IT University of Copenhagen

Master Thesis

Designing a Mobile Game for Art Engagement

A Case Study on
Exploring Meaning Making at Museums

Authors:
Elín Ingimundardóttir
Kristoffer Kjul Sachse
Greta Stančiauskaitė

Supervisors:
Timothy Daniel Wray, Ph.D., Anders Sundnes Løvlie, Ph.D.

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Abstract

Museums are making great efforts to cater to their visitors' needs. In many cases, this has lead to the development of digital technology projects that try to target as many visitors as possible. This has largely proved unsuccessful, and research shows that efforts are perhaps better spent on targeting more specific visitor segments.

This case study explores how a mobile game about collaborative storytelling supports a meaningful social museum experience for young adults aged 14-29. Through user testing at the National Gallery of Denmark, it is discovered that some participants of the target group respond well to such a mobile game while others find it to be a distraction from learning about artwork. This largely depends on predetermined factors such as the users' preferred way of learning.

While the mobile game does facilitate social interaction and encourages the museum visitors to view more artwork, it is not yet possible to conclude whether this makes the museum experience greater than it would have been without the mobile game.

Keywords: Museum Experience, Meaning Making, Mobile Game, Digital Technology, The Contextual Model of Learning

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Contents

1 Introduction

This case study is a part of a research project called *GIFT - Meaningful Personalization of Hybrid Virtual Museum Experiences Through Gifting and Appropriation*, led by the IT University of Copenhagen. The *GIFT* project is concerned with an appropriate use of technology in order to engage museum visitors with cultural heritage [1].

Cultural activities such as visiting museums are increasingly seen as one of the main ways that people spend their leisure time [2, 3]. In order to stay competitive with other leisure activities, museums are making an effort to find ways to cater to their visitors' needs and enhance their museum experiences [4, 5, 3]. One of those ways has been introducing digital technologies such as mobile applications to the museum setting [4, 6, 7]. As a consequence there has been a growing interest in understanding how digital technologies could be used to enhance the museum experience of visitors and mediate their interpretations of the artwork [7, 5]. Museum research has mainly concentrated on visitor demographics, activities and education. However, relatively little work has been done that focuses on a more holistic view of the museum experience [8, 9]. Despite the lack of research in this area, museums have begun to realise that visitors should be seen as active participants who can forge their own meanings and interpretations about the artwork, rather than being seen as passive receivers of information [3, 2].

The goal of this case study is twofold: firstly, to explore how a mobile game can be designed to create a social museum experience. Secondly, to explore how the mobile game supports a social museum experience for young adults

in Denmark, aged 14-29[1]. Although 14-29-year-olds are seen as the age group who visits museums the least [11], it is also stated that their engagement is critical to continued relevance of museums [5]. To further narrow down the target group, a decision was made to specifically focus on exploring how the mobile game supports the social museum experience. This was done as a great majority of people visit museums with a companion [11].

Thus, the research questions of this case study are the following:

1. *How can we design a mobile game that supports a meaningful social museum experience for visitors aged 14-29?*

2. *How does the mobile game support that experience?*

By answering these research questions, this case study will outline the development of a mobile game that will be tested at a museum[2].

The case study is structured as follows:

In Chapter 2, the literature review is presented to explain the research focus. Changes that have happened to the museum experience are then described and a framework for understanding the museum experience is introduced. Case studies of other digital museum products are then evaluated in the context of this museum experience framework.

Chapter 3 outlines this case study's approaches and methods for the project management, design and development, user testing, and analysis of results.

Chapter 4 presents the final implementation of the mobile game developed in this case study in regard to the user experience, the technical implementation and the design. It also covers the iterations undertaken for the mobile

[1]This rationale was also used by another GIFT project called *Exploring Motivating Factors of Young Adults in a Museum Context Through Mixed Reality Games* [10] to design a game for young adults.

[2]The source code of the mobile game can be found at `https://github.com/iioit/word-by-word`. The compiled mobile game (Android only) can be downloaded at `http://rebrand.ly/wbwpr0451`.

game and evaluation phases that took place after every user test. The implementation details presented in this chapter will be used to answer research question 1.

Chapter 5 presents the results and reflections from the user tests that are related to the museum experience through the framework previously introduced. The findings presented in this chapter will be used to answer research question 2.

Finally, Chapter 6 concludes the case study by summarising the research outcomes and how they answer the research questions. The reflections that follow outline the areas that this case study did not manage to cover in theory or in practice. They could be addressed in possible future work.

2

Literature Review

This chapter outlines the context for this research by defining the key factors that make up the museum experience based on the literature[1]. It then provides a review of relevant digital museum games, and puts them in context of the museum experience through these key factors. This chapter will focus on the intersection between museum studies and digital technologies and their role in shaping visitors' museum experience.

Although this case study is largely based on the development of a mobile game, literature on game theory will not be reviewed. The reason is that the scope had to be limited due to time constraints. Instead, a well-established game concept (Section 3.2) was chosen by the Product Owner as a foundation for the mobile game. However, the following literature closely correlates with the notions used in this case study and could serve as an extended literary background:

- "Homo Ludens: A Study of the Play-Element in Culture" by Johan Huizinga [12].
- "Man, Play, and Games" by Roger Caillois [13].
- "Play Matters" by Miguel Sicart [14].
- "Critical Play" by Mary Flanagan[15].

[1]Part of the following literature review was conducted and submitted as a report for the course "Thesis Preparation SDT" in the autumn of 2016.

The above mentioned sources analyse the act of play not as only a form of entertainment, but as an activity that is a part of the sociocultural context (Section 2.2.1.2).

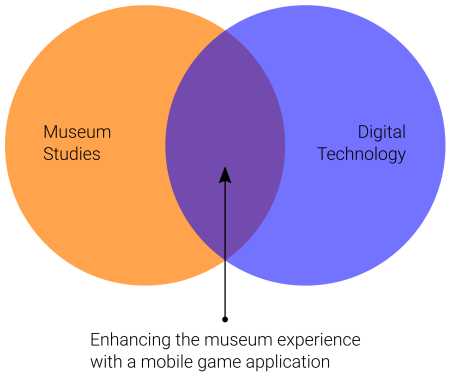


Figure 2.1: The research focus

Museums have attempted to meet the ever increasing technological expectations of their museum visitors by supporting the museum experience with digital technologies [16, 4]. The results have varied; some projects have been embraced by and managed to engage museum visitors, while others have failed. Nonetheless, the authors of this case study acknowledge that opposing views exist which express concerns about digital technologies distracting the visitors from the artwork [17].

In her review about digital technology in the museum context, Myrczik [4] writes that the term "digital technologies" is often used broadly or as a synonym for "interactive," "virtual" or, as most recent literature have focused on, "mobile technologies." When reviewing previous academic work for this case study, the term "digital technology" is used in the same way as Myrczik [4] uses it – "which allows the incorporation of a wide variety of technologically mediated ways for the visitor to make sense of the museum experience" [4, p. 181].

How previous digital technology museum projects have supported the mu-

seum experience will be discussed later in this chapter. First it is necessary to define what is generally meant by the museum experience; how it has changed over the years and how it is often defined now.

2.1 The Museum Experience

Museums have shifted from primarily having their focus on their collection and preserving their artwork [2] to their current emphasis on the visitors' experience [2, 3] as can e.g. be seen in the digital museum game examples later in this chapter. This has sometimes been called a shift from museums being "expert-centric" to becoming "visitor-centric" [18]. The commonplace expectation now is that museum professionals should be concerned with supporting the museum visitors in being active participants of their museum experience [2], but this has not always been the case.

2.1.1 The Museum Voice

Traditionally, museums mainly used wall text and object labels to convey information and meaning to the museum visitors. They were usually written in an anonymous and "authoritative" *museum voice* [19]. Museums identified what they thought the museum visitors needed to learn and transmitted that information to the visitors. The learning was almost solely measured by whether the museum visitors could repeat the information or apply the newly acquired knowledge [3]. The introduction of digital technologies such as the linear audio tour did not change the fact that the museum's voice was still channelled into the ears of the museum visitors [19]. In 1970, a big philosophical change started with a movement called the *New Museology Movement*. The idea of the visitors being able to put their own meaning into the artwork was born with the movement. As a consequence, it redefined the relationship between the museum and the museum visitors. The movement called for a more active role for the museum visitors as both the leaders

of their own visit and also the leaders in the curatorial function [20]. This meant that the role of the museum curator was challenged and that there were many different equally valid views on the same artwork [19]. Despite diverse attempts to engage museum visitors, many of them including digital technology, many museums have continued to rely on their authority of how to present the artwork. They have been rather reluctant to break the "proverbial fourth wall" [19, p. 8] and listen to visitors describe what they see at the museums. For example, in the early 2000's, a professor and his students made it to the headlines of the New York Times for bringing digital recorders to the Museum of Modern Art (MoMA), recording their own opinions on the artwork, and releasing it online:

> The news rippled like shock waves from an earth tremor in the museum world. For the first time [...], someone had publicly usurped the museum voice from an esteemed, authoritative institution and substituted a set of opinionated, perspective, and irreverent alternatives [19, p. 6].

2.1.2 Meaning Making

The Constructivist Museum perspective [21, 17] dictates that, rather than being passive receivers of information, museum visitors should be active participants and construct their own meaning from the museum experience [21]. In a review about designing technological aid for meaning making for museums, Kaptelinin [22] states that there is currently a general consensus among museum researchers that a museum experience can be sufficiently described with the term *meaning making*:

> "Meaning making" generally refers to an active interpretation of objects and events, through which interpretation an individual or a group develops a personal meaning, deeply integrated with one's own values, beliefs, feelings, and aspirations [22, p. 1].

Museums are increasingly incorporating this perspective as a fundamental component of museum education by engaging visitors with their artwork [4, 5, 3]. Digital technologies should aim to support and reinforce meaning making activities within the museum [17]. This is precisely the key to introducing digital technologies at museums – to reinforce the meaning making activity when engaging with artwork [23]. As a logical continuation, there has been a shift in recent years to many museums accepting that the visitors participate and actively contribute to the museum experience [5, 18].

Many museums are embracing that visitors use digital technologies to connect to one another around artwork and actively contribute to exhibitions by creating content. This manifests itself in a philosophy, movement and museum strategy which has gained a significant adherence, called *the Participatory Museum* [24, 5]. This movement has asked questions about how museums can "use participatory techniques not just to give visitors a voice, but to develop experiences that are more valuable and compelling for everyone" [24, p. 1]. In the Participatory Museum, the museum is a platform that connects museum visitors who act as the content creators, distributors, collaborators and critics, and who all participate in each other's museum experiences where they make meaning [24]. When museums have decided to invite visitors to be content creators they have often gotten exceptional responses. For instance, over the course of two months, the National Gallery of Denmark increased their Instagram reach by 2,500 percent by encouraging their visitors to share pictures from their personal museum experience [25]. As Ryan Dodge, the Digital Engagement Coordinator at the Royal Ontario Museum put it:

> In the future, museums will recognize that we can no longer attempt to tell people we are fun and interesting places to spend time, our community has to do it for us and museums need to provide and encourage those experiences onsite and Online [26].

2.1.3 Museum Games

Museums have introduced games [27, 28, 29] to their visitors with the aim of supporting visitors' meaning making in the museum experience [30]. The museum visitor then becomes an active participant, a "player," instead of just a "visitor" [31]. Traditionally, limited attention has been paid to digital games at museums, but this is now changing as games offer the possibility of allowing the audience to view objects in different ways [32]. But even though many of the museum games that have been made have reported increased engagement with artwork, they have focused on the visitors only accumulating factual knowledge about the exhibition as opposed to constructing their own meaning [30]. Yiannoutsou and Avouris pose the question whether there might be a way to design a game where museum visitors are encouraged to construct their own meaning [30]. They then go on to propose that the best way to answer this question is to get the museum visitors involved in designing a museum game.

Three different museum games were chosen for this case study based on their reported success on engaging people with art. They will now be described. Later on, they will be put into context with a prominent framework for capturing the museum experience.

2.1.3.1 Tate Trumps

A museum mobile game was launched by the *Tate* gallery in 2010 called *Tate Trumps*. Different art pieces were presented on digital cards, that were used for a game to find out who had chosen the best examples from the selection. The application offered four different modes. Battle mode asked the players to choose the cards according to how powerful that particular artwork would be in a battle if it came to life. This mode allowed the players to play either alone or with others. Mood mode asked the players to choose the cards according to how strong they would be in three different categories: menacing, exhilarating and absurd. Collector mode allowed the players to

set up their own art collection. And finally, the Anywhere mode allowed the players to play wherever they were situated, not necessarily inside the Tate gallery. In this mode the players chose the artwork from a virtual gallery and could play against human or a computer simulated player.

2.1.3.2 ARTeMuse

The Davis Museum launched the mobile game *ARTeMuse*. The target audience was museum visitors who had little experience in engaging with art. In fact, this target group was only glancing at the art pieces and occasionally reading the wall text and object labels [27]. From this, it could be deducted that they were not constructing their own meaning. The interviews conducted by the researchers of ARTeMuse revealed that the target audience was generally uncomfortable forming their own opinions about artwork. This problem was addressed by having the users scan a QR code located next to an artwork. With the help of a series of different prompts the game then encouraged the user to interact and reflect on the artwork. The prompts were specific to every artwork in the museum, and would contain questions that would lead to deeper insights, anecdotal pieces of information, or a short physical activity that would encourage the user to consider the story of the artwork, the style or the artist's intention [27].

2.1.3.3 Scavenger Hunt

The Chicago History Museum created a mobile game in the form of a *Scavenger Hunt*. The target audience was children aged 9-13 years old. The museum's goal with the game was to get these visitors more engaged with the objects on display. The game encouraged the players to find certain objects around the museum space. Once the players had found an object, the game posed questions about it. The results showed that the young visitors liked the game and tried as best they could to find the objects instead of just guessing the answers to the questions [33].

2.2 The Museum Experience and Digital Technology

Tost and Economou [7] review the three main research fields regarding evaluation of digital technologies in cultural heritage such as museums.

