KARELIA UNIVERSITY OF APPLIED SCIENCES
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ENHANCING HISTORICAL ATTRACTIONS THROUGH AUGMENTED REALITY

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Title
Enhancing Historical Attractions Through Augmented Reality

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Abstract

The thesis set out to enhance the attractiveness of historical attractions through augmented reality with a concrete, executable example of augmented reality application for a set historical attraction. The technological and technical solutions of the application were to be feasible within 1–2 years of the time the thesis was written.

The research done for the thesis included outlining the core concepts. The knowledge base was built by familiarisation with prior research about augmented reality, tourist attractions and museums. The current situation of historical attractions was examined with literature and an expert interview. Augmented reality's current applications and the state of its technical and technological solutions were described based mainly on expert interviews, research, and concrete examples. The ethical, methodical and methodological choices of the research were reflected regarding responsible conduct of research and literature on subject.

Salpa, the application innovated, ended up having a more game-like solution for more competitive users as well as an idler mode for less competitive users. In addition to technical choices, distribution possibilities were considered. The process behind the thesis and suggested subjects for further research were introduced at the end of the thesis.

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cultural tourism, historical attractions, augmented reality, digitalisation, Joensuu Bunker Museum

Karelia AMMATTIKORKEAKOULU	**OPINNÄYTETYÖ** **Helmikuu 2018** **Matkailu- ja palveluliiketoiminta** Tikkarinne 9 80200 JOENSUU Puh. (013) 260 600

Tekijä
Lotta Honkanen

Nimeke
Historiallisten kohteiden parantaminen lisätyn todellisuuden avulla

Toimeksiantaja
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Tiivistelmä

Opinnäytetyön tavoite oli parantaa historiallisten kohteiden vetovoimaisuutta lisätyllä todellisuudella esittelemällä konkreettinen, toteutettavissa oleva lisätyn todellisuuden sovellus määrätylle historialliselle kohteelle. Teknisten ja teknologisten valintojen valossa sovelluksen tuli olla mahdollinen toteuttaa 1–2 vuoden sisällä opinnäytetyön kirjoittamisesta.

Opinnäytetyötä varten tehtyyn tutkimukseen kuului keskeisten käsitteiden määrittely. Tietopohja rakennettiin tutustumalla aiempiin tutkimuksiin lisätystä todellisuudesta, matkailijakohteista sekä museoista. Historiallisten kohteiden nykytilannetta tutkittiin kirjallisuuden ja asiantuntijahaastattelun avulla. Lisätyn todellisuuden olemassa olevia sovelluksia sekä siihen liittyvän teknologisten ja teknisten ratkaisujen nykytilaa kuvailtiin pääasiallisesti asiantuntijahaastatteluiden, tutkimusten sekä konkreettisten esimerkkien pohjalta. Tutkimuksen eettisiä, metodisia ja metodologisia valintoja pohdittiin suhteessa hyvään tieteelliseen käytäntöön sekä aiheesta tehtyyn kirjallisuuteen.

Innovoituun sovellukseen Salpaan sisällytettiin pelinomaisempi ratkaisu kilpailuhenkisemmille käyttäjille sekä rennompi ratkaisun vähemmän kilpailuhenkisille käyttäjille. Teknisten valintojen lisäksi opinnäytetyössä on pohdittu mahdollisia jakelukanavia. Prosessi opinnäytetyön takana sekä aiheita jatkotutkimukselle nostettiin esille opinnäytetyön lopussa.

Kieli englanti	Sivuja 102 Liitteet 7 Liitesivumäärä 21

Asiasanat

kulttuurimatkailu, historialliset kohteet, lisätty todellisuus, digitalisaatio, Joensuun bunkkerimuseo

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Glossary

AR	Augmented reality; overlaying digital elements over a view of real world that is being seen through a device. A technology utilised e.g. in hit game Pokémon GO.
Beacon	Relatively small that sends a BLE signal to a receiving device. Application on the receiving device then react to the signal by completing a set action. (Olcay 2015.)
BLE	Bluetooth Low Energy; Bluetooth protocol that sends less data and uses less energy. (Olcay 2015.)
HMD	Head-Mounted Display; display device worn on one's head. (Stobing 2016.)
HUD	Heads-Up Display; transparent display showing the critical information without blocking the view; Used in air forces, name refers to that the pilot can access data such as altitude, airspeed and horizon line without lowering their gaze to the aircraft's instrumentation. (Perdue 2017.)
LI	Location Intelligence; understanding and exploiting the spatial aspect of information (Moon 2008, 2).
MR	Mixed reality; mixture of real-life and virtual elements. (Milgram, Takemura, Utsumi & Kishino 1994, 283.)
VR	Virtual reality; interactive simulation/synthetic world created with computer graphics.
OS	Operating system; programme controlling both hardware and software, e.g. Microsoft Windows, Linux Ubuntu, Google's

	Android, Apple's iOS.
QR code	Quick Response code; marker containing data such as text, link, or control code (Denso-Wave 2010); see examples of QR codes on page 42.
URL	Web address, or more accurately, a character encoding associated with web addresses (Connolly & Sperberg-McQueen 2009). Used as an abbreviation for web address.
XR	Extended reality; umbrella term for AR, VR, and MR; alternative version X reality, "X" being a non-specific variable. (Pixvana 2016; Augmented World Expo 2017.)

1 Introduction

Digitalisation has brought new ways of telling stories. Although in its core it is the story that captivates people, new medium help in drawing attention. Technology today can already do more than a casual consumer can imagine and yet, without stories to tell, the lengths it can go are practically meaningless.

As the competition for consumers' leisure time escalates, culture services such as theatres and museums face increasing challenges. To better improve visitor satisfaction, it is necessary to examine visitors' needs and wants. In historical attractions, clear differences in visitor satisfaction are apparent: whereas others enjoy the attractions immensely, spending hours at site, others seem to rush through the obligatory educational part of their travel as quickly as possible.

Why is that? Throughout the human history, the appeal and force of stories is apparent - some of the myths and legends of past centuries and even past millennia are still stored in the modern common memory, as these stories have passed from a generation to other both in spoken and written forms. Indisputably, historical attractions have captivating stories to forward. Therefore, the failure to appeal to some visitors must rather be in the storytelling than in the stories per se.

The thesis discusses this basic problem with certain restrictions that were necessary to maintain a practical approach. This approach was deemed to best serve in combining the rather formal world of technology, where certain restrictions and possibilities are undebatable and results of certain actions are quite predictable, and the multidimensional world of history, where practically everything is a subject to interpretation. The restrictions used in the thesis are that the technology for the enhancement is augmented reality, and that the attractions are historical attractions, as defined in the thesis. In accordance with the practical approach, the thesis introduces a plausible augmented reality (AR) based solution for a set historical attraction to help it enhance its attractiveness. To better ensure the plausibility of the solution and to assist the reader in un-

derstanding its justifications, research was done to introduce the current state and the direction of the development of augmented reality and historical attractions. To broaden the viewpoint, some existing AR applications are examined and briefly evaluated in the thesis.

