Linking archive materials through interactive storytelling for innovative spatial exhibition design in cultural heritage

The Surat Castle case study

Master Thesis

Laine Kaleja

Aalborg University Copenhagen
The Technical Faculty of IT and Design

The Technical Faculty of IT and Design
Aalborg University Copenhagen
http://www.aau.dk

AALBORG UNIVERSITY
STUDENT REPORT

Title:
Linking archive materials through interactive storytelling for innovative spatial exhibition design in cultural heritage

Theme:
Master Thesis

Project Period:
Spring Semester 2020

Participant(s):
Laine Kaleja

Supervisor(s):
Luis Emilio Bruni

Page Numbers: 85

Date of Completion:
May 28, 2020

Acknowledgments:
I would like to thank my supervisor Luis Emilio Bruni for his guidance and support throughout the project development. Furthermore, I would like to thank Sonal Mithal and the whole team from People for Heritage Concern for support to bring the project to its fruition in the Surat Castle.

Abstract:

The purpose of this project was to design a spatial interactive installation that can be used to enhance visitor experience at museums and also inspire the audience to visit the real historical places shown in the virtual environment. This project developed a case for the Surat Castle in India. The proposed solution is based on interactive storytelling, spatial design and natural interaction to merge the user experience of a museum with a congruent and engaging exhibition element. The solution was developed in Unity software with the Kinect sensor to provide natural interaction to the users. The storytelling was made interactive with the help of adaptive discourse and is based on the traveler diaries from the seventeenth century. Research revealed that current spatial installations invest significant resources into virtual reconstruction of the past environments and the applied storytelling often lacks an emotional connection with the museum audience. The developed solution successfully linked archive materials through interactive storytelling and demonstrated promising results by engaging the audience emotionally.

Contents

List of abbreviations CH - cultural heritage, PHC - People for Heritage Concern, VR - virtual reality, AR - augmented reality, UX - user experience,, UI - user interface

Chapter 1

Introduction

Motivation

The central motivation for this study was to bring a multimedia product to fruition in a museum in India. A case study for this project was conducted at the Surat Fort (also known as Surat Castle); this was possible due to the previously conducted project-oriented work with People for Heritage Concern (hereafter referred as PHC). PHC has been working on the Surat Castle renovation process since 2014 and has carried out a significant amount of historical research. As indicated on their website: "Our conservation ideology is to treat heritage as a resource for present-day and future development. Our design philosophy encourages subjective experiences of the visitors. We are dedicated to information dissemination and cultural education of the visitors about heritage sites. For this we develop innovative artistic methods to make historical research accessible to community." [1]

As part of my previous project work, an early prototype was developed in a short period of time and only the few resources available on the location were deployed. The prototype was built for a dedicated room inside the museum. The lack of multimedia presence are the core reasons to look closer into methods that can be applied to deliver high quality multimedia experience to the museum visitors. The aim of this study is to take the prior idea and its prototype to develop it further by designing methodology that integrates interactive narrative with spatial design congruent with cultural heritage data. The aim is to contribute to the current methods used in digital exhibition design and analyze how the resulting prototype can be generalized for other museums.

Another leading motivation factor was the information from the locals that Surat history is not part of school curriculum. Also, the absence of tourism guides and fundamental knowledge about the establishment of Surat showed how forgotten the historical significance of the city was. The museum appeared crucial to inspire children and locals to learn more about their own city.

[1] People for Heritage Concern http://peopleforheritageconcern.com/

Role of technology
Visitors passing by, shortly glancing at objects, running after children, or checking phone notifications are common in the technological era. How to engage visitors and bring value to their time in the museum is an important question to ask. Framework, introduced by Falk (2006), describes different factors that influence visitor motivation, which leads to a notion that not everyone will be willing, or able, to fully engage; nonetheless, this framework gives a baseline on how to design for museum visitors.

An interesting viewpoint is that creating dialogue and giving a platform for discussion should be the role of digital technology, not the 'one way' street of digitizing museum artifacts by simply offering the same content only on a different platform. People go to museums for different reasons and technology could be used to deliver personalized, engaging, interactive learning experiences that contribute to the existing exhibition by using the flexibility technology offers. (Barr, 2005)

Digital storytelling
Contemporary society encounters immersive media on every corner. A historical map from old times on a wall will bring little value if a more appealing approach to tell the story behind is not used. Bedford 2001 mentions that data is harder to remember, if not structured as a coherent narrative . Storytelling is part of being human; it helps to connect with the message on an emotional level. Stories help to create meaning as they give space for personal interpretation and connection with individual's past experiences. Storytelling plays a significant role in cultural heritage. Often, guides and educators are responsible for delivering the ultimate storytelling experience. However, museums have slowly started to recognize that technology could aid in delivering personalized, interactive narratives. Digital storytelling frameworks, such as Emotive (Katifori, Roussou, et al., 2018) have been developed to bring affective interactive storytelling into the field of cultural heritage.

Spatial design and multimodal experiences
Educational success and motivation to learn increases by involving multiple senses and actively participating in the learning process. Multimodal and spatial design offered by technology could be the key ingredients to provide engaging, interactive learning methods. The survey of emerging technologies in cultural heritage indicates that very few applications integrate multimodal and sensor-based interfaces (Bekele et al., 2018). It appears the cultural heritage field may agree with this theory, but is often reluctant to commit to novel technological applications.

Initial problem statement
Digital storytelling and spatial design are rarely combined in one experience and applied inside a museum. It is worth exploring if such a combined system offers any significant benefits compared to the more typical technology such as AR (augmented reality), mobile guides and interactive multi-touch displays. Therefore the question to ask is: *"How can*

spatial design and interactive narratives improve the existing dissemination methods in cultural heritage museums?".

Background research will be conducted in order to look closer at the suggested problem.

Chapter 2

Background Research

This chapter will look at the related projects and frameworks to determine what questions to ask in order to answer the problem statement, or to find out if the problem statement must be changed. This chapter will also mark the limits of the problem field and define the main pillars for further work.

The initial problem statement was derived from the notion that there is a general lack of large-scale spatial exhibition designs in the museum sector. The question was: *"How can spatial design and interactive narratives improve the existing dissemination methods in cultural heritage museums?"*. Problem statement was complemented with additional research question to assess how digital spatial exhibition design gives any advantage over other mediums such as mobile/VR/web solutions in regard to visitor experience.

After further research, it was clear that spatial solutions do exist, however they are still in their infancy and implemented only in few museums. Additionally, the wide variety of multimedia solutions led to an understanding that a clear category of technological applications has to be defined in order to delimit the research field of this project.

2.1 Categories of technological applications

The survey of augmented, virtual, and mixed reality for cultural heritage suggests that immersive technology use in cultural heritage can be categorized on the continuum scale from real to fully virtual applications. Augmented reality (AR) is used to add extra information onto existing museum objects, virtual reality (VR) with head-mounted displays (HDM) is most often used for fully immersive virtual exploration, whereas mixed reality and semi-immersive VR applications are in the middle of the continuum and combine the real and virtual environments. The survey also indicates that virtual exhibitions that allow group participation are less common in cultural heritage due to the emergent technology and the high costs of the solutions (Bekele et al., 2018).

It is true that the high-end CAVE^{TM} environment is still available only for scientific purposes, even with the price drop from 2 millions to 196 thousands USD (Manjrekar et

al., 2014). Deep Space (Kuka et al., 2009) is one of the rare examples based on CAVE^{TM}, where an interactive narrative was implemented for multiple users. However, few solutions using lower technical complexity with sensors and desktop projections have also been implemented and can be described as semi-immersive VR experiences. Research will look closer to the cases that have been implemented inside museums and can be defined as *virtual exhibitions or semi-immersive VR experiences*. It is also important to recognize if there are any patterns in the virtual exhibition design, which should be questioned and are possibly slowing down the wider implementation of such projects within cultural heritage.

2.2 Virtual exhibition design case studies

There are multiple case studies of virtual exhibitions which have been evaluated over the past years. Figure 2.1 summarizes the cases which will be analyzed further.

The earlier mentioned survey suggests that these cases are not widely spread, however at a glance it seems that they are successful examples of an interaction, which offers group participation, active learning and do not hide the interior of cultural heritage museums (Bekele et al., 2018).

2.2.1 Virtual world design

The survey by Bekele et al.(2018) indicates that common modelling method for VR is 3D data from current and historical time, where museums are focused on representing geometrical aspects of artifacts derived with high quality 3D scans. All the case studies shown in Figure 2.1 of virtual exhibitions reveal that high-end digitization techniques such as photogrammetry, photomodeling, GIS and laserscanning were used in order to create precise, detailed representations (Pietroni et al., 2013, Pietroni et al., 2015, Pietroni, Pagano, and Poli, 2016, Fanini and Pagano, 2015, Pagano et al., 2015).

Pietroni, Pagano and Rufa in *the Etruscanning project* (Pietroni et al., 2013) concludes that further work should be on object manipulation and animations of objects. One of the reasons for focus on object quality could be the argument by Pietroni (2019) that for exploration purposes it is assumed that users are experts, so focus should be on high quality models and accurate data. Fanini and Pagano (Fanini and Pagano, 2015) confirm that 3D reconstruction is fundamental for reliability of the represented urban scape.

However, the study by Pujol-Tost (2019) reports that precision of graphics is less important than narrative according to the user studies. Undoubtedly digitization gives its benefits, but also increases the costs and the development timeline.The detailed focus on presented objects are reminiscent of a metaphor by Falk (2004), which compares a museum and a film: *"Imagine that the producer made the set designer the director. She, not surprisingly, thinks that the sets and props are fundamental to the quality of the film—which of course they are. But given control of the camera, virtually all the footage seems to be of sets and props.(..) The actors and actresses become almost superfluous."* Falk's metaphor may be an amusing exaggeration,

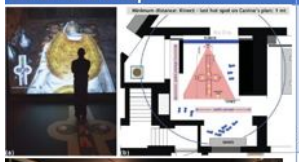
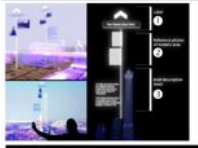
Installation setup	Project name	Short description	Interaction (using Kinect)	Storytelling	Evaluation
	Etruscanning (2012)	A virtual exploration of an Etruscan tomb reconstructed in its original aspect, with funerary goods and dead personages inside.	Walking and mid-air hand gestures	Storytelling in first person,once an object is selected the storytelling starts directly from the voices of the two personages buried inside the tomb.	Usability aspects: utility, learnability, efficiency, stimulation
	Livia's villa (2015)	Virtual Reality installation for the communication of the ancient Via Flaminia archaeological landscape.	Mid-air hand gestures, hotspots on the floor such as "Menu","Go forward","Stop and rotate".	Historical characters (actors) appear in the villa while performing their daily activities and they dialogue with the user about their life, their religious and domestic dimension and the legends of that place, the meaning of decorations.	Attractiveness, educational potential, usability
	Tiber Valley Virtual Museum (2016)	Virtual dissemination of the knowledge and the affection towards the territory north of Rome, in Augustan time.	User can 'fly like a bird' and 'swim under water' using mid-air hand gestures.	User can trigger movies with stories related to the territory and literary fragments narrated by multiple voices. Additionally user can experience the story of the freed slave Mena, guided by a narrative paths, on crossroads user can make a choiec to access different stories and places.	Attractiveness, usability, educational potential (attention, recognition, memory, reasoning), stimulating people to visit the real places
	"Imago Bononiae" walk in city (2015)	Serious game focused on the interactive exploration of a large 3D reconstruction of urban model of Bologna in Italy during the Roman period.	Walking, teleportation by stepping on an icon, mid-air hand gestures to reveal current state of the objects and fly over the city.	Simple informational text about the landmarks.	Usablity, predictability, visibility, reliability, memorability
	Admotum exhibit in "Keys to Rome" project (2015)	Serious game allowing visitors to virtually explore 3D reconstructed environments using body gestures and motions.	Mid-air hand gestures, such as grapping, and moving hands up and down.	An old merchant and his nephew guides the visitors through the multimedia experience. The objective of the exploration is to collect objects, following the treasure hunt game mechanics. When an item is found, an audio clip tells its story. When all items are collected, the visitor is rewarded with the complete story.	Memorization and learnability among high school students

Figure 2.1: Case studies of virtual exhibitions in cultural heritage museums, which use projection and the Kinect camera for interaction (also called virtual exhibitions or semi-immersive VR experiences)

but the point is clear - also the visitors and the interweaving narrative has to play a key role in the museum exhibition design.

It is important to understand what purpose the 3D models are fulfilling and question if different asset types can be used, especially for projects where funding is limited and museum objects are not digitized yet. According to museum archives, there is plenty of material consisting of drawings, sketches, topographical data, and stories, which were originally created to document the past.

2.2.2 Natural interaction

The survey by Bekele et al.(2018) acknowledges that technology in cultural heritage is leaning towards a shift from screen-based user interfaces (UI) to more intuitive and natural interaction methods such as movement, gaze, speech and gestures.

Pietroni (2019) mentions that perception through body or proprioception is the next most influential sense after visual as it contributes significantly to the user feeling involved in the interaction process.

Simple, intuitive interaction is very important in order to serve the broad target group of museums. It is important to keep in mind the shyness factor, as museum visitors might be reluctant to try out new movements especially in front of a group of people. Research shows that it is a challenge to foster a transition from the passive role of spectator to more active role of participant in public installations (Webber et al., 2015).

The virtual exhibition cases mentioned earlier have implemented walking and mid-air hand gestures as the interaction methods by applying motion tracking technology. In order to navigate around the world different methods are used, such as stepping on an icon or moving the hands upwards. For example, in the *Livia's Villa installation*(Pietroni et al., 2015), the camera moves on but in order to explore the scene freely, the user has to walk backwards to take control over the camera. Interaction also includes the movement of opening the left hand to the left or right, to control the view of the camera.

In order to instruct the visitors, the interaction movements are shown on the projection, or even printed as a poster or sticker on the floor. The evaluation of *the Tiber Valley exhibition* (Pietroni, Pagano, and Poli, 2016) reveals that users are reluctant to read instructions and prefer to ask the personnel for help. The case of *"Keys to Rome" exhibition* (Pagano et al., 2015) also admits that visitors prefer to watch others to avoid learning new interaction methods and possibly feel embarrassed. An interesting finding is that people below 30 and above 60 are the most open to trying new technology (Pietroni, Pagano, and Poli, 2016), which might sound counterintuitive knowing that the technical literacy of older generations is presumed lower than for the rest of the society.

After analyzing the interaction methods of the cases studies, it is clear that they can engage the audience on a new level, but the natural interaction could be improved. In order to provide good usability, it should be possible for the audience to grasp the interaction just by trying the solution, without a necessity for explicit instructions. A good example is developed in *the Virtual Exploration of Bologna* (Fanini and Pagano, 2015), where the user is

invited to follow the crowd in order to navigate around the virtual space. It is an intuitive interaction, since the attention automatically is fixated on the crowd.

The different case studies reveal that multiple navigation methods are practiced; however the interaction should be kept as natural as possible and user goals should be considered when designing the navigation strategy.

2.2.3 Game mechanics

The Key's to Rome exhibition (2015) and *the Virtual Exploration of Bologna* Fanini and Pagano, 2015 have included treasure hunt game mechanics in the virtual solution. The visitors have to find special objects or interact for a longer time in order to unlock new information or gain player skills such as teleportation. It is not clear how much game mechanic strategies contribute to the museum visitor experience. However it can definitely impact user motivation if implemented successfully.

2.2.4 Sounds and lightning

Sounds and lightning are important part of the virtual experience and can either distract or entice the users. Sounds and lightning can aid in building the atmosphere as well as provide guidance around the environment. A lot of resources have been invested in color and lightning management in the Livia's Villa installation (2015) to bring the right atmosphere to the visitors. Moreover, the Etruscanning project case study concludes that a dark, dedicated room for the interactive experience lets the users focus longer on the narratives (Pietroni et al., 2013).

2.2.5 Proportions of the 3D world

The virtual museums cases discussed so far, have implemented only 'true scale' virtual worlds, where the virtual world matches with the players proportions. However, spatial design has the affordance to scale the virtual space in a way that users can interpret location through embodied sensory experience. For example, cityscape could be scaled smaller and user could be given the chance to explore to city in different proportions, with smaller distances between the landmarks. Nevertheless, Pietroni (2019) suggests that large projections are used to show the origins of objects or highlight the details of images and figures. She also explains that touch tables are good interfaces to browse through maps, collections and see connections among objects.

2.2.6 Educational potential

Educational potential and memorability was evaluated in all the reviewed virtual exhibition cases. Additionally, two of the solutions also evaluated the potential of raising curiosity of the historical places by asking if the visitors are more interested in visiting the actual historical locations.

Learning in the museums is affected by many circumstances and can be adequately measured only in long term studies (J. H. Falk, 2006). The complexity of measuring learning explains why 'educational potential' or 'memorability' are measured instead. It is evident that virtual museum exhibitions have to provide educational value and it is crucial to acknowledge what are the pedagogical intentions of the exhibition. This is an important factor to note, since educational potential can be an important goal when developing the prototype design.

2.3 Storytelling

People are natural storytellers; stories help us to make sense of our experience in this world. Stories help to connect emotionally to other people's experience and recall information more vividly. As Bedford explains, storytelling is the true work of museums where experiences are created to resonate deeply and emotionally with the visitors (Bedford, 2001). Cultural heritage benefits significantly from implementing storytelling that creates emotional resonance and therefore, technology is recognized as one of the ways to bring an affective storytelling to the visitors.

2.3.1 Narrative in cultural heritage

Narrative is a key ingredient to engage the audience and so different strategies can be integrated. Pietroni (2019) recommends that narration should be kept short when multimedia is located close to the artefacts. However, if a dedicated space is available, virtual exhibition with deeper storytelling is welcome and can be added at the beginning or the end of the museum visit.

The virtual exhibition cases discussed earlier have integrated storytelling from different perspectives. In the 'Livia's Villa' installation (2015) users can meet different characters such as a gardener and a painter. The characters start their dialogue only once approached in the virtual world, but a logical problem appears, when the user revisits the same character, because the user will be faced with the same narration as before. In the Etruscanning project (2013), users also experience the narrative from the first-person perspective, however, once the narration is activated, users have no control over it and they cannot stop the process if they lose interest. Lastly in the virtual Bologna city project (2015) there is no interweaving narrative and information is shown as a plain text attached to the different significant buildings.

It should be noted that users can have different levels of power over the narrative, which can greatly influence engagement as well as narrative intelligibility. It is necessary to look closer at the techniques which can be applied to improve the storytelling experience in virtual exhibition design.

2.3.2 Storytelling frameworks in cultural heritage

Regarding affective storytelling in cultural heritage two long-term projects, which were conducted from 2011-2019 are proposing methods and tools for creating user-centered, affective narratives in this field. The Emotive project [1] is a continuation of the Chess project [2] and provides guidelines for museum professionals. However, so far the Emotive framework has been applied only to projects deployed on mobile and tablet interfaces. Conclusions from case studies, where the Emotive framework was applied reveal that narratives should be about people not things (Katifori, Karvounis, et al., 2018) and that the interactive experience can be powerful if it offers choices that establish the characters. The evaluation of these case studies also shows that museum visitors felt too guided and restricted in their choices and the implemented narratives were perceived as too linear without any actual control over the experience (2018). To give the users more freedom over the stories, techniques from interactive narratives can be applied.

2.3.3 Interactive narratives

Narrative can be a very broad term, however the narrative definition is needed to develop interactive narratives. Abbott (2008) suggests the following definition: "Narrative is the representation of events, consisting of story and narrative discourse, story is an event or sequence of events (the action), and narrative discourse is those events as represented." One of the key rules of interactive narratives is that the possible choices should matter and have a meaningful impact on the experience either on the system or the story level. In the case studies discussed earlier (Figure 2.1), the user interaction has no real impact on the story development, however, the user has impact on the experience on the system level. As described by Ryan (2005), these types of interactive narratives can be categorized as *external and exploratory*, where the user can observe the world from the outside, without affecting the story itself. It is important to understand that the user can indeed also take the role of a character and affect the story development. This type of interactive narrative is called *internal and ontological* and could possibly solve the issues faced in the virtual exhibition case studies. With this in mind, we will take a closer look at the plot structures for interactive narratives.

Ryan (2008) suggests three basic plot types: epic plot, epistemic plot and dramatic plot. The epic plot is focused on the physical actions of the main hero and is often used as the plot structure in fairy tales. The epistemic plot structure is driven by the desire to know, to solve a mystery. The dramatic plot, on the other hand, follows the pattern of dramatic arc, where interpersonal relationships of the character undergo change. According to Miller (2019), the most dominant structure in interactive systems is the Hero's Journey (Campbell,

[1] EMOTIVE, a EU-funded research project developing tools for interactive storytelling https://emotiveproject.eu/

[2] CHESS, Cultural Heritage Experiences through Socio-personal interactions and Storytelling https://emotiveproject.eu/

2008), which is an often used technique to build the narrative. Hero's Journey follows the dramatic plot structure and is a common starting point for developing interactive narratives.

By contrast, Koenitz (2018) argues that Hero's Journey and dramatic arc are not suitable narrative structures for interactive storytelling. He discusses other narrative structures such as multi-climactic and cyclical oral storytelling forms.

Another aspect that can be made interactive is the discourse of the narrative. The story-world can adapt to the users actions, where the user can affect the narrative unintentionally without a prior knowledge (Larsen and Schoenau-Fog, 2019).

Accordingly, it is obvious there are multiple aspects that can help in creating the narratives interactive. These aspects will be kept in mind when developing the prototype, but the main point remains: the narrative interactivity should have a direct impact on the narrative development and the characters involved.

2.3.4 Narrative intelligibility and closure

Creating a coherent interactive narrative is a challenge. Not only do causal relations have to be logical, additionally, the chronological order has to make sense to the user unless the work is intended to be abstract... Furthermore, in cultural heritage sites visitors freely move through exhibitions and their attention can easily be distracted, which leads to interrupted storytelling experiences.

A compelling framework to analyze the success of the narrative communication is presented by Bruni and Bacevicuite (2013). Narrative intelligibility and narrative closure are the suggested concepts, which are closely affected by the system goals defined by the author and interpretation abilities of the user. Narrative closure is independent of the author's intentions and is achieved whenever the user experiences a satisfying, meaningful end of the interactive experience. On the other hand, narrative intelligibility is closely related to the goals of the author and can be evaluated by assessing how well the user has understood the narrative and meaning behind the interactive experience.

It must be noted that narrative closure and intelligibility are two significant aspects, which help to analyse the post experience of the user interaction and the perceived value from the user's perspective. This framework could be very relevant in the cultural heritage domain, in order to analyze, how well the interactive system is fulfilling its purpose.

2.4 Key findings in the background research

The surveyed virtual exhibitions are focused on re-creating real historical places and scenarios into the virtual environment. None of the solutions have reviewed the possibility to adjust the proportions of player and virtual space, which could give the possibility to combine maps, storytelling, and natural interaction methods in one place. Additionally, none of the solutions have implemented truly interactive narrative design, which could

contribute to the visitor engagement and personalization of the experience. Also, majority of the solutions use instructions to explain the interaction method with the installation, which shows that interaction could be made more natural and intuitive in the future.

Chapter 3

Case Study

As mentioned earlier the case study for this project was conducted in the Surat Fort shown in Figure 3.1. The Fort was built during the sixteenth century in Surat to protect the merchant city from the Portuguese invaders. The Fort is still under renovation, but major parts of the Fort have already been open as a museum. The museum currently has multiple exhibition halls displaying historically important documents, maps, photographs, objects and displays disseminating the renovation process. The museum also has a cinema room, a library, conference rooms and a café. There were no official statistics about the demographics of the visitors. However, it was observed that visits of school groups for children aged 11-13 were often organized. It was also evident that most of the fort visitors are local inhabitants since the city is not known as a tourist destination in India.

Figure 3.1: Surat Fort

3.1 Prototype design

The first prototype idea was developed with the aim to utilize the existing museum assets and present the material in a new light with the help of multimedia technology. Until now,

the design of the exhibition has only focused on traditional information dissemination methods. As indicated by Sonal Mithal, the main contact person throughout the project development process and the director and conservation architect at People for Heritage Concern (PHC), a challenging problem was that museum visitors were often glancing at the textual information, but rarely read through the whole story. For example, the traveler diaries were displayed in a dedicated room together with the descriptions of the travelers, however it was observed that visitor engagement was lacking. So an idea was born, to combine the text from traveler diaries with archival illustrations and organize the content according to an ancient Surat city map.

It was decided to use motion tracking as an interaction method in order to raise the involvement among the audience. The figure 3.1 shows the early prototype idea. The interaction was based on visitor movement around the city map and is described in detail in the chapter 6. The texts about the corresponding cultural heritage were shown once the visitor stepped on one of the landmarks, which was highlighted on the city map laying on the floor.

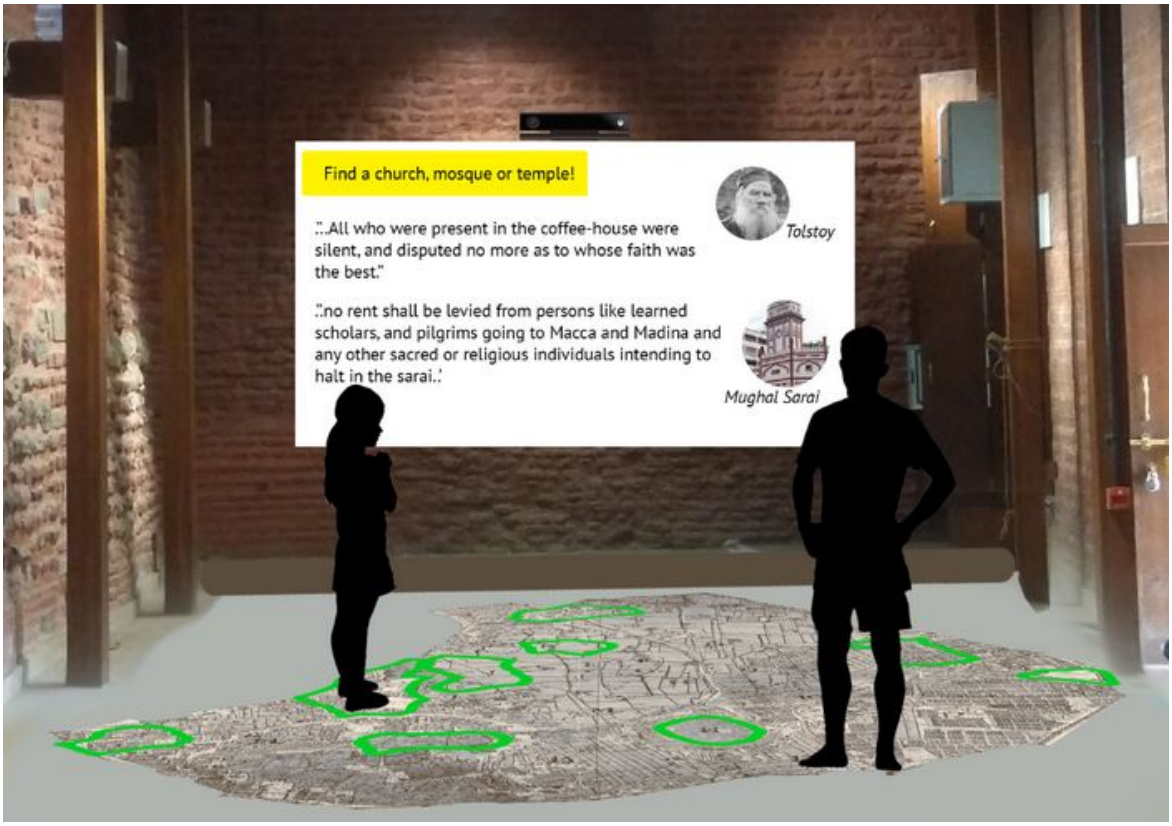


Figure 3.2: One of the first prototype ideas, where the city map on the floor is connected with the visitor's movement and displays the stories from the traveler diaries.

3.2 Proof of concept test in India

During the last days of my project oriented work in India, a proof of concept test was organized. A total of 12 subjects (8 males, 4 females) with average age 26 (SD = 6,9) took part in the prototype test. In all cases, subjects' consent was obtained; the consent form can be found in Appendix A.3. The reasons for having only 12 subjects were the lack of contacts in Surat as well as the misunderstanding with the museum about the available testing space. The goal of the test was to evaluate the idea and usability of the prototype in the dedicated museum environment where the prototype was planned to be installed. Time tracking and observations in combination with semi-structured interviews were the two assessment methods used. Additionally, user interaction was recorded to confirm the observation notes.

3.2.1 Results

Time tracking revealed that the average interaction time per subject was 6.53 minutes (SD=2.59) and the average interaction duration per landmark was 24 seconds (SD=6.38). It was observed that on average subject visited 9 out of 16 landmarks (SD=4). The semi-structured interviews were analyzed, and the recurring findings are as follows:

- Text was not noticed by 2 subjects and 4 subjects did not understand who the portraits in the user interface were.
- 2 subjects recommended scaling the city map, to avoid collisions and overlapping of the content.
- 3 subjects indicated that they would like to be guided to walk around the city.
- Desire for audio and voice integration was mentioned by 3 participants.
- 5 participants mentioned that the 3D environment does not represent the city of Surat.
- 4 subjects mentioned that they would like to move around the object and see the objects from different angles.
- Adding elements from the present-day Surat was mentioned by 3 participants.

3.2.2 Conclusion to the proof of concept test

The time tracking showed that none of the visitors read the full stories about the cultural heritage landmarks. Surprisingly, almost half of the interaction time (48%) was used to explore the motion tracking technology and the diverse angles supported by the interaction method. A possible explanation for this outcome is the novelty of the motion tracking

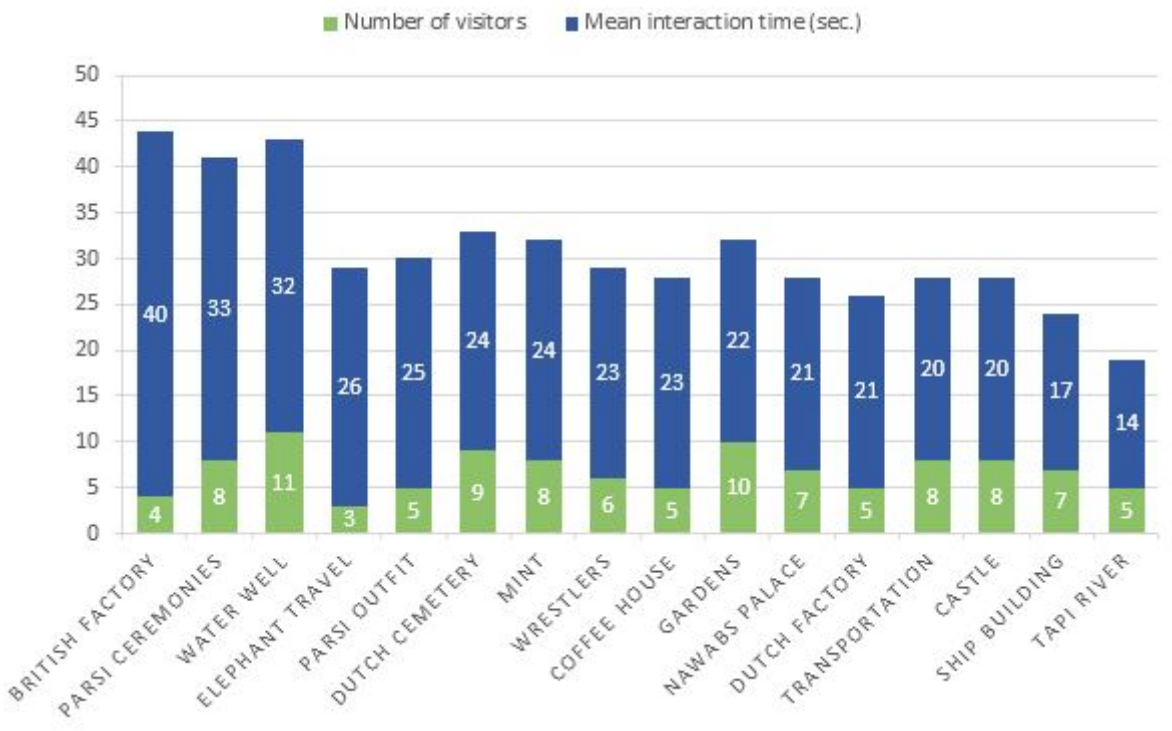


Figure 3.3: Participant interaction time and objects visited during the proof of concept test in India

technology, as only 4 subjects had previous experience with virtual reality or technology using motion tracking. The time spent on the historical texts was lower than anticipated. Earlier research has mentioned that technology should not overshadow the communicated message. Technological solutions must be driven by the core ideas and wants of the museum to successfully disseminate information, rather than being driven for the sake of being innovative (Maye et al., 2014).

Despite the test results, positive feedback was received from the Principal Conservation Architect at PHC, Sumesh Modi. Modi mentioned that a virtual reality experience would be more immersive, yet the suggested installation fits the purpose to show the city very well. He indicated that it was natural to move around and interesting to see how the different locations correspond to the movement. The full feedback can be found in the Appendix A.1. Also, the Surat Municipal Corporation[1], the client and the main decision maker at the Surat Fort, approved the project proposal. To bring the project to its fruition further refinement of research and implementation was needed. However, as mentioned by Sonal Mithal, the project approval opened up new avenues for proposing and designing similar projects for the Surat Castle.

[1]Surat Municipal Corporation, the governing body of the Surat Fort museum https://www.suratmunicipal.gov.in/

Chapter 4

Conclusions to the background research

This chapter will define the final problem statement, which is formulated based on the conducted background research and the proof of concept test at the Surat Fort. The final problem statement is as follows:

How can spatial design and interactive narratives improve the existing methods of virtual museum exhibition design in cultural heritage?

This problem statement will be addressed with the help of several research questions, which are answered through the implementation and evaluation of the final solution.

As discussed in the background research, aspects such as narrative intelligibility and closure are important and are concerned with the post experience, while the interaction itself and the production process are the other side of the coin to fulfil the museum goals.

Involvement
Both the Emotive Framework and virtual museum solutions show that a stronger emotional link between interaction and storytelling should be established. Therefore the following question will support the problem statement:

- How can an interactive narrative be implemented to raise involvement and emotional engagement?

Educational potential
The proof of concept test showed that the subjects enjoyed the embodied interaction, but the stories were lost in the shadow of the technology. Providing pedagogical value is an important aspect for museum exhibitions, therefore another question to ask is:

- How can learning be encouraged throughout the interaction process?

The post experience
It is important to investigate how well the goals of the virtual exhibition have been met. It is

possible that the audience generates a meaning from the interactive experience, which does not necessarily match with the author's intentions. The following question will address the post experience:

- How can intelligible narrative experience be designed?

Archive materials

So far the virtual exhibition designs have invested massive resources into 3D reconstruction and photo-realism. However, it is evident that a lot of valuable historical materials (e.g. travel logs, hand-drawn illustrations, maps and diaries) are laying in the museum archives, away from the visitors' sight. Therefore, a question that needs to be raised is:

- How can the existing archive materials be utilized?

Generalization of the proposed design methods

In order to better contribute to the existing spatial solutions, it should be discussed how to apply the proposed design concept in other domains and contexts as well. Therefore the following question will be asked:

- How can the proposed solution be generalized for other cultural heritage projects?

Chapter 5

Design

5.1 Design requirements

The design of the application was developed and adjusted through the iterative design method. The design requirements were defined in the beginning, but multiple ideation, prototyping and test rounds were still used to refine the final prototype. This method was chosen because it is one of the most rapid ways to improve the design concept.

The following are the design requirements, which were defined according to the problem statement and are visualized as multiple design layers in Figure 5.1:

- The core is usability, which is considered a prerequisite for any digital solution. Interaction should be intuitive, enjoyable, and easy to learn for a broad audience.
- The second layer centers on learning and cultural heritage assets. Museums aim to provide the learning opportunities which are enjoyable and attractive. Also, it should be clear what historical assets and stories are intended to be disseminated as the experience will be built around the cultural heritage content.
- The third layer is involvement, personalization, and emotional engagement. Different interactive narrative techniques will be explored and tested to address these aspects.
- The final layer is concerned with the success of the intended communication goals. Clear system and narrative goals should be defined in order to analyze the intelligibility aspect. Also, context and closure should be provided to the audience, in order to deliver a complete user experience.

All of these layers together will help to develop the prototype and evaluate how well the suggested design concept contributes to the existing exhibition design strategies.

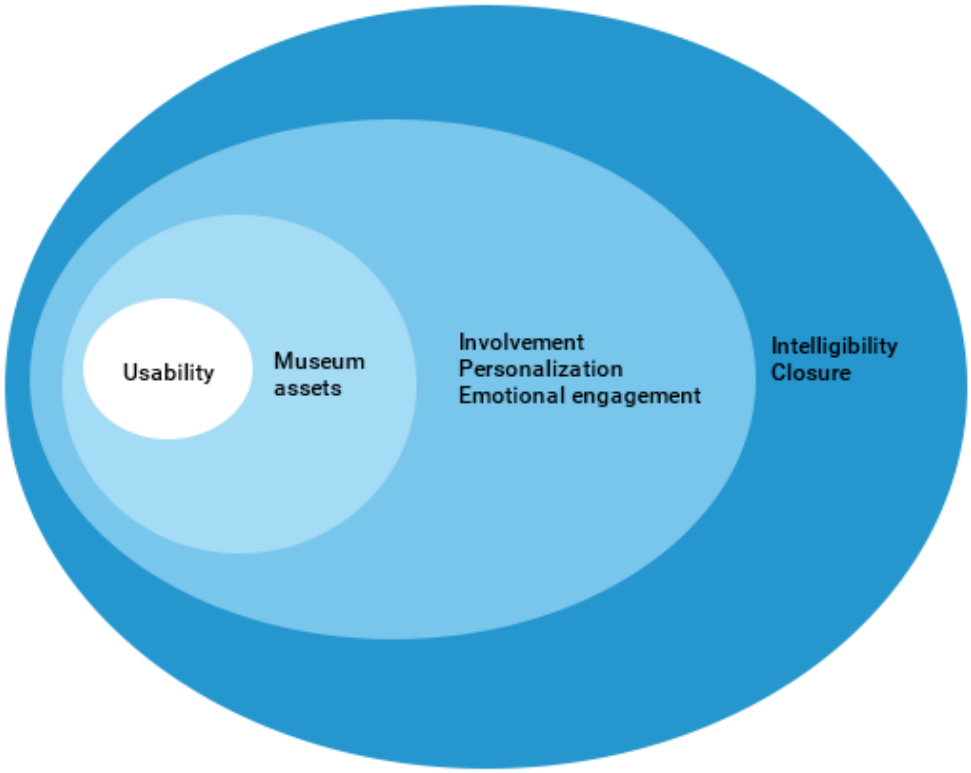


Figure 5.1: Design layers as the starting point of the prototype development

5.2 Cultural heritage materials

Research showed that the case studies thus far, invest significant resources to achieve photo-realism in the historical representation. However, there are so many resources in the museum archives that are never shown to the visitors. The materials collected by the PHC for the Surat Fort could be divided into the following categories: historical maps, illustrations of cultural heritage and traveler diaries (see Figure 5.2). In the first prototype, 16 landmarks were picked, which were generally well documented in the traveler diaries. Likewise, deeper research of the traveler diaries was conducted in order to choose which characters to portray in the implementation. In the early design, 9 character portraits were displayed. As described in the Emotive Framework guidelines 2019, the characters must follow a well-defined role and should be consistent throughout the story. It was decided to keep the possible characters open until the narrative is more defined. However, according to the earlier test results, it was determined that at least 9 landmarks should be integrated to support the exploration of the city.

Figure 5.2: Museum archive materials for the Surat Castle could be categorized in maps, illustrations and traveler diaries

5.3 System and interactive narrative goals

The narrative goals were defined in order to measure the success of the narrative communication. The interactive narrative techniques were chosen as the key element for the emotional engagement, therefore the narrative goals match with the system goals. The narrative goals are as follows:

- To inspire curiosity about cultural heritage in Surat.
- To communicate different angles of the history.
- To engage visitors emotionally.
- To offer a personalized experience.

These goals will be the guidelines when creating the narrative, in order to have a clear direction for the creative process and the evaluation at the end of the implementation.

5.4 Interactive narrative design process

It was decided early on that the museum visitor will be the protagonist of the story, but the travelers will be the characters encountered during the journey. This type of interaction can be described as internal since the user will be situated inside the virtual world (Ryan, 2005).The purpose of internal interaction is to emotionally connect with the museum visitors and to invite the users to explore the historical city in the first-person perspective. It was decided to integrate multiple characters in order to communicate different perspectives from the history as well as to utilize the traveler diaries found in the museum archives. The narrative was geared towards the cultural heritage assets, which represent different landmarks across the historical city. Furthermore, it was decided to start the story at the Fort since that is where the museum visitors were located in reality.

5.4.1 First iteration: The Dramatic Arc

The final narrative structure was created through multiple iterations. In the first iteration the plot was written following the dramatic arc and the paper prototyping method was used (see Figure 5.3). The dramatic arc was used as suggested by the Emotive Framework guidelines (2019) and Miller (2019). As a result, the main character was developed together with hero's goals, that should be reached through the dramatic arc. It was decided that the most feasible way to create a climax in the plot was to define *contradicting wants and needs* for the main hero. It was decided that the hero wanted to leave Surat city and travel the world, but what she actually needed was to save the city from invaders and contribute to the society back home. The character personality was based on a personal story and the knowledge that many young people in Surat aspire to travel abroad. It was believed that this plot could give the feeling of self-identification to the younger museum audience. The full script of the first narrative can be seen in Appendix B.1. The plot followed a linear structure, as it was decided to add multiple side-branches to the plot once the story was validated.

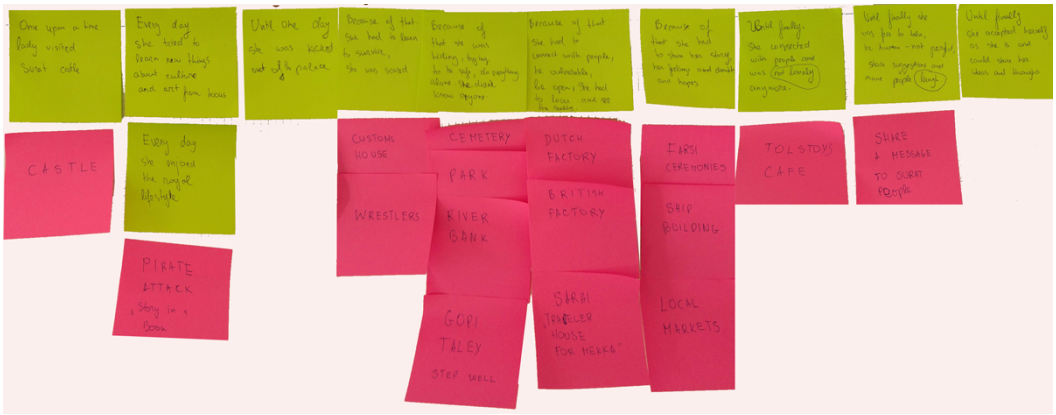


Figure 5.3: Paper prototyping to create the plot structure during the first iteration of the narrative design

5.4.2 Second iteration: Multiple Endings

The story was proposed to the director at the PHC, in order to keep the narrative development in tact with the museum requirements. One of the suggestions was that the events presented should be credible and have a clear historical background. This feedback led to deeper historical research and finally it was decided to base the story on the records of Shivaji's attack (Takakhav, 2018). It is known that Shivaji, the Maratha king, attacked Surat in 1664 as his request for a tribute was rejected. The bibliographic sources tell that the attack was aimed at the wealthy merchants and as a result, the army looted the accumulated gold and jewelry of the latter. The sources mention a merchant called Virji Vora who was in close contact with the British, but was devastated by the Shivaji's attack. It was decided that there would be a change to the protagonist to take the role of Virji Vora's assistant. Consequently, the goal of the protagonist was to search for the spies in the city in order to save the merchant from the attack. The plot was created using Twine software[1] and the full script of the second narrative iteration can found in Appendix B.2 . The plot structure intergrated multiple branches at the end, where the protagonist can choose to stay in the city or travel together with the foreigners, in addition to the choice by the protagonist of where to go after the Dutch Factory.

After sharing the new narrative to the PHC, the feedback suggested that the potential of visitors freely moving around was not fully utilized. The main downside of the proposed interactivity was that the system response had to be restricted and give guidance to the user to go to the next landmark according to the predetermined plot. Another suggestion from the PHC was to create different themes for each character (e.g. coffee traditions, ship building, customs). This structure would clarify the possibilities to the users and give the choice to learn about the preferred topic. Multiple paths were considered, but a serious limitation was that more information had to be gathered for the story building. Finally, it was decided to update the previously suggested plot structure to a free exploration where the visitor can visit the landmarks in any order. The main goal of the visitor was to find the spies, which could be reached once the user visits the Ship Building landmark for the second time. The narrative was implemented in Unity software [2] and a preliminary test was organized, where a questionnaire and link to the prototype online[3] was sent to the participants.

5.4.3 Preliminary test

The preliminary test was created in order to investigate how motivated users are to follow the set hero's objective. A serious limitation was that test participants in Surat could not run the online application due to limited internet connectivity and lack of available

[1]Software for interactive narrative development https://twinery.org/

[2]Software for 3D and 2D game development https://unity.com/

[3]The interactive prototype after the second design iteration: https://laine-k.itch.io/preliminary-test?secret=lOSRSy1iSEI2AfDAUzVaCyZ78

computers. In the end, the test was conducted by 5 participants. The results indicated that 4 participants did not feel that they have any impact on the story and that they forgot that their task was to look for the spies. Additionally, two of the subjects pointed out that the character at the Ship building was the most exciting, as it felt more like a real person and was not just sharing plain facts. The full test results can be found in Appendix B.3.

5.4.4 Final narrative design

The results of the preliminary test lead to the final narrative design. It was surprising that two subjects mentioned the same character only because of the more 'human' response. Also, the feedback from the pilot test conducted in India brought back in memory the suggestion of integrating some humor from the stories of Akbar and Birbal (Naim, 1995), famous for the witty political and history jokes. As mentioned by Katifori et al. (2018), emotions trigger attention and memory, which are critical for learning. As for the final narrative design, it was crucial to find a way to trigger emotional response in the visitors. The plot thus far was inviting visitors on a quest and the objective was accomplished by visiting the correct landmark, but an emotional connection was missing. Moreover, it was questionable if the visitors will find it intuitive to visit the landmarks for the second time to find the spies.

Finally, it was decided to integrate adaptivity. Adaptivity, as defined by Larsen and Schoenau-Fog (2019), is "When a game changes the storytelling based on previous actions/behavior from the player, without revealing to the player that it has done or will do so when the action is performed." Adaprivity was used to make the discourse more dramatic rather than altering the plot structure. In other words, the user was making a choice without knowing it. The character responses were re-written in a more believable way, revealing the personality of the characters. The discourse was created adaptive by giving memory of the user's movements to each of the virtual characters. For example, if the Garden was visited before the Factory, the user would be invited for a dinner at the Factory. Then, once the visitor reached the Factory, the character will ask the visitor why is he arriving so late. On the other hand, if the Factory is visited before the Garden, then the character will note that he was not invited, but will welcome the visitor in the Factory nevertheless. As indicated by Larsen and Schnoenau-Fog (2019) such remarks can make the player feel seen and give a sense of control. The narrative design was updated for the third time and the full script can be found in Appendix B.4. The final narrative included 6 characters and 10 different landmarks, where the stories are triggered (see Appendix B.5 and B.6). The script at each landmark was divided in three sections: introduction, middle and remark (see Figure 5.4). Introduction is the element, which reveals the adaptive discourse, while the middle section presents the historical events and is predetermined from the beginning. The introduction and middle sections are played only one time, and when the visitor has heard the sequence until the end, the sequence will not be triggered again. The remark section is triggered if the user visits the same landmark again and has already heard the introduction and middle sections.

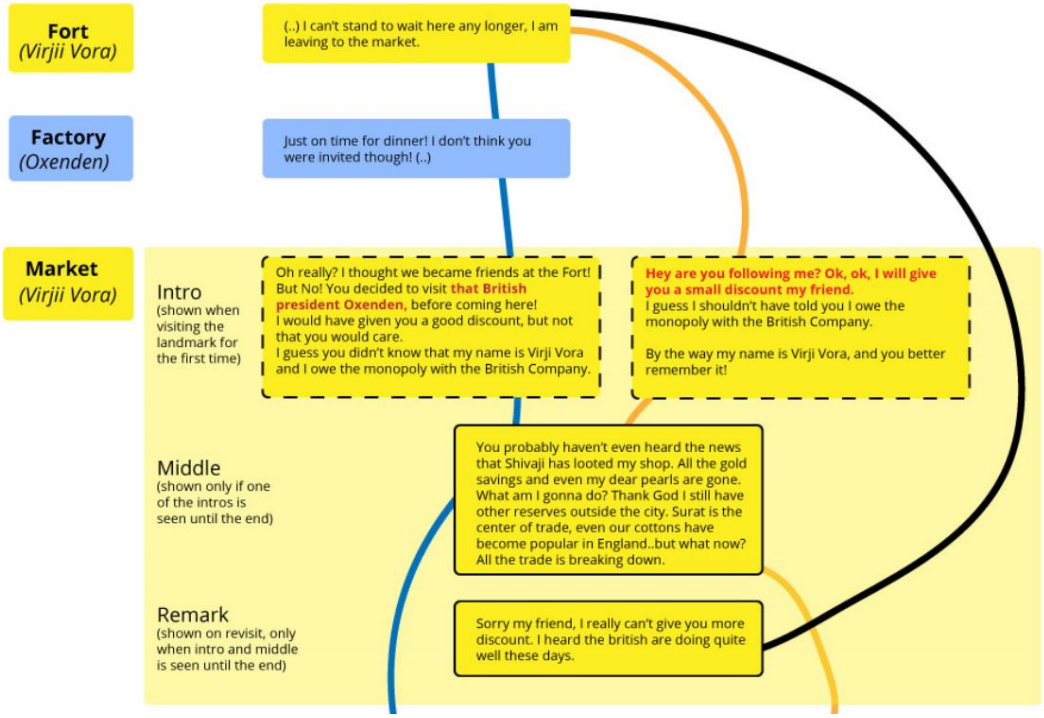


Figure 5.4: Example of the script at the Market landmark, where the script is divided in three sections: introduction, middle and remark. The introduction section is determined according to the previously visited landmarks.

Context and closure The objective to find the spies was integrated in order to follow the dramatic arc. However as mentioned by the Emotive Framework guidelines (2019) and the preliminary test, the user must be reminded about the objective throughout the experience. Therefore, it was decided to remove the quest from the solution and instead invite the visitors to explore the city and its inhabitants. The invitation to the users and the historical origins of the characters was integrated in the introductory video and the closing sequence was played once the user had visited all the landmarks on the map. In order to provide narrative closure to the audience, it was decided to guide the visitor back to the Coffee House for the final Goodbye, when all the landmarks had been visited. When visiting the Coffee House for the final time, the visitor has a choice to hear the full story "The Coffee House of Surat" by Tolstoy (Tolstoy, 2019).

Once the idea was presented to the People For Heritage Concern, it was confirmed as a good strategy to end the experience at the Coffee House, as it logically matches with a city tour. It can be concluded that the final interactive narrative was refined in order to make the visitors feel seen as well as provide freedom to explore the city independently. Considerable attention had to be paid to character believability in the final script.

Chapter 6

Implementation

6.1 Interaction method

The aim of the project implementation was to utilize archive data and possibly combine three types of historical materials: maps, illustrations, and traveler diaries. Through a brainstorming process, it was decided to display an interactive large-scale city map on the floor. The idea was to connect the monuments on the map with a projection on the wall with the information about the monuments. The key feature was that the stories are activated by stepping on the markers indicated on the map. The proposed idea was found attractive and approved by the Surat Fort museum, and was therefore developed further. Originally two possible motion tracking solutions were considered: motion tracking cameras and pressure sensors built in the floor. After a consultation with experts, it was decided to use the Kinect motion tracking camera. The alternative solution was found more costly and more cumbersome in regards to maintenance. A Kinect Xbox One camera was purchased, since the new Azure Kinect DK cameras were not available yet. The maximum coverage of the Kinect camera is 4x4 meters, however it must be noted that the coverage is triangular.

The Kinect camera was integrated in the Unity solution to track the body position in the space. The Kinect with MS-SDK library[1] was imported from the Unity Asset store. The initial motion tracking was set to match the real step size in the 3D world. The challenge was to let the user cross the whole city with 4 steps. To solve the problem it was decided to scale the tracked skeleton since the user avatar was not part of the design requirements. An alternative idea was to scale the 3D environment to a smaller size, but that would have let to lower quality graphics and the illustrations would look blurry. The following code was written to adjust the skeleton size.

```
private static Vector3 GetVector3FromJoint(Kinect.Joint joint)
```

[1]The Kinect with MS-SDK library for Unity software https://assetstore.unity.com/packages/tools/kinect-with-ms-sdk-7747

```
{
return new Vector3(joint.Position.X * 60, joint.Position.Y * 10, -(joint.Position.Z * 60));
// - z to go opposite direction - mirror- in space
// Z increase -> long spine // sleeping position
// X increase --> long limbs
}
```

An expanded tracking space was one of the requests from the museum after the early prototype test. Multiple Kinect cameras can be combined in order to provide a bigger camera coverage. There are various techniques to implement multi-kinect installation. One of the techniques is to calibrate multiple Kinects according to the body position. The study by Støvring et.al (2016) shows an example on how to combine two Kinect cameras according to the tracked skeleton. The authors were contacted to clarify the implementation details, but unfortunately there was no response. An alternative solution was to use markers to calibrate the cameras (Munaro et al., 2016, but this technique was found too lengthy for the installation set-up. After consulting with two software developers about the possible solution, it was recommended to connect the Kinect cameras with two RaspberryPi single-board computers[2] and send the tracked coordinates to a separate computer running the Unity solution. The final suggestion was found to be reasonable for the final installation in the museum, but was out of the project scope and was left as a future implementation.

6.2 Graphics and animations

6.2.1 3D world design

The terrain of the city was created using real world height maps[3], which gave the correct proportions of the Surat landscape. The height maps were used to generate the terrain texture in the 3D world. The code sample below shows how the image of the heightmap is iterated to generate the varying heights of the terrain.

```
public void LoadTexture(){
    float[,] heightMap = GetHeightMap();
    for (int x = 0; x < terrainData.heightmapWidth; x++){
        for (int z = 0; z < terrainData.heightmapHeight; z++)
        {heightMap[x, z] += heightMapImage.GetPixel((int)(x * heightMapScale.x),
        (int)(z*heightMapScale.z)).grayscale * heightMapScale.y;
        }
    }
    terrainData.SetHeights(0, 0, heightMap);
```

[2]RaspberryPi single-board computers https://www.raspberrypi.org/
[3]https://terrain.party/

```
}
```

According to the feedback from the proof of concept test, the 3D world was not a realistic representation of the Surat city. It was considered to implement 3D city buildings, but the lack of Google Street View and 3D data of Surat city stopped this idea. Another idea was to develop the whole 3D environment in a drawn style by using limited color schemes and abstract material effects, seen in games such as Paper Mario[4] and Return of Obra Dinn[5] (see Figure 6.1). This design idea was considered as time consuming and didn't fit with the goal to re-use the existing museum assets as much as possible, therefore the environment design was left open for future ideas.

Figure 6.1: Environment design in the games "Paper Mario" and "Return of Obra Dinn"

6.2.2 Landmarks - points of interest

It was important to bring the existing archive materials in new light. Each point of interest was represented with historical images from the cultural heritage database. Landmark illustrations were extracted from the traveler logs and imported in the 3D environment in the real historical location (see Image 6.2). The proof of concept test showed that on average the test participants visited 9 out of 16 landmarks. In order to fulfil the request from the museum two new landmarks were added - the Marketplace and the Mughalsarai. It was decided to implement 10 landmarks in the final solution in order to meet the narrative goals. Nevertheless, additional landmarks can always be imported in the environment.

6.3 Interactive narrative implementation

The final interactive narrative was implemented in three steps: audio recording, character design, and development in Unity.

[4]Video game "Paper Mario" https://www.mariowiki.com/Paper$_{M}ario$
[5]Video game "Return of Obra Dinn" https://obradinn.com/

Figure 6.2: Landmark design

6.3.1 Audio

Audio was first recorded by the author to test the length of the narration and flow of speech. It was considered to hire voice actors, but the project being a prototype there was no budget available, so the audio was recorded with the help of friends whoes accent would match with the character. Once the audio was recorded, it was imported in the Adobe Character Animator software[6].

6.3.2 Character design

Character design was based on the historical paintings of the personalities. Character Animator was used to bring the portraits to life and lip sync the audio recordings. Image 6.3 shows how live motion-capture is used to create the facial expressions of the characters. To use the motion-capture, character portraits had to be modified, in order to have a clear character front view. Portraits were modified using Intuos drawing tablet, Photoshop and Illustrator.

[6]The Adobe Character Animator software https://www.adobe.com/products/character-animator.html

Figure 6.3: Character design pipeline

6.3.3 Unity development

Once the character animations were created, the recorded video files were cut in Premiere Pro. The video files had to be converted to a webm format in order to keep the transparent Alpha background in Unity. Conversion was done using the FFMPEG package[7].

The final video sequences were imported in Unity and connected to the video player using user interface elements and animator. The Unity code was used to control the interactive narrative and was loosely implemented according to the Model-View-Controller pattern[8] (see 6.4). Dialogue data is restricted by the Dialogue class and the video sequence can only be accessed through Data.json file. This solution is easy to expand and connect to a database in future since the separation of concerns was kept in mind during the development. When the user moves, the Kinect sensor sends a signal to the DataLoader class to trigger a dialogue. Once the TriggerDialogue method is called the DialogueManager class starts to play the video in Unity. DialogueManager is also responsible to check the relations between the different landmarks and update the video sequences according the previously visited landmarks. The full code of the narrative implementation can be found in Appendix B.

[7]Solution convert audio and video files https://ffmpeg.org/
[8]Model-View-Controller pattern https://dotnet.microsoft.com/apps/aspnet/mvc

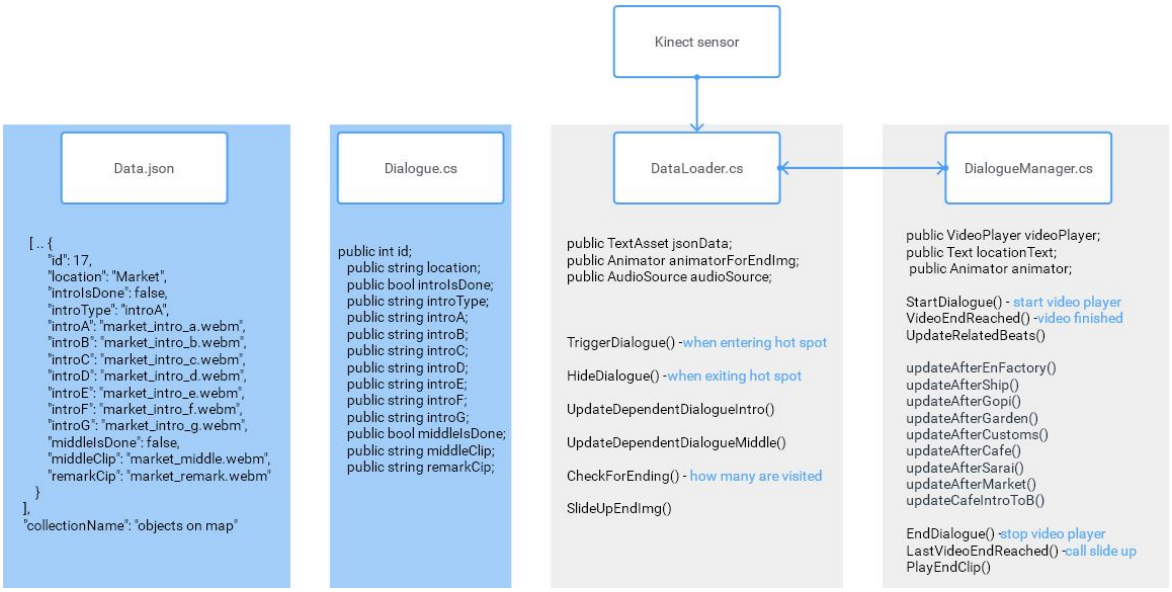


Figure 6.4: Classes and methods for Interactive Narrative implementation

Chapter 7

Evaluation

It was planned to evaluate the prototype implementation in a lab environment in Copenhagen, even though to reach the maximum reliability the test has to take place in the Surat Castle with the actual museum visitors at the subjects. Due to the lockdown, the test was organized in the student dormitory. A combination of observations, questionnaires, and semi-structured interviews were used to evaluate the application. This mix of methods has been used by the reviewed virtual exhibition designs and has proven to be efficient (Pescarin et al., 2012, Pietroni, Pagano, Amadei, et al., 2016, Pietroni, Pagano, and Poli, 2016). The combination of observations and questionnaires allowed the examination of the consistency between what is being said and what is being done. This evaluation technique was expanded with interactive narrative assessment strategies suggested by the Emotive Framework (Economou et al., 2017), the intelligibility framework (Bruni and Baceviciute, 2013) and the research of narrative evaluation techniques (Roth, 2016; Nikolakopoulou and Koutsabasis, 2020). This chapter is organized according to the research questions suggested by the final problem statement in the chapter 4.

7.1 Test procedure

7.1.1 Usability

System usability is a crucial step in the virtual exhibition design as it affects the total media experience and user satisfaction. It was not mentioned in the problem statement but should be included as a prerequisite for any digital solution. Originally, usability consists of three dimensions - effectiveness, efficiency, and satisfaction - as defined by the International Organization for Standardization (ISO) (Bevan et al., 2015); however additional aspects such as learnability and information accessibility are also significant in the exhibition design context.

To test the **learnability** of the application, the test participants were observed while approaching the application for the first time without having been given any explicit inter-

action advice. This observation helped to investigate if the set-up facilitates exploration of the installation. The following aspects were used for the observation as well as evaluated by the user in the post-experience questionnaire:

1. Does the visitor see the start marker on the floor to activate the project?
2. Does the visitor understand that there is an interactive area in front of the projection?
3. Does the user walk on the start circle?
4. Does the user walk towards the fort as instructed by the introduction?

7.1.2 Involvement

User involvement was examined to answer the previously defined research question:"How can an interactive narrative be implemented to raise involvement and emotional engagement?". User involvement during the interactive experience can be measured using the concepts of immersion, presence, engagement, flow and character believability among other concepts (Roth, 2016). It was decided to examine three aspects: character believability, discourse adaptivity, and emotional engagement.

The 5-Point Likert scale statements and observations of the user's movement, facial and vocal expressions were used to analyse user involvement. It was noted at which landmarks and moments the expressions appear.

It was decided not to follow the 6 basic emotions defined by Ekman (1969), as the expressions were expected to be very subtle. Therefore, the emotional response was evaluated by the test participants using the self-assessment manikin method (SAM) (Bradley and Lang, 1994) right after the interactive experience. The SAM method is widely used by researchers to investigate pleasure, arousal, and dominance in the emotional response to stimuli and is recommended by the Emotive Framework (Economou et al., 2017). The SAM manikin pictures were combined with the following 5-Point Likert scales to complete the statement: "Characters and their stories made me feel..":

1. Excited, wide awake (1) - Sleepy, calm (5)
2. Guided, controlled (1) - In control, important (5)
3. Happy, satisfied (1) - Annoyed, bored (5)

The Likert scale statements regarding character believability were defined as suggested by Roth (2016) and were posed to the users as follows:

1. I felt like the characters acknowledged me.
2. My decisions had no influence on the characters.

The discourse adaptivity was assessed similar to the agency and the following Likert scale statement was posed:

1. I discovered how my earlier actions influenced what happened later in the story.

Educational potential To address the question: ”How can learning be encouraged throughout the interactive process?” the user ability to recall information from the narrative was evaluated. According to the virtual museum projects, the recognition and recalling tests are recommended as the method for the educational potential assessment (Pietroni, Pagano, Amadei, et al., 2016). Test participants were asked to recognize the illustrations out of the scenes and connect with the corresponding name of the character or landmark. The recognition test of the historical data was given after the interacive experience. It was assumed that the test participants in Copenhagen will not have any previous knowledge about the history of Surat, therefore a prior knowledge test was not given to the participants.

7.1.3 Success of narrative communication

The question “How can intelligible narrative experience be designed?” helps to address the overall success of the communicated narrative. Narrative intelligibility and closure are novel concepts. To clarify the possible ways to analyze the different aspects proposed by Bruni and Bacevicuite (2013), the intelligibility framework is compared to the usability evaluation in Figure 7.1.

Usability	Success of narrative communication
Effectiveness	**Intelligibility**
The ability to complete tasks	Audience generates meaning as expected by the author
Efficiency	**Author-audience distance, interpretation gap**
The amount of effort to complete a task	The amount effort to interpret the narrative according to the author's intentions
Satisfaction	**Closure**
User's subjective reactions to using the system	How coherent and complete was the users's subjective experience

Figure 7.1: Comparison between the evaluation of usability and the evaluation of narrative communication

It was decided to observe if the users interact with the narrative as intended. The order of the visited landmarks and user comments were noted down. Furthermore, the following 5-Point Likert scale statement was posed:"I was curious to find connections between the landmarks and the characters". Additionally, users were asked the following questions in a semi-structure interview after the experience:

1. Why do you think there are multiple characters?
2. What value do you see in the whole experience?
3. Where are the stories inspired from? Who is the author of the stories?

To evaluate how relevant and coherent the user’s subjective experience was, the participants were asked to give the following explanations in a semi-structured interview:

1. I ended the interaction with the prototype because (I lost track of the story; I visited all the landmarks; I reached the end screen; Other)
2. Would you like to visit the real historical places shown in the prototype?
3. How did you feel about the end?
4. How do you think the experience could be made more meaningful and coherent?

7.2 Test results

A total of 22 participants (7 females, 14 males, 1 preferred not to say; average age M=26.6 years, SD =3.45) took part in the prototype test. Figure 7.2 shows the test set-up in the common area of the student dormitory. 12 of the users tried the prototype alone and two

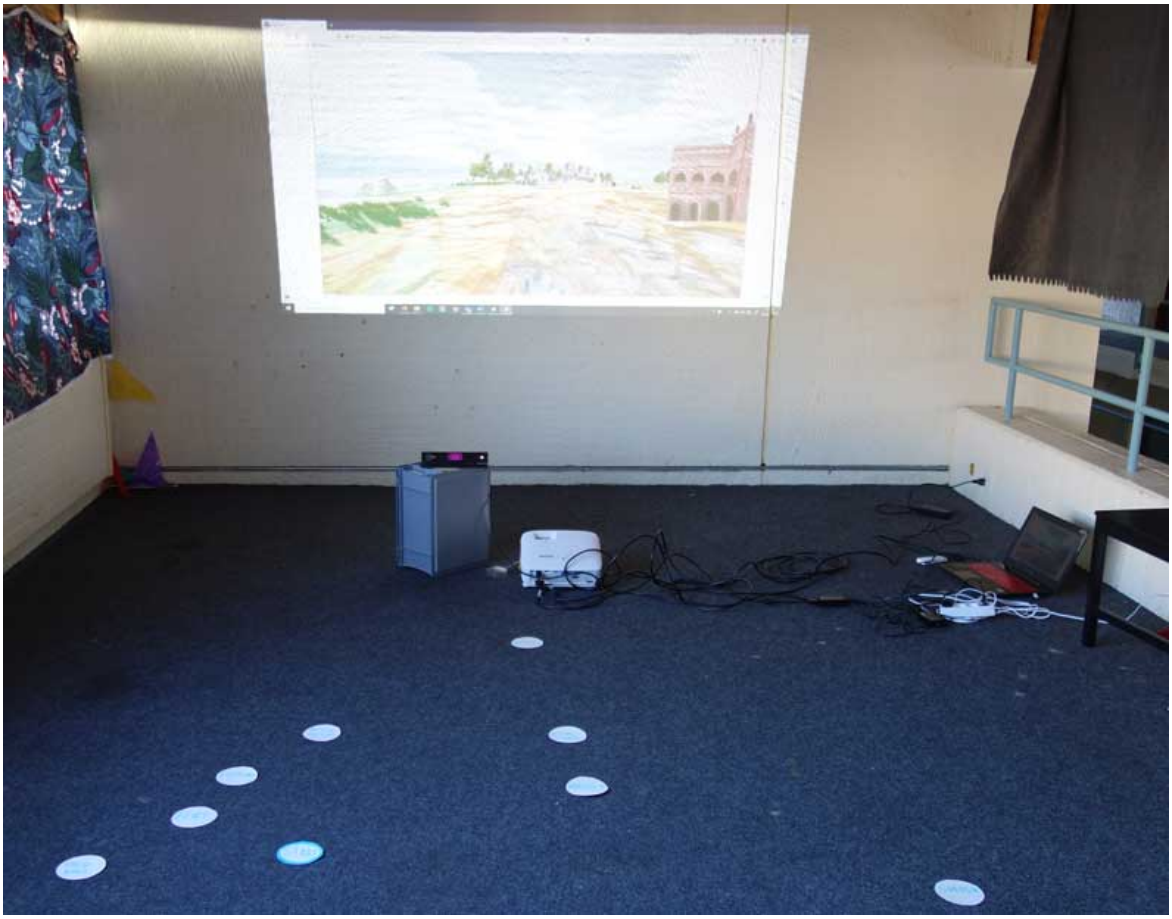


Figure 7.2: Test setup in the student dormitory

groups of 4 people and one couple participated in the test. Participants had 12 different

nationalities, 4 participants had a connection to India (2 Indians, 1 Kenyan with one parent from India, 1 Danish with parents from Pakistan). One participant had been in Surat as a child. At the beginning of the test, the only instruction was: "Try out the prototype, you are welcome to explore it as long as you wish. Don't hesitate to ask for help if needed or if something is unclear." For the groups of people, it was mentioned that only one person can interact at a time, but they are welcome to change the active role during the interaction or ask to start the experience from the beginning for the next person. Test participants were also asked to sign a consent form if they agreed to be filmed. The recordings were made for documentation purposes and to help clarify the observations later on. Participants were not informed about the purpose of the installation, or where it is going to be used to examine the possible future implementations.

7.2.1 Usability results

Observations and 5-point Likert scale statements ranging from "strongly disagree" to "strongly agree" were used. The results are shown in Figure 7.3 and are as follows: "I instantly understood that there is an interactive area in front of the projection" M=4.0, SD=1.15; "It was confusing to understand how to move and trigger the stories" M=2.7, SD=1.42. According to the observations and multiple-choice questions, 7 participants stepped on the start marker, in the beginning; 18 stepped towards the fort as instructed by the introduction (3 missed the instructions, 1 intentionally stepped somewhere else).

According to the observations, every participant closed the story unintentionally at least once, by stepping too far away from the objects. No one asked for help or explanation on how to trigger the stories. However, twice the observer commented to step to the left, because the marker on the floor had shifted away from the virtual representation and the landmark would have been missed otherwise.

7.2.2 User involvement results

The observed emotions were very subtle, and the only expression that clearly stood out was short laughter or chuckles. In the groups specifically, people would laugh 4 times throughout the experience. When alone, only 6 out of 14 people laughed, and, when they did laugh, participants laughed 3 times on average.. Participants laughed at the following remarks: "Are you following me?", "I don't think you were invited", "It's none of your business!", "Oh la la, so persistent!", "I'm starting to think you want to join the pilgrims!" and "Sorry my friend, I can't give you more discount".

On average the subjects used 13 minutes for the whole experience (SD 3.46) and visited on average 14 landmarks (SD 5.125).

Additionally, user involvement was assessed with a 5-point Likert scale statement, again ranging from "strongly disagree" to "strongly agree" (see Figure 7.3). Answers were as follows: "I felt like characters acknowledged me" M= 3.68, SD = 0.89, "My decisions

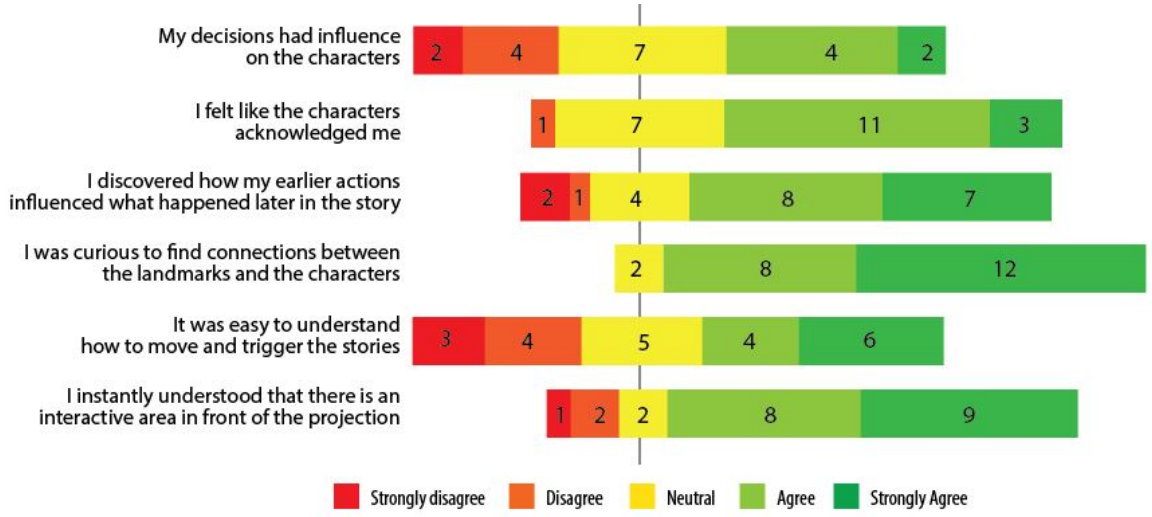


Figure 7.3: Test results to the 5-point Likert scale statements; the numbers in the graph represent the number of responses in the given category

had no influence on the characters" M=2.3, SD=0.9, "I discovered how my earlier actions influenced what happened later in the story" M=3.77, SD=1.23.

The emotional response was additionally evaluated by the participants with three different 5-point Likert scales accompanied by the SAM manikin pictures, shown in Figure7.4. The Likert scales started with the statement "Characters and their stories made me feel (..). The following are the corresponding options and data: "Excited, Wide awake" to "Calm, sleepy" (M=2.1, SD= 0.88). "Guided, controlled" to "In control, important" (M=3.27, SD=0.98). "Happy, satisfied" to "Annoyed, bored" (M=1.95, SD=0.84).

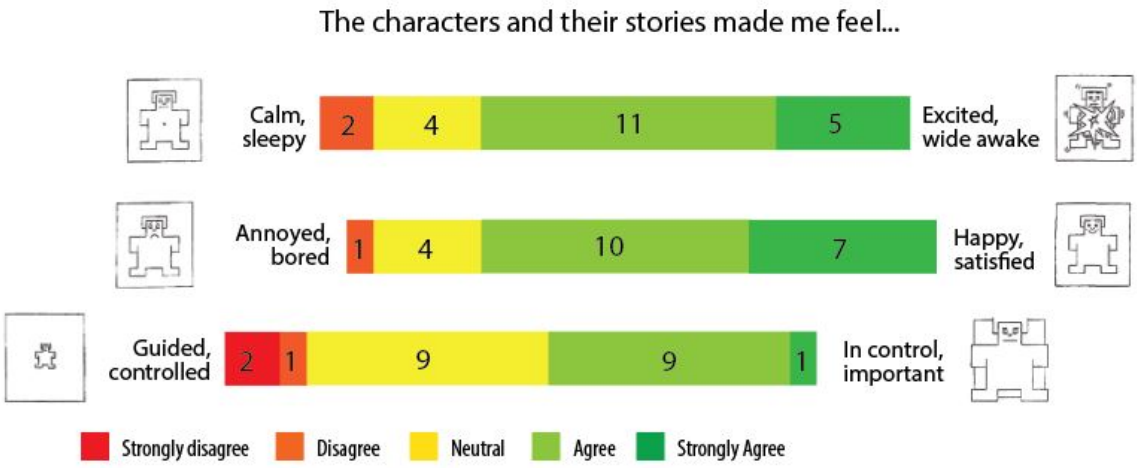


Figure 7.4: Results of 5-point Likert scales accompanied by the SAM manikin pictures to evaluate emotional response

7.2.3 Content recalling results

Participants were asked three questions regarding the historical details; the results are shown in Figure 7.5. To match the image and the purpose of the Mughalsarai, only one

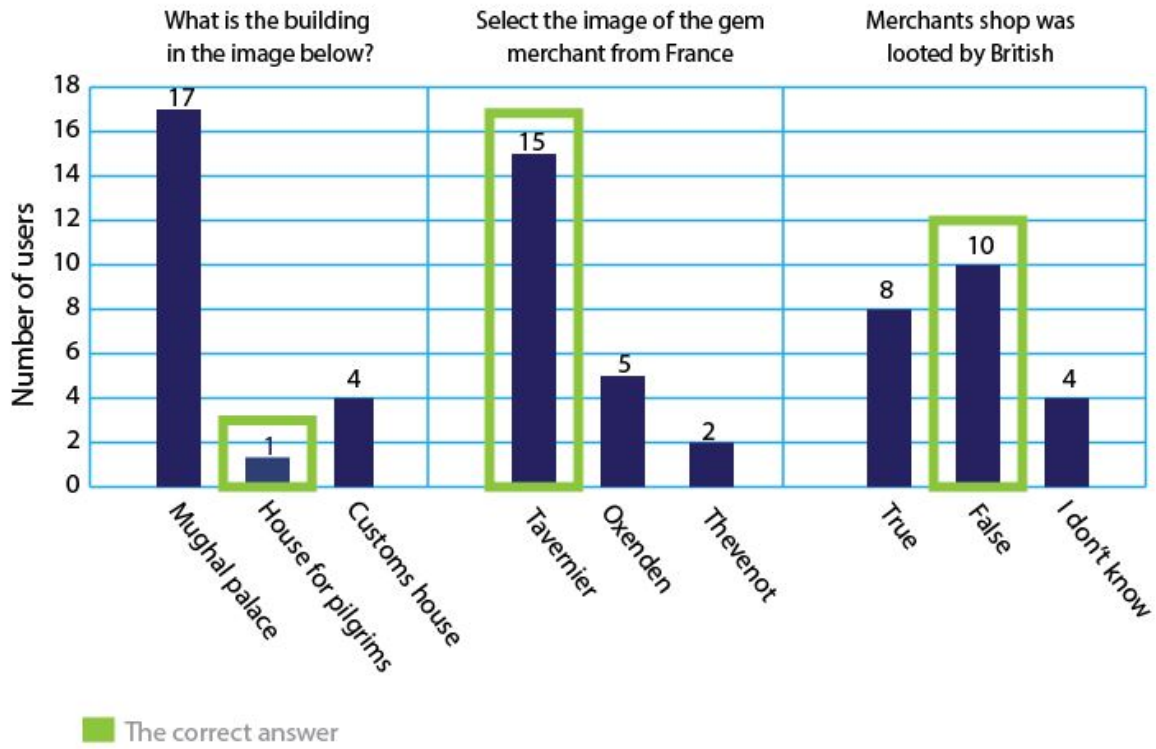


Figure 7.5: Results to the recalling questions

participant selected the correct answer, "House for pilgrims", and 17 participants selected "Mughal palace". When asked to identify the gem merchant, 15 people selected the correct answer; 5 selected the British president; and 2 selected a character, which was not present at all. When asked to validate the statement: “The Merchants shop was looted by British", 10 participants chose the correct answer "false”; 8 participants chose "true”; and 4 choose ”I don’t know".

7.2.4 Narrative intelligibility and closure results

Questionnaire

21 out of 22 participants answered, that they would like to visit the real historical places shown in the prototype.

1 out of 22 people noticed that the source of the text is traveler diaries, shown in the introduction.

The following answer to the 5-point Likert scale statement (ranging from "strongly disagree" to "strongly agree”), "I was curious to find connections between the landmarks and the characters", was **M=4.45**, SD=0.67.

The statement "I ended the interaction with the prototype because:" was answered as follows:

1. I visited all the landmarks (59,1%);
2. I reached the end in the story (27.3%);
3. I lost track of the story (9.1%);
4. I couldn’t find an ending (4.5%).

Semi-structured interview

Participants were asked to elaborate on multiple questions in a semi-structured interview after the interaction with the prototype. The full answers can be found in Appendix (ref).

When asked, "How did you feel about the end?", participants often mentioned the lack of objective and being confused about the walking order. The following presents the corresponding feedback:

- I wasn’t sure if I had visited everyone, I didn’t expect it will end so suddenly.
- I walked by a mistake in the wrong order, so there was no connection. I didn’t understand the story, because I was all over the place and when I reached the end, it didn’t feel like the end.
- Is there a clue? I felt I did something wrong. Maybe I walked in the wrong order.
- In the beginning, there was no objective, so the ending was okay. But when I saw others in the group to find the end, it was frustrating, because I didn’t know how to reach the end.
- I didn’t expect much, so it was good. Excellent for a museum.
- I thought there will be a sequence. A clear objective would help. I needed an exact map of where to go, or what am I achieving.

When asked, "What motivated you to keep interacting", participant answers were more diverse:

- Characters mentioned some places, so it felt that I should go there.
- I was following the hints, but I think I missed one, so then I was just exploring. From the game point of view, it’s good there is not so much guidance, because then I’m more willing to discover on my own.

- It was compelling, how you interact with it, how the camera moves.
- I was motivated to learn something new.
- The connections between some of the objects made it really fun.
- I wanted to make sure I have visited all the markers on the floor.

When asked, "How to make the experience more coherent and meaningful", participants often mentioned that they would like to receive a clear direction where to go next:

- Every story should give me a clue where to go next, so the storyline is connected.
- If there was an objective, why am I walking around the city. Even as simple as ”Walk around the city” would work.
- It would be smoother if I knew where to go, then I would follow the story.
- I was asking myself ”How do we know this? Is this information valid?”
- I am not an audio person, so only on the third time, I could start understanding the accents, adding more visuals or numbers would help.
- I thought there could be more detailed information about the historical events.
- It would help if it would be in a museum with some more context around. The place of the installation would change the meaning a lot.

When asked, "What value do you see in the whole experience?", participants with the connection to India mentioned:

- I knew about major politics, but not about this merchant city. I would not read such a piece of information if it was not presented in an entertaining way.
- Solution gives a different way of learning, it’s more interactive, which makes it more interesting. I would be very bored if someone came to me and told me about Surat, but when I have to be part of it, it makes me want to explore rather than just listen.

Other participants mentioned similarly:

- Depends on where it is used, e.g. in a museum, this could make it easier for people to go in-depth with the information, especially for children and young people.
- Solution gives knowledge and entertainment, for example in an airport it would be great fun when you got nothing to do.
- Excellent way to convey information in an exhibition or a museum, the solution tricks people to care a little bit more.

When asked about the intention of having multiple characters, the majority mentioned that the characters are there to show different perspectives from history, as well as make the story more fun and lively. Participants stated:

- To give some life to the experience, show different angles.
- One voice would be too monotonous.
- Show different roles, they form the structure of the city inhabitants.

Observations

The order of the visited landmarks was observed, it was noted that 14 participants after the Fort, visited the Market as the next landmark. After all of the landmarks had been visited, 12 people started re-visiting the previously visited landmarks.

Expressions such as these were observed: "Where is the secret entrance"; "How can I join the pilgrims?"; "Yes, I would like to clean the step-well!"; "I am confused"; "I don't know where to go next.";"Did I went to the wrong place?"; "Can I go inside the British Factory?".

Chapter 8

Discussion

The aim of this study was to broaden current knowledge of virtual museum exhibition design by implementing spatial design and interactive narratives. This chapter is organized according to the research question proposed in the chapter 4.

8.1 Usability

As anticipated the test subjects learnt to interact with the prototype very quickly, supported by the fact that no one asked for help or instructions on how to interact with the 3D environment. On the contrary, the average response to the statement *"It was confusing to move and trigger the stories"* falls in the middle of the Likert scale (M=2.7, SD=1.42). This was probably a result of the fact that nearly all subjects triggered the story unintentionally at least once. It is very likely that the close distance between the markers on the floor led the users to trigger the stories unwillingly. Another explanation might be the sensitivity of the Kinect camera; as a result of stepping too far away or leaning towards the graphics, the story was paused and the character disappeared. Likewise, the feedback during the semi-structured interviews confirms that a bigger interactive space would improve the efficiency of the interaction. As outlined in the literature review, previous implementations only used actual size virtual worlds, for example users must step backwards in 'the Livia's Villa' (2016) or use hand gestures in 'the Tiber Valley' (2016) to control the camera view of the virtual environment. As predicted the conducted experiment demonstrates that 3D environment can be represented in a smaller size without raising misunderstanding among the users. However, careful attention must be paid in connection to the user goals, as the earlier mentioned solutions offer a bigger variety of functionality (e.g. swimming in the river, flying over the city and teleporting). The proposed solution of this study has integrated only natural interaction methods, which is an advantage, when museum visitors are faced with a novel technology and might feel shy in front of a group of other visitors.

8.2 Archive materials

When subjects were asked to comment about the graphics and animations, only two participants indicated that they would like to go inside and around the presented buildings. Broadly speaking, users approached the presented character animations and the historical assets with curiosity and did not have suggestions for improvement. It is significant that assets taken from the museum archive could be integrated in the solution in an aesthetic way. The research revealed that previous spatial installations had only approached 3D environment design by digitizing and virtually reconstructing the past environments. A realistic virtual reconstruction is only possible with a significant amount of financial resources and is conducted using techniques such as laser scanning, photogrammetry, and photo modeling. These techniques are fully justified if the goal of the installation is to create precise, detailed representations. However, the conducted study and the applied design technique demonstrates a novel way to utilize the historical assets from the museum archives. It is important to note that historical assets themselves have a significant value as they depict the people and events in history and are often displayed in the museum exhibitions individually.

8.3 Involvement and emotional engagement

According to the observations, over half of the subjects laughed during the interactive experience. It was observed that the laughter is related to the short responses of the characters, which were played according to the previously visited landmarks. Interestingly, the adaptive discourse is revealed exactly at the moments of the short phrases when participants laughed. These results prove the success of the narrative development, as the main focus was on the character believability and discourse adaptivity. These observations are supported by the questionnaire results where the majority of the subjects agreed that their actions could influence what happens later in the story and that the characters acknowledge them (see Figure 7.3).

Consequently, when asking the subjects to evaluate the overall emotional response, the majority agreed that they felt excited and satisfied with the experience. However, the results need to be interpreted with caution. The evaluation method originally was designed to analyze single stimuli and not a long interactive experience (Bradley and Lang, 1994). It is very likely that the response would be different if single images or phrases were analyzed, which could help to understand implicitly which narrative details caused the users to feel aroused or bored. Nevertheless, the Emotive Framework guidelines (2019) indicate that emotional response measurement methods in the cultural heritage field are still in their infancy and suggests the SAM-manikin evaluation method (1994) as one of the most widely used evaluation tools.

Additionally, the results from the time tracking during the experiment reveal that on average a subject spent 13 minutes on the interactive experience in comparison to the first

user test, where the average duration per person was 7 minutes. The time difference is significant and demonstrates how powerful the implementation of the interactive narrative is. This finding is further supported with the answers to the question *"What motivated you to keep interacting"*, as half of the participants commented that they were curious to follow the hints and discover why some of the landmarks were mentioned by the characters. An interesting comment was "I was captured by the character at the ship, she said I should not go inside the Fort, so then I thought - of course I'm going in! Now I want to go in". Additionally, comments such as "I liked when characters gave hints", and "I liked the merchant character because he gave clear directions" show that small remarks were appreciated by the subjects. One exception arose when one participant mentioned that he liked the Italian character, as that was the only one who did not ask for anything.

The user response offers compelling evidence that adaptive discourse helps to create narrative continuity as well as engage users to interact for a longer time. The results are in line with the suggestion that adaptive storytelling might have the same effect as agency (Larsen and Schoenau-Fog, 2019). This technique could be very relevant in the cultural heritage field since the historical facts throughout the interactive narrative have to stay valid.

8.4 Success of the narrative communication

An unexpected response was that only one person recalled the content from the introduction video, which revealed that the stories are based on real traveler diaries. Additionally, the majority did not hear that the goal is to explore the city and thought there is a trick to reveal something more in the story. This observation is confirmed by the answers that emerged from the question "I was curious to find connection between the landmarks and the characters" as the majority of respondents strongly agree to this statement (M=4.45, SD=0.67). The introduction was designed to present the historical significance of the characters and their stories. During the consultation with the director of PHC, one of the major concerns was the validity of dates, personalities, and the origin of the illustrations. It was discussed that an attribution is needed, if the illustration is depicting another region in India. The semi-structured interviews revealed that participants did not know the source of the stories or if the historical information is valid. Even though the characters were based on real personalities, the test participants thought it might be a fiction.

Surprisingly, the majority (81.8%) followed the instructions from the introduction to step towards the Fort and over half of the participants (63%) visited the Market as the next landmark after the Fort. The connections between landmarks were designed to give personalized content and excite visitor curiosity, however the end of the story was reached independently of the visiting order. Unexpectedly, the majority of the subjects indicated that they felt puzzled at the end of the experience. Comments such as "What was I supposed to do? Did I have to go randomly, or follow to the places the characters mentioned?", "Is there a clue? I felt I did something wrong", reveal that users were perplexed about the

end. There was a significant number of subjects (54%) who started re-visiting the landmarks; the observations confirm that the subjects were searching for something more. The apparent lack of closure can be explained by the questionnaire results. When the subjects were questioned about the reasons for ending the interaction, over half (59,1%) reported that they visited all the landmarks, only 27,3% indicated that they reached the end in the story. Almost half of the participants (45%) reported that clear directions or an objective would help to make the experience more meaningful.

The user feedback gives a legitimate concern about the narrative closure. It would certainly help if the installation was placed in the real context in the Surat castle, as the subjects would have different expectations for the experience and the completeness of the interaction would be supported by the surrounding environment. Accordingly, when asked how to make the experience more meaningful few subjects confirmed that the context would help to bring more understanding to the experience and would affect their expectations for the installation. Interestingly enough, three subjects mentioned that they liked the story about the wood used for the ship building, because it mentioned Europe. This supports the studies by Falk (2006), where he indicates that visitor learning depends on interests and previous knowledge. This suggests that museum visitors will have a very different response to the stories, as they already have a personal connection to the city and the presented content will be more relevant. Additionally, the museum environment and the exhibitions will prepare the visitors to understand the context of the virtual story world.

Even though the interactive experience left some questions unanswered and the feeling of finality is questionable, the general goals of the narrative were met as intended by the author. Over one third (36%) indicated that the intentions of having multiple characters is to show the different angles from the same time period. Remarkably, 95.5% reported that they would like to visit the real historical places shown in the prototype. Also, the majority commented that they found the presented material educational and entertaining at the same time.

8.5 Generalization

The experiment was conducted out of the museum context, which allowed the subjects to be asked where they think the installation could be used. The results showed that 90.9% found a museum as a relevant place for the installation, with the tourist information center as the second choice (77.3%) and school as the third (40.9%). Additionally, outdoor urban space and airports were mentioned by one subject. As anticipated, the results showed that the concept design could be applied to diverse use cases.

The first choice was a museum, which fits with the Surat Fort case study. Despite the fact that the implementation was developed for the specific museum case, it is possible to outline what type of assets are needed to apply the proposed concept in other museums. The key feature of the concept is a map based on geography of the location.

Generally speaking, maps can help the audience in interpretation by providing depth to the presented information. Figure 8.1 shows maps displayed in The National WWII Museum [1] and The Riga Art Nouveau Centre[2]. In both cases the geography maps reveal the chronology of events or linkage between the historical places.

Figure 8.1: Geography maps in The National WWII Museum and The Riga Art Nouveau Centre. Image Courtesy of The National WWII Museum and The Riga Art Nouveau Centre.

It is possible that maps which are based on content and meaning rather than geography could be more suitable for natural history and art museums. In such cases, the implementation could be adjusted to show a semantic map. Figure 8.2 shows an example of an interactive map used to communicate interconnections between intangible cultural heritage around the world[3]. Such a map could also be displayed on the museum floor, where the visitor can step on a category and be presented with multiple interconnected stories. Another example could be to display a timeline on the floor, where the visitor can walk through centuries and be presented with different artworks on the projection. The Figure 8.3 shows an example of an interactive timeline developed by The British Museum and Google[4].

Over half of those questioned (77.3%) reported that the tourist information center could be a suitable location for the installation. Such a solution could be compared to the one developed for the Surat Fort, yet more focused on the current and most relevant tourist destinations. Several subjects (40.9%) indicated that schools could be a possible space for the installation. The experiment results regarding the recalling of the presented data were varied. As underlined by Falk (2006), learning depends on many variables, and is

[1]The National WWII Museum in New Orleans https://www.nationalww2museum.org/visit/museum-campus-guide/campaigns-courage/road-berlin

[2]The Riga Art Nouveau Centre in Latvia http://www.jugendstils.riga.lv/eng/muzeum/

[3]Visual navigation through intangible cultural heritage created by UNESCO https://ich.unesco.org/en/divedisplay=threattabs

[4]Interactive, chronological view of art history developed by The British Museum and Google https://britishmuseum.withgoogle.com/

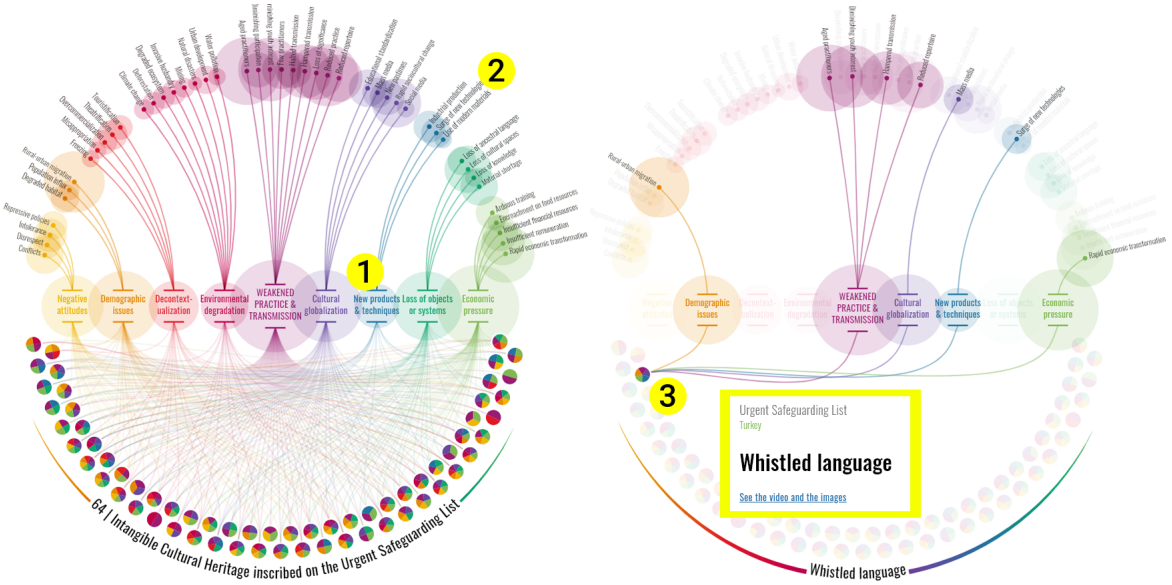


Figure 8.2: Semantic map of interconnections between intangible cultural heritage developed by UNESCO

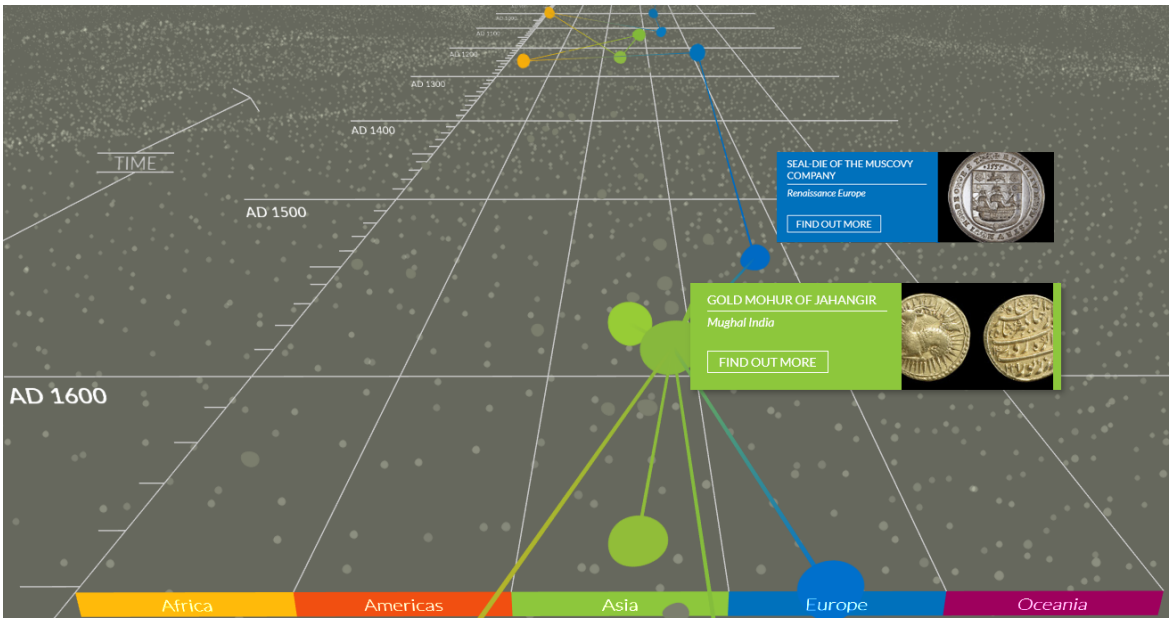


Figure 8.3: Chronological view of art history developed by The British Museum and Google

cumbersome to measure. Nevertheless, for schools, the pedagogical value plays a major role and the solution could be adjusted to a question and answer format. For example, the characters could ask, where do you think the coins were made and give multiple options to go to the Customs House or the British factory. This technique would be able to involve students in a more typical learning scenario.

Chapter 9

Conclusion

This study addressed the following research question:

How can spatial design and interactive narratives improve the existing methods of virtual museum exhibition design in cultural heritage?

To answer this question a spatial exhibition design was developed for the case of the Castle in India. One of the requirements from the Surat Fort was that the visitors should be able to understand the interaction method quickly and without any instructions. Therefore, usability was at the core of the concept design and the experiment demonstrated that users could interact independently and grasp the interaction method very quickly without extra help. This observation is significant, because the users were in full control of the camera view in the 3D world, contrary to the previously developed spatial solutions. It must be noted though, that users were restricted to move the camera only on the x and z axes and limited by not being allowed to rotate the camera view fully. However, the results of the experiment confirmed that a bigger interactive space is necessary. Research into combining multiple Kinect cameras is already in progress and is the next step to bring the solution to fruition.

Visitor emotional engagement was another important factor, which was addressed by developing interactive narrative that is adaptive at the discourse level. The integrated discourse adaptivity showed promising results regarding engagement, as almost half of the test participants laughed during the experience. However, it was discovered that the introduction sequence of the story was missed by most of the test subjects. It can be argued that the historical significance of the developed characters was diminished, because the users missed the information about the origins of the presented material. It can be concluded that the important information must be part of the main narrative and not only at the introduction or the end of the experience.

Regarding the intelligibility of the solution, the communication goals were assessed. The main goal of the application was to inspire the museum's audience to visit the cul-

tural heritage sites in Surat. The results showed a positive response, nevertheless this question should be addressed in the final museum environment and presented to the actual museum visitors to make a valid conclusion. In regard to the narrative closure, over half of the subjects reported that they felt confused at the end of the interactive experience. It can be concluded that a clearer objective, repeated throughout the narrative, could provide a better closure to the audience.

Finally, it can be concluded that the applied design technique demonstrates a novel way to utilize historical assets from museum archives, which can also be applied in other domains. Very few subjects mentioned that they would like to go around and see the represented material from different angles, which makes the 2D archive assets a viable design concept for creating virtual museum exhibitions. In summary, the designed prototype presents an innovative method to link archive materials through interactive storytelling.

Chapter 10

Future work

10.1 Multi-Kinect motion tracking

One of the usability problems was the proximity of location of the points of interest on the floor which were too close together. As mentioned earlier, combining multiple Kinect cameras would help to expand the interactive space. For the Surat Fort, most likely two Kinect cameras will be sufficient, however, it is also possible to combine four in order to track all the angles of the active user. A solution that tracks all of the angles could provide a chance to see the presented graphics from other angles and even make a projection on multiple walls.

10.2 Improving the educational potential

One of the suggestions received from the People of Heritage Concern was to show the historical dates and key events visually by written text. Also, the interviews from the experiment revealed that the audio could be complemented with text to emphasize the historical details. This could easily be added to the Unity solution and could improve the educational potential.

10.3 3D soundscapes

Sounds have the power to create a special ambience as well as guide users and provide a different type of information. This modality could undoubtedly enrich the user experience and contribute to the narrative immersion.

10.4 Content creation

The trend of content creation could be adapted to the spatial solution and potentially offer a remarkably stunning effect. For example, one can develop a situation for the younger generation of visitors where they are provided with an instance of a template of a house in future Surat. The children could color the house to encourage more engagement. Further, the house could be scanned and directly inserted into the virtual solution where the visitors can step into the 'Future district of Surat' and find their own creation on one of its blocks.

10.5 Social interaction

Creating social interaction and raising discussions among museum visitors is an important factor for museums. The proposed solution could be further developed to allow multiple active users at the same time. The Kinect motion tracking currently allows tracking up to 6 persons, and so one of the ideas was to develop a role-playing scenario for the audience. For example, one user would be in charge of the main role and the camera angle, but when another user steps into the interactive area, the characters could say that a king has arrived, or that an invader is approaching the city center. Such role-play offers potential to involve multiple people and raise more interaction among the audience.

Bibliography

Abbott, H. P. (2008). The cambridge introduction to narrative. Cambridge University Press, p.16.

Barr, J. (2005). Dumbing down intellectual culture: Frank furedi, lifelong learning and museums. *museum and society*, *3*(2), 98–114.

Bedford, L. (2001). Storytelling: The real work of museums. *Curator: The Museum Journal*, *44*(1), https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.2151-6952.2001.tb00027.x, 27–34. https://doi.org/10.1111/j.2151-6952.2001.tb00027.x

Bekele, M. K., Pierdicca, R., Frontoni, E., Malinverni, E. S., & Gain, J. (2018). A survey of augmented, virtual, and mixed reality for cultural heritage. *J. Comput. Cult. Herit.*, *11*(2). https://doi.org/10.1145/3145534

Bevan, N., Carter, J., & Harker, S. (2015). Iso 9241-11 revised: What have we learnt about usability since 1998? In *International conference on human-computer interaction*. Springer.

Bradley, M. M., & Lang, P. J. (1994). Measuring emotion: The self-assessment manikin and the semantic differential. *Journal of behavior therapy and experimental psychiatry*, *25*(1), 49–59.

Bruni, L. E., & Baceviciute, S. (2013). Narrative intelligibility and closure in interactive systems, In *International conference on interactive digital storytelling*. Springer.

Campbell, J. (2008). *The hero with a thousand faces* (Vol. 17). New World Library.

Economou, M., Perry, S., Young, H., Katifori, A., & Roussou, M. (2017). D9. 1–evaluation framework and guidelines.

Ekman, P., Sorenson, E. R., & Friesen, W. V. (1969). Pan-cultural elements in facial displays of emotion. *Science*, *164*(3875), 86–88.

Emotive conceptual framework. (2019). https://emotiveproject.eu/wp-content/uploads/2017/11/EMOTIVE_D5.1_ConceptualFrame-Guide_v1.0.pdf accessed: 26.04.2020

Emotive evaluation framework. (2019). https://emotiveproject.eu/wp-content/uploads/2018/11/EMOTIVE_D9.1_Evaluation_Framework_Guidelines_v1.0.pdf accessed: 26.04.2020

Falk, J. (2004). The director's cut: Toward an improved understanding of learning from museums. *Science Education*, *88*(S1), S83–S96.

Falk, J. H. (2006). An identity-centered approach to understanding museum learning. *Curator: The museum journal*, *49*(2), 151–166.

Fanini, B., & Pagano, A. (2015). Interface design for serious game visual strategies the case study of "imago bononiae", In *2015 digital heritage*. IEEE.

Katifori, A., Karvounis, M., Kourtis, V., Perry, S., Roussou, M., & Ioanidis, Y. (2018). Applying interactive storytelling in cultural heritage: Opportunities, challenges and lessons learned, In *International conference on interactive digital storytelling*. Springer.

Katifori, A., Roussou, M., Perry, S., Drettakis, G., Vizcay, S., & Philip, J. (2018). The emotive project-emotive virtual cultural experiences through personalized storytelling., In *Cira@ euromed*.

Koenitz, H., Di Pastena, A., Jansen, D., de Lint, B., & Moss, A. (2018). The myth of 'universal'narrative models, In *International conference on interactive digital storytelling*. Springer.

Kuka, D., Elias, O., Martins, R., Lindinger, C., Pramb¨ock, A., Jalsovec, A., Maresch, P., H¨ortner, H., & Brandl, P. (2009). Deep space: High resolution vr platform for multi-user interactive narratives, In *Joint international conference on interactive digital storytelling*. Springer.

Larsen, B. A., & Schoenau-Fog, H. (2019).
well, that was quick"–towards storyworld adaptivity that reacts to players as people, In *International conference on interactive digital storytelling*. Springer.

Manjrekar, S., Sandilya, S., Bhosale, D., Kanchi, S., Pitkar, A., & Gondhalekar, M. (2014). Cave: An emerging immersive technology–a review, In *2014 uksim-amss 16th international conference on computer modelling and simulation*. IEEE.

Maye, L. A., McDermott, F. E., Ciolfi, L., & Avram, G. (2014). Interactive exhibitions design: What can we learn from cultural heritage professionals? In *Proceedings of the 8th nordic conference on human-computer interaction: Fun, fast, foundational*, Helsinki, Finland, Association for Computing Machinery. https://doi.org/10.1145/2639189.2639259

Miller, C. H. (2019). *Digital storytelling 4e: A creator's guide to interactive entertainment*. CRC Press.

Munaro, M., Basso, F., & Menegatti, E. (2016). Openptrack: Open source multi-camera calibration and people tracking for rgb-d camera networks. *Robotics and Autonomous Systems*, *75*, 525–538.

Naim, C. (1995). Popular jokes and political history: The case of akbar, birbal and mulla do-piyaza. *Economic and Political Weekly*, 1456–1464.

Nikolakopoulou, V., & Koutsabasis, P. (2020). Methods and practices for assessing the user experience of interactive systems for cultural heritage, In *Applying innovative technologies in heritage science*. IGI Global.

Pagano, A., Armone, G., & De Sanctis, E. (2015). Virtual museums and audience studies: The case of "keys to rome" exhibition, In *2015 digital heritage*. IEEE.

Pescarin, S., Pagano, A., Wallergård, M., Hupperetz, W., & Ray, C. (2012). Archeovirtual 2011: An evaluation approach to virtual museums, In *2012 18th international conference on virtual systems and multimedia*. IEEE.

Pietroni, E. (2019). Experience design, virtual reality and media hybridization for the digital communication inside museums. *Applied System Innovation*, *2*(4), 35.

Pietroni, E., Forlani, M., & Rufa, C. (2015). Livia's villa reloaded: An example of re-use and update of a pre-existing virtual museum, following a novel approach in storytelling inside virtual reality environments, In *2015 digital heritage*. IEEE.

Pietroni, E., Pagano, A., Amadei, M., & Galiffa, F. (2016). Livia's villa reloaded virtual museum: User experience evaluation, In *Proceedings of the 9th annual international conference of education, research and innovation*.

Pietroni, E., Pagano, A., & Poli, C. (2016). Tiber valley virtual museum: User experience evaluation in the national etruscan museum of villa giulia.

Pietroni, E., Pagano, A., & Rufa, C. (2013). The etruscanning project: Gesture-based interaction and user experience in the virtual reconstruction of the regolini-galassi tomb, In *2013 digital heritage international congress (digitalheritage)*. IEEE.

Pujol-Tost, L. (2019). Did we just travel to the past? building and evaluating with cultural presence different modes of vr-mediated experiences in virtual archaeology. *Journal on Computing and Cultural Heritage (JOCCH)*, *12*(1), 1–20.

Roth, C. (2016). Experiencing interactive storytelling. *Vrije Universiteit*.

Ryan, M.-L. (2005). Peeling the onion: Layers of interactivity in digital narrative texts, In *Based on a talk presented at the interactivity of digital texts conference*.

Ryan, M.-L. (2008). Interactive narrative, plot types, and interpersonal relations, In *Joint international conference on interactive digital storytelling*. Springer.

Støvring, N. M., Kaspersen, E. T., Korsholm, J. M., Najim, Y. A. H., Makhlouf, S., Khani, A., & Erkut, C. (2016). Multi-kinect skeleton fusion for enactive games, In *Interactivity, game creation, design, learning, and innovation*. Springer.

Takakhav, N. (2018). The sack of surat and barselor, 1664-1665.

Tolstoy, L. (2019). *What men live by*. BoD–Books on Demand.

Webber, S., Harrop, M., Downs, J., Cox, T., Wouters, N., & Moere, A. V. (2015). Everybody dance now: Tensions between participation and performance in interactive public installations, In *Proceedings of the annual meeting of the australian special interest group for computer human interaction*, Parkville, VIC, Australia, Association for Computing Machinery. https://doi.org/10.1145/2838739.2838801

Appendix A

Proof of concept test in the Surat Castle

A.1 Interview with Sumesh Modi, the Principal Conservation Architect at PHC

What were your first impressions, when walking around the map?

It's easy to get information, but circle on the map has to be very bold or highlighted in some way. Perhaps raise from the surface - pop up from the floor surface would be a good addition, so you feel with the feet once you step on the object. It was natural to move around, it was interesting to see how everything corresponds to the movement.

Have you experienced anything similar in other museums or exhibitions?

VR of a stepwell in Gujarat, where you can move around the stepwell. VR is more experiential, you forget everything. VR is interesting for one monument, but here we cannot use VR. What you suggest is excellent for the purpose. We want to connect the people with the city, and city cannot be in VR, because you don't know how to go, where to go and where are the monuments. Suppose you are in VR, you will se only two things and come back, because you don't know the map. That's why you need to have a map at the base and 20 things, which are little popped up and you know that you have to see these 20 things, so by default we are giving an information.

What did you think about the illustrations?

Once you turn to the side, the other face of the castle cannot be seen. It would be beautiful to add other angles of the monuments. This kind of connectivity would be beautiful, because right now it just looks like an image. For children it is interesting, but 3D objects would be more interactive.

What did you think about the 3D environment?

It was beautiful. It's no 100% fitting the era, the pathways should be added. The roads that are visible in the map should connect the buildings.

How did you feel about triggering the stories?

It is fantastic. That is how you actually connect. Can you recommend other stories that could be represented? Mughal Sarai, Step Well near Katargam. Makka Karai, which became Makkai Pur – it creates interest, because there is a connection in the names from the old times. Meaning has changed, but some connection is still there. Bega Pura, the queens in royal families used to have beautiful gardens and there are also stories about it.

Any additional comments?

We should scale the area bigger, to have more movement. Monuments should have s bigger distance and length in-between.

A.2 Photos from the Surat Castle

A.3 Consent form

Information Sheet for Participants

I am a Medialogy student from Aalborg University, Denmark. I have developed a prototype and am interested to hear your feedback on it.
This will roughly take 15 minutes and you are free to

- not answer any questions or perform tasks that make you feel uncomfortable,
- request to stop and delete the recording and
- end this session at any point.

While talking to you I would like to (video) record our conversation and how you're interacting with the prototype. The recordings will be treated confidentially. I will transfer and store them at a secure site for further analysis. If you consent, images may be used for scientific publication purposes and my project report and its presentations only.

Participant Consent Form

I _____ hereby agree to voluntarily participate in the research being undertaken. I have been informed that the consent to participate can be revoked at anytime, or that I can have certain identifying data withheld from the research publications.

I give permission for recorded images and/or videos to be:

- taken of me during the interview and trial Yes ☐ No ☐, and
- re-produced in scientific publications, student reports and presentations: Yes ☐ No ☐

Name:

Signature: Date: / /

Appendix B

Narrative design

B.1 First iteration: The Dramatic Arc

Once upon a time, there was a girl. She lived in the castle. Her father was taking care of the library. She loved books. Her father used to read for her ever since she was a baby showing her all the universes and possibilities of those stories. In the history books she found her safe spot, imagining how people live in other places and times. With a wild soul her biggest dream was to travel the world, but she was not even allowed to leave the castle. Every day she would hide in her room and wait for the time when people go to sleep, so she can enjoy the garden. Some days she was lucky and she could see through the keyhole the concerts and dancers entertaining the royal family.

Until one day the king was kicked out of the castle, all the property was taken away by foreigners (ANTAGONIST) and people were let go. Her father made a secret deal hoping that the daughter is in safe hands and can travel the world. But her father was betrayed and killed, and his daughter was left alone on the streets of Surat.

Hungry but yet not hopeless, she pursues her dreams and goes to the British Factory to ask for a job on a ship and food. They dismissed her out of the building under rude screams of fear and ignorance.

She goes to a cafe to meet travelers. It was known that travelers all over the world come to meet in Surat. But they ask her to join their religion in order to join.

She visits pilgrims' house and fire ceremonies. But even in her fight for survival those beliefs don't tempt her enough to accept new fate.

She goes to a shipbuilding place, to get to know people and find a boat. She sees that the city is devastated, local people are starving and try to sell everything to her. At the shipbuilding they ask for money in exchange for help. All she has left is jewelry from her mother, but she has to exchange it for money..she is hurt that she has to give the last memories of her mother away.

She goes to the king in the hope that he would buy it from her. He is devastated and tries to encourage local people to fight against foreigners and save the city. He knows that

travelers are cheating and are looking for help. She doesn't care much, but she sees that people are crying. She just wants to leave. King sends her to the customs house in order to melt jewelry in coins.

She runs to customs, the city is in ruins. At customs she notices how foreigners are cheating and hiding jewels when entering the city.One of the Dutch travelers notices the unwelcomed eyes. He is anxious. He offers a space on his ship if she does not reveal to the city governors how they are cheating at the customs. She accepts the offer.

She goes together with the foreigners to the Dutch factory to meet the crew, they are disgusting. Eating, getting drunk, and being rude to her; singing songs she cannot understand. On the way to the ship she sees wrestlers - who are drugged to death with opium. She has tears in her eyes, she cannot believe they can be so cruel.

She gets on the ship. It is wonderful - She is finally on the way! But she feels miserably lonely, she doesn't belong here.

She discovers a secret plan of Europeans on how to slowly destroy the city. She knows that this would save the local king and give the power back to the locals of the city. On the river bank she sees women washing laundry and locals catching fish.

She grabs the secret plan, jumps off the ship, and runs to the king who was devastated and previously asked for help. The Dutch notice her escaping and try to stop her. But she fights back and escapes. She arrives at the king and reveals the secret plan. The city is saved. She gets a chance to contribute to the city development (museum visitor adds their image/message in the virtual exhibition).

B.2 Second iteration: Multiple Endings

Mughal officer at the castle gate:

Oh, I can see that Shivaji's sudden attack is threatening your business. It is true that you need to protect your goods, but there is no way I can let you inside the Fort. Our governor Inayat Khan is inside the castle. Unwilling to face the Maratha forces he is hiding inside together with his family. Yes, you have heard right! The top merchants are hiding inside as well. Our governor asked for a high fee to enter the fort, but now it's too late for you! All I can tell is that Shivaji's 8000 strong armies are approaching, go and try to get a boat at the river bank! That is the only way out of the city right now. Of course you can linger for a bit longer. I have been serving at the fort all my life. I can tell you about the Portuguese attacks, which are the reason this fort was built in the first place. More about the fort and Mughal Empire: Surat is the richest city in the whole Mughal Empire, it is so far from the South Maratha Empire, that our emperor Aurengzeb has not thought of protecting the city. An awful choice I tell you! But the fort was built to protect the port from Portuguese, they used to attack at sea - the latest attack caused the emperor to stop all the contact with Portuguese merchants. Turns out the Akbar's wife was on the ship when the Portuguese attacked.

Maratha soldier at the riverbank:

Are you asking for a boat to leave your city? I see you are working for one of the rich merchants living in this city. Shivaji attacked Surat after the demand for the tribute was rejected. Our ships are arriving now, don't you dare to hide your wealth from our king! It's better you run back to your master and prepare the goods to give Marathi away. We will take them by strength if you don't give your gold and silver voluntarily.

More about the attack:

Why did we attack? Of course, I can tell you 'WHY'. Your city is a cash cow for the Mughals. Their revenue is in lakhs just on account of taxes. It is the main port from where the Haj pilgrims leave for Mecca. And on top of that Surat is safely established in the Mughal territory, but with not a single fort or soldier guarding it. Surat is like a Mughal queen roaming freely in the royal gardens without any fear. I can see how unprepared you were - I am sure you could never dream of our attack here. Now go to your merchant, I am sure he is still in the market place and has not managed to get very far with all his gold.

Virji Vora at the entrance of his shop near the local market. Virji Vora was one of the most prominent merchants in Surat and the main contact with British Company, he owned monopole and set rules for local merchants:

I can't believe our governor's actions, how come he did not let you inside the Fort! My name is Virji Vora, I am one of the most prominent merchants in Surat! I am the main contact for the British Company. I even set the rules and prices in our local market! Disgusting, his city would be nothing without us, the merchants. Look at the market! It's such chaos! And Marathi army has just taken away all our silver and gold savings, they even carried away 28-seers of large pearls. Thank God I have other reserves out of the city center. Where would ordinary people go? All the spices, textiles, and silver are in such a mess. I don't know what to do. Go to the other merchant, he lives at the parks. I remember him telling me that the governor used to come to his gardens, even before entering the city. He knows how to reach our emperor Aurengzeb and get some help!

More about markets and trade:

Of course you are allowed to take a rest, but remember this is still your workplace. I can tell you - the markets used to be the pearl of our Empire. The famine and rains have been destroying the trade slowly, and now this attack! Our cotton textiles have already become popular in England. And diamonds from all over India are being polished here. Also so many spices from Java islands in the South are coming through our markets before they reach the rest of the world. I can't believe we have to find a new place to start our business. Now go and look for help near the parks.

Tavernier, the french gem merchant who had royal contacts, resting in the rich merchants' garden.

Hello my dear, let me introduce myself. I am a gem merchant from France, my name is Tavernier. Unfortunately the merchant you are looking for is not home at the moment. I am so relieved! I have just received a message from my partner Bernier, he says that Shivaji has respected the residence of our missionary father Ambrose. I can assure you, it's good

to be connected with the royalties of the empire. I can see you really need some help to protect your business. I heard that the British have their own army to protect themselves, so it's a safe place to hide until you find a way out of the city. Otherwise the Mughal Sarai is also known as a safe place for travelers.

More about the garden:

You are welcome to join me for a walk in the garden. I must say the gardens here have nothing in the fashion of our gardens Europe, but a few ponds and fountains. This garden is of considerable extent but has not the least appearance of regularity in the design. The rest is a confusing mix of buildings and small orchards. It is beautiful though that the summer houses in gardens are spread with carpets and refreshed with various figures of the rising water.

Manucci at Mughal Sarai:

Hello there, are you missing a place to sleep overnight? You can safely stay here...Shivaji promised not to touch any religious buildings. You can hide here from the Maratha army. All the travelers are charged a fee..the only exception is learned scholars or pilgrims going to Mecca and Madina. Also other sacred or religious individuals are accepted for free, but I believe you will have to pay a fee. Soldiers are strictly prohibited here. Your rent will be spent on maintenance and repair of the building; wages of watermen and sweepers; and purchasing food for animals. The rest of the income should be donated to the pilgrims going to Macca. Maybe you should join the pilgrims if you have no money to support yourself? Otherwise, go to the English Factory, I heard they are hosting some of the top merchants at the moment.

More about Mughal Sarai:

It was built during the period of Mugal Emperor Shah Jahan in the year 1644. According to these inscriptions it was stated that though this building was built as Sarai during the rule of Emperor Shahjahan in the name of Almighty Allah it was in fact believed to be heaven during those days.

Dutch Factory, Camouflage character (not important to progress in the narrative)

Oh, how do you like it here? I furnished myself with some of this place, you are welcome to stay! But English are stronger now, perhaps they can help you to leave the city, I heard they are preparing to move most of the trade to Bombay now. Also Mecca travelers could help..they are resting in Mughal Sarai. Shivaji promised not to touch any religious buildings, so it should be safe and sound there. More about gem merchant I can tell you more about my biggest success so far! I have sold the biggest diamond ever found to my majesty King Luis XIV.

Sir Oxenden, at the British factory (the governor in the Surat British Factory)

Welcome to the English factory. I am Sir George Oxenden, the president of the factory. I'm so sad to hear that your master's home was plundered for three days and an incredible amount of money and precious stones were carried away. One of our guards was protecting the house of another merchant (Haji Sayad Beg). This brought about an exchange of threats of defiance between Shivaji and me. I am sure Shivaji would have

carried off a much greater amount of treasure if it would not be for our gallant stand. Our ship is leaving soon for Bombay, I can guarantee you a spot on this ship to escape the ruined city. But first you have to go to the Customs house..you will need to melt your last pieces of silver into coins to pay for the trip. You can also join us for dinner! Tonight we are celebrating the received gift from Aurengzeb. The emperor has presented me with a jeweled crest as a special distinction. The emperor even honored us with the presentation of a special gold medal as a mark of imperial favor. The British merchants were granted a remission of 2.5% in the customs duty; the proprietors of the British East India Company were honored with the presentation of a special gold medal as a mark of imperial favor.

Customs house, Tavernier:

Usually when gold and silver are brought in Surat it is counted here in the custom-house. You have to talk to the Mintmaster who can coin your last pieces of gold into money. He will give you back the amount that fits with the standard of the bullion.Don't you think it would be wise to meet the rest of the travelers, before melting your last jewelry, which your mother left you? You can meet them at the Coffee House. You can also hurry straight to the port, I have to wish you good luck with the English crew.

More about the customs house:

I see you are curious to hear more about the customs house... I often have to go through customs with my gemstones.As soon as the merchandise is landed at Surat it has to be taken here, which adjoins the fort. The officers are very strict and search for persons with great care. Private individuals pay as much as 5% duty on all their goods. As for the English and Dutch Companies, they pay less. But, on the other hand, I believe that taking into account what it costs them in presents, which they are obliged to make every year at court, the goods cost them nearly the same as they do to private persons.However, Sir Oxended received even lower customs duty, as Aurengzeb was so impressed by their actions under Shivaji's attack. In all places at a distance from towns, where the common people do not understand money well, they will not accept a piece of silver until they have first put it in the fire to ascertain whether it is good or not; this is especially practiced at the river crossings. As regards gold, the merchants who import it use so much cunning in order to conceal it, but little of it comes to the knowledge of the customs officers. The former do all they can to evade paying the customs, especially as they do not run so much risk as in the custom-houses of Europe. For in those of India, when anyone is detected in fraud, he is let off paying double. 10% instead of 5, the Emperor comparing the venture of the merchant to a game of hazard, where one plays double or quits. Now enough about customs, you are already late for your ship.

The Coffee House, Manucci:

But I cannot resist telling of one case that happened to me with a well-connected widow woman, the daughter of Dindar Khan. On one occasion I had treated one of her sisters at Qasr. This lady was present and took such a fancy to me that she wanted to marry me. She herself spoke to me about it and told me she would make her own arrangements for departure. At first, I paid no heed to these things, still, seeing the woman so determined,

and she is rich, well proportioned, and intelligent, I began to entertain the idea of carrying her off to Europe as she desired. The agreement was that she should give sufficient money to buy a big ship... Then she would pretend that she had vowed a pilgrimage to Mekka and would obtain permission to leave home. The agreement was in the process of execution, but she was not sufficiently prudent. On finding that her project could not succeed, the widow married Misri Khan but only lived for eight days after her marriage.

Oxenden replying to Manucci:

Enough Manucci, we all know you arrived in Surat as a 17-year-old Italian lad, who just wanted to see the world. By now you have called yourself - traveler, hustler, observer, 'doctor', emissary, and soldier. Tell me which of these roles can we trust? Better don't waste our time! The British Ship is leaving, join us at the river bank now! That is the only way out of the city! We have finally received a new demand for cloth, pepper, indigo, and silk.

Virji Vora joining the conversation:

Wait! You cannot leave! We have to help and restore the city! Come and help to restore water in Gopi Talev!

Tavernier:

It's better to relax and drink some tea. Did you know Surat is so famous among travelers, that its name has reached Russia? Here goes the story by Tolstoy (..).

ENDING 1: Girl at the Gopi Talev

I am so proud you decided to remain in the city! Around 1500, a rich Hindu trader named Gopi settled in Surat. He induced other merchants to settle at Surat and founded one of the quarters of the town named Gopipura. He also enlarged a pond by lining it with stones. The pond is called Gopi Talev. Until some decades ago it was still providing Surat with fresh drinking water (1638). After that, we didn't manage to take care of it, the famine, heavy rains, and now Shivaji's attack..all these misfortunes led to forgetting about Gopi Talev. However these times are over now, it is time to celebrate the rich history of our city! Now go there - color your own rangoli, and you will find it here - in this book of the future Surat!

ENDING 2: Oxendedn at the Port

Oh, how dare you to arrive so late! We were missing someone to help with cleaning up the storage rooms, and started to think you won't make it! You know.. in Surat you were respected as a rich merchant's assistant, but here is a different game - this ship belongs to us, and you will have to follow our rules. And don't you dare to speak up and practice your religion here, or eat dinner at the same table.

Figure B.1: Plot design process for the second narrative design iteration using the Twine software

B.3 Preliminary test

Please share any additional comments

3 Responses

ID ↑	Name	Responses
1	anonymous	My answers might be affected by the fact that my computer was overheating due to the processing of the game, thus I had to limit my time exploring the environment. Very much like the clean aesthetics and moving faces in the game!
2	anonymous	1. I forgot what was my task and when I returned to the page, I didn't know how to "mark" who is the spy 2. would be nice if it would be marked on the map what places I already visited 3. I really liked the story of the person on the ship, I felt it was much more personal than the rest of the stories. The rest of the stories were more like a facts, than a "real person" talking to me, if you know what I mean.
3	anonymous	The first time I played I did not know characters were going to appear, so I passed them unintentionally, when I tried to go back, they told the second story and it made it very confusing.

Figure B.2: Preliminary test results show the responses to the Likert scale statements by 5 test participants

B.4 Final iteration: The Discourse Adaptivity

Relations between the landmarks:

The Factory affects: The Garden intro
The Garden affects: The Factory intro
The Market affects: The Gopi intro

The Mughalsarai affects: The Coffee House intro

The Coffee House affects: The Mughalsarai intro and The Customs House intro

Exceptions to the relationship pattern:

The Fort doesn't affect any landmark, but has to be triggered as the FIRST visited landmark. All the landmarks affect the intro of The Coffee House, if they are visited AFTER the Mughalsarai and BEFORE The Coffee House. All the landmarks affect the intro of the Market, if they are visited AFTER the Fort and BEFORE The Market All the landmarks have a unique final remark, which is triggered only on the REVISIT and if the intro and middle has been played until the end.

Script for the introduction video:

We are traveling back in time. Merchants and explorers from all over the world have left records of their life in Surat. Compelling diaries from travellers such as Mundy, Niebhur, Fryer, Thevenot , Manucci, Tavernier are inviting you on a journey to the historical city of Surat.... It is the year 1664. It is the year when Surat was the richest port in Mughal empire and was attacked by Shivaji's army from the south. Visit the landmarks on the map to encounter the people of Surat! Take a step towards the Fort and get ready for the journey!

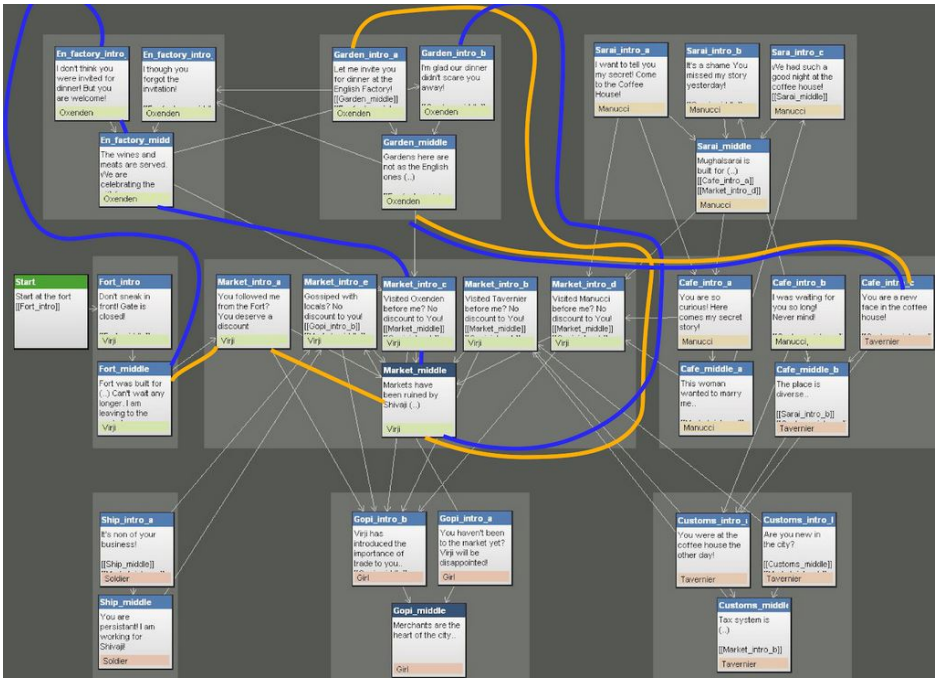


Figure B.3: The final narrative design iteration using the Twine software

Figure B.4: The introduction video, showing traveler diaries as the source of the stories

Script for the final narrative:

1 - The Fort (Virji Vora)

Intro A:

Hey, I came here first. Even though the Castle gates are closed, don't you dare to sneak in front of me! Unless you know the secret entrance of course, but I rather doubt it!

Middle:

I can't believe Shivaji's army is approaching our city and the governor is simply hiding in the fort. This is so selfish of him.

Anyways the fort was built to protect Surat from the Portuguese pirates attacking from the river, I think it was in the mid 16th century. Their latest attack caused the emperor to stop all the trade deals with the portuguese merchants. I wonder what the governor intends to do.. I heard the rumours that Shivaji's army is using guerilla techniques. Is he really going to fire the cannons towards his own city?

I can't stand to wait here any longer, I am leaving to the market.

Remark:

Hey, the gates are still closed, are you really trying to find the secret entrance?

The Market (Virji Vora)

Intro A:

Hey are you following me? Ok, ok, I will give you a small discount my friend. I guess I shouldn't have told you I owe the monopoly with the British Company. By the way my name is Virji Vora, and you better remember it!

Intro B

Oh really? I thought we became friends at the Fort! But No! You decided to visit (that British president Oxenden) before coming here! I would have given you a good discount, but not that you would care. I guess you didn't know that my name is Virji Vora and I owe the monopoly with the British Company.

Intro C (..) that italian lad Manucci

Intro D (..) Tavernier

Intro E (..) you had to hear the latest gossip from the locals

Middle:

You probably haven't even heard the news that Shivaji has looted my shop. All the gold savings and even my dear pearls are gone. What am I gonna do? Thank God I still have other reserves outside the city. Surat is the center of trade, even our cottons have become popular in England..but what now? All the trade is breaking down.

Remark:

Sorry my friend, I really can't give you more discount. I heard the british are doing quite well these days.

The Mughalsarai (Manucci)

Intro A:

Oh my! If you would know what happened last night! Sorry I just really have to let it out! There was this woman who wanted to marry me. I really don't know if it's

appropriate to talk about it here..This place is known as Mughalsarai. It's dedicated for pilgrims going to Mecca. Listen, I would love to tell you more about yesterday, but then you need to join me in the Coffee House! Otherwise I will just guide you around here! By the way my name is Manucci and I came all the way from Italy.

Intro B:

Oh, I told such a good story yesterday at the Coffee House. No wonder you missed it, you were so engaged with Tavernier that you missed all the secrets about my future wife. By the way my name is Manucci and I came all the way from Italy.

Middle:

Shivaji promised not to touch any religious buildings, so this is a safe place to stay overnight. Also soldiers are strictly prohibited here. I am charged a small fee which covers rent and repair of the building..the only exception is learned scholars or pilgrims. Actually, they even receive donations from other travellers. It was built only 20 years ago by Emperor Shah Jahan, so the building is still quite fresh, I believe it was in 1644!

Remark

You come here so often, I am starting to think you want to join the pilgrims.

The Coffee House (Manucci and Tavernier)

Intro A:

Manucci: Honestly, I thought you care much more about my story, I was ready to open my heart for you! I have been waiting for hours. Now I will just keep it to myself!

Tavernier: Enough Manucci, By now you have called yourself - traveller, hustler, observer, 'doctor', emissary and soldier. Tell me which of these roles can we trust?

Intro B (Tavernier):

Hmm, You are a new face in this Coffee House. Don't worry...travellers from all over the world are meeting here. Just relax, I am sure you will fit in.

Intro C (Manucci):

Huh, you are quite curious about my story aren't you? The Coffee House is the best place to meet travellers from all over the world.

Middle A (Tavernier):

As you can see locals revive their wasted spirits at any part of the day. In fact they may drink as long as they please. Yes the diversity of people here is unbelievable.. The tales that left Surat even inspired Tolstoy to write the short story called "The Coffee House of Surat".

Middle B (Manucci):

But I cannot resist telling of one case that happened to me with a well-connected widow woman. This lady took such a fancy to me that she wanted to marry me. At first I paid no heed to these things, still, seeing the woman so determined, and she being rich and intelligent, I began to entertain the idea of carrying her off to Europe as she desired. The agreement was that she will give enough money to buy a big ship.. Then she would pretend that she is on a pilgrimage to Mekka and would obtain a permission to leave her home. The agreement was in process of execution, but she was not sufficiently prudent.

On finding that her project could not succeed, the widow unfortunately married Misri Khan.

Remark (Tavernier):

Sorry we are closed, you can always drink tea with the locals.

The Customs House (Tavernier)

Intro A:

Hello, think I saw you at the Coffee House the other day! I do expect - you will hear my story about this Customs House without any extra help from this drink.

Intro B:

Hello,you look like a stranger, are you new in the city? I do think you need to know the tax laws set by Aurangzeb! Of course there are people cheating here, but I am not the right person to guide you in crime.

Middle:

In fact I would prefer that you remember my name - I am known as Tavernier. I am famous for selling the the Blue Hope diamond to my king Luis IVX. Do you see the coins? They are very special. Akbar established a new religion, his son Jahangir made a system where twelve zodiac signs were stamped on the face of the coins. Usually when gold and silver is brought in Surat it is counted here in the customs house. The officers are very strict and search persons with great care. Everyone has to pay tax duty on all their products. Though it is known that the English and Dutch Companies do pay less.

Remark:

Ohh, don't disturb me. I don't think you have any expertise in gemstones!

The British Factory (Oxenden)

Intro A:

Just on time for dinner! I don't think you were invited though. My British manners won't let you leave hungry. Let me introduce myself, I am sir Oxenden - the president of The British Factory.

Intro B:

Oh, you finally arrived! I was starting to think you forgot my invitation for the dinner. Middle: I am proud to tell that our table is spread with the choicest meat Surat affords and equal plenty of Sherash wine and Arak punch is served around the table. But European wines and English beer are the most desirable liquors. By the way - tonight we are celebrating the medal received from Aurangzeb. We were protecting the local merchants and even stood in front of Shivaji's army with our own forces. I do believe we deserve tax benefits given by our emperor. Oh, and totally unrelated - can find my grave in the British cemetery, they made it quite prominent!

Remark:

Seems that you really enjoyed dinner the other night! Sorry, tonight we don't welcome any foreigners.

The Ship Building place (Maratha Soldier)

Intro A:

It's none of your business, how long I have worked here. All I can tell is that I am helping to unload ships and see who is arriving in Surat. Did you know the wood used here is much better than European as it is not attacked by worms and lasts for decades. It's better you leave now, I don't need extra eyes!

Middle:

Wow you are really persistent! You are right, I recorded every single ship that entered Surat. I also found out who are the richest merchants in town and reported to Shivaji immediately. You know, Surat is like a cash cow for the Mughals. However, his ships are already leaving. Now, where do you want to go with the news?

Remark:

Can't you find a better sport to watch the ships passing by?

The Gopi Talev (Girl)

Intro A:

You haven't paid a visit to the market yet? Virji Vora for sure will be disappointed, he is one of the most influential merchants in Surat!

Intro B:

I heard you already met Virji Vora, he must have introduced you to the important role of marchants in this city. He is one of the most influential merchants in Surat.

Middle:

Gopi Talev is also built with the help of the merchants, it used to provide drinking water until 1638, but famine and heavy rains stopped us from taking good care of this water reserve.. Around 1500, a rich Hindu trader named Gopi settled in Surat. He invited other merchants to settle here and established Gopipura. Merchants are the beating heart of this city. Surat is also the main port from where the Haj pilgrims leave for Mecca. And still there is not a single fort or soldier guarding it. Sometimes I am scared to think where the future will take us..

Remark:

Oh, I am glad to see you again! Are you going to help to clean up the Gopi Talev?

The Gardens (Oxenden)

Intro A:

It's good to see you. I am glad that our dinner traditions the other night didn't scare you away. It must be quite different from what you are used to.

Intro B: You know gardens are beautiful, but the dinner table is the real place to enjoy life. I am sir George Oxenden. You are officially invited for dinner to the British Factory!

Middle:

I would love to enjoy your company in this garden. I must say the gardens here have nothing in the fashion of our gardens in England. This garden is quite spacious, but has not the least appearance of regularity. Honestly the rest is such a confused mix of buildings and small orchards. It is beautiful though that the summer houses in gardens are spread with carpets and refreshed with various figures of the rising water.

Remark:

You know I didn't show you this place to simply roam around like this..you have to learn to appreciate the beauty of nature.

The first end sequence, shown at the location of the user (Girl) Have you really visited everyone? I am sure you can try to re-visit, but I don't promise anything! Go to the coffee House for a proper Goodbye!

The second end sequence, shown at the Coffee House (Tavernier)

Olalla! So persistent! I hope you don't expect too much from our Goodbye! You can still hang on with Tolstoy and hear his short story The Coffee House of Surat. I don't know where you are heading next, but do remember - Surat used to be the richest port to meet travelers from all over the world.

The audio starts playing 'the Coffee House of Surat' by Tolstoy. The end image appears inviting the users to start the interactive experience all over by stepping on the start marker.

B.5 Characters

Niccolao Manucci,
Italian writer and traveler, 1656

Sir George Oxenden, the governor of the British East India Company in Surat, 1662

Jean-Baptiste Tavernier.
French gem merchant and traveler, 1641

Virji Vora (c. 1590– c. 1670s)
Merchant in Surat

Maratha Soldier

Local Musicians

Figure B.5: The historical illustrations of the final characters

B.6 Landmarks with the city map

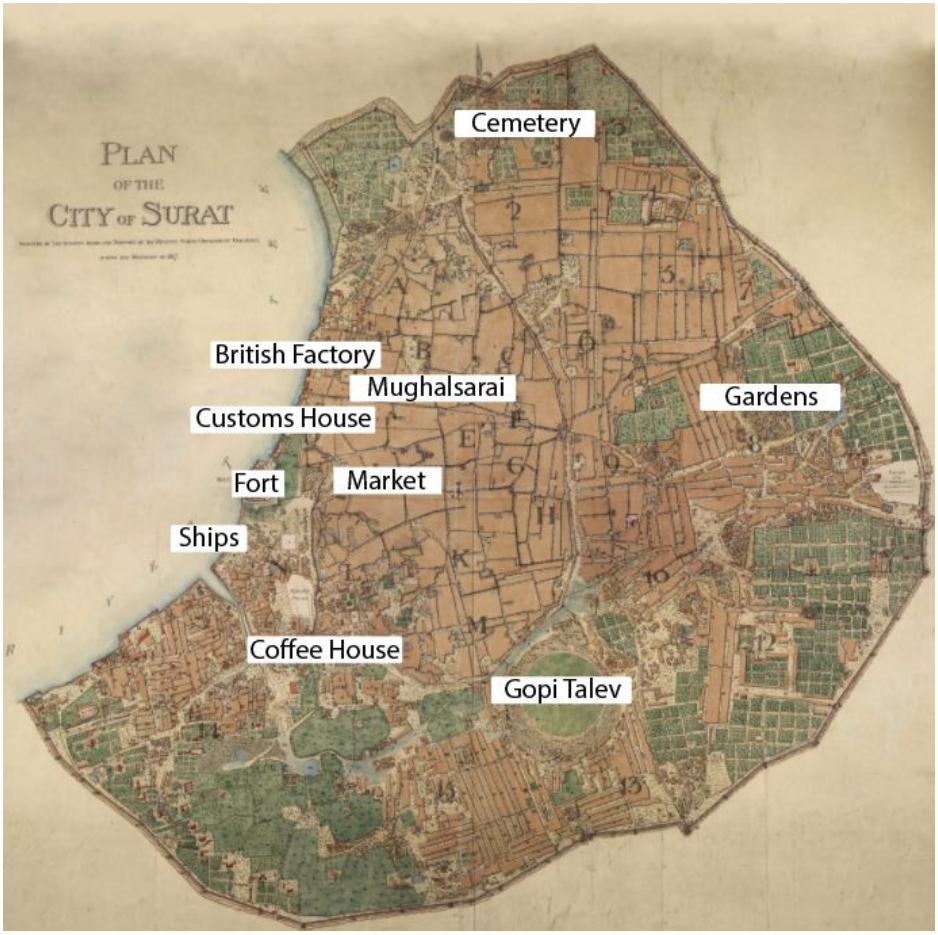


Figure B.6: The historical city map, which is displayed on the floor with the markers of the landmarks

Figure B.7: The illustrations of the landmarks, which are displayed when the user walks to the corresponding location in the room

Figure B.8: The illustrations of the landmarks, which are displayed when the user walks to the corresponding location in the room

Appendix C

Code samples

DataLoader.cs

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;
using System.IO;


public class DataLoader : MonoBehaviour
{
    [SerializeField]
    public DialogueCollection dialogueCollection;
    private Dialogue dialogue;
    public TextAsset jsonData;
    public Animator animatorForEndImg;
    public AudioSource audioSource;


    private void Awake()
    {
          string json = jsonData.text;
          dialogueCollection = JsonUtility.FromJson<DialogueCollection>(json); // deserialize json

    }

    public void TriggerDialogue(int dialogueNumber)
    {
        //Debug.Log(dialogueCollection.dialogueData.Length + " - Length, Dialogue with this number starts: "
        if (dialogueCollection.dialogueData.Length > dialogueNumber)
        {
            dialogue = dialogueCollection.dialogueData[dialogueNumber];
            FindObjectOfType<DialogueManager>().StartDialogue(dialogue);
        }
    }


    public void HideDialogue()
    {
        FindObjectOfType<DialogueManager>().EndDialogue(dialogue);
    }
    //update dependent dialogues
    public void UpdateDependentDialogueIntro(int dialoguenumber, string value)
    {
        dialogueCollection.dialogueData[dialoguenumber].introType = value;
    }
    //update the state of the running dialogue - is intro or middle done?
    public void UpdateDependentDialogueMiddle(int dialoguenumber, string value)
    {
        dialogueCollection.dialogueData[dialoguenumber].middleClip = value;
    }
    //check if all middle stories are played
    public void CheckForEnding()
    {

        int numberOfSeenClips = 0;
        int numberOfLandmarks = 10;
        for ( int i = 0; i< dialogueCollectio
        {
            if (dialogueCollection.dialogueDa
            {
                numberOfSeenClips++;
                Debug.Log(numberOfSeenClips
                if (numberOfSeenClips == numb
                {
                    Debug.Log("Play end clip"
                    dialogue = dialogueCollec
                    FindObjectOfType<Dialogue
                    break;
                }
            }
        }

    }
    public void SlideUpEndImg()
    {
        Debug.Log("SLIDE UP CALLED");
        animatorForEndImg.Play("SlideUp");
        audioSource.Play();
    }
}
```

Figure C.1: Code sample

Dialogue.cs

```cs
using System;
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

[System.Serializable]

public class Dialogue
{
    // class that we can pass as an object to dialog manager
    public int id;
    public string location;
    public bool introIsDone;
    public string introType;
    public string introA;
    public string introB;
    public string introC;
    public string introD;
    public string introE;
    public string introF;
    public string introG;
    public bool middleIsDone;
    public string middleClip;
    public string remarkCip;
}
```

Data.json

```json
{
    "dialogueData": [
        {
            "id": 0,
            "location": "End",
            "introIsDone": false,
            "introType": "introA",
            "introA": "end.webm",
            "introB": "end.webm",
            "introC": "end.webm",
            "introD": "end.webm",
            "introE": "end.webm",
            "introF": "end.webm",
            "introG": "end.webm",
            "middleIsDone": false,
            "middleClip": "end_cafe.webm",
            "remarkCip": "end_cafe.webm"
        },
        {
            "id": 1,
            "location": "Dutch Factory",
            "introIsDone": false,
            "introType": "introA",
            "introA": "test_intro_a.webm",
            "introB": "test_intro_b.webm",
            "introC": "test_intro_c.webm",
            "introD": "test_intro_d.webm",
            "introE": "test_intro_e.webm",
            "introF": "test_intro_f.webm",
            "introG": "test_intro_g.webm",
            "middleIsDone": false,
            "middleClip": "test_middle.webm",
            "remarkCip": "test_remark.webm"
        },
        {
            "id": 2,
            "location": "British Factory",
            "introIsDone": false,
            "introType": "introA",
            "introA": "british_intro_a.webm",
            "introB": "british_intro_b.webm",
            "introC": "test_intro_c.webm",
            "introD": "test_intro_d.webm",
            "introE": "test_intro_e.webm",
            "introF": "test_intro_f.webm",
            "introG": "test_intro_g.webm",
            "middleIsDone": false,
            "middleClip": "test_middle.webm",
            "remarkCip": "test_remark.webm"
        },
        {
            "id": 15,
            "location": "Coffee House",
            "introIsDone": false,
            "introType": "introC",
            "introA": "cafe_intro_a.webm",
            "introB": "cafe_intro_b.webm",
            "introC": "cafe_intro_c.webm",
            "introD": "test_intro_d.webm",
            "introE": "test_intro_e.webm",
            "introF": "test_intro_f.webm",
            "introG": "test_intro_g.webm",
            "middleIsDone": false,
            "middleClip": "cafe_middle_b.webm",
            "remarkCip": "cafe_remark.webm"
        },
        {
            "id": 16,
            "location": "Mughalsarai",
            "introIsDone": false,
            "introType": "introA",
            "introA": "sarai_intro_a.webm",
            "introB": "sarai_intro_b.webm",
            "introC": "sarai_intro_c.webm",
            "introD": "sarai_intro_d.webm",
            "introE": "test_intro_e.webm",
            "introF": "test_intro_f.webm",
            "introG": "test_intro_g.webm",
            "middleIsDone": false,
            "middleClip": "sarai_middle.webm",
            "remarkCip": "sarai_remark.webm"
        },
        {
            "id": 17,
            "location": "Market",
            "introIsDone": false,
            "introType": "introA",
            "introA": "market_intro_a.webm",
            "introB": "market_intro_b.webm",
            "introC": "market_intro_c.webm",
            "introD": "market_intro_d.webm",
            "introE": "market_intro_e.webm",
            "introF": "market_intro_f.webm",
            "introG": "market_intro_g.webm",
            "middleIsDone": false,
            "middleClip": "market_middle.webm",
            "remarkCip": "market_remark.webm"
        }
    ],
    "collectionName": "objects on map"
}
```

Figure C.2: Code sample

DialogueManager.cs

```cs
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;
using UnityEngine.Video;
using System.IO;

public class DialogueManager : MonoBehaviour
{

    public VideoPlayer videoPlayer;
    public Text locationText;
    public Animator animator;
    private Dialogue activeDialogue;
    private bool sarai_intro_a_visited = false;
    private bool allClipsPlayed = false;


    public void PlayEndClip()
    {
        allClipsPlayed = true;
        videoPlayer.url = Path.Combine(Application.streamingAssetsPath, "end.webm");
    }

    public void StartDialogue(Dialogue dialogue)
    {
        if(allClipsPlayed == true && dialogue.id == 15)
        {
            videoPlayer.url = Path.Combine(Application.streamingAssetsPath, "cafe_end.webm");
            videoPlayer.loopPointReached += LastVideoEndReached;
        }
        activeDialogue = dialogue;
        locationText.text = dialogue.location;
        videoPlayer.isLooping = false;
        // call when intro OR long content is DONE playing
        if (dialogue.introIsDone == false && allClipsPlayed == false)
        {
            //play intro

            string introClip = "";
            switch (dialogue.introType)
            {
                case "introA":
                    introClip = dialogue.introA;
                    break;
                case "introB":
                    introClip = dialogue.introB;
                    break;
                case "introC":
                    introClip = dialogue.introC;
                    break;
                case "introD":
                    introClip = dialogue.introD;
                    break;
                case "introE":
                    introClip = dialogue.introE;
                    break;
            }

            videoPlayer.url = Path.Combine(Application.streamingAssetsPath, introClip);
            videoPlayer.loopPointReached += VideoEndReached;

        }
        else if (dialogue.middleIsDone == false && allClipsPlayed == false)
        {

            videoPlayer.url = Path.Combine(Application.streamingAssetsPath, dialogue.middleClip);
            videoPlayer.loopPointReached += VideoEndReached;
        }
        else if (allClipsPlayed == false)
        {

            videoPlayer.url = Path.Combine(Application.streamingAssetsPath, dialogue.remarkCip);
        }


        // call when intro OR long content is DONE playing
        // int value = dialogue.id;

        void LastVideoEndReached(UnityEngine.Video.VideoPlayer vp)
        {
            Debug.Log("END REACHED for LAST VIDEO");
            animator.SetBool("panelSlideUp", true);
            FindObjectOfType<DataLoader>().SlideUpEndImg();
        }


        void VideoEndReached(UnityEngine.Video.VideoPlayer vp)
        {
            if (dialogue.introIsDone == false && activeDialogue.id == dialogue.id)
            {
                Debug.Log("INTRO END REACHED for:" + dialogue.location);
                dialogue.introIsDone = true;
                StartDialogue(dialogue);
                UpdateRelatedBeats(dialogue.id);
            }
```

Figure C.3: Code sample

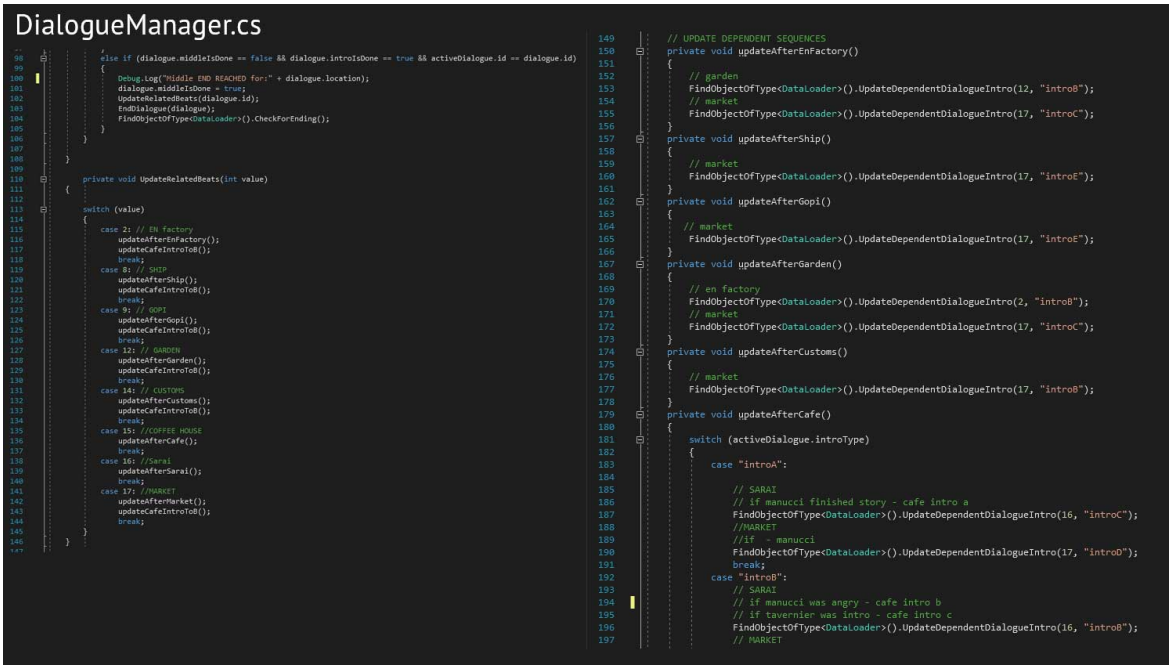


Figure C.4: Code sample

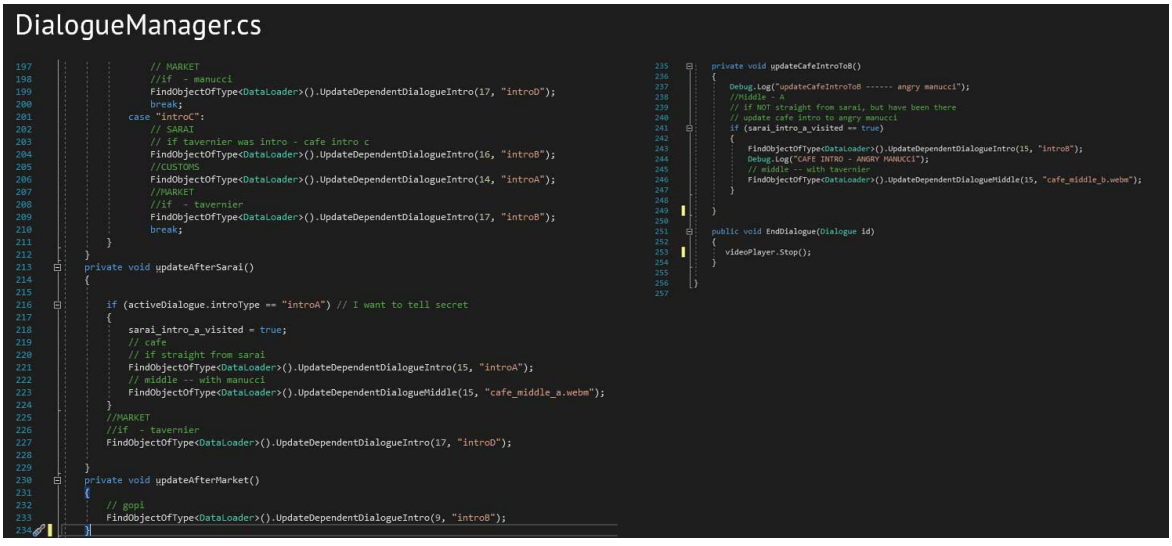


Figure C.5: Code sample

Appendix D

Semi-structured interviews

What motivated you to keep interacting?

1. Curiosity to find out more, the connection between stories

2. I was captured by the character at the ship, she said I should not go to the Fort, so then I thought" Oh, of course, I'm going in! Now I want to go in!". Then at the Fort they said I should go to the Market, so then I was curious to find out what is going on.

3. Characters mentioned some places, so I felt that I should go there.

4. The small things they mentioned about other places, so I thought I would just try to go these

5. I was following the hints, but I think I missed one, so then I was just exploring. But I'm not sure if I followed the rules. From a game point of view, it's good there is not so much guidance, because then I'm more willing to discover on my own.

6. I play games, it triggered a response, so I wanted to complete the game, and I like history. I liked that I could choose where the story went. It reminded me about the Dungeons and Dragons book.

7. It was compelling, how you interact with it. I was told to remember a name, so I was curious if there is something more.

8. Information about the secret passage and coins was interesting, also I was wondering that there should be a bigger connection.

9. Visit all circles and find a connection

10. The connection between some of the objects made it fun

11. To make sure all the circles on the floor are visited

12. I followed the spots on the floor, instead of jumping back and forth.

13. The points on the floor and their names made me curious

14. It was special how the camera moved

15. I was motivated to learn something new

How did you feel about the end? What was on your mind?

1. Maybe you should make an endpoint on the floor, so you go a full round in the city

2. I wasn't sure if I had visited everyone, I didn't expect it will end so suddenly in the coffee house.

3. So what is the point of all this? What was I supposed to do? Did I have to go randomly, or follow to the places the characters mentioned? What is the sequence? I saw that for me it said something different than for others, I feel there is a sequence, so if you follow the story then there is a linkage, but if you go somewhere else by a mistake then there is no connection. I didn't understand the story, because I was all over the place and then I reached the end, it didn't feel like an end. You reach a stalemate when you have visited every one.

4. I got disconnected, the flow was broken, because I didn't know where to go.

5. I expected something different like a traditional storyline – I thought cemetery will be the end of all the stories from different places would meet up.

6. There were a few characters, which were guiding, and it was clear. But for others I wasn't sure, I didn't know if I'm done. Especially when I revisited, then they started talking more. I thought there will be a sequence. A clear objective would help. I need an exact map of where to go, or what am I achieving.

7. Is there a clue? I felt I did something wrong. Maybe I walked in a wrong order to get into the Fort, but I didn't find the entrance.

8. I already visited the coffee house, so I didn't follow the guidance, I assumed it will just repeat itself. I didn't expect anything different in the end, I was just exploring like in a museum.

9. I knew it was the ending because someone told me that I have to go for a goodbye.

10. I didn't expect much, so it was good. Excellent for a museum. Rich information - more than a game. It helped that it told it's the end.

11. In the beginning there was no objective, so the ending was okay. But when I saw others in the group to find the end, it was frustrating, because I didn't know where to go or reach the end.

12. I felt good to reach the end. I didn't expect that something would happen. A clear objective would help.

13. I was missing a challenge at the start.

Why do you think there are multiple characters? What is the intention?

1. Multiple angles of the history
2. Different roles, they form the structure of the city
3. To give some life to the experience, show different angles.
4. Describe history from different perspectives
5. Different angles
6. A different point of view
7. Have historical sides, different perspectives
8. Different angles
9. More engaging

10. One voice would be too monotonous

11. To direct the player to different locations, not to have a monotone storyteller

How do you think the experience could be made more meaningful?

1. Every story should give me a clue, where to go next, so the storyline is connected.

2. I thought the idea was to capture different stories and then put a puzzle together in the end.

3. I think the secret entrance was mentioned multiple times, it would be great to have it there. If there was an objective, why am I walking around the city, even as simple as " walk around the city" would work?.

4. It would be smoother if I knew where to go because then I would follow the story

5. I didn't prioritize going to the water well, because it wasn't mentioned, so I went wrong

6. I was looking for the ending and connections between the landmarks

7. Add objects from the story in the physical space (e.g. coins), add the possibility to zoom in to the images.

8. I understand there are merchants in the city, but once I'm in the city I was missing to connect the dots. I understood that lots of Europeans were coming, but I could not link the stories with Shivaji's attack. The red thread was missing.

9. The story could be more elaborate, it would help to have a sense of working towards something. Think it's fine that it ends with Tolstoy, maybe Tolstoy's story could be more connected to the rest.

10. It would be great if audio, or soundscape of the places would be added, it could be guiding as well, e.g. coffee house sounds or background mumbling with hints where to go.

11. I thought there could be more detailed information. It depends on the context, what would I expect from it, but the interactive part made it very fun.

12. If it would be in a museum with some more context, or the content had any connection to my previous knowledge, I guess I would enjoy it more.

13. I was asking myself *"How do we know this? Is this information valid?"*

14. I'm not an audio person, so only on the third time, I could start understanding the accents, add more visuals or numbers.

What value do you see in the whole experience?

1. I knew about major politics, but not about such a merchant city. I would not read such information if it was not presented entertainingly.

2. It is informative

3. The solution gives a different way of learning, it's more interactive, which makes it more interesting. I would be very bored if someone came to me and told me about Surat, but when I have to be part of it, it makes me want to explore rather than just listen.

4. It depends where it is used, e.g. in a museum, this could make it easier for people to go in-depth with the information, especially for children and young people.

5. See different views of the history

6. It gives knowledge and entertainment (e.g. in an airport it would be great fun when you got nothing to do)

7. an excellent way to convey information in an exhibition or a museum, the solution tricks people to care a little bit more.

8. It would help children to keep the attention

Where are the stories inspired from? Who is the author, what is the source?

1. I do not know, it felt like something from a museum

2. History books

3. From British historical sources

4. Middle age movie

5. History books from British, because they stored all the information from colonial times

6. Two different books, from two different countries – to reflect on different angles

7. From the story about the Coffee House, history books and research

8. History books

9. It's a mix of fiction and history. I know that Akbar was the first Mughal emperor, the other guys I don't know, the secret passage is probably a fiction

10. from people who lived there

11. Historical sources, personalities are made up

Comments about the graphics

1. I liked the style, like crayon drawings, very cool

2. I liked how the graphics reacted to my movement

3. I found the mouth movements of the characters very nice and funny

4. I would like to go around or behind the houses

5. In a dark room would look better

6. Very static, I would like to walk around the market

7. Low budget

Comments about the characters

1. I like the contrast between the character – the polite, and the direct

2. It seemed that the English are dominating the main points

3. I liked that the merchant gave direct hints were to go next

4. I liked the small jokes

5. Some of the stories were monotone, I couldn't pay attention when the sentences were plain.

6. Adding more details and longer dialogues would be good.

7. The characters should tell to sit down or move differently.

8. I liked the Italian character because that was the only one who did not ask for anything, the others had motives.

9. It was hard to focus so long on the dialogues. Some pauses were so long, I thought it's done.

10. I liked the story about the wood, I could connect because it mentioned Europe.