- The first field has focused on technological issues related to the usability of interfaces.
- The second field is concerned with the formal learning environment and cognitive issues that arise from the use of digital technologies.
- The third field has undertaken studies about evaluating the effectiveness of digital technologies from a communicative/learning standpoint.

The problem is that the third field has not been concerned with taking components that constitute the museum experience into account [7]. The following section is concerned with just that; evaluating digital technology, with a focus on games at museums, while putting it into context with components of a framework designed to understand the museum experience.

2.2.1 The Contextual Model of Learning

The *Contextual Model of Learning* by Falk and Dierking focuses on understanding why people visit museums, what they do during the visit and how they make meaning from that experience [2]. The authors [2] write interchangeably about how museum visitors make meaning from the museum experience and about how they learn from the museum experience, hence the name of the model. The model is a framework meant to explain the complex interplay of three main contexts that make up the museum experience [2]. As Gammon and Burch [17] highlight, any digital technology deployed at museums has to consider all of the three contexts of the Contextual Model

of Learning in order to be successful in engaging the museum visitors with the artwork; it has to fit in the complex nature of social interactions between the museum visitors, correspond to their personal interests and fit into the museum space.

The Contextual Model of Learning consists of three overlapping contexts that make up the museum experience:

1. *The Personal Context.*
2. *The Sociocultural Context.*
3. *The Physical Context.*

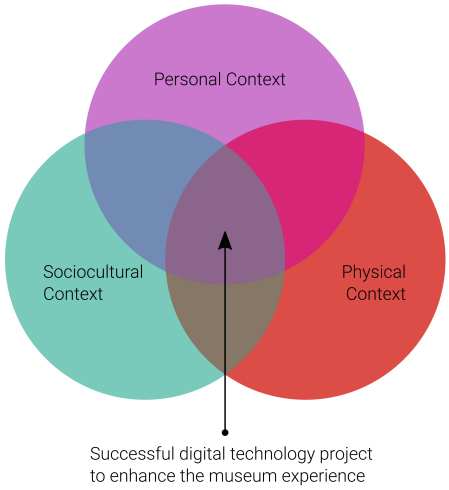


Figure 2.2: The factors a successful digital technology project has to consider

Even though Falk and Dierking [2] break the museum experience down into the three above contexts, they emphasise that the museum experience must be understood as one whole by considering the contexts together [2].

These three contexts will be described in the following sections. In each section, the digital museum games described in Section 2.1.3 will be evaluated with respect to that context.

2.2.1.1 The Personal Context

The Personal Context includes each museum visitor's varying degree of experience and prior knowledge about the museum. It also includes the visitor's preferred approach to learning and engaging, and differences in individual interests, attitudes, behaviour and motivations for the museum visit [2]. Even though the Personal Context is more or less predetermined before the museum visitor enters a museum, there is evidence to suggest that digital technologies can positively influence the museum experience by "enabling visitors to customize their experiences to meet their personal needs and interests" [34, p. 27]. In order to appeal more to the museum visitors, digital technology projects should therefore align themselves with the users' personal interests, ambitions, motivations and prior knowledge [17, 31].

Aligning themselves with the users' personal interests, ambitions and prior knowledge has proven to be difficult for museums and many digital projects have failed. The reason for these failures has often been that the target audience has been too wide. Research on mobile museum applications has shown that including information and features to target as many museum visitors as possible can lead to failure [17]. Visitors have reported feeling overwhelmed by options that are of no relevance to them. As a result, it may be more useful to target a specific audience [17]. Sachatello-Sawyer et al. segments museum visitors into four categories [35]. These will be explained in further detail in Section 2.2.1.2. The categories will be used in the design process of this case study to narrow down the target audience even further and design for a social museum experience.

As mentioned in Section 2.1.3.2, ARTeMuse had a defined target group of museum visitors with little experience in engaging with art. It focused on the Personal Context of the museum experience by asking museum visitors to reflect on the artwork. Asking questions about art is a popular technique in the Participatory Museum to encourage people to engage deeply with artwork [27, 24]. ARTeMuse categorised their questions into three categories:

questions that encourage museum visitors to look closer at artwork, questions that draw on the museum visitor's personal experiences, and questions that encourage the museum visitors to make connections between artwork [27].

The ARTeMuse experience did not end after the visitors had answered the questions and reflected on the artwork. On the contrary, they could share their reflections with their friends through social media – a practice that aligns itself with the Sociocultural Context of the Contextual Model of Learning.

2.2.1.2 The Sociocultural Context

A great deal of research indicates that the social aspect of the museum visit is paramount in shaping the museum experience; museum visitors are strongly influenced by social interactions such as collaborations and conversations [2, 7, 36, 37]. It can be argued the museum experience is in essence a social experience. For instance, as many as 93% of museum visitors in Denmark in 2009-2011 visited museums with a companion [11]. Most of the research on social interactions within the museum walls has focused on families or school classes. A few studies have focused on all adult groups and they have indicated that social interaction is an important way for young adults to make meaning during their museum visit [34]. However, such studies are scarce. Falk and Dierking [2] have pointed out that the lack of research focusing on adult museum visitors is a "significant deficit" [2, p. 157] in understanding the museum visit experience.

As previously mentioned, Sachatello-Sawyer et al. categorises adult museum visitors in four different groups. The *Knowledge Seekers* have a strong desire to learn and look for resources that help them achieve this. The *Socializers* go to museums for the social interaction and use the visit as an opportunity to spend time together with someone else. The *Skill Builders* are looking to improve or learn a specific skill, and this purpose is what separates them from the Knowledge Seekers. The *Museum Lovers* are people who

love everything about the museum [35]. According to Falk, the motivation for the museum visit is a desire to fulfil an identity-related need [9]. Put in the context of the visitor categories the Socializers, for instance, might go to a museum to fulfil their social needs and feel cultural.

In their review on digital technologies within the Contextual Model of Learning, Gammon and Burch [17] state that the design of the digital technology needs at least to allow existing social interaction to continue. A successful application must fit within the social interactions between users and their companions at the museum. Studies have shown that if well designed, museum mobile applications can support social interaction and actually increase them as opposed to disrupting them. When badly designed however, they seem to isolate museum visitors and discourage social interaction [17].

The ARTeMuse mobile game aligned with the sociocultural context by having an option for the users to share their responses to the questions and prompts on Facebook, along with the possibility to recommend artwork to their Facebook friends. This was done in an attempt to fulfil the museum visitors' identity-related needs. The creators of ARTeMuse wanted the sharing option to enable the users to build their identity in regard to the artwork and their whole museum visit [27]. Around 30% of the users of ARTeMuse shared a device with another user while using the game even though it was not especially designed for collaborative use. A large number of those users reported higher levels of enjoyment than those who used the game on their own. In particular, the users testing the game with another user said that they felt more comfortable discussing their opinions about the artwork with a partner than they would have felt typing their own responses into the device [27].

These results align themselves with results from a study in the research field of Computer Supported Cooperative Work (CSCW). This research field, in its most general form, focuses on the communications that take place within a group of people when interacting with a technological system [38].

The particular study investigated how an electronic audio guidebook *Sotto Voce* could support social interactions at a museum. The audio guidebook enabled the museum visitors to listen to the audio guidebook of their choice, but more importantly, also to listen in on the audio guidebook of their museum companion. Museum visitors said they felt more connected to their museum companion even though they were physically separated. Listening in on each other's audio guidebooks also engaged the museum companions in a "far more natural, rewarding forms of conversation" [39, p. 437].

ARTeMuse did not have its main focus on how the museum visitors interacted with each other. The museum visitors shared their museum experience with their friends online only after they had experienced the art and constructed their own meaning – not while they were engaging with the artwork.

For the most part, Tate Trumps aligned itself between the Sociocultural Context and the Physical Context. It focused on making users enjoy the art experience together in a playful manner. Moreover, it supported that players could enjoy the art experience outside of the physical walls of the museum.

2.2.1.3 The Physical Context

According to Falk and Dierking [2], the Physical Context is the physical setting of the museum and includes the architecture and "feel" of the building along with the artefacts contained within it [34]. The physical context strongly influences how visitors move, observe and remember at the museum [2]. As museums explore digital technologies, it is important to take into account how they can fit into the physical space of the museum "while providing an additional layer of engagement" [40, p. 317]. The design of the mobile museum application therefore needs to consider those sometimes unpredictable factors should it be successful. Furthermore, it is likely that such a design needs to be specifically designed for each museum [17].

The aforementioned Scavenger Hunt (Section 2.1.3.3) had its focus on the

Physical Context. It attempted to engage the visitors by encouraging them to move around in the physical space of the museum. This approach has been criticised as it only "encourages students to see the museum as a bunch of disconnected, decontextualized artifacts" [40, p. 317] and does not encourage the visitors to think deeply about the artwork [40].

Through the three dimensions of the Contextual Model of Learning presented in Section 2.2.1, this case study will explore how the mobile game developed supports a meaningful social museum experience. This will be done by exploring how the museum visitors construct their own meaning with the artwork and how they feel about their museum experience when playing the mobile game.

3

Methodology and Approach

This chapter presents the project and research approaches: Scrum was used to manage the team and deliverables, and User Centred Design was employed as a means of gathering requirements. Then, the game concept will be outlined. Lastly, the testing methods, test participants and the analysis of the data gathered from the tests will be described.

3.1 Project Management

Agile approaches, such as *Scrum*, are iterative and appropriate to use when the requirements of a system change rapidly. Their goal is to deliver software to the users in a short amount of time. Agile approaches also facilitate that the users can suggest new requirements or that the current requirements can be changed [41].

3.1.1 Scrum

Scrum is a framework to manage the workflow of an iterative development [41]. It was chosen for this case study at the request of the *Product Owner*, one of the supervisors of this case study. The Product Owner also set the initial requirements for the team developing the mobile game. The development team consisted of three students from the IT University of Copenhagen. Although their work overlapped, two of them mainly focused on the development while one focused on the user tests and research and on documenting

the process for the thesis report.

The *Sprint* is the main event in Scrum. It has a certain time limit and a definition of what to produce within that time limit, which is the Sprint's *Goal* [42]. There were six Sprints in this case study and each Sprint lasted two weeks. At the end of a Sprint, the Product Owner and the development team met to review the previous Sprint and to agree on the coming Sprint's Goal. Possible solutions to problems discovered during user tests were also discussed.

3.2 The Game Concept

The concept of the mobile game was supplied by Anders Sundnes Løvlie and Bogdan Spanjevic from the company Next Game, the members of the GIFT project. It is as follows:

The idea of the mobile game is to allow users to interact with artwork at museums by creating a story. The mobile game starts by matching two players and presenting them with a picture of an artwork and a sentence that fits the picture. This combination acts as the start of a story. Then, one of the players continues the story by taking a picture of an artwork and then writing the next sentence of the story. After the submission of that picture and the sentence, it is the other player's turn to do the same to continue the story. After finishing the mobile game, the players have an option to choose whether they would like to have their story published in a gallery which is available to all of the users of the mobile game.

This mobile game concept is inspired by older games. One is called *Consequences*, where the players take turns writing a sentence on a piece of paper. The paper is then folded to hide the sentence that has just been written, before it is passed to the next player [43]. The outcome is a story that the players have written together. Another example is a game called *Exquisite Corpse* where, in one version [44, 45], the first player draws a head and a

neck on the top section of the paper. That section is then folded but the lines of the neck are extended so they reach just below the fold. The next player/s then take turns drawing a body. The last player draws the legs and feet. The outcome is called the Exquisite Corpse [46].

3.3 User Centred Design

The user experience is of central importance in this case study as only the users can shed light on how the mobile game supports their meaning making during the museum experience. As *User Centred Design* methods help designers and developers meet the needs of their users [47], they were used in this case study.

User Centred Design is a broad concept with various approaches. Its definition has been discussed and debated since the mid 1990's. Endsley [48] defines User Centred Design from what it is not; the traditional technology-centred approach where the design of a system has the main focus on the functionality of the system and not how the users like it nor feel about it when they use it. As an alternative, to achieve more user friendly systems, User Centred Design is increasingly being applied in the design of systems [48].

3.3.1 Design Thinking

The Hasso-Plattner Institute of Design, better known as the *d.school* [49] has developed an approach to User Centred Design called *Design Thinking*. It is a philosophy, a methodology and a mindset which provides "a glue that brings teammates together around a common goal: make the lives of the people they're designing for better" [49, p. 1]. It is meant for projects that have a human element in them. It enables the people behind the project to understand the users, gain insights and conduct experiments towards the right solution [50]. Design Thinking recommends certain methods and strategies

for accomplishing these factors.

Design Thinking has five phases: *Empathize*, *Define*, *Ideate*, *Prototype*, and *Testing* [51]. Certain approaches within the first two phases proved useful when the wants and needs of the users were being studied. Those two phases provide methods to gain empathy for the users by observing and interviewing them. Rational conclusions are then deducted about their thoughts and feelings from the actions they perform and from what they say during observations and interviews respectively. The Ideate phase is about coming up with solutions to problems encountered during the previous phases [51]. For this case study, the Ideate phase was visited after every user test. The user test results were then discussed together with possible solutions to problems identified. The possible solutions were then implemented in the Sprint that followed.

The Prototype phase in Design Thinking recommends building low fidelity prototypes early on in order to test them and get feedback from the users as quickly as possible. The prototype should increasingly have higher fidelity as the project progresses [51]. Finally, the Testing phase suggests testing the prototype in a location that captures the real situation and to put the prototype in the hands of the users without explaining how it works [51].

The Design Thinking process has been described in a linear way above for simplicity, but it is important to note that it is an iterative process like any other User Centred Design method [51]. Additionally, the authors of Design Thinking stress that designers can make the process their own by adopting additional frameworks [51]. Even though this case study based its process on Design Thinking, additional frameworks were followed within the Prototyping and Testing phases.

3.4 Testing Methods and Design

A method called *Formative Evaluation* was used for evaluating the mobile game for this case study in the form of user tests. Formative Evaluation's goal is to determine drawbacks in a system so they can be fixed, and to guide the design and development [52]. Formative Evaluation is most often conducted during the development or improvement of a system. Also, it is usually conducted more than once by the people involved with the making of the system in one way or the other [53]. This goes hand in hand with the philosophy behind iterative development, where it is recommended to involve users as early as possible in the design process [41]. The Formative Evaluation took place in the form of user tests at the National Gallery of Denmark (hereinafter referred to as SMK, which is the official abbreviation of the museum's Danish name). As per agreement with SMK, all user tests took place during Sunday afternoons in the spring of 2017. The user tests were conducted on the upper floor of the museum, a space which is described in further detail in Section 4.3.1. All users tests at SMK were structured in the same way: after the participants agreed to take part in the test, they were asked to play the mobile game with each other while they were being observed. After playing through a round of the mobile game, the participants were then asked to complete a short, semi-structured interview. This approach is recommended by Schell [54]. The interviews were conducted with both participants at the same time as this can result in the participants identifying more issues than they would otherwise have done in a one-on-one interview [55]. However, it should be noted that due to the difference in group dynamics this could potentially have led to somewhat different insights than the the results of the group interviews [54, 56]. The testing was always facilitated by two people. For the interviews, this meant that one person conducted the interview while the other person acted as an observer and took notes. When the participants allowed it, the interviews were recorded and later transcribed. For this case study, there were four user tests at SMK.

They were conducted at the end of Sprint 3, 4, 5, and 6. The reason why the users were not included in Sprint 1 and 2 is that the basic functionality of the system was not in place by then. Each user test had a specific focus as Schell recommends [54]. The first user tests focused on figuring out whether the technical implementation worked without major technical issues. A decision was made to focus on this first, as any such issues might have interfered with the user experience and, at worst, made the mobile game unplayable. Afterwards, the user tests focused on the user interface and whether it was intuitive and easy to use. Lastly, the focus was on *Playtesting* [54], where the goal was to answer research question 2 by exploring how the mobile game supported a meaningful social museum experience.

3.5 Test Participants

As mentioned in Section 1, the target audience for the mobile game developed in this case study was narrowed down to young adults between the ages of 14-29. This was because this age group is of importance to the continued relevance of museums [5]. A decision was made to focus on the social museum experience, since 93% of people visit the museum with a companion [11]. The participants were asked about their motivation for the museum visit. The aim was to single out the ones that only came for the social experience, namely the Socializers [35] (Section 2.2.1.2). Potential participants that were visiting SMK in pairs of two and fitted the age bracket of the target audience were approached and asked to participate. The ones who agreed were asked about their age and motivation for visiting the museum before they were asked questions about the mobile game. After the interview, the participants were asked to sign a consent form (Appendix B) which stated that the data used from their interview could be transcribed and used for this case study. The transcriptions from user tests 2-4 can be found in Appendix C. The participants in first user test did not wish to be recorded,

therefore no transcriptions were produced. Table 3.1 lists test participants with fictionalised names but actual ages.

Sprint	**Prototype Focus**	**Test Participant**
3	Implementation	Allan, 30 Benjamin, 35
3	Implementation	Carrie, 21 Dorothy, 22
4	Look and Feel	Edith, 21 Fay, 21
4	Look and Feel	Gabriele, 35 Harry, 35
5	Role	Irene, 23 Janet, 23
5	Role	Kate, 20 Louis, 22
6	Role	Mia, 21 Nancy, 21
6	Role	Olive, 30 Pablo, 32

Table 3.1: The list of the participants

3.6 Data Analysis

The transcriptions of the interviews were analysed through a *closed coding* as defined by Kvale and Brinkmann [57] where statements from the participants

were mapped to the different contexts of the Contextual Model of Learning [2] (Section 2.2.1). Afterwards they were *open coded* [57] to identify subthemes in the responses. The results from this analysis will be presented in Chapter 4 and Chapter 5.

4

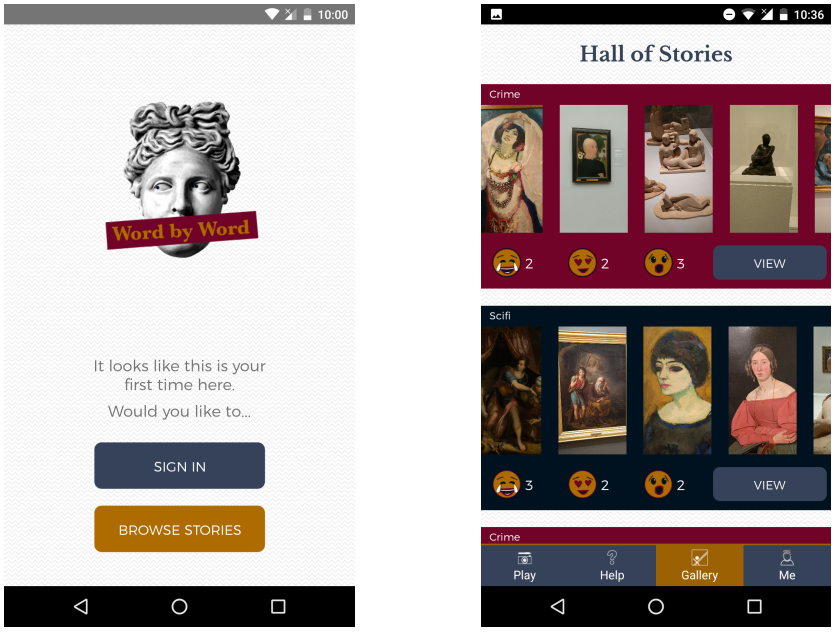
Design and Implementation

This chapter presents the final implementation of the mobile game produced in this case study. Section 4.1 describes the user experience of a play-through of the final version of the mobile game. Section 4.2 describes its technical implementation. Section 4.3 depicts how user centred design was used to get to know the users. Section 4.4 describes the various iterations of the mobile game's development and evaluation phases, in line with the Scrum methodology described in Section 3.1.1.

4.1 The User Experience

4.1.1 Opening the Mobile Game

Users can either play the mobile game after signing in via Facebook or Google, or they can browse existing stories that have been created by other users. By browsing existing stories, they can see what the outcomes of previous games have been. Once users are signed in they can either follow a tutorial that explains how the mobile game works, or they can begin playing straight away.



(a) Sign in screen (b) Story gallery

Figure 4.1: If a user has never signed in before, they are presented with a sign in screen. Otherwise they are redirected to the story gallery

4.1.2 Playing the Mobile Game

Two users can play the mobile game together. When they choose to play a new game they are presented with the same question:

Who is closer to the ceiling?

The answer is used to determine who gets the first turn. The user closer to the ceiling always starts. The starting user then decides on one of three possible story themes: crime, fairy tale, or science fiction. Once the starting user has chosen a theme, a code word appears on the screen. The other user has to enter that code word on their mobile phone to join the game. This code

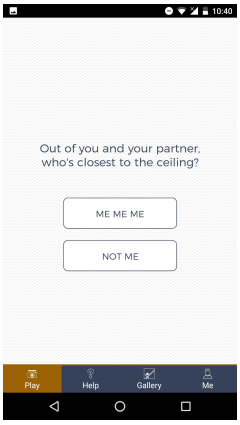


Figure 4.2: Screen to decide users' turn

word is unique to that one game and is always related
to the theme of the story, e.g. if the theme is crime, the code word might be "weapon." That is how two users are matched.

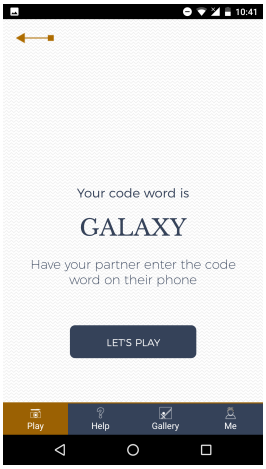


Figure 4.3: A given code word matches two users to the same game

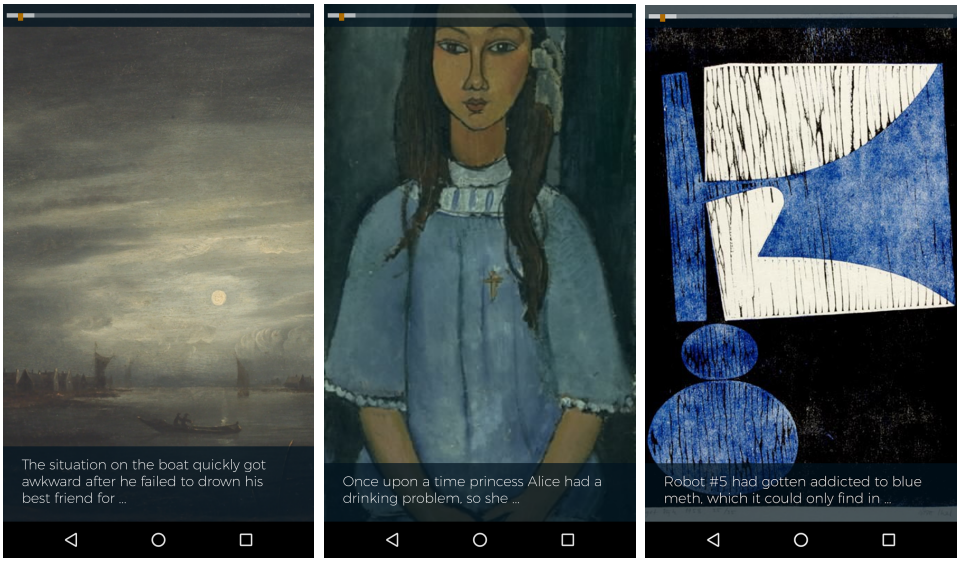
When the game begins, both users are shown a *story starter*, which is a picture of an artwork from SMK, and a starting sentence fragment. They both match the theme chosen for the story. The sentence is incomplete so the user having the next turn can finish it.

Each user has two tasks every turn. These two tasks are outlined below and will from now on be referred to as a user's *story contribution*:

1. Take a picture of an artwork that continues the story.
2. Finish the sentence that was provided earlier and start a new one for the other user to finish.

After the story starter has appeared, the starting user continues the game by submitting a story contribution. Taking turns, the users build a story together by finishing each other's sentences and taking pictures to accompany what they write. Each user gets five turns before the story ends. The finished story consists of eleven pictures and eleven sentences in total.

At the end of the game, both users can choose to publish the story to the story gallery. If they both agree, the story can then be viewed by other users of the mobile game. The users can also choose to share their story on social media.



(a) Crime (b) Fairy tale (c) Science fiction

Figure 4.4: Different story starters according to a chosen theme

The Story Gallery

The story gallery is a database of stories that users have created and chosen to publish. Users can rate each other's stories by adding reactions to it in the form of emojis. The story that has received the most reactions is at the top of the story gallery. The possible reactions are: love, laughter, and shock.

Below is a flowchart describing the navigation of the mobile game.

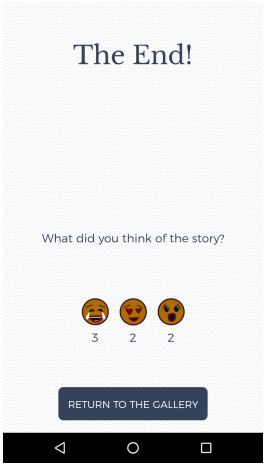


Figure 4.5: Users can add reactions to stories read in the story gallery

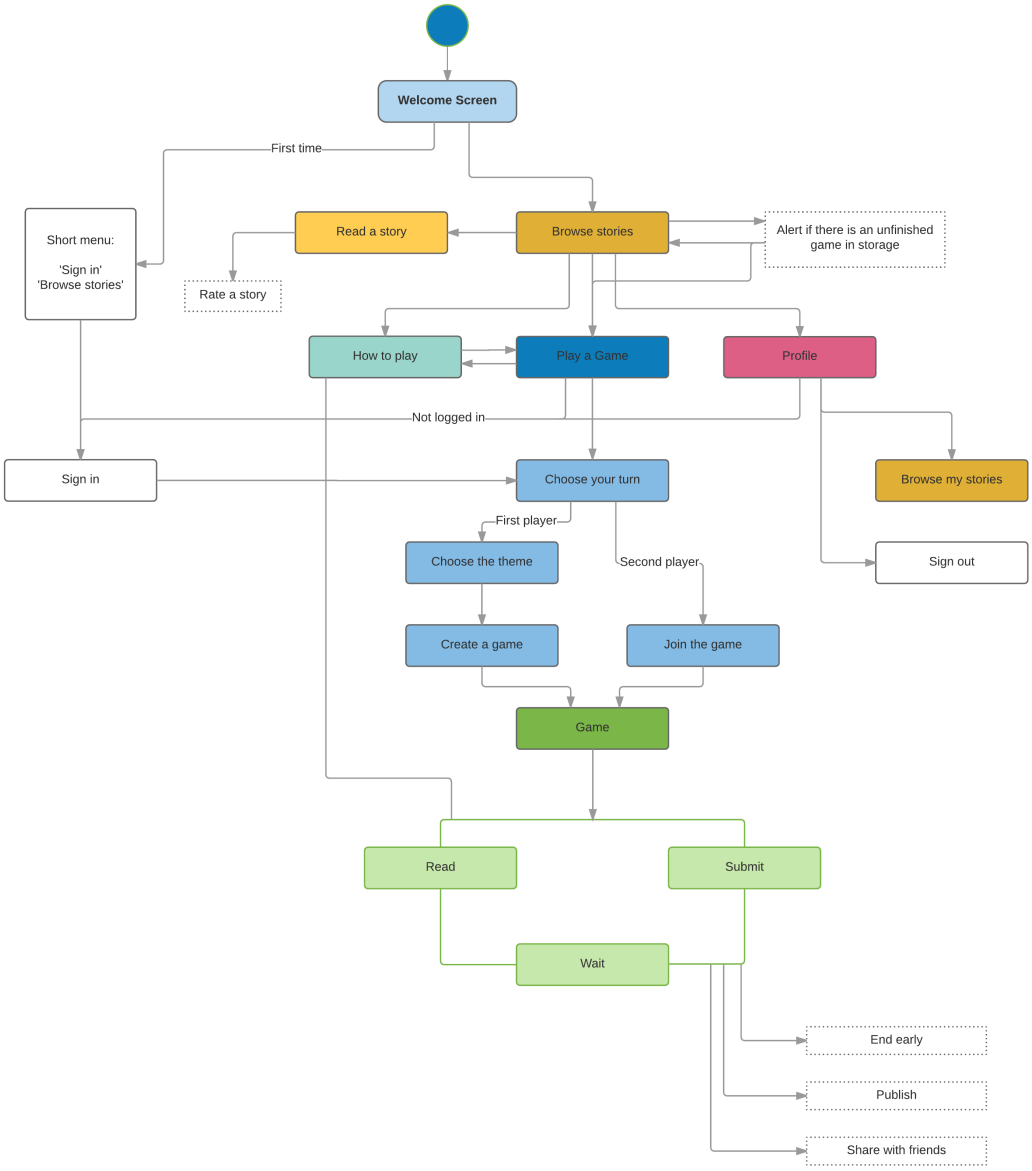


Figure 4.6: A flowchart of the navigation

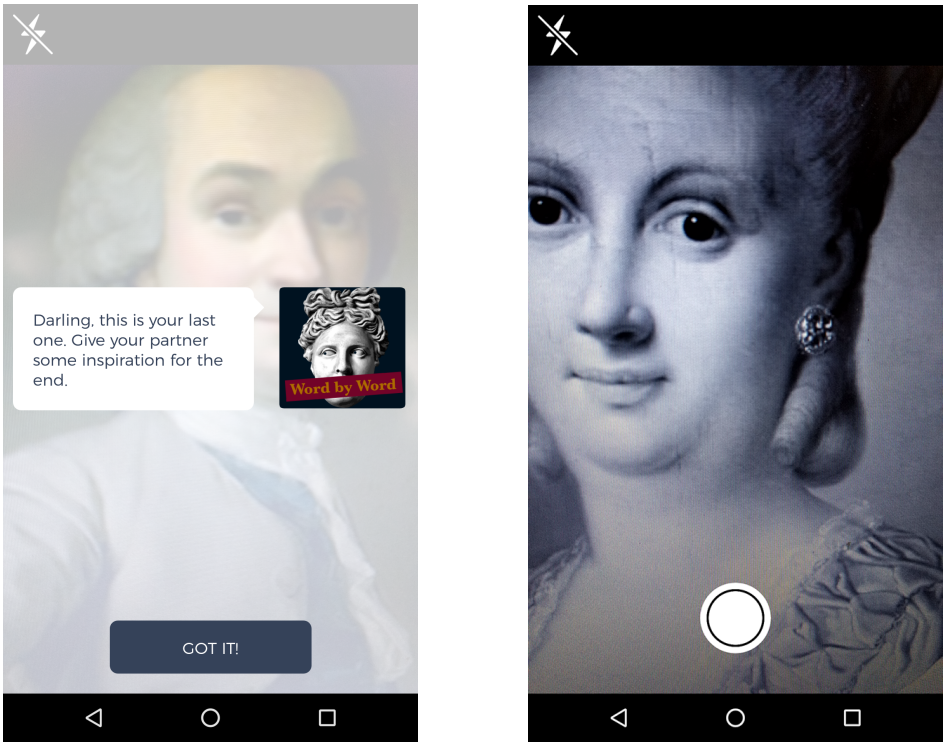
4.2 Technical Implementation

The technical implementation will now be explained, first by detailing the facets that influence the user experience, then by explaining what takes place behind the scenes and out of the user's view. A decision was made to prioritise the use of technologies that would drive the development process forward as fast as possible towards the final product, without compromising the user experience. The reason for this prioritisation was the limited amount of time given for this case study.

4.2.1 Client side

The final product was developed with the user interface framework React Native [58]. The React Native framework allows for the development of native applications for Android and iOS in JavaScript. This framework was chosen because the development team already knew JavaScript and because it gave access to important features: React Native enabled the users to receive push notifications to indicate when a response to their story was published.

Another benefit of choosing React Native was the integration that it made possible with the camera view, which could be fitted to the mobile game's needs. For example, custom buttons and prompts could be shown on top of the camera's view. This integration can be seen in figure 4.7.



(a) Camera view with a prompt (b) Camera view

Figure 4.7: Customisation of camera view

4.2.2 Server side

The client side of the mobile game communicates with its database through a query language called GraphQL [59]. This communication is facilitated by the Apollo library [60]. Apollo offers, what at the time of development was, the most evolved GraphQL client available. It has bindings to implement live updates with WebSockets, which help remotely push new data to a client. This is used in the mobile game to instantly update the state of the user's game when a story contribution is added to the story, and to keep track of if a user leaves the game before it has ended. If the latter case is detected, the remaining user is presented with an option of wrapping up the story with one last entry.

The database is provided by Graphcool [61], which offers a hosted SQL database with a GraphQL endpoint. In this case study, every story and all data related to it is hosted in this database. Graphcool also offers an integration with the user authentication service Auth0 [62], which is used to implement OAuth support for Google and Facebook accounts.

4.3 Understanding Users Through Design Thinking

The requirements engineering process [41] of this case study started with the Product Owner describing the idea of the mobile game in an interview conducted by the development team. Those requirements were not based on an analysis of users' needs or wants. For that reason, there was a considerable space for the development team to identify the user requirements through Design Thinking.

Museums have used Design Thinking to augment the museum experience [63, 64, 65, 66]. In this case study, elements of Design Thinking are used to identify the needs of the users and shape the user experience based on those needs.

The activities prescribed by Design Thinking that were performed in this case study will now be described.

In User Centred Design the designers of a system must attempt to understand the users they are designing for; who they are and what they need. For this purpose, designers must build empathy for the users [51]. The Empathize phase of Design Thinking is the process in which the designers gain an understanding about the users they are designing for [51]. The activities prescribed by Design Thinking for gaining empathy with the users were performed at SMK during the initial stage of the case study, before any design or development took place.

4.3.1 Observation

Design Thinking recommends gathering knowledge about the users by observing them [51]. Observations have been used as a technique to understand human behaviour in the context it takes place, because there might be a disconnect between what people do and what they say. For example, people might report behaving differently than they do in reality because that kind of behaviour might be socially unacceptable [67]. Accordingly, "powerful realizations" [51, p. 1] might be discovered that cannot be detected by other means [51].

The observation's focus was to see how museum visitors who fitted the age group of the target audience explored the museum.

A tool for documentation of the observation called the A, E, I, O, U [68] was used. This tool is a framework of the following points that the observers should keep in mind:

- Activities: What are the users doing?
- Environments: What spaces are they using?
- Interactions: What interactions are they having?
- Objects: What objects do the observers see?
- Users: Who are the users the observers see? [69]

Design Space - SMK

The observation as well as all user tests took place at SMK. It is important to describe SMK's interior because it influenced the user tests. This will be discussed in Chapter 5. SMK is the largest museum in Denmark [70] and has two floors. During the time of the observation, there was a temporary art exhibition on the ground floor about Japanese art called *Japanomania*. On the first floor, there were permanent exhibitions with European art from 1300-1800, French art from 1900-1930, and Danish and Nordic art from 1750-1900.

The exhibitions mainly consisted of paintings with people as motifs, many of them having references to Christianity. A number of landscape paintings were also to be found there.

Digital Interactivity

There are a few locations inside the museum that invite the visitors to take part in activities, some involving digital technology. The digital technology activities that were observed were mainly interactive screens. One of them allows museum visitors to explore artwork through the eyes of an art historian, an artist and a conservator. Instead of encouraging museum visitors to construct their own meaning, it encouraged looking at artwork through the eyes of professionals

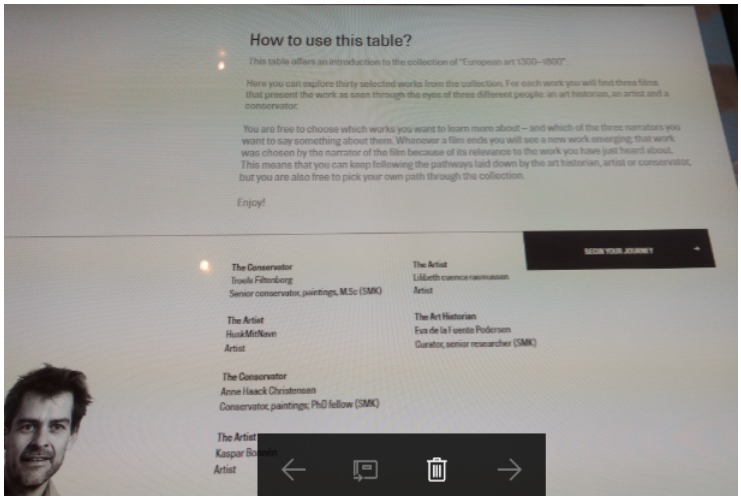


Figure 4.8: A digital interactive screen at SMK

Viewing Art

Museum visitors were observed during their stay at the Japanomania exhibition hall. They chose to experience the exhibition in a chronological order, i.e. they started by looking at the first artwork next to the entrance and then continued to the artwork situated right next to that one etc. An observation

was made that they spent considerably less time viewing each artwork the further away they got from the entrance. The observed subjects did not wish to be interviewed, so the disconnect mentioned above between what people do and say could not be investigated.

4.3.2 Interviews

Instead of interviewing the observed subjects, two semi-structured, exploratory interviews were conducted, one with two female friends in their early '20s and one with a man in his early '30s. The interview with the man revealed that he chose not to use his mobile phone during museum visits, as he felt it disconnected him from the artwork. He also preferred visiting museums alone so nobody disturbed his art engagement. He was therefore categorised as a Museum Lover [35] as defined by Sachatello-Sawyer et al. in Section 2.2.1.2.

By Sachatello-Sawyer et al.'s categorisation of museum visitors [35], the female friends could be categorised as Socializers [35]. They preferred visiting museums with friends and were comfortable using their mobile phones to reflect on art with other people. One of the girls said that if an artwork reminded her of someone, she would sometimes pick up her mobile phone, take a picture of the artwork, and send it to that person. This case study emphasised designing for the social aspect of the museum experience. Since the female friends were categorised as Socializers, the interview with them was used as a basis for the user persona created for this case study.

The observation and interviews described above only cover the field research conducted before the implementation of the actual mobile game started. Observations during and after interviews were also an important technique used in the user testings as mentioned in Section 4.4.1.1.

4.3.3 Creating a User Persona

The purpose of creating a user persona can vary [71, 72]. For this case study, it was to make sure that the development team had the same idea about for whom they were designing and developing [72], and to confirm that they were not designing for themselves [71]. Additionally, the user persona was created because, as stated in Section 2.2.1.1, digital technology projects must appeal to the users' personal interests [2]. The results from the observation and the interview with the two female friends were used as a basis to create the user persona. Furthermore, the user persona guided the design at the starting phase of the case study, as will be described in Section 4.4.1.2.

Design Thinking's Define phase is about processing the information gathered in the Empathize phase. The purpose is to define the needs and the wants of the users [51]. Just like in the Empathize phase, Design Thinking provides tools to accomplish that. One of the tools is the *empathy map* [51].

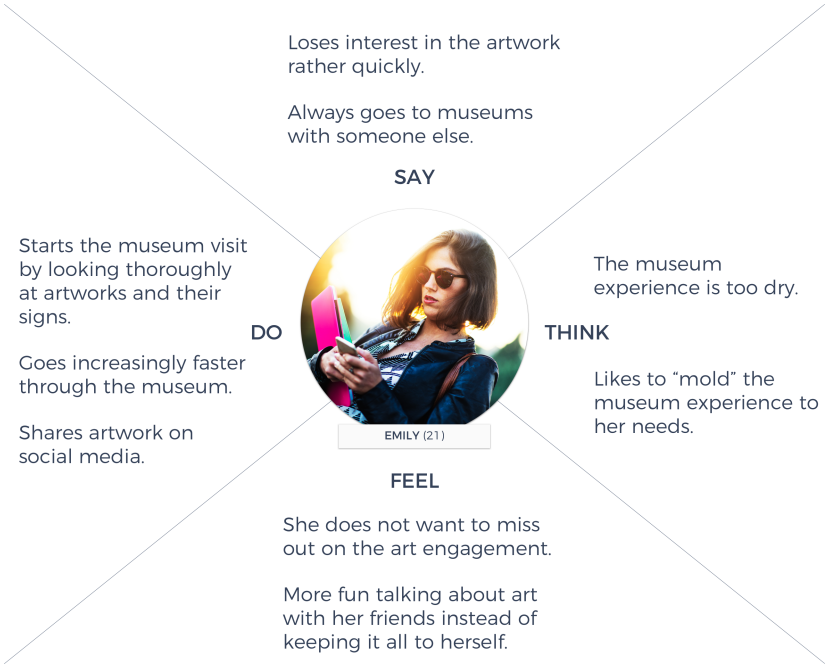


Figure 4.9: The empathy map that inspired the user persona

The empathy map has a quadrant layout with fields called *say*, *do*, *think* and *feel*. These fields were populated with data that was collected from the interviews in order to create a user persona:

Emily, 21 years old
Emily is studying political science at the University of Copenhagen. She works as a waitress during the weekends at a cafe in Copenhagen. She started her studies because she wanted to have a chance to make a difference. Now she does not like it much because she finds it too theoretical. She wants a more "hands-on" experience. Therefore, she has a plan to volunteer in Ecuador next summer. She likes her job because she gets to talk to a lot of different people. She goes to museums once in a while with her friends and goes mainly for the social experience. When she visits with friends, they often end up going their separate ways at first, simply looking at whatever artwork that catches their interest. Emily's appreciation and enthusiasm for the artwork is at its highest at this point and she tries to read as much information about the artwork as possible. After a while, however, she usually begins to lose her concentration. When that happens, she meets up again with her friends whom she went to the museum with, and talks to them more than she looks at the artwork. Sometimes they talk about the artwork. Other times, they find it more interesting to talk about other things. Once in awhile she takes a picture of an artwork she sees at the museum and shares it on Instagram and Snapchat - her favourite social picture sharing applications. Using her mobile phone at the museum, e.g. by taking a picture of an artwork she thinks her mum would like and sending it to her, does take her out of the art experience. But at the same time, it makes it more fun by communicating the art experience. For instance, she always takes a picture when she sees something her mum would like.

The Define phase is supposed to result in a point-of-view statement. That

statement is the definition of the challenge that a project deals with [51]. Deriving from the empathy map, Emily wanted to be able to share her art experience with somebody else. At the same time, she wanted to enjoy the art experience in a more meaningful way than only learning about the facts of the artwork. From these results, a point-of-view statement [51] was formed:

A Socializer goes to a museum to engage with art but easily gets bored. She wants to feel a personal relation with the artwork, but does not know how to create such a relation.

The creation of the empathy map and the user persona was instrumental in driving the design of the first version of the prototype, as presented in the next section.

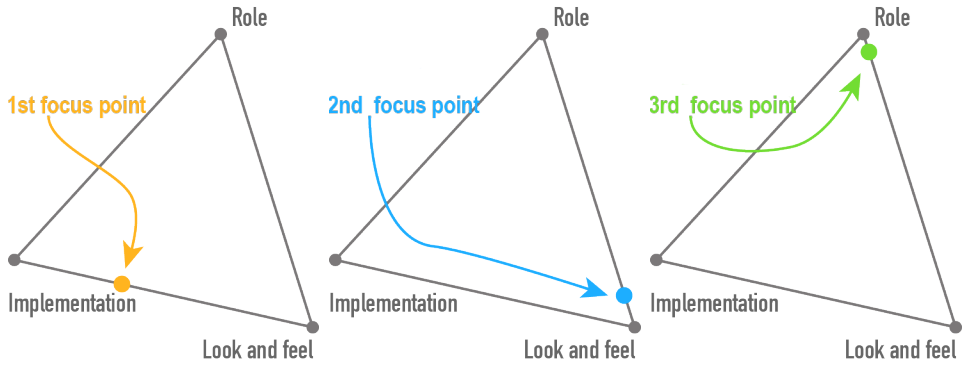
4.4 Prototyping and User Testing

Prototypes are widely considered to be the most important tool when exploring solutions to design and implementation challenges [73]. The idea of making prototypes is to produce an easily changeable view of the design [74]. In this case study, a prototype is defined in the same way as Houde and Hill [73] define it, as "any representation of a design idea – regardless of medium" [73, p. 379]. The form of this case study's prototype went from paper wireframes in the beginning to a fully functional mobile game.

4.4.1 The Prototype Model

Each version of the prototype in this case study had a specific focus when it was tested on users. These focus areas can be classified into the three dimensions of Houde and Hill's *Prototype Model*: the *Implementation*, the *Look and Feel* and the *Role*. The Implementation refers to the technical implementation of the prototype; e.g. which technologies were used and

how. The Look and Feel refers to the user experience, i.e. what the users see and feel in regard to the user interface while using the prototype. The Role refers to how the final product will influence the users' lives [73]. The first two prototypes of the mobile game focused on the Implementation, the next two focused on the Look and Feel, and the last two focused on the Role.



(a) Implementation (b) Look and feel (c) Role

Figure 4.10: The three different focus areas of the prototypes

Each iteration of the prototype was tested on users. After every user test, the Ideate phase in Design Thinking was revisited and possible solutions to the challenges encountered during the user tests discussed. Decisions were then made about what should be added to or changed in the subsequent prototype.

4.4.1.1 Implementation

The Implementation dimension of Houde and Hill's Prototype Model is focused on the technical parts of the final product. It is exploratory in nature as it is meant to define what is technically feasible, as well as to get feedback from users on technical issues [73]. In this case study, the Implementation prototypes were developed to investigate technical details such as how to load and unload the camera as needed, how to best implement the swiping

navigation and the user authentication, and to test whether the technical implementation that was described in Section 4.2 worked.

The first Implementation prototype was the very first prototype of the mobile game that was user tested at SMK. It was a native application that, when opened, would enter the game by showing a story starter immediately. The users were then able to swipe to go into the camera mode in order to take pictures. Once the picture had been taken, it could be annotated and sent to another user. Hence, the Implementation prototype could test the most essential features for the users to submit story contributions and thereby build a story together.

Quality Assurance Testing

Quality assurance testing is focused on finding bugs in the technical implementation [54]. The first Implementation prototype was played through two times in total by two pairs of users at SMK. The mobile game behaved in almost the same way both times: it was running smoothly and without any technical problems at the beginning. Once the users had made a few story contributions each, technical issues arose. In some cases the mobile game crashed, pictures did not load or the user interface was not responding to interactions. Furthermore, the mobile phones became hot and unresponsive, which slowed down the mobile game. As a consequence, the users could not continue their participation in the tests as the same issues kept occurring. Two causes were mainly at fault for the majority of these issues. The first cause was that the camera was left on to run in the background, even when it was not shown on the screen. This drained the mobile phone battery and consumed too much memory and computing power, which caused the slowdown of the mobile game. The issue was fixed by loading and unloading the camera as the user accessed it.

The second cause of issues was the wireless internet connection at SMK, which could be slow at times. The result was that sending and receiving

pictures could fail without letting the users know what had happened. Users could think they had sent a picture although the other user never received it. This was a clear violation of Nielsen's guidelines for interaction design, which state that the user should always be able to tell the status of the system [75]. The technical issue with sending pictures on poor connections was minimised by implementing on the fly picture resizing that would lower the file size as much as possible. To help the user understand when the picture was in the process of uploading and sending to the other user, a loader animation was added.

Solutions to the problems encountered in the first user test were added to the second Implementation prototype. When this prototype was tested on users at SMK it ran without any critical issues. The users were thereby able to play and finish the game without technical hindrances. At this point, several technical features were still missing when the Implementation prototypes were tested. For example, there were no restrictions on the users' turns. The users therefore had to decide amongst themselves who would have the first turn. They had to take turns submitting a story contribution even though they could in theory submit many consecutive ones. Another example is that the mobile game was not restricted to a two player game. Anyone who had the mobile game on their mobile phone could contribute to the same story as everyone else. These features were gradually implemented throughout the course of this case study. Even though they had not been implemented when the focus of the prototyping was on the Implementation, such aspects of the implementation were also tested for in the Look and Feel prototypes that followed.

4.4.1.2 Look and Feel

Both of the Look and Feel prototypes had their main focus on the mobile game's user experience. The focus was also on designing, implementing and user testing additional user experience requirements that were discovered in

the previous prototypes in order to make the mobile game more enjoyable for the users.

The Look

The first Look and Feel prototype was in the form of paper wireframes. The purpose with making the wireframes was to determine what look and feel of the mobile game would appeal to the user persona described in Section 4.3.3. The target group, as exemplified by the user persona, uses picture-driven social media applications such as Instagram [76] and Snapchat [77]. Both of these social media applications inspired the initial look of the user interface – a look that changed very little during the course of this case study. The most distinctive feature of the look is that all the story starters are shown in full screen mode, similar to how pictures are shown in Snapchat. Another feature that was influenced by Snapchat's design was that users were able to write sentences and story contributions as semi-transparent overlays on top of the pictures.

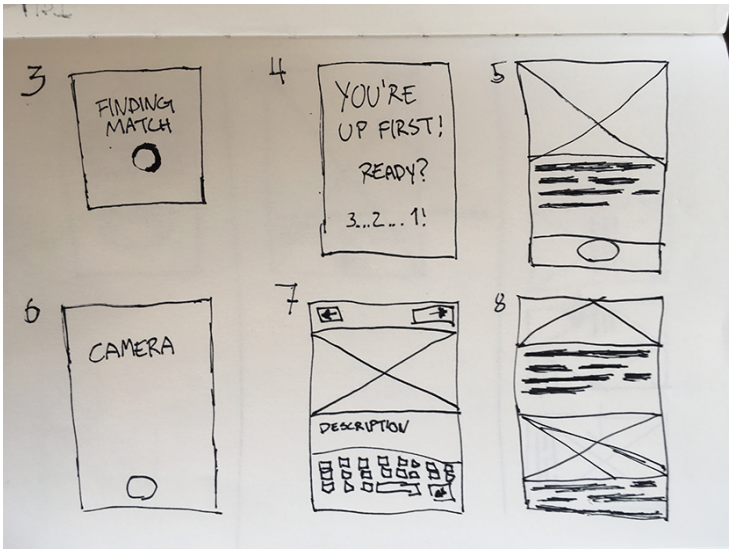
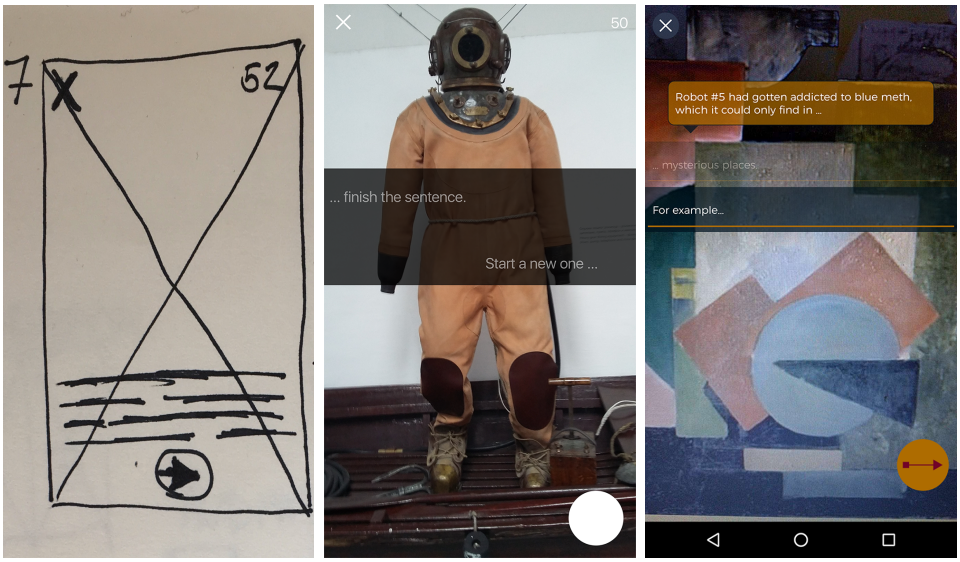


Figure 4.11: The initial paper wireframes

The Feel

A few design decisions were made in order to keep the users engaged with the physical artwork and immersed in the mobile game at the same time. The idea of the pictures being full screen had an additional purpose to it, namely to immerse the users in the mobile game without distractions from the user interface. The system status bar, which contains information about the current internet connection and battery life of the mobile phone, was hidden when playing. In addition, when playing the mobile game, the main menu only became visible by tapping on the screen. All of this was done to diminish the difference of looking at artwork at a museum and in the mobile game as much as possible.

The next step was to turn the paper wireframes into a clickable prototype once the initial look and feel had been determined. A prototyping tool called Marvel [78] was used for this purpose. The clickable wireframes were then able to be tested on mobile phones as they simulated a mobile application. They were tested on friends of the development team with the objective of getting feedback about the overall look and feel. The users said that the clickable wireframes reminded them of the look and feel of Snapchat. Since the feedback confirmed the goal of these initial wireframes, they were implemented into the first Look and Feel prototype that was user tested at SMK.



(a) Paper wireframes (b) Clickable prototype (c) Final prototype

Figure 4.12: The three stages of prototype development

Encouraging a Coherent Story

Even though the Implementation prototypes had their focus on investigating how the technical implementation worked in the user tests, the results also gave important feedback on what needed to be implemented visually. What stood out was that the users were uncertain about how to build a story in the mobile game. This problem became evident once they used the mobile game as a chatting application, where they discussed their daily lives in their story contributions. The sentences submitted were without context and did not resemble a story in any way. In addition, the sentences did not match the pictures that they annotated. As a result, the story contributions did not make sense in relation to story building. The confusion was confirmed in the interviews conducted after the user tests. The participants explained how they did not understand what the mobile game was about, despite the mobile game being explained to them in words before the game play started. In order to counteract this, two features were designed and implemented in

the Look and Feel prototypes; prompts and a modification to how to story contributions were submitted.

Prompts were added at specific points in the story to emphasise the structure of the story to the user whose turn it was. Only one user sees each prompt. For instance, the user who takes the first turn sees a prompt asking "Any idea of what happened there?" in reference to the story starter. Another prompt asks the user whose turn it is to submit the highlight of the story once it is halfway through. Both users get a prompt on their last turn telling them to wrap up or end the story with a grand finale.

Previously, users had taken turns submitting whole sentences. In order to help facilitate a coherent story, the user interface was redesigned in such a way that the users would finish each other's sentences. Each turn then required the users to finish the previous sentence started by the other user, and then start a new sentence that the other user could finish.

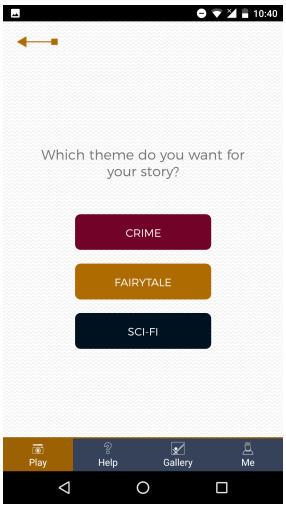


Figure 4.13: Screen to choose a theme

To further help users build a story, a decision was made to let them choose a theme for their story. This could help align expectations between users for the structure while also catering more to the users' personal interests. Three main themes were chosen: crime, fairy tale and science fiction.

When the aforementioned concepts were user tested, a few users said that while they were playing, they wanted to know how many story contributions had been made in the story. Additionally, the users mentioned wanting to know where each story contribution was in the story - whether it was towards the beginning, the middle or the end. These needs were addressed by designing and implementing a horizontal progress bar at the top of the story. This helped informing the users of how many story contributions had been made. At the same

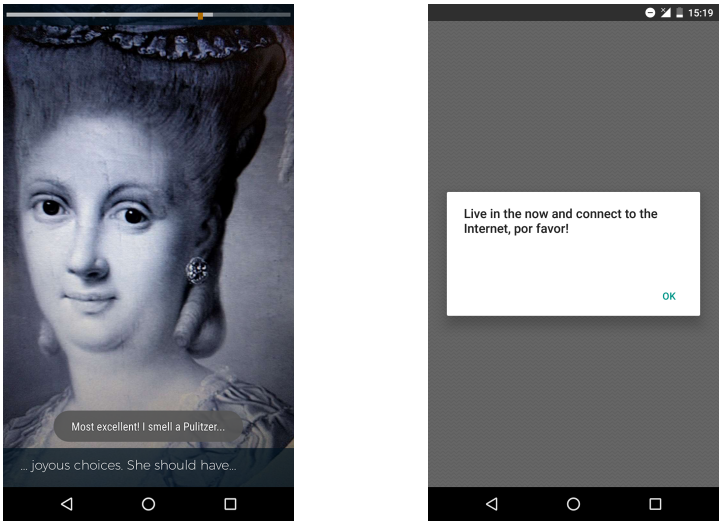
time, it let them know where in the story they were situated. This worked well for the remaining user tests of this case study with respect to the story building aspect and going back and forth in the story. The majority of the users wrote coherent stories in tone similar to the story starters of each story.

Setting the Mood

During user testing some participants mentioned how they felt they were "not being creative enough" or "definitely not being funny enough." This indicated that some of the users felt that they were expected to create story contributions that adhered to a certain standard. The mobile game had failed to let the users know that the purpose of the mobile game was to have fun in whichever way they wanted to. Setting the mood of the mobile game to be entertaining and informal therefore became an important part of the Look and Feel prototypes.

Keeping the target audience in mind, careful consideration was given to the phrasing of the instructions and the different words presented to the users in the mobile game. The emphasis was to keep all the text entertaining and informal. This was supposed to give users a similar approach to the artwork in SMK.

The same entertaining and informal phrasing was used in the small feedback pop-ups that were displayed at the bottom of the screen when a user submitted a story contribution (As seen in Figure 4.14a). These pop-ups were meant to affirm the user that the submission had been sent. The mobile game thereby adhered to Nielsen's aforementioned guidelines for interaction design [75]. For instance, after a user had submitted the first story contribution, the pop-up appeared with a message saying "Good Start!", while the second story contribution lead to a message saying "Nice! Have you done this before?"



(a) Message appears after submitting a story contribution

(b) An alert if there is no internet connection

Figure 4.14: Examples of the informal tone used to communicate with the user

Tutorial Development

A decision was made to develop a tutorial that the users could choose to go through before playing the mobile game. Before the tutorial was developed, the concept of the mobile game and how to play it had to be explained in person to test participants. The tutorial was made to further emphasise the preceding points in this section, namely to:

- Familiarise the users with the user interface and its interactions.
- Underline the story building concept of the mobile game.
- Emphasise the entertaining and informal feel of the mobile game.

The tutorial was initially designed and implemented in clickable wireframes. During the first test of the Look and Feel prototype, the plan was to ask the users to click through the wireframes and thereafter to play the mobile game. The idea was to see whether the wireframes did the

job of explaining and teaching the users how the mobile game worked. If that proved to be the case, nothing would have to be verbally explained to the users and the mobile game could then stand on its own. This was tested on two pairs of users. One pair said that they found the wireframes to be "way too complicated." After clicking through half of them, they ended their participation in the user test, saying "it is not for us." They ended the test before they had the chance to play the mobile game.

Figure 4.15: The initial tutorial in the clickable prototype

The other pair of users reported understanding the wireframes "quite well," but being surprised by how "simple the game was in comparison to them," i.e. they thought that the wireframes indicated a much more complex mobile game. These users managed to play the mobile game from start to finish without asking any questions and without the test facilitators explaining the mobile game in words beforehand.

The tutorial for the second Look and Feel prototype was simplified by shortening the tutorial substantially and including less explanatory text. In this form, the tutorial was fully implemented in the actual mobile game. Two pairs of users were again asked to go through the tutorial and play the mobile game afterwards. Both pairs played the mobile game without asking questions about the story building or the user interface.

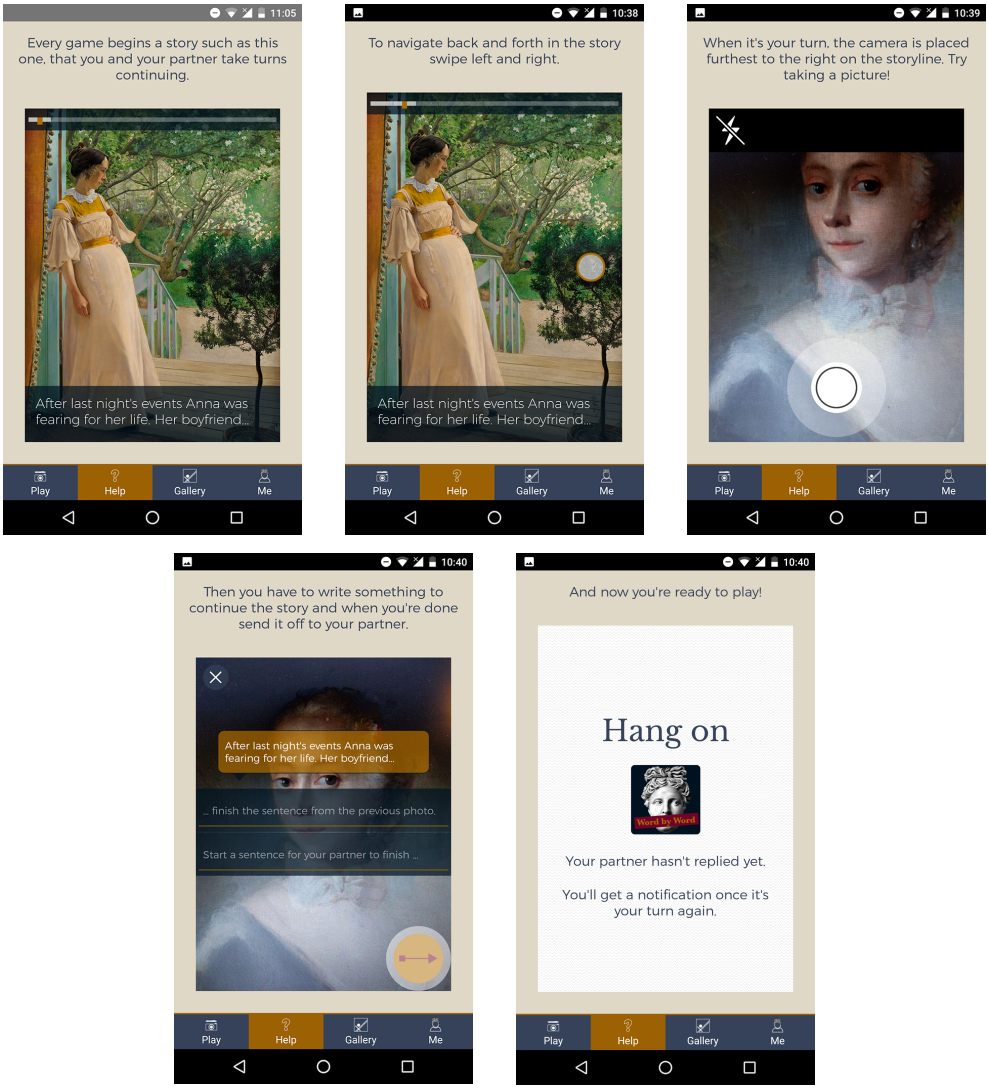


Figure 4.16: Final implementation of the tutorial

Story Starter Pictures

Pictures of artwork from an open source database hosted by SMK [79] were chosen as story starters. The pictures were of European art from 1300 - 1800. By annotating them in a humorous way, they were presented in a context different from the traditional museum context described in Section 2.1.1. Removing the artwork from this serious context and presenting it in

a humorous and playful tone was inspired by how Tate's *Tate Trumps* let users battle using artwork in a competitive card game (Section 2.1.3.1).

Some users expressed how it was less fun playing the mobile game in areas of the museum where there was less artwork with human characters. They said that they felt bored because it was difficult to continue the story. At this point, all of the artwork chosen for story starters featured people as motifs. This challenge was addressed by making a new set of story starters with landscape or abstract paintings. Like the other story starters, they were annotated with humorous sentences. This was done to show the users that any kind of artwork could be used in a story.

Figure 4.17: Story starters were phrased in a humorous fashion

Customisation of the User Experience

Some of the users found the mobile game to be too long and wanted the option to end it sooner. The option of ending the mobile game at any point was therefore implemented. If one user chose that option, the other user would get a prompt requesting one last story contribution to wrap up the story.

Sharing of completed stories was implemented due to the initial requirements set by the Product Owner. If a user decides to share the story on social media, a link to a website where the story can be read is provided.

4.4.1.3 Role

The last two user tests were solely intended to investigate the Role, i.e. how the final product impacted the lives of the users of the mobile game.

From this point on it was expected that the mobile game would work well technically, and that the users could play the mobile game without needing an explanation on how to play. The test results for this part of the Prototype Model are vital as they relate to the literature in Chapter 2 and are the ones answering research question 2 in this thesis. For these reasons, the following chapter is dedicated to discussing these results.

5

Results, Analysis and Discussion

The findings from the user tests are now presented in context of two theoretical frames. First the Contextual Model of Learning (Section 2.2.1) that describes the various facets of the museum experience [2]. Then in the context of Gammon's and Burch's recommendations for how a successful digital technology should align itself with the Contextual Model of Learning [17]. The chapter concludes with other findings that were of relevance to both research questions of this case study.

5.1 The Museum Experience

The Contextual Model of Learning explores the museum experience from the three following contexts: the Personal Context, the Sociocultural Context and the Physical Context [2] (Section 2.2.1).

5.1.1 The Personal Context

As mentioned in Section 2.2.1.1, the Personal Context of the Contextual Model of Learning is to a large extent predetermined before the museum visit takes place. The Personal Context includes personal factors such as the preferred approach of engaging with art, behaviour, interests, motivation for the museum visit and prior knowledge about the museum [2] (Section 2.2.1.1). Gammon and Burch [17] recommend that a museum mobile application should align itself with the Personal Context by appealing to the

aforementioned factors and narrow the target audience. The former was achieved through the design of the mobile game as outlined in Chapter 4. The target audience was narrowed by age and motivation for the visit as it is described in Section 3.5.

5.1.1.1 Preferred Way of Engaging With Art

Factors belonging to the Personal Context affected how the mobile game supported the users' museum experience. The most noticeable factors were how the museum visitors preferred to engage with art and how strong of a preference this was.

When Mia and Nancy[1] were asked about what their personal engagement with the artwork was like while playing the mobile game, they responded:

> Not very deep. It's because we don't know the pictures [...] It's just that it [the mobile game] is not so deep (Mia, Sprint 6) (Mia, Sprint 6).

> [when playing], you don't read a lot about them [the artwork] (Nancy, Sprint 6).

When Mia visits the museum, she usually demonstrates a deep engagement with the artwork. Her comments reflect that the mobile game interrupted her art engagement and made it shallower.

Similarly, Olive's preference for how to engage with artwork seemed to be as strong as Mia's, as she thought the mobile game interrupted her in doing so:

> [...] So maybe if you have an exhibition for school classes, it [the mobile game] would be really nice because they probably don't know what to do. But I know what I want and I don't want to be disturbed (Olive, Sprint 6).

[1] As mentioned in Section 3.5, the names of all test participants are fictionalised.

The mobile game did encourage Carrie and Louis to look at the artwork differently than what they were used to. Carrie explained how, when playing the mobile game, she felt that the game allowed her to "put thoughts into their [the people in the painting] heads" instead of "not knowing what they were really thinking when the painting was made" (Carrie, Sprint 3). Related to that, Louis said the following:

> I looked for stuff [when playing the game] to fit the story when normally I would just look at who painted it [the artwork] (Louis, Sprint 5).

These findings indicate that the mobile game has the ability to encourage a personal interpretation of the artwork. Similarly, it can inspire the museum visitors to notice other aspects of the artwork than what they are used to. This supports the theory that digital technologies can positively influence the museum experience [34] (Section 2.2.1.1).

The users who found the mobile game to be an interruption to their museum experience, said that they would prefer to play it on a subsequent visit to the museum. The reasoning behind it is explained in the following section.

5.1.1.2 Prior Knowledge About the Museum

According to the Contextual Model of Learning, the museum experience is affected by the prior knowledge that the visitors have about the museum [2] (Section 2.2.1.1). That seemed to align with the results of this case study. The museum visitors who thought the mobile game interrupted their art engagement preferred playing on a subsequent museum visit. Then they would have more knowledge about the artwork in the museum.

Irene and her museum companion Janet, said that they would prefer to play the mobile game on their second visit to the museum:

> If I would have already been at the museum once, and I would be going to refresh my memory of the art, I would probably play it

> because I would not be there for the first time trying to appreciate all the art. Because then [during the first museum visit], I think it is a bit distracting having to think of a story, because I want to see the art for the first time and have responses to it. But I think many people go to galleries second time and third time because of the new art. I think then it would be fun, because then you can appreciate the art from a new perspective because you have a different mission. So I think then it would be nice (Irene, Sprint 5).

Mia would also choose to play the mobile game on her second visit to the museum, but for different reasons than Irene:

> Maybe if we would have been here the whole day and knowing [sic] all the pictures and knowing what they were about, maybe it would be easier to connect the pictures [when playing the game] (Mia, Sprint 6).

5.1.2 The Sociocultural Context

The museum experience is, for the great majority of visitors, a social experience [2, 7, 36, 37] (Section 2.2.1.2). A digital technology project at a museum must fit within the social interaction of its users. At best, an application can increase social interaction at a museum, and at worst it might isolate the museum visitors from having social interaction that they might otherwise have had [17] (Section 2.2.1.2)

5.1.2.1 Supporting Social Interactions

As explained in Section 2.2.1.2, a successful museum application must be able to support the interaction between its users [17]. This was interpreted in the two following ways:

- A museum application should support the social interaction taking place around the artwork that would have otherwise occurred at the museum without the mobile game.
- A museum application should support everyday social interaction.

The answers that the users gave about how they normally discussed art during the museum visit were usually short and without depth. Therefore, it proved to be difficult to estimate whether the mobile game supported the normal interaction between the museum companions that would have otherwise occurred at the museum without the mobile game. However, one pair of users stated that the mobile game made them talk about art in a way that they were not used to.

The mobile game seemed to support a certain aspect of everyday social interactions, namely in-jokes. This was seen in the stories that the test participants created. Using in-jokes was never an explicit decision made by the participants, but something that happened naturally while playing the mobile game. One participant said that she had specifically focused her efforts on finding artwork to photograph that her museum companion would find funny. In three cases when the participants met up with each other after having played the mobile game, they would share a laugh and comment on specific parts of the other player's story contributions. The in-jokes might be one of the reasons why most of the participants said that they would only like to play the mobile game with a friend. They would only consider playing it with a family member if that particular family member shared their sense of humour.

In addition, the mobile game seemed to fit well within the social interaction of participants who had previously done activities together:

> But it is easy for us [creating a story together] because we have been making theatre together for three years, so we know [each other's sense of humour] (Irene, Sprint 5).

Irene and Janet were theatre students who explained that a great part of theatre is about creating and/or interpreting stories. Because of that and Irene's comment above, it can be said that the mobile game supported those users' everyday life social interaction. However, Irene and Janet are representatives of a small group of people, namely theatre students. Thus, the mobile game might not support most users' everyday activities in the same way.

Adapting the Social Interaction

One of the worst impacts that a museum application can have regarding the Sociocultural Context is prohibiting social interaction or isolating its users from having social interaction that would have otherwise occurred without the application [17] (Section 2.2.1.2). At a minimum, the mobile game did not isolate its users from having social interactions. Even the participants who seemed to like the mobile game the least turned to using it as a communications tool:

> [...] in the middle of the story, we lost the point of the storytelling. It converted into chatting (Pablo, Sprint 6).

Olive, Pablo's museum companion agreed:

> Yeah, chatting was quite nice really (Olive, Sprint 6).

> Because it [the game] is a real chat form, the same chat as in real life. You send each other some pictures, some story (Pablo, Sprint 6).

Hence, the users who did not like the mobile game, adapted their established social interaction to the format of the mobile game. In this case, social interaction still took place, even though it was not in the form intended.

5.1.3 The Physical Context

The Contextual Model of Learning's physical context refers to how the physical setting of the museum, e.g. the museum space and its artwork, affects the museum experience [80] (Section 2.2.1.3). It is important that a digital technology used in museums considers these unpredictable physical factors [17] (Section 2.2.1.3).

5.1.3.1 Movement and the Level of Engagement

The participants that seemed disinterested in the mobile game were mostly seated while playing. The participants that reported liking the mobile game were observed to constantly walk around the exhibition halls, looking for artwork that fitted the story. One of the participants, Louis, confirmed this during the interview after he had played the mobile game:

> I think it was pretty funny that you get to look at some paintings that you would maybe ignore otherwise because you are looking for some stuff to fit your story (Louis, Sprint 5).

As mentioned in Section 2.2.1.3, movement in the physical space might not in itself constitute engagement with the artwork [40]. For that reason, the mobile game can be susceptible to the same criticism as the Scavenger Hunt [40] (Section 2.1.3.3). The difference between the mobile game of this case study and the Scavenger Hunt is that the former encouraged the participants to look at more artwork and interpret it in order to fit the story. Additionally, the participants might have looked at artwork in a different order than what they were used to. The participants might have thereby formed new associations between the different artwork. Thus, it can be argued that the mobile game did not encourage the museum visitors to view artwork as "a bunch of disconnected, decontextualized artefacts" [40] (Section 2.2.1.3). The "additional layer of engagement" [40, p. 317] that is necessary to create a

successful digital museum technology [40] (Section 2.2.1.3) might have been reached.

5.1.3.2 The Artwork's Motifs

The selection of artwork that surrounded the participants while playing the mobile game seemed to influence how engaged they were with the game. Edith described how she felt restricted when the game was played in a certain section of SMK's exhibition hall with Danish and Nordic art (Section 4.3.1), where much of the artwork is of landscapes with no human characters:

> If it is pictures of a lot of landscapes and stuff, then it is not fun [to play]. [...] We came for the [Japanese] exhibition because we have both been in Japan. I think the game would have been more fun if we would have played it there. The paintings here were a bit boring (Edith, Sprint 4).

The findings mentioned in this section highlight two factors. Firstly, how museums' artwork can influence the engagement with the mobile game. Secondly, how the mobile game can support engagement with more artwork that the museum visitors might otherwise not see.

Furthermore, Edith's comment above shows how the different contexts of the Contextual Model of Learning can overlap [2] (Section 2.2.1) as will be explained in the following section. In her case, the Personal Context came into play together with the Physical Context, as she wanted to play the mobile game in an exhibition hall that she had a personal relation to.

5.1.4 The Overlapping of Contexts

The three different contexts of the Contextual Model of Learning often overlap [2] (Section 2.2.1). Edith's comment above demonstrates how the Physical and the Personal contexts overlapped when Edith said that she would

prefer playing the mobile game in an exhibition hall that she had a personal relation to. Another example of the overlap of the contexts was when Irene was asked to reflect on the idea of playing the mobile game with a stranger. Then she differentiated between playing with a stranger in the same physical space or in two separate physical spaces, where her and the stranger would not be able to see each other:

> We [Irene and Janet] were talking about overthinking your responsibility of having to be funny. I think if you would play with a stranger [in the same physical space], it might be more so, because you are worried about what they might think because they don't know you. But if you would not see that person, that would be quite funny because you would [...] feel like an anonymous (Irene, Sprint 5).

Janet, agreed and said:

> Then you would maybe go further with it [playing the mobile game]. You would be less afraid to just do crazy stuff (Janet, Sprint 5).

These reflections show how the Sociocultural Context overlaps with the Personal Context; Irene and Janet would each play the mobile game differently depending on how well they knew the other player. The reflections also show how the Physical Context overlaps with the Personal Context; Irene said she would play the game differently depending on whether she would be located in the same or a different physical space from the other player.

The overlapping of the three contexts show how the categorisation of the above results are not necessarily clear-cut, and could be interpreted in relation to other contexts than they were in this case study.

5.1.5 Other Findings

One of the initial goals of this case study was to design a mobile game for the Socializers, according to the Sachatello-Sawyer et al. categorisation of museum visitors [35] (Section 2.2.1.2). This proved to be a problematic categorisation because all of the participants said their motivation for visiting the museum was for the art experience. That would put them in Sachatello-Sawyer et al.'s Museum Lover category [35] (Section 2.2.1.2). However, this categorisation was often contradicted by several factors: first of all they were visiting the museum with a friend, and most of them said they always did that. Secondly they said that they rarely go to museums. Thirdly and most importantly they were often observed actually spending very little time at the museum. Hence, it can be argued that many of them were, in fact, Socializers and not Museum Lovers. Another problem with the categorisation was that the participants could fall within several of Sachatello-Sawyer et al.'s categories. An example of this is Olive, who said she visited the museum for the art experience. However, she said that sometimes her main goal was to learn factual knowledge during her museum visit. Thereby, she would fall within both the Knowledge Seeker and the Museum Lover categories [35]. Because of this problematic way of categorising the museum visitors, the focus shifted from designing for Socializers in particular to exploring how the mobile game worked for all the participants interviewed.

5.1.5.1 Sharing the Museum Experience – During and After

Research on social interactions between adults at a museum are scarce [2, p. 157] (Section 2.2.1.2). Therefore, an emphasis was put on gathering in-depth data about the users' feelings about the social interaction that took place while playing the mobile game.

Discussing Art in Real Time

The users of ARTeMuse that shared a device together to play the game could

discuss art in real time. They reported enjoying the mobile game more than the participants who did not share a device to play the game [27]. Similarly, the users of Sotto Voce (Section 2.2.1.2) expressed feeling closer to each other when knowing what their museum companion was doing, even though they could not see each other [39] (Section 2.2.1.2). The mobile game of this case study offered users a kind of feature similar to ARTeMuse and Sotto Voce, namely to discuss art together in real time while knowing what their museum companion was doing, despite being in separate spaces. Two of the participants in this case study mentioned how the mobile game provided a means for a different kind of discussion about art than what they were used to. However none of the participants gave an emotional response when asked how they felt about discussing art in this way with their museum companion.

5.1.5.2 Discussing Art on Social Media

ARTeMuse (Section 2.1.3.2) offered an option for all the participants to share their reflections on the artwork on social media after they had played the game [27]. The purpose was to enable the museum visitors to fulfil their identity related need around the artwork and their museum visit [27]. The same option was offered in the mobile game of this case study; the participants could share their story on social media and thereby let their online friends know they had been in a creative writing process at a museum. However, none of the participants decided to take advantage of this option. When asked why, they said that they thought that none of their online friends would be interested in the story, or that the story was "just too ridiculous to share" (Olive, Sprint 6).

The participants of ARTeMuse and Sotto Voce gave more elaborate response about their feelings when interacting with a museum companion through digital technology. It seems that more time was needed to collect data on how the participants felt while reflecting on art through the mobile game.

6
Conclusion

This chapter concludes the case study and summarises its outcomes in Section 6.1. Section 6.2 reflects on parts of the case study that could have been performed differently and also evaluates potential future work.

6.1 Research Outcomes and Contribution

The research questions of this case study were as follows:

1. How can we design a mobile game that supports a meaningful social museum experience for visitors aged 14-29?

2. How does the mobile game support that experience?

A mobile game for museums was developed by involving the users in the process, as proposed by Yiannoutsou and Avouris [30]. Additionally, this case study provides insight into other areas that remain to be explored in-depth by other academic research. Those areas are the museum experience itself, the evaluation of the effectiveness of digital technologies in museums, and how adults interact with each other during the museum visit (Sections 1, 2.2 and 2.2.1.2 respectively).

Research question 1 can be divided into three parts and answered accordingly:

1. How can we design a meaningful ...

2. ... social museum experience ...

3. ... for visitors aged 14-29?

1) How can we design a meaningful ...

Chapter 4 answered this part of the research question by outlining the design process. The users were involved in the design process to such a large extent, that all major decisions of what should be included or changed in the mobile game were based on the feedback from the users. This was supposed to make the mobile game more enjoyable for the users. How the mobile game supported a meaningful museum experience will be answered later in this chapter.

2) ... social museum experience ...

How the mobile game developed for this case study supported a social museum experience will be discussed in the answer to the second research question of this case study. The original intention was to design specifically for Socializers [35] (Section 2.2.1.2) who would participate in the user tests of this case study. However, as explained in Section 5.1.5, the reason for not achieving that was the problematic way of categorising the museum visitors.

3) ... for visitors aged 14-29?

To target young adults specifically, this case study sought design inspiration from popular picture-driven social media applications and used humorous and informal language. In addition, only young adults visiting SMK together were asked to participate in the user tests. The feedback from them about the look and feel of the game was then used to lead the design of the next versions of the prototype.

How Does the Mobile Game Supports that Experience?

Research question 2 can be answered as a whole by looking at what the meaningful museum experience is. The museum experience was explored

thoroughly in Chapter 5 through the three dimensions of the Contextual Model of Learning, namely the Personal Context, the Sociocultural Context and the Physical Context.

Predetermined factors belonging to the Personal Context (Section 2.2.1.1), such as the preferred way of engaging with the artwork and how open the users were to alternative ways of doing so, seem to affect how the mobile game influences the art experience (Section 5.1.1.1). Furthermore, prior knowledge about the museum's artwork seemed to positively correlate to how enjoyable the users found the mobile game to be; the more knowledge they had about the artwork, the more enjoyable they imagined the mobile game to be.

Regarding the Sociocultural Context (Section 2.2.1.2), the mobile game supported a different way of discussing art from what two users were used to. It proved to be difficult to draw conclusions about how the mobile game supports the social interaction that comes naturally during the museum visit. However, the mobile game appeared to support everyday social interactions for users that have done creative activities together before. It also seemed to encourage the use of in-jokes – which is a type of social interaction that the participants share before visiting the museum (Section 5.1.2).

Concerning the Physical Context (Section 2.2.1.3), the artwork in some cases influenced the users' engagement with the mobile game. This engagement affected how much the users moved around the museum and how much artwork they saw and connected to the story.

6.2 Reflections and Future Work

As explained in Section 3.4, user testing after each Sprint was limited to two pairs of players each time. The low amount of test participants means that the test results of this case study should not be extrapolated to draw general conclusions until more tests are performed. If time had allowed, a more in-depth interview process with both individual and group interviews

could have lead to greater discovery about the museum experience through the three contexts of the Contextual Model of Learning.

Because the user test interviews were conducted in person, it is plausible that the feedback received was biased. As the participants knew that they faced the creators of the game, they might have been more likely to give positive and pleasing feedback. This bias could possibly have been lessened, had the tests been conducted by a third party which did not have a personal relation to the mobile game.

The user tests were all done in the same specific area of SMK as per the museum's request. Had it been possible, it could have provided additional interesting insights to test the game both in different areas of the museum and in different museums altogether. This would be to investigate if results similar to the ones seen in this case study could be recreated elsewhere. For instance, SMK could potentially attract a very specific subset of museum visitors, that might not behave similarly to visitors who go to other museums.

As mentioned in Section 4.4.1.2, the mobile game imposes an informal humorous approach towards artwork on its users. This proved successful with the users that the mobile game was tested on, as they were observed laughing and successfully writing stories that continued in the same vein. It is important to note, however, that people could potentially find the humorous approach off-putting. While it is no surprise that humour is not a "one size fits all" solution towards supporting a meaningful social museum experience, this case study did not investigate further when and why this approach worked.

In the future, research could investigate the subject of humour and its impact on the perception and interpretation of art. Such academic work should be able to build on the findings of this case study.

Future work could also investigate the actual game structure that the mobile game imposed on the users; how this structure made them look at and interpret artwork, and how this affected the museum experience. The mobile

game's constraints of setting a strict game length of five turns for each player or requiring users to finish each other's sentences meant that users had less freedom to personalise the game experience. These game constraints were added to help the users build coherent stories, which is based on a presumption that coherent stories are desirable for the museum experience in the first place. Based on the very first user test results, the development team used its best judgement to develop and add these constraints so that the mobile game played better. Future work could look into whether the presumption about the desirability of coherent stories holds true, and whether the game constraints were actually helpful for supporting a personal engagement with art.

Each person's museum experience needs to be explored and understood as one whole, which is the sum of three contexts of the Contextual Model of Learning [2] (Section 2.2.1). Furthermore, as stated by Gammon and Burch [17] (Section 2.2.1), a successful digital technology needs to align itself with the three contexts in order to support an enjoyable museum experience [17]. It is debatable to what extent the mobile game of this case study supported the museum experience for each participant. The participants did not have enough time to engage in in-depth interviews that provided a deep insight into the three contexts of the Contextual Model of Learning [2] (Section 2.2.1) that form their museum experience as one whole.

This case study provides insight into how a collaborative storytelling mobile game supports a meaningful social museum experience through the three contexts of the Contextual Model of Learning. The mobile game encouraged the users to be active participants in their own museum experience by putting the artwork in context with a story that they created. The users constructed a personal meaning about the artwork that they saw during their museum experience by interpreting it in relation to the story. This is the definition of meaning making in a museum [21] (Section 2.1.2) and often the motivation for bringing games and digital technology into the museum setting

[30] (Section 2.1.3). Because the mobile game of this case study encouraged the collaborative story creation and the options of sharing on social media and rating each other's stories (Section 4.1), the users automatically became content creators, distributors, collaborators or critics who participated in each other's museum experiences. Thus, the mobile game aligned itself with current trends in museums that emphasise that the visitors participate and actively contribute to the museum experience [24, 5] (Section 2.1.2).

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Appendices

A

Initial Requirements from the client

- The app shall challenge the player to tell the story when she opens it. (5)
- Only two players are matched at each time. (3)
- Players are put in a queue if there are no peers they can be matched with. (6)
- The player who starts the game is presented with a sentence and a picture that are chosen at random in the beginning. (4)
- Players can take a picture and upload it to the matched player. (2)
- Players can write a sentence and upload it to the matched player. (1)
- Players are obliged to create a login account or use their Facebook or Google accounts to sign in.
- The user profile should include gender, age, how many sentences the user has posted.
- Players shall be able to save their old games.
- There shall be a database of stories.
- Players shall be able to rate the stories that are in the database (secondary).
- The story that got most points shall be at the top in the database(secondary).
- There shall be a time limit for answering.
- The game ends when one of the players runs out of time to answer.
- There shall be a leaderboard.
- There shall be achievement.

- Players can give user-defined badges to one another.
- Players should be able to post their badge on social media.
- The game is wrapped in a web application.
- Players should receive notifications when they receive ratings or a badge.
- Players should be able to have the option of shutting down notifications.
- Players should be able to make the story publicly visible (only if both players agree).
- Up to 1000 players should be able to play the game at the same time.

B

Participants' Consent Form

Consent

By signing this you give consent to participate in the thesis project "Users perceptions of a personalized museum mobile app" conducted by Elin Ingimundardottir, Greta Stančiauskaitė and Kristoffer Sachse, students at the IT-University of Copenhagen.

Your participation will consist of one user test. Audio from the test is recorded and can be transcribed. The information you provide can be used as basis for scientific analysis, and the things you say can be cited in academic publications. The researchers oblige to respect the ethical guidelines for using this data so that your integrity is secured and your privacy is protected.

Participation is voluntary and you may at any time revoke your consent (until the time when the data has been published). You will be asked for your approval of any quotes that are going to be used. Audio and transcriptions will be deleted at your request.

For any questions, please contact Anders Sundnes Løvlie at email: [redacted] or phone: [redacted].

Place and date: _____

Signature: _____

Name: _____
(w/ capital letters)

C

User Tests Interview Transcriptions

C.1 Interview Transcription of the User Test No.: 01

Date:	Mar. 26, 2017
Place:	SMK
Interviewees:	Edith, 21
	Fay, 21

At the beginning once we were going over how the game works [going through the wireframes], did you get a clear understanding of what you were going to do?
Edith: Yes, I think so. I think it helped when I got started in the game, then I got it pretty quick. But I think [when looking at the wireframes] then it was more complicated than it was. So I read it [the wireframes] really closely and when you take the first picture you just get it. But I was confused when at the beginning [when looking at the wireframes]
Would you liked to have the tutorial in the actual game?
Edith: I think it was fine as it was.
Nothing in the wireframes that was unclear?
Fay: No, just while playing the game, I got out of it two times by pressing the triangle [the back button].
So overall experience. How was it?
Edith: It reminded me of Snapchat. How I use it. I send a lot of snaps and it's stuff like that, back and forth, back and forth. I think it was fun actually. The first picture I got, I was laughing. You just have to make something up.
But do you think you looked at artwork differently when you played the game?

Both: Yes.
Edith: I was not looking at everything as it was nice to look at. I was looking for something fun. Like, how can I write something fun about this one?
Fay: Also something that is fun for you [referring to her friend] and we wrote some stuff about ourselves.
Was it like private humor?
Edith: Yeah, kind of.
But do you feel like it took you out of the art experience? Did it ruin anything for you?
Edith: I think it was fine.
Fay: Yeah.
Edith: It's just that we didn't have a lot of time, but if we would have a lot of time then we would take time to look for something funny.
But what did you think about the length of the story?
Edith: I think it was fine.
Fay: I think so too.
Did you think it was easy to build a story, like to bounce sentences back and forth?
Edith: The first one was a bit hard. I think you could have started without the first starting picture because it was hard to build this kind of random thing. I think it is easier if you start on your own.
Fay: Yeah, I don't think it should be longer.
Are you here today just for fun?
Both: Yes.
Edith: We don't go very often to museums though. We came for the Japanomia exhibition because we have both been in Japan. I think the game would have been more fun if we would have played it there.The paintings here were a bit boring. It depends on the pictures. If it is pictures of a lot of landscapes and stuff, then it's not fun.

Yeah, it's hard to make a story of that maybe.
Edith: Yeah, I think it depends on what you are looking at.

C.2 Interview Transcription of the User Test No.: 02

Date:	Apr. 09, 2017
Place:	SMK
Interviewees:	Irene, 23
	Janet, 23

Besides bugs, do you think you would ever play this game when visiting a museum or is it not your thing?

Irene: I think it would be fun. It depends on who you go with I think. If I would have already been at the museum once, and I would be going to refresh my memory of the art, I would probably play it because I would not be there for the first time trying to appreciate all the art. Because then I think it is a bit distracting having to think of a story, because I want to see the art for the first time and have responses to it. But I think many people go to galleries second time and third time because of the new art. I think then it would be fun, because then you can appreciate the art from a new perspective because you have a different mission. So I think then it would be nice.

Janet: I think going with a friend for the sole purpose of playing this game in an art gallery could be quite fun.

Irene: That could also be quite good to get more people to go to art galleries.

Janet: It reminds me of Facebook pages like 'Classical Art Memes' where there are serious artworks and people just write nonsense to them and taking things out of context. It is quite fun.

Irene: It would be cool if you could save your stories and then you would have a memory of your trip.

Do you think you would like to share your story on social media?

Both: If it was a nice story, then yes.

But what about playing with somebody who is not your friends, like a family member or a stranger?

Irene: It would be really interesting playing it with a stranger. For theater students, it is easier because you have a really relaxed approach to art and stories. We know that everything can be a story, so we are not overthinking. We were talking about overthinking your responsibility of having to be funny. I think if you would play with a stranger, it might be more so, because you are worried about what they might think because they don't know you. But if you would not see that person, that would be quite funny because you would [...] feel like an anonymous.

Janet: Then you would maybe go further with it.You would be less afraid to just do crazy stuff.

So maybe more crazy stuff than you would with your friend?

Both: Yes.

Irene: Unless you are really good friends who understand [...]

But what about a family member?

Janet: I would not do it with my father.

Irene: Maybe with my dad because he is quite funny, but my parents are not that good with technology. My brother though, yes.

Janet: Yeah, but my brother would not go to art galleries.

But did you feel like you were on the same 'vibe,' e.g. humor-wise when playing the game?

Irene: I think so. But it is easy for us because we have been making theater together for three years, so we know. I appreciate your fairy [... reference the story they made].

But did it take you out of the art experience?

Janet: Not necessarily because it took awhile between we got each response. So you had a time to and look at art and stuff and then it was quite fun to go and take pictures of things. I mean, the first time it was quite easy because I just took a picture of the first thing I saw.
Irene: It becomes quite different. It was not like it distracted.
Do you guys go to a museum for the art experience or the social aspect?
Both: The art experience.
Do you think you would like to play this game in another context, like an amusement park?
Irene: Then I think it just becomes too much like Snapchat because you can take a picture of anything and then add on to your person and then it's like an Instagram story or something. But it might be interesting if you are on different platforms, like one person is in a contemporary art museum and take pictures of all the funky statues and the other one could be in a renaissance painting area, that might be quite funny.
Janet: If you would be in a botanical garden, you would not have people [to photograph].
Irene: You would have to be an artist to go and take pictures of plants and say "This is a character."
Janet: You could just always add yourself in the picture.

C.3 Interview Transcription of the User Test No.: 03

Date:	Apr. 09, 2017
Place:	SMK
Interviewees:	Kate, 20
	Louis, 22

How did you like the game?
Kate: I don't really play games in general so I don't know if it is like... I think it was good but my only issue with it was like that it would be too long to do it one time. But it is also like, do it over multiple settings, you probably would forget everything.
So, maybe you would like to do it with three pictures each?
Kate: Yes.
Louis: I think it was pretty funny that you get to look at some paintings that you would maybe ignore otherwise because you are looking for some stuff to fit your story. So it is quite nice that way.
Did you feel like you looked at art differently with this game?
Louis: Yeah, I looked for stuff to fit the story when normally I would just look at who painted it.
Kate: It was cool to just look at a painting and see how it could fit because I think somehow that most things could work if you make something up.
How did you feel like making a story together? Do you feel like you were on the same wavelength like humor-wise?
Kate: I don't know.
Louis: This is actually the first time I ever meet Allison.

Would you like to post your story on social media?
Louis: I think I would not.
Kate: I don't think I would.
Why not?
Louis: Because I cannot imagine that any of my friends would like to see what I write.
Do you think this kind of game would work in another setting?
Kate: I was thinking while I was playing that you could probably do this like in life, in general, just take a picture of something random and fit it in. I don't know if you need to be in a specific thing.
Do you go to museums often?
Louis: Yes.
Kate: No.
Why?
Louis: I go to look at art in a museum.
Do you think that this game disconnected you from the art experience?
Kate: I think it kind of did but it is only a certain period of time. I don't think it would help me look at it more. I think it would help me focus on something else within art. But that does not have to be a bad thing.
Louis: I have been here before and seen all the art.

C.4 Interview Transcription of the User Test No.: 04

Date:	Apr. 30, 2017
Place:	SMK
Interviewees:	Mia, 21
	Nancy, 21

What was your favorite thing about playing the game?
Both: The creativity of making a story out of pictures.
What was your least favorite thing?
Both: The waiting time.
How was your connection to the artwork while you were playing?
Mia: Not very deep. It's because we don't know the pictures.
Nancy: You don't read a lot about them.
Mia: Maybe if we would have been here the whole day and knowing all the pictures and knowing what they were about, maybe it would be easier to connect the pictures. Because I was just walking around, like "oh, there is a picture of a girl."
So without the game, you would look more closely at the artwork?
Both: Yup.
Normally when you are at a museum, do you then look for a long time at each artwork and read about them?
Both: Yes.
What did you feel about discussing art together through this game together?
Nancy: It's not the way we usually do it.

Mia: We just walk around and talk about the pictures and not about the story behind the picture. It's just that it's not so deep. It's very... it's fun.
But is it normally deeper when you go to a museum?
Mia: Yes.
Would you share this kind of game on social media, like your story?
Both: No.
Why not?
Mia: It's very ridiculous.
Did you think the game was too long?
Mia: I think if we did the game voluntarily, like "ok, now we are committing to this," then maybe not. But now that we were like "oh, here's a game, lets try it," then it's long. But if you know what you are in for and you are prepared, then yes, it would then not be too long. Because then you would also spend some time really trying to find the picture I think.

C.5 Interview Transcription of the User Test No.: 05

Date:	Apr. 30, 2017
Place:	SMK
Interviewees:	Olive, 30
	Pablo, 32

[Due to technical difficulties, the first part of the interview recording has been lost.]
[...]
Olive: If I would be here the second time, for me it would be easier but now the game is distracting me a little bit. Because I need to think about this guy [unintelligible] and try to pick up these pictures somehow to make them...
Pablo: There's also a comment about that in the middle of the story, we lost the point of the storytelling. It converted into chatting.
Olive: Yeah, chatting was quite nice really.
Pablo: Because it's a real chat form, the same chat as in real life. You send each other some pictures, some story.
So for you, it was something like Instagram?
Both: Yes.
Was it because you got bored in the game?
Olive: It was not about the game. The pictures were just so corny and I was mostly busy with them.
So the game took you out of the art experience?
Both: Yes.

Olive: Yes, so it took me out of the art. Because usually, you want to be in silent and think about life and not you know...
Pablo: [unintelligible]
Olive: A museum in Russia where I have been many times, I usually I have a walk there. I would play the the game much better there. Because here, I just want to concentrate on the art.
Pablo: Yes.
If you would come here for the second time, you would like the game more?
Pablo: Yes, it might be easier to create a story.
Olive: Yes.
So, did it make you look at art differently?
Pablo: Yes, as part of a story. Trying to find something interesting to fit the story.
Did it then make you look at art more?
Pablo: Yes, time wise.
Olive: For me it was not like that. Because I was reading a lot about the pictures [unintelligible]. because my goal was to watch the pictures and not doing anything else. So maybe if you have an exhibition for school classes, it would be really nice because they probably don't know what to do. But I know what I want and I don't want to be disturbed.
Was there something you liked in particular about the game?
Pablo: It is a new format which I have never played.
Olive: For me it would be interesting if I could for instance answer some questions about the artwork.
About facts?
Olive: Yes, like a Coursera course. Then it would make sense for me.
But would you share your story on social media?
Olive: No, I don't think that would make any sense, because it's just so ridiculous. Maybe you should make it like Escape rooms, where you go as a

team and you have team building [unintelligible]. But maybe after that you could answer some questions...

So, make it into a competition?

Olive: Yes, I would say it like that. To have some target. For me at least.

So you go to museums to learn facts about paintings?

Olive: Yes.