2 Starting point

2.1 The topic of the thesis

Digitalisation and modern technologies rapidly change the world we live in. The common comprehension of the possibilities offered by technology often follows with a delay: if in 1993 the internet was basically empty, in a couple of years practically every kiosk already had its own website (Jouslehto 2017). Even so, even today there are artisans whose only way of communication occurs via the telephone. The augmented reality has the potential to be the next great mass media, should the content be interesting enough to the masses (Jouslehto 2017). At the same time as those with the technology look for stories to share, those with the stories look for technology to enhance their storytelling. No technological solution should be done for the sake of the technology (Gröhn & Nevalainen 2017). This thesis operates as the missing link, showing through a concrete example the lengths the technology can go within the next couple of years, and how the stories can give it the meaning its creators seek.

A typical example of a historical attraction is a museum, and many of the concrete examples and statistics used in the thesis concern mainly museums. However, the thesis hopefully brings forward that there are historical attractions with a very different angle towards our ancestry. Archaeological sites, city centres with historical buildings deconstructed, and long forgotten battlefields are some prime examples of such historical attractions.

2.2 The choice of subject and restrictions

The inspiration for this thesis is a compilation of the author's background as a history enthusiast, her family member's enthusiasm for AR, and her professional interest in sustainable cultural tourism. The time felt right for the thesis topic, as digitalisation changes tourism - alongside almost every walk of life. As the puzzle pieces came together, so did the topic of the thesis too. The two main pieces - AR and historical attractions - fit, and the possibility that they could serve in solving a real issue on less commercially-oriented historical attractions became apparent: how to attract visitors without compromising the main mission of culture preservation and forwarding? Due to the thesis subject origins, the restrictions of augmented reality (instead of digital solution) and historical attraction (instead of a cultural attraction) were inherent.

The way each of us enjoy a historical attraction varies. The author's travels in Europe, Northern Africa and Latin America had served several opportunities to observe other visitors of historical attractions – some of whom scrutinised almost every artefact of the exhibition, some of whom kneeled to pray apparently for a good Instagram picture, some of whom found a spark for a lively conversation in the attraction, and some of whom seemed quite distracted, hurrying through the attraction or finding it hard to concentrate on the guide's stories.

There is no one true way to experience an attraction, and it is more than complex to claim that one subjective way would definitively be better than the other. However, as testified by the issues presented in chapter 4, some enhancement would be welcome to the historical attractions. AR has the potential to be that enhancement. Noteworthy about AR is that although it was successfully implied in 2016 hit game Pokémon GO, it has not yet seen its breakthrough, giving it a bigger novelty value and leaving more space for innovation.

Although broadened with international references, the main framework for the thesis lays in Finland. This is due to the location of the chosen attraction as well as the author's personal insight and experience of the Finnish society – this facilitates in finding useful trails to follow, e.g. Finnish stance on museums, what

the Finns find intriguing in their history, and what kind of attitude Finnish people have towards technology.

2.3 Research task and objectives

The thesis investigates different applications of the augmented reality technology in tourism attractions of historical nature. Based on the background research, the thesis aims to further innovate ways to use the AR technology to enhance attractiveness of historical sights. This is the main objective of the thesis. The research task is to create a plausible new solution for a set historical attraction to enhance its attractiveness using augmented reality.

The solution is to be plausible within a reasonable time range, meaning that the technology should either already be at the point where the solution can be executed, or it should be reasonable to assume that it will be at that point within 1-2 years[1]. Therefore, one of the objectives is to find out, what we are able to do with the technology today, and what the experts predict that we will be able to do with it in not too distant future.

Regarding a more motivational approach, the thesis aims to serve as an inspiration for cultural tourism attractions to use modern technologies to enhance their services and products. This can potentially assist in helping new customer segments find historical attractions and an excitement towards learning about history through the modern technological solutions.

[1] The time range is kept short on purpose due to the general nature of digital solutions: the novelty of a technology/a solution utilising a certain technology is gone often in a very short time period. Although still adaptable, some updates to the planned solution should be made if the time range for the execution grows any longer.

2.4 Client

This thesis was commissioned by the Tourism and Hospitality Management Programme of Karelia University of Applied Sciences. Working in collaboration with the regional industries, Karelia UAS aims to offer high-quality university level education. The eastern-most University of Applied Sciences in the European Union, Karelia UAS has seven major fields of study, amongst them Tourism and Hospitality Management. (Karelia University of Applied Sciences 2016, 2–6.) It was due to the currentness of the topic that the Tourism and Hospitality Management Programme of Karelia UAS became interested in commissioning this thesis.

Research, development and innovation activities, i.e. so-called RDI activity is emphasised in Karelia UAS, be it short or long-term co-operation projects, research, surveys and analyses, or students' practical work and theses. The success of the surrounding region is one of the objectives of all RDI activity. (Karelia University of Applied Sciences 2017.)

3 Knowledge Base and Core Concepts

3.1 General

As mentioned earlier, not that much notable research has been made on the topic of the use of augmented reality in enhancing historical attractions per se. Therefore, the main research material used as the knowledge base for this thesis is research on specific fields relating to the thesis: augmented reality (AR), tourist attractions, museums, cultural tourism, and marketing. When speculating about the future possibilities of AR technology, its state today, and its adaptability to historical attractions sector, the knowledge base is completed with interviews.

To gain more of this thesis and to better understand its objectives, some core concepts have been defined. The three core concepts discussed in the thesis are: (1) augmented reality, (2) attractiveness (of an attraction), and (3) historical attraction. These concepts are somewhat vague and strict universal definitions are hard to provide. Thus, it is even more important to clarify what is meant by each in the context of this thesis.

In subchapter 3.2 the interviews and the justifications for the selection of interviewees are briefly introduced. The following subchapters also introduce the main concepts and contemplate some of the difficulties faced in their definition. Although not absolute, these definitions are as accurate as possible based on research literature and the objective of the thesis.

3.2 Interviews

Three interviews were conducted to further complete the knowledge base for the thesis and to ensure its currentness. The interviews cover three points of view: that of the museum sector, technical, technological, and software developer point of view, and marketing industry's point of view. Two of the interviews were conducted face to face, recorded with the permission of the interviewees and later transcribed so that the interviews could be better utilised as a part of the knowledge base of this thesis. The third interview was conducted via telephone and summarised in a text format. Although in the planning phase of the thesis other options were considered as well, ultimately the interviews were held in Finnish to better allow free flow of thought and easiness of expression. The interviews lasted approximately 30–50 minutes each.

Representing the museum sector, Curator Iiris Heino has not only had a long career mainly in her current post in the North Karelian museum Hilma, but she is also currently participating in a project called ENI Interactive History, which aims to utilise virtual storytelling to promote the industrial history of Utra region in Joensuu from a period from which very little concrete evidence has survived. As a part of the project, the museum plans to use AR in the museum setting to

help the visitors experience the history. She has familiarised herself with augmented reality and gamification through training courses of the Finnish Museum Association, and has become acquainted with the digitalisation already in late 1990s through a multimedia screenwriting course in the Theatre Academy Helsinki. (Heino 2017.) The summary of Heino's interview can be found in Appendix 1.

Commenting the technology as well as technical and software developer viewpoints, the second interview was conducted simultaneously with the Game Programming Lecturers Anssi Gröhn and Seppo Nevalainen of Karelia University of Applied Sciences. The choice of interviewing Gröhn and Nevalainen at the same time was due to that even though the author had acquainted herself with the topic, the author's ability to advance a more technically orientated conversation was still somewhat limited, especially when compared to the way the interviewees could help each other to find new aspects to topics presented. The choice of interviewing Gröhn and Nevalainen was an easy one to make, as they had taught and done research in programming for over a decade and were pioneers in launching the game programming degree programme in Karelia UAS. Gröhn had also worked in a project called Network Oasis, which included building a mixed reality environment. (Gröhn & Nevalainen 2017.) Gröhn's and Nevalainen's interview is summarised in Appendix 2.

Commercial application of augmented reality was addressed in the third interview. Originally planned to be a video-call interview, due to technical difficulties the interview of Emmi Jouslehto of Arilyn was conducted via telephone, and the answers were typed to a text document in brief during the interview to minimise the chance of error due to an inadequate recollection. A more coherent summary was written immediately after the phone interview.

Arilyn is a Finnish start-up company specialised in augmented reality. It has been a part of all the few nation-wide AR campaigns released in Finland thus far. When the re-adaptation of a classic Finnish war film Tuntematon sotilas (The Unknown Soldier) was released in 2017, a large Finnish dairy company

published a campaign, where the consumers could watch a trailer of the film right on the side of their milk cartoons with the help of the Arilyn application.

Prior to this, very few AR campaigns had been used outside the capital city area. The visibility gained through the campaign benefited also from the fact that the original film has a very special status in Finland. It is broadcasted every Independence Day, and in a large study about Finnish people's perception of history, it was the piece of work that was mentioned most times when asked for artwork that has left an impression (Torsti 2012, 108–109). The groundbreaking AR work both in Finland and in foreign countries (e.g. the Union Station AR experience in Washington D.C.) added to the AR-orientated business idea made Arilyn's CEO and co-founder an intriguing person to be interviewed. Apart from Arilyn, Jouslehto also has a long professional history with geographic data and information, and as she points out, geospatial data and information go well together with AR. (Jouslehto 2017.) For a summary of this interview, see Appendix 3.

The process of creating frames for the interviews was somewhat straightforward. The work began by writing down in a question-form issues that should be covered in the interview. These issues were classified with a colour-code: green – easy/basic question, yellow – basic question/frequently encountered issue for the interviewee, orange – requires some pondering, red – requires much pondering/interpretation/prediction. The classification was based on my estimation about how the interviewee probably finds the question. After the classification, the questions were organised in the most logical order according to the issues addressed and the set difficulty levels of the questions (ordering the questions from the easiest to the most challenging).

The themes and original questions of the interview frames can be found in Appendix 4. The interviews were semi-structured discussions, meaning that even though they were based on a set frame and lead on with certain predetermined questions, the questions and question order were modified as the interviews progressed. Further questions were also made based on the answers of the interviewees. The most important aspect of the interviews was to allow the inter-

viewees to express their views and opinions freely and to bring up aspects that may not have had risen in the fixed questions. Each interview ended with an open question of whether the interviewee/s would like to bring up something else relating to the topic. Each interview also ended with a new aspect that the persons interviewed disclosed. Thus, the open question at the end worked as planned.

Each person interviewed seemed to carefully consider their answers, and often they evaluated the issue presented from more than one point of view. They openly brought up whether the issue is their expertise or whether they feel their experience on the topic is partial. To minimise the threat of misinterpretation, each interviewee was also offered an opportunity to read through the summaries of their interview.

The exact transliterations of the recorded interviews and the summary of the telephone interview have been left out of this chapter on the base of their length, colloquiality, and ambiguity (especially with the lack of context). In addition, translating the interview transliterations would have tipped the work–benefit ratio to a negative value. The summaries of all the interviews can be found in Appendices 4–6.

3.3 Core concepts

3.3.1 Augmented reality (AR)

Some of the earlier definitions for augmented reality or AR were not very consistent. On two separate occasions with very little time apart, AR was firstly defined rather broadly as “-- augmenting natural feedback to the operator with simulated cues”, then quite strictly as “-- a form of virtual reality, where the participant’s head-mounted display is transparent, allowing a clear vision of the real world”. (Milgram, Takemura, Utsumi & Kishino 1994, 283.)

The first description lacks accuracy, whereas the second one does not consider all the possible AR applications since it limits the use of AR only to so called HMDs (head-mounted displays). HMDs, such as Google Glass, HTC Vive or Oculus Rift, are devices worn on the head that consist of either one larger display or two smaller ones - one for both eyes or one for each eye. Although in many ways useful devices for many AR purposes, wearable AR devices for the entertainment use of great masses are still under development. The lack of steadiness in the quality due to the underdeveloped sensor technology, narrow field of view resulting in clear recognition of the line between a virtual and a real-world object, and the effect that different light sources should have on a virtual 3D object are some of the problems holding AR HMDs back. The current AR devices are also somewhat heavy to wear for longer periods. (Gröhn & Nevalainen 2017.)

Virtual reality (VR) on the other hand has been more successful on HMDs. Often mentioned alongside AR, VR is an interactive, synthetic world or a simulation created using computer graphics. Its objective is to create a realistic-looking world, in which the users can immerse themselves. (Burdea & Coiffet 2003, 2.) HMDs for VR use are sold widely. Oculus Rift, the device that was mentioned above as an example of an HMD, has been quite a tide-turner for the union of VR and HMDs, and in 2014 Facebook invested $2 billion in Oculus, the company whose flagship product it is. Oculus Rift has been praised to have solved the nausea caused using VR devices, one of the major problems of VR thus far. (Heffernan 2014.)

A pioneer in the research on augmented reality, Ronald Azuma suggested already in 1997 that it is not necessary to link AR definitely to the wearable technologies. In a scientific article published in 2001, Azuma, Baillot, Behringer, Feiner, Julier and MacIntyre find that instead of the display technology used, there are three other features that rather define augmented reality.

AR is a technology which blends real elements with virtual ones in a real-world environment. It is interactive in real-time, and is registered in three dimensions, referring to that the virtual objects need to convincingly appear to be co-existent

with the real-world ones. Apart from these three defining features, it is characterised by its objective to “--enhance the user’s perception of and interaction with the real world”. (Azuma et al. 2001, 1.) Although this definition is accurate when compared to the first one offered on page in this subchapter, if we go into detail, not all information offered in an AR display is three dimensional, as most applications complete the user experience by offering texts and other 2D elements. However, using mostly 3D elements or using some 3D elements can be seen as a defining feature of AR.

The AR defining features determined by van Krevelen and Poelman (2010, 1) are similar to those presented by Azuma et al. However, they draw attention to the fact that the AR definition should not be limited to sight, since AR potentially can be used to all senses from hearing to touch to smell.

Some experiments have already been made. With the help of a type of lasers sending short impulses to user’s fingers, touch can be simulated up to certain extent. Although the impulse deceives the user into thinking that they are touching something, the technology is still far away from the point where the feel could be simulated more elaborately, e.g. the user would think they are touching something hairy. Simulating smells is possible, and as the taste actually consists in large part of smells, simulating taste is not impossible, either. In an experiment a sensor was located into a drinking glass, and as the participant drank water, a smell was released. This tricked the participant into thinking that the water had a certain taste to it. (Gröhn & Nevalainen 2017.)

AR can also be used not only to add virtual elements to a real environment, but to also remove them, e.g. in the case of visually removing parts of an existing building to re-create it as it was on a set historical period. Sometimes called diminished reality, this kind of feature can also be included in the definition of AR. (van Krevelen & Poelman 2010, 1.)

Most definitions of augmented reality refer to what is known as a reality–virtuality continuum (see Figure 1). Introduced by Milgram et al. in 1994 (283), this continuum suggests that the real environment (i.e. the real world we live in)

and the virtual environment (i.e. a computer-generated world) are not antitheses but rather opposite ends of a continuum. Between the two extremes (reality–virtual reality) are concepts with differing quantities of reality/virtuality - e.g. augmented reality, where reality is augmented with virtual elements, and augmented virtuality, where virtual environment is augmented with physical objects. Thus, augmented reality is a type of mixed reality. Mixed reality, or MR, on the other hand is a mixture of real-life and virtual elements.

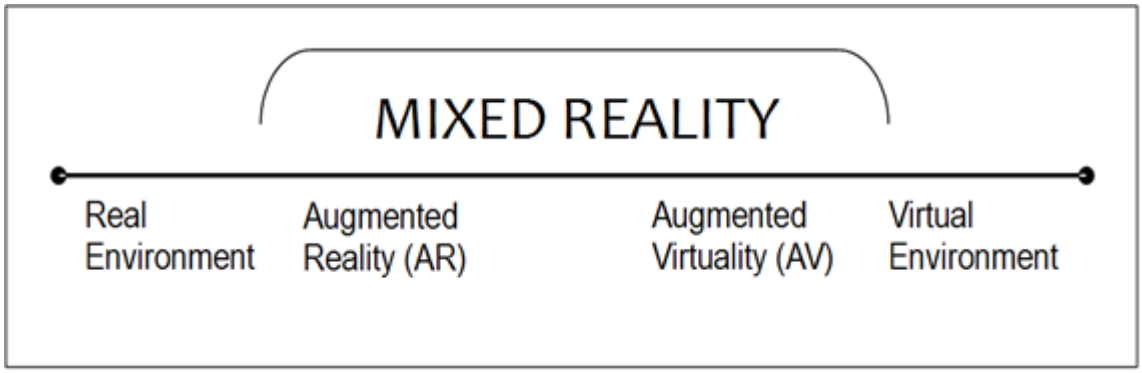


Figure 1 A simple reality–virtuality continuum based on the theory of Milgram et al. (1994).

Newer addition to the terminology relating to AR, VR and MR is XR, which is an umbrella term covering augmented, virtual and mixed reality. XR stands for extended reality, although companies such as Pixvana (2016) have used it as an abbreviation of X reality as well - in this case, X stands for a non-specific variable, much like in mathematics. In the latter case, 360° video is included in the definition. Both extended and X reality are defined not only by being the common concept for the immersive technologies but also by having emphasised aspects such as human–device interaction, the fading line between biological and digital realities, and the possibility to have a single device for multiple XR technologies. (Augmented World Expo 2017; Pixvana 2016.) For a simplified comparison between different XR concepts, see Appendix 5.

As for augmented reality's position in consumer market, AR has not yet reached great popularity. On the other hand, there are no apparent misconceptions about AR neither. (Gröhn & Nevalainen 2017; Jouslehto 2017.)

To summarize, a respected dictionary Merriam-Webster (2017) crystallises augmented reality as “-- the use of technology to overlay digital information on an image of something being viewed through a device”, noting that the term AR may also refer to the technology used to create such augmentation. For a more accurate definition, it can be added that the digital information offered is at least in most parts in three dimensions, and is aligned with the real elements, creating a credible illusion. In comparison to the real environment (affected by the physical laws) and to the virtual environment (not necessarily in any connection with them), AR is what we call mixed reality, which is in some interaction with both the virtual and the real world.

3.3.2 Attractiveness (of an attraction)

To investigate how the historical attractions could be enhanced, definition of the objectives of this enhancement are needed. Briefly, the objective of the enhancement of the historical attractions is to make them more attractive to the visitors and potential future visitors, the prospects.

This attractiveness means that the consumer feels intrigued by the attraction, is interested in visiting it, visits it, and/or participates in peer marketing. Some of the tools to achieve the growth of prospect and visitor interest are publicity and marketing. By emphasising customer experience in developing new services and products, attractiveness can also be promoted in an efficient, profound way. Services often have something left to improve, even if the user feedback is positive as a rule - evaluating the entire service from the user’s perspective can unveil the room for improvement and help in making the service truly user focused (Sudbury-Riley & Hunter-Jones 2017, 227–228).

The brand image plays a key role in customer perception of the organisation. It holds symbolic values and provides identity extensions (Enginkaya & Yılmaz 2014, 219). Using modern technology may affect positively the customer perception, as it provokes curiosity. The attraction should create attention towards

it by its solutions and features, the logic being that when the attraction is attractive enough, prospects become visitors.

The tools used by marketing can also be used to measure attractiveness - e.g. the number of unique visitors on the web page, the reviews on peer marketing sites such as TripAdvisor, and the quantity and quality of search results when searching with the brand name. The most concrete result of attractiveness is often the amount of visitors and the amount of money they have been willing to put into the experience provided - as has been proved in the apparel sales, the brand image (and therefore, the customer perception/the attractiveness of the brand) affects the purchase intention and frequency (Erdil 2015, 203). For non-profit organisations the emphasis may be on the number of visitors rather than on the money made, but even for these organisations making the ends meet must be one of the priorities.

3.3.3 Historical attraction

The third core concept for the thesis is historical attraction. Due to the lack of a commonly used and purpose fitting definition, a definition determining the attractions meant in this thesis is provided.

Attraction itself has been defined multiple times. One of the broader definitions is as follows:

> A visitor attraction is a feature in an area that is a place, venue or focus of activities and does the following things.
>
> 1. Sets out to attract visitors/day visitors from resident or tourist populations, and is managed accordingly.
> 2. Provides a fun and pleasurable experience and an enjoyable way for customers to spend their leisure time.
> 3. Is developed to realize this potential.
> 4. Is managed as an attraction, providing satisfaction to its customers.
> 5. Provides an appropriate level of facilities and services to meet and cater to the demands, needs, and interests of its visitors.
> 6. May or may not charge an admission for entry.
>
> (Walsh-Heron & Stevens 1990 cited in Swarbrooke 2002, 4.)

However, as pointed out by Swarbrooke (2002, 3–4), attractions are a broad sector and thus hard to define. When considering only permanently established excursion destinations, expositions and festivals are ignored. Many definitions also fail to recognise nature attractions. The definition of a historical attraction used in this thesis is based on a definition of attraction made by Swarbrooke (2002, 4–5):

> In general terms, attractions tend to be single units, individual sites or clearly defined small-scale geographical areas that are accessible and motivate large numbers of people to travel some distance from their home, usually in their leisure time, to visit them for a short, limited period. -- [Therefore,] this definition implies that attractions are entities that are capable of being delimited and managed.

Differing from the definition provided above, whether the attraction needs to motivate a “large number” of people to travel, can be argued. In order to argue about whether the amount of visitors needs to be a “large number”, first we would need to define which number is large in this context, and whether this number is dependent on the size and location of the attraction (which would be advisable).

To define historical attractions, four points have been made: historical attractions are pieces of environment, buildings, collections, and other destinations that

A) are (at least in part) open and potentially interesting to visitors,

B) are delimited and managed in some way,

C) have a connection to history, and

D) (at least in part) owe their attractiveness to their connection to history.

To particularise:

A) To qualify as a historical attraction, the sight must first qualify as a tourist attraction. This means that the visitors must be able to visit the sight, and as Walsh-Heron and Stevens defined already in 1990, the attraction needs to set out to attract these visitors from both local and visiting populations (Swarbrooke 2002, 4). However, to qualify as an attraction, the visitors need not to be able to

visit all the parts of the sight. Especially in the case of archaeological sites, it is often necessary to limit some of the areas inaccessible. A case in point is the ancient Roman city of Italica in Santiponce, located near the Andalusian capital Seville. Most of Italica is accessible to visitors willing to walk around the impressive site. However, some of the buildings have restricted access based on the on-going research in the said buildings.

B) Referring to the definition by Swarbrooke (see above), the attraction needs to be delimited and managed in some way. This delimitation and management means that the visitor needs to be made aware in one way or another why the sight is an attraction. Although the limits are often obvious as they are concrete with attractions with infrastructure, this limitation to the definition is necessary when considering e.g. past battlefields, locations of city walls deconstructed long ago, etc. Managing the attractions does not necessarily require active maintenance of the sight or making a notable profit from the sight, nor does the delimitation of the sight necessarily mean building concrete barriers around it. The management and delimitation rather refer to helping the visitors understand when they are in the attraction and when they have exited it. Thus, management and delimitation can be made e.g. with a written guide or a mobile application.

C) A strong connection to history means that the attraction has a natural, notable connection to history. In practice, the attraction in some way promotes its own history, has not been modernised i.e. is in its historical state, has been a scene of an important historical event, has a collection of historical artefacts, aims to educate the visitors about the history of region, or in some other way links itself firmly to the history. Giving a strict definition of a connection to history is problematic, since many of the features listed above are very much debatable, and since every existing building and every existing place has its own history. This in mind, it could be argued, that in essence the connection to history is not merely a concrete connection to historical events and phenomena, but more the attitude the attraction and those operating on it have towards these events and phenomena. It should be emphasised however that for the sake of histori-

cal accuracy, the concrete connection and awareness of this connection are necessary for the attraction to qualify as a historical one.

D) The connection to history is one of the attraction's main assets. The possible actor can have other assets and functions as well. A case in point is Joensuu tourism centre Carelicum, which also hosts the North Karelian museum Hilma. Although Carelicum has many other services available as well - e.g. tourist info, the Kid Street, space for meetings, tickets for public transport - the museum is an essential part of their operations. The building itself also has an interesting history, as the building used serve as a regional bank (City of Joensuu 2017a). History being only one of the assets also refers to the cases of natural sceneries that have been scenes of important historical events, but arguably are valuable and attractive on their own right as well. These sceneries may be popular amongst visitors interested in wandering in nature, camping, or spending time outdoors in general. An example of this kind of a historical sight is the dugout made for the Junkers combat aircraft in the Onttola region near the city of Joensuu in Eastern Finland. The condition of the dugout has been declining after the latest renovation, but the forest environment with safe conditions to cook outdoors makes it quite a pleasing place to visit for those who know of its existence.

As can be deduced from the features listed above, in reference to the four main types of attractions as defined by Swarbrooke (2002, 5), the historical attractions often fall under the category of "human-made buildings, structures and sites that were designed for a purpose other than attracting visitors". However, some museums can also be seen as purposefully constructed to attract visitors, thus making them category 3 type of attractions. As discussed earlier in this chapter, some historical attractions even qualify as "features within the natural environment".

4 Current Situation of Historical Attractions

4.1 Special nature of historical attractions

A vital component of understanding the restrictions of commercialising historical attractions is to understand their special nature. They do not aim only to entertain the visitors, or to offer an enjoyable way of passing leisure time. As they are concrete pieces of cultural heritage, they are very vulnerable if used improperly. As their main objective is to forward the heritage and a message, they naturally evoke emotions, and should thus be ideal for constructing loyal customer relations. This enables the use of historical attractions for other uses, such as forwarding political means as well.

Historical attractions and exhibitions serve many causes. They may bring forward little known connections, like the Finland–Mexico exhibition held in the National Archives of Finland in 2010, highlighting the Mexican presence in Finland (Gutiérrez Canet 2010). They may find a meaning for the research done in sharing the results, as sharing the result is very characteristic for science in general. An example of such case is the archaeologists working in the space provided by the Bizkaia Archaeological Museum in Bilbao (Ariztondo Akarregi 2009, I–9). With the changing exhibitions, historical attractions can also play a role in today's politics, like the national defence in North Karelia region -exhibition held in Finnish Stone Centre in Juuka right after the closure of a nearby Kontioranta garrison (Vauhkonen 2013, 6–7). Historical attractions aim to deepen our knowledge of a set historical period, add nuances to our view of the period, and to restore the remains of the historical period, instead of allowing it to vanish from our common memory - a case in point being the archaeological site of Madinat al-Zahra (Torres Ruiz 2015, 5). As Heino (2017) points out, although the museums want to attract lots of visitors as well, the core of the museum operations is to advance the cultural heritage to all people.

The educational objective of historical attractions is testified by the co-operation between schools and museums. In Finland during the year 2016 in total

308 000 visitors who participated in a guided museum tour belonged to either a nursery school, an elementary school or a student group (National Board of Antiquities 2017). In addition to formal learning, the historical attractions also aim to non-formally educate their visitors during their visits. In the latest decennial survey of museum visitors in Finland, 25% of the respondents expected to gain knowledge from their visit to the museum, and back in 2002 when asked about what the visitors gained from their visit, 70% answered knowledge. (Taivassalo & Levä 2012, 12.)

Historical attractions tie the visitors to the history of mankind and in their own way pass the non-physical heritage from our ancestors. In this sense it can be claimed that they serve a higher purpose. This also leads to that the visitors easily give different kind of meanings to the attraction in comparison with e.g. an amusement park: the felt connection to the ancestors and the learning experience, educating oneself, and possibly reassuring one's own identity - e.g. for some visitors, the main motivation see certain exhibition is the sense of heritage (Falk & Dierking 2016, 41). Apart from gaining knowledge, it is probable that visitors appreciate the experiences and the nostalgia provoked in them by visiting e.g. a museum exhibition: this may even inspire them to generously share their stories with fellow visitors (Heino 2017).

Historical attractions often manifest cultural identity of a pre-set group of humans, who have some defining feature, e.g. ethnicity, a place of origin, or a religion. Artefacts found in the attractions represent this cultural identity in a concrete way. Trafficking or illegally selling artefacts risk cultural assets and cause severe damage. Protecting cultural heritage has even been seen as an intrinsic part of protecting people. Back in 2014, the World Tourism Organization (UNWTO) launched a campaign against trafficking together with the United Nations Office on Drugs (UNODC) and the United Nations Educational, Scientific and Cultural Organization (UNESCO). Raising awareness about several types of harmful trafficking forms, one of the vocal points was trafficking cultural artefacts. (World Tourism Organization 2014.)

In its Global Code of Ethics for Tourism (GCET), the UNWTO aims to promote sustainable and responsible tourism through 10 articles, covering topics from understanding between peoples to the liberty of tourist movements and all the way to the rights of both the workers and the entrepreneurs of the industry. In the article 4, the World Tourism Organization (2017) presents tourism as a "--user of the cultural heritage of mankind and contributor to its enhancement". The article acknowledges the local communities' particular rights and obligations towards the tourism resources of their areas. It also emphasises that all tourism activities and policies should respect the cultural heritage, which is meant to be passed on to the generations to come. Monuments, shrines, museums, and archaeological and historic sites are given special attention, as the GCET comments that they must be open for tourists to visit. Traditional cultural assets such as crafts and folklore should be supported rather than degenerated with the tourism activity, and the income gained from the visits to cultural sites and monuments should supplement the upkeep and development of this heritage. (World Tourism Organization 2017.)

Comparing historical attractions to other tourism attractions is not very straightforward. One similarity is that historical as well as other attractions need to recall the growing digitalisation: after all, it has been estimated that in 2030 only the poorest population is not connected online (Future Foundation 2015, 20). Nonetheless, due to the historical attractions being inseparably connected to the cultural heritage of human-beings, they have many assets that other attractions lack. Although they have the potential to evoke more profound emotions in the visitors, they are also in many ways more vulnerable than completely artificial attractions. Whereas the damage done to the artificial attractions is primarily financial one, the damage done to the historical attractions is a sign of disrespect towards culture, its people, and those working to protect the culture. Therefore, the damage done in the latter case can be remarkably greater.

4.2 Possibilities

In a global world, where global corporations allow people to stay on their comfort zone even when abroad - eating the foods we eat at home, shopping the clothes we shop at home, and sleeping in the same hotels we sleep at home - local cultures and their unique features have fought back, as a new wave of travellers have found locality and authenticity as important values. Testified by multiple countries' marketing actions and target group studies, the culture and history have proven to be a draw for many a traveller.

Finnish Convention Bureau (FCB) has determined a group called Modern Humanists as the core target group of its marketing actions. To further differentiate potential travellers, FCB has also defined three most important segments for Finnish travel operators within the group of Modern Humanists. From these segments one called Culture Fans is especially interesting in regards of historical attractions. In a research executed in six European countries (Germany, Great Britain, France, Spain, Italy and the Netherlands), it was found that especially Spanish Culture Fans are very interested in visiting museums and other historical attractions. They were also keen on combining city and nature attractions. (Finnish Convention Bureau 2014, 7–16.) In the Finnish case, this offers a great opportunity for historical attractions, as the persons most likely to visit them are also the ones the whole nation's tourism marketing efforts are aimed towards.

Similar phenomena can be seen in the tourism marketing efforts of other countries as well: in its plan for the Spanish tourism in 2020, the General Secretary of Tourism (2007, 60) noted that alongside some other products, cultural tourism has allowed Spain to capture new demand segments. Although tourism in Spain has been increasing steadily, already in 2007 there were indicators that the profitability of a mere "sun and beach" product - which, at the time, made 75% of receiving demand - was decreasing. For these reasons, it was deemed necessary to develop new tourist products based on the identity and singularity of the various Spanish destinations. (General Secretary of Tourism 2007, 59–62.) History can also attract people to travel to distance: in its account of 2014,

the Chilean corporation of the tourism promotion, Turismo Chile, presented results that historical and cultural attractions formed travel motivation for 42% of the German, 58% of the French, and 50% of the English travellers to Chile (Turismo Chile 2014).

In an international survey it was found that 80% of Chinese travellers preferred going to museums and historical sites as well as experiencing arts and culture during their holiday. Out of the eight countries selected to participate in the survey, the least culture-oriented travel planners were the Danish travellers (57%). 70% of the US travellers emphasised culture experiences in their travel itinerary, as well as 68% of the UK travellers and 67% of both the Japanese and Canadian travellers. They were followed by the French and Australian travellers with the percentage of 64. (Expedia MediaSolutions 2017, 18.)

As 50% or more of even the least history-motivated traveller groups are either inspired by historical and cultural attractions or emphasise history and culture in their travel programmes, it is safe to assume the historical attractions have a global market. As testified by the strategies presented earlier in this chapter, countries are also keen to attract travellers with history and culture motivations.

Historical attractions have a good reputation, and, in general, the visitors seem to be content with their visiting experience. In a Finnish survey it was found that 98% of the museum visitors found the exhibitions interesting, 98% of them were satisfied with the customer service, 98% of them were satisfied with their visiting experience as a whole, and 90% would visit the museum again and even recommend it to their family and friends. Visitors, who answered the survey in Russian, were satisfied with their visit in 86% of the answers, whereas the corresponding number for answers in English was 79% and answers in Swedish 74%. Overall the perception of the museums was quite traditional, and the museums were seen as smart places for leisure time and relaxing. (Taivassalo & Levä 2012, 8–14.)

These examples demonstrate that there is a demand for historical attractions. Whether they form an essential part of the attraction of the destination country

(like in the case of Finland), or assist in broadening the current tourism scene (like in the case of Spain), the history tied with the culture also serve for distinguishing the destination of others, thus forming a fundamental part of the destination's image.

4.3 Challenges

Today historical attractions face serious challenges, especially when it comes to funding. Although academically highly qualified, the leading status personnel tend to lack knowledge on commercialisation, which leads to incomplete understanding of customer experience, marketing needs and tools, and productisation. (Heino 2017.)

One of the challenges is the decreasing funding. In the Finnish museum context, when comparing tentative calculations of state funding between years 2013–2018, a downward trend of approximately three million euros can be seen (see Appendix 6). Should the funding for year 2018 actualise, the funding will rise almost 1 million euros from its lowest point in 2017 (32.7 million euros). Although new museums were added to the State funding system, the funding of these museums only account for 23,449 euros. (Ministry of Education and Culture 2017a-b.) Thus, it could be argued that the political direction in Finland is better for the museums than it has been in previous years[2].

Globally speaking, the phenomenon of downward funding pressures non-profit organisations to prove their public value concretely (Falk & Dierking 2016, 61). One way of doing this is to increase the visitor numbers, which can be achieved through better marketing and e.g. new, more attractive digital solutions. Contradicting with this solution model, in reality the decreasing funding affects negatively the already somewhat disregarded operations of historical attractions,

[2] However, it is important to consider that the tentative calculations for 2018 can only be confirmed after the Finnish Parliament accepts the proposition of the economic situation estimation of 2018 (Ministry of Education and Culture 2017a).

such as marketing and service design. Even though more commercial competences are needed to complete the traditional museum personnel capabilities, with a minimal budget left for development and marketing, compiling new service packages, paying attention to customer experience, or constructing long-term marketing is practically impossible. (Heino 2017.)

Another challenge faced by historical attractions is more of a qualitative one, and therefore somewhat more complex. The challenge is understanding and predicting the visitor motivation and the visitor experience. Visitors with similar demographical backgrounds, conditions of visit, and reasons for visiting may have completely different visiting experiences and conduct patterns. This can be due to the emphasis given on social interaction or the content of e.g. the museum exhibition. In the case of two visitors, whose primary reason for visiting the museum is to entertain their out-of-town relatives on a rainy day, one of the visitors greatly emphasises the discussion with the family members, whereas the other visitor goes separate ways with their family members to ensure everyone can familiarise themselves with the parts of the exhibition they find most interesting. These two visitors have completely contrasting experiences and memories of the exhibition. (Falk 2016, 17–20.)

Even though the two visitors may spend very varying time in the exhibition, the time spent does not necessarily affect whether they have enjoyed the exhibition or not. The person who spent two hours in only one of the exhibition floors has the same chance of having enjoyed the exhibition as the person who visited the whole museum in half an hour. (Heino 2017.)

Due to the financial support being more limited than before because of governmental cutbacks and financial and political turbulence, and due to the increasing difficulty to obtain individual donations, understanding and predicting the customer experience has become a necessity for museums. Understanding the visitor motivation and therefore the correct marketing approach to each motivation-based group is vital, as was proven in the early 1990s in the case of marketing African art collection to a new focus group, African Americans. The initial approach of marketing the exhibition through remarkable photos of the beautiful

artefacts exhibited did not work as planned: as found in the formative testing included in the project, the target group found the artefacts lovely, but they were not enough to change the recipients' attitudes towards visiting the museum. As the museum divided the vast target group into smaller groups, they were able to identify the groups' general motivations for visiting a museum and reasons why they felt reluctant to visit this particular museum. Through a new approach to the exhibition, new marketing channels, co-operation with relevant operators, and publicity through sponsoring school-based programme the museum was able to increase its African American visitor percentage from less than 10% to almost 25%. (Falk & Dierking 2016, 45–49.)

The example presented above shows how understanding the target audience makes a concrete difference in reaching it. Since the 1990s the landscape of marketing channels has changed dramatically. Instead of knowing in which magazines to publish their advertisements, the organisations now need to examine the relevant social media and online channels for their marketing. Nevertheless, the core challenge remains: how to adapt the existing content to fit the needs and desires of the target audience?

To address the issue, the Finnish Museum Association conducts a survey every ten years to chart the demographics, motivations and experiences of the museum visitors in Finland. In its latest publication, the one depicting the results of the 2011 survey, some of the answers to an open question were classified under the visitor categorisation by John Falk. The original types (Explorer, Facilitator, Experience seeker, Professional/Hobbyist) are introduced shortly in the report. (Taivassalo & Levä 2012, 5.) In this manner, the museums are offered the tools for recognising their visitor tendencies.

In a study it was found that 90% of museum visitors were enthusiastic about the topic, but they were accompanied by 10% who did not care too much about the topic of the museum but went with someone who was. Another study showed that after the initial 15 minutes into the exhibition, the focus on the content of the museum began to decline. (Falk 2016, 23–32.) Therefore, it is reasonable to assume that at least 10% of the visitors are in danger of being bored during

their visit to the museum as the content of the exhibition no longer succeeds in entertaining them.

The focus span was examined as an average of the visitors instead of dividing them into groups based on their motivation or enthusiasm towards the contents of the museum in the first place. However, as the human focus span is limited, it is safe to assume that even those enthusiastic about the museum content cannot maintain the same level of focus throughout the exhibition. This may lead them to regret afterwards that they did not concentrate enough on the content on the latter parts of the exhibition.

Some museums have tried to expand the focus span of the visitors. Large historical attractions, such as the British Museum in London, Museo del Prado in Madrid, or the Alcázar of Seville, often have cafés and/or restaurants on their grounds. In addition to the possibility to rest on site, many attractions also allow their visitors to exit and re-enter the attraction with the same ticket. An example of the latter case is the San Telmo Museum in San Sebastián/Donostia. The San Telmo Museum and the Segovia Mint – amongst others – also offer free audio guides to better engage their visitors with the content. In the instance of the Segovia Mint, the audio guide also utilises storytelling in the sense that the tour is given by a character that is based on a real historical character who used to live in the mint.

Gamification - that is, adding “game mechanics to non-game activities to prompt specific behaviours” (Bunchball, Inc. 2016, 2) - could assist in expanding the visitor focus span. Even though there is shortage of research on gamification elements and their effectiveness in marketing, this hypothesis is supported by the fact that the mechanics used by games fulfil some intrinsic desires humans have (Bunchball, Inc. 2016, 6; Hofacker, de Ruyter, Lurie, Manchanda & Donaldson 2016, 34).

Although the educational tasks are in the core of museum operations and gaining knowledge is a default value for visitors, the deeper understanding and appreciation of the museum object often proves to be a secondary objective for

many visitors, who rather aim to satisfy their own needs and goals, such as intellectual or social interests. (Falk & Dierking 2016, 36–39.) In a Finnish study, it was found that 31% of the visitors expected to have an experience while visiting the museum, whereas 25% expected to gain knowledge and 21% expected to enjoy themselves. When the same study was conducted 10 years earlier, experience ranked third in the expectations for the visit, after knowledge and enjoyment. (Taivassalo & Levä 2012, 12–23.) A clear change towards the visitors emphasising the experience can be seen. This is also testified by how the museum exhibitions have been changing. Instead of merely having the artefacts in a vitrine, more and more attention is paid on how the artefacts are presented, with even some interior designers specialising in museum exhibitions (Heino 2017).

As the museum personnel is usually highly academic, for them the educational and scientific frames of reference may be more intrinsic than the commercial one. However, to ensure the continuity of the operations in the future and to secure better basis for the research-related and educational tasks of the museums, promoting a better user experience is of great importance for museums and other historical attractions alike. There is also detectable interest for implementing some business elements into museums inside the museum sector (Heino 2017).

Another issue stemming from underlining the educational purpose is what could be called a problem of calibration. In comparison to well-designed games, the difficulty level of a museum often proves to be too high for a novice user. Well-designed games tend to take the advantage of gradually growing the player's skill level so that they can face more difficult levels without feeling frustrated by a challenge too big, whereas museums can have a tendency of assuming that the visitor already possesses broad knowledge and understanding on the topic. (Heaton 2013.) Meeting the needs of visitors of all levels of knowledge is challenging. Some visitors may be advocates of history, whereas others hardly remember a thing about their history lessons. The trend seems to be that using text in museums is forbidden, but at the same time especially history enthusi-

asts wait to learn more about the topics introduced (Heino 2017). Meeting the very different needs of these two groups can be challenging.

4.4 SWOT analysis

In a brief SWOT analysis (see Appendix 7), some strengths, weaknesses, opportunities and threats of historical attractions are brought forward. Some of these features have already been discussed in the earlier subchapters.

Referring to subchapter 4.1, the historical attractions are keepers of our common cultural heritage. This is closely related to the deeper meanings a visitor may place upon the attraction. For example, the Inquisition Museum of Seville may not hold inside the proudest moments of Hispanic history, but it certainly delivers on its promise of being a place for reflection, as stated in its brochure. In this case the deeper meaning given by the visitor is that by acquiring knowledge of these events, they in a way respect the victims of inquisition while broadening their own view of the world. Another example is visiting an ethnic museum, or a museum dedicated to local culture - such as the North Karelian Museum Hilma, which promotes Karelian history, culture and way of life. In this case a local visiting the museum may feel in touch with their ancestors and may experience a sense of getting to know oneself better. For a person interested in history, visiting a historical attraction may meet the needs of self-actualisation. It may work in a similar way for persons who regard themselves as educated. As these meanings are often in touch with feelings, they are a definite strength for historical attractions. As a noteworthy annotation, both of these example museums have also applied some digital solutions to increase the interactivity of their exhibitions. For instance, the Inquisition Museum brings the obscurity of inquisition to a more touching level through audio-visual storytelling with a fictional story of a girl denounced by a disappointed suitor.

The importance of storytelling in creating memorable tourism experiences is undebatable. Some of the many benefits of storytelling is provoking emotions in customers, setting apart from the competition, and creating lasting customer re-

lations (Olenski 2015). As authenticity is a notable value in storytelling, the fact that historical attractions have dozens of intriguing true stories is a huge strength.

It is also captivating how new findings surface, creating fresh buzz around the attraction. A case in point is the Great Pyramid of Giza, also known as Pyramid of Khufu. In 2017, a new void was found with the help of cosmic-ray collisions – a technique used primarily in the field of particle physics. No one knows yet, which cause the void used to serve, but as the news broke into international consciousness, an iconic travel destination got itself some novelty value at the respectable age of more than 4,500 years. (St. Fleur 2017.) In this way, the ever-developing and constantly self-repairing nature of science can serve in creating interest in the field of tourism as well. History reveals itself like a solution in a detective novel: little by little, keeping the observer guessing.

This mystery-solving serves in satisfying the intrinsic motivation towards learning and the pure curiosity of human beings. The national efforts on acquiring new target groups interested in cultural tourism provide an opportunity for historical attractions as well. (For more information on these efforts, see subchapter 3.2.) Sustainable and cultural tourism may not yet profit as much as mass tourism, but the operators both on and off the tourism field are clearly growing more and more conscious about the growth and prospects of both cultural and sustainable tourism. This is verified by that the European Union has recognised the value of culture in the European tourism experience as well as its potential role as identity enhancer (European Commission 2017). Sustainability, on the other hand, was lifted on a pedestal in 2015 when the World Summit on Sustainable Tourism was held, and World Charter for Sustainable Tourism +20 was adopted (Biosphere Responsible Tourism 2017).

As for the weaknesses, the lack of interaction with the content (be it the exhibition at the museum or the remains of a dugout) makes the content less captivating for the visitor. Those interested in history possibly unconsciously create this interaction themselves by comparing the data gathered from the attraction with the information they already possess on the topic. The content is often passive,

leaving the active role to the visitor, who may not even be greatly interested in history (see subchapter 3.3). In keeping with the results of the earlier surveys, a Finnish survey found that the most frequent singular wish from the visitors was to be able to touch the exhibition items, as 14% of the visitors answered it in the survey. 10% wished to have more information on the exhibition topic and 9% wished more interactivity to the exhibition. (Taivassalo & Levä 2012, 12.) Although the sensation of touching a virtual object and feeling how it feels like can potentially be acquired through augmented reality, it is still a thing of the future (Gröhn & Nevalainen 2017). Therefore, AR as it is today is not a straight answer to the demand of ability to touch the artefacts. Nonetheless, AR experiences can inarguably increase the amount of interaction in the exhibition.

One of the weaknesses is also that the visitor already possesses a notable amount of knowledge and understanding on the topic. The threat is that the visitor receives little guidance whereas they are given a load of choices to make. (Heaton 2013.) Historical attractions have multiple objectives, whereas many other attractions aim to entertain only. This can either be seen as a weakness - as it makes the situation more complex - or as a strength, as it means that visiting a museum is seen as a smart way of spending leisure time and as something with deeper meaning. The public also appreciates museums and their conservation work whether they visit museums or not. (Taivassalo & Levä 2012, 8.)

Interested in history or not, the study result that humans generally have a 15-minute focus span on content (see subchapter 3.3) is a clear threat to historical attractions. Even if the content could be reduced into 15 minutes long visit, it is hard to see how the ticket prices could be kept low enough to make the attraction tempting for visitors but high enough to maintain an adequate level of profit. In addition to the profitability problem, reducing the content would notably endanger other objectives historical attractions have, such as forwarding the spiritual heritage and education (see subchapter 3.1). It would also contrast the interests of those visitors, who wish to have more knowledge on the topic (10% of the visitors, as found in the survey mentioned above). If in this way concentrat-

ing too much on the commercial aspects is a threat, so too is concentrating only on the educational and scientific ones.

As discussed in subchapter 3.3, from a financial standpoint it is often unrealistic to believe that visitor numbers do not matter – although it is noteworthy, that at least in the Finnish framework it is improbable that any museum could operate under direct laws of market economy (Heino 2017). From an attraction point of view, the educational and commercial aspects can benefit from the same actions, as attracting more paying visitors also means attracting more learning visitors. Relating to the too scientific an approach, if the level of background information and dedication needed for understanding and enjoying a museum is raised, there is a real threat that the museum becomes unalluring to a regular consumer.

5 Current Situation of AR and Existing AR Applications

5.1 Commercial use and use in tourism industry

Although augmented reality has not yet become a household technology, dozens of applications utilising it have already been made, as it has been used for a long time commercially and for decades in the research facilities (Jouslehto 2017). With recent investments it is possible, if not even probable, that AR rapidly becomes more common. Augmented reality HMDs have suffered from multiple flaws, high prices, and they cannot yet provide a solid, repeatable experience. However, progress is made to advance the arrival of wearable AR technology to the public.

Some of the AR applications thus far have been in military and medical uses. Whether referring to the HUD (Heads-Up Display) that allows the fighter pilot to see critical data without having to look down at the aircraft's indicators, the ground troops HMDs highlighting the enemy location, or using the technology for training, the military has been somewhat eager to adapt the technology. AR

can also be used to practice e.g. surgery, as has been done by medical students. (Perdue 2017.) AR could serve however in countless applications, be it interactive 3D blueprints for architects, studying neuroscience, sharing new information and stories, or reinventing the phone calls, to mention a few (TED 2016). Thus far the most popular consumer application appears to be Pokémon GO, published in July 2016. In the game the player needs to find virtual Pokémons located in the real world. Utilising the camera of the smartphone, the application shows the Pokémon nearby when the player is in the right area. The player can then collect the Pokémon by throwing a Poke ball at it in the application. The Pokémons can then be used to battle other players' Pokémons in Gyms. (Google Play Store 2017a.) Instead of HMD, the game is played on a regular smart phone utilising its camera and display. Reaching its download peak on its publishing day 7th of July 2016, on 14th of July 2016 Pokémon GO already had over 25 million active daily users. (Britton 2016.)

Commercially, some of the biggest opportunities of AR lay in workforce and sales enablement as well as in customer experience and interaction (Mozenix 2017). One of the major benefits of using augmented reality is customer engagement, i.e. customer's attachment to the product, brand, or experience, and their will to return to it. Companies' opportunities to use platforms instead