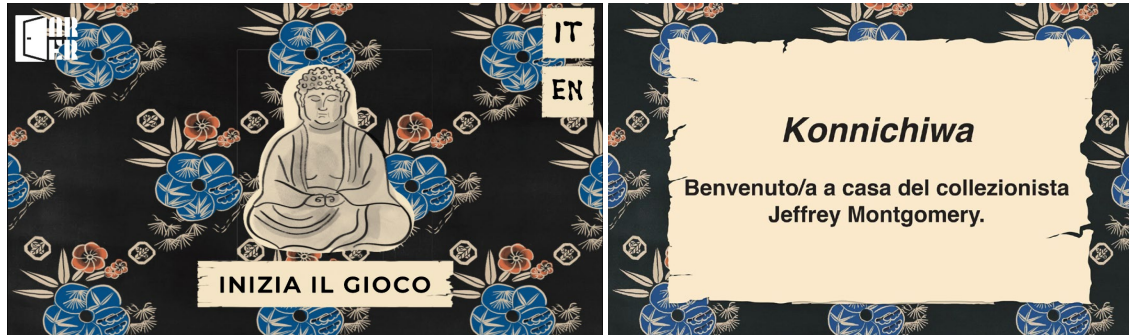


Figure 3: The starting scene of the game, where players can start the game or pick another language. The game then starts with the introductory narrative

The first puzzle was found in the following room, with a marker hanging close to a horse painting (Figure 4). The players were asked to find the differences on the image shown on the tablet with respect to the original.



Figure 4: A player interacting with the horse puzzle by scanning the marker near the painting

In the following room, players could find a series of different shaped backpacks and everyday utensils. The marker hanging on a wall asked the players to find a particular backpack in the room and, through a multiple-choice quiz, tell the material that was used to craft it. The answer could be found on the label of the object or on the brochure visitors received upon entering the exhibit.

In the next room, visitors could find four tall banners and a QR code. The code was hiding a Japanese haiku, made up by the game designers, which was a riddle that could be solved by closely observing the banners.

Near the end of the first floor, visitors could find a plate with a figure engraved on it and a marker. By looking at the brochure, or having paid attention to the previous room with no quizzes, visitors knew the figure engraved on it meant "longevity" (Figure 5).



Figure 5: Player interacting with the plate quiz. The tab shows the multiple-choice puzzle

The first upstairs room had a series of plates showing chrysanthemums, symbolizing longevity and royalty in the Japanese culture. Players had to understand the word for *Kiku* used in the riddle (chrysanthemums) and count the number of chrysanthemums on the plates in the room.

After one QR giving some insight to the players regarding their status in the ER and regarding the room they were visiting, the next puzzle required players to drag-and-drop everyday use objects in 1800 in Japan with nowadays items with the same usage.

The next riddle asked the players to find the number of the *futon* (a mattress) in exhibition given the description of the symbols on it, unlocking the final piece of the kimono. Finally, the final puzzle asked the players to recompose the kimono, that was torn apart by the tanuki, with which players were able to free Jeffrey Montgomery (Figure 6).



Figure 6: The kimono puzzle when all the pieces have been found

The narrative then concluded, inviting the players to tell their friends to try the experience at the museum.

4. Qualitative Feedback and Outcomes

In over a period of 4 months, the EER has been played by more than 2000 visitors and was overall a success. Visitors who experienced the game were happy and positive, and said they would tell their friends and family to visit the exhibition and to try playing the escape room. Players admitted that such an experience helped them to better observe details of the art exposed in the museum, and to be patient and take their time to learn about the various objects on display. Such comments are very important, given that Jeffrey Montgomery himself, the actual collector that owns the objects in the exhibition, used the same approach to pick the items for his collection in the first place. The museum staff was also happy with the outcome of the project and asked if it was possible to set up more escape rooms for future exhibitions that could also target families and young adults. Their hope is to increase the number of visitors to their exhibitions, lower the age range, and open up to families and young adults, as well as increase the engagement the visitors have while visiting MUSEC.

During the exhibition, the local television recorded a television service about the game². Figure 7 shows two frames.



Figure 7: The local television filmed a report of the AR experience at the Museum. The journalist was getting close to the marker in order to solve the horse puzzle in the first image, and was solving the banners riddle in the second

5. Conclusions and Outlooks

In this case study we presented the game design process and results of UnlockArt, an EER project developed as a cultural mediation tool at the Museo delle Culture (MUSEC) in Lugano, Switzerland. The project took approximately a year from requirements to deployment, from May 2021 to June 2022. After a testing phase, it has been deployed in the museum from September 2022 to January 2023, when the exhibition closed, welcoming over 2000 visitors.

The case study showed how to design an educational escape room in a context that is not a classroom, a university laboratory, or a company, but a museum, with a series of very important non-flexible constraints. It also illustrated the design process of an augmented reality escape room in the museum context. While this study only gathered informal feedback and was not supported by structured data gathering an analysis, we believe our work could give some important insights to escape room designers.

Escape rooms are a powerful tool that besides fostering soft skills (Reuter et al., 2020) can also assist the development of subject matter competencies and knowledge. Studies have shown how educational escape rooms can foster such development, with this case study we showed they may also help fostering knowledge that we learn within a museum exhibition. By gamifying the museum experience through augmented reality, we were able to create an interactive and entertaining environment for visitors, which could challenge themselves while visiting the exhibit. Our (educational) escape room can be seen as a cultural mediation tool, which could be applied in other contexts, such as architectural and historical sites.

Our case study also showed how, with the use of technology and augmented reality, we could design and develop an escape room within a set of very strict constraints, without interfering with other people's experience at the museum, yet offering a valuable experience. The key aspects of the design included how, by making use of augmented reality, we were able to skip the reboot phase of an escape room by just restarting the application. Moreover, we have shown how such approach, within the museum context, suits with a linear game-flow, which usually does not work in big classrooms where a branching game-flow works better. The narrative used real elements shown in the exhibition, making it feel more real and not only as a gimmick to motivate the experience. Lastly, by lending the tablets instead of asking visitors to download the application on their devices, we lowered the technological gap that could be intrinsic in such experiences and could be a deterrent for some less technologically-inclined individuals.

Visitors as well as the museum staff were positive about the game and asked for more, highlighting once again the power of this format.

We are planning to work on more experiences of this kind at MUSEC by including data gathering through the application, and more formal feedback by the users, which could help with future developments and studies in

² <https://www.rsi.ch/play/tv/il-quotidiano/video/il-quotidiano?urn=urn:rsi:video:15792037&startTime=1871> (in Italian)

the field. Open questions on how much the experience helped visitors to learn and how the experience may be conducive to other museum visits could be open questions in said formal feedback.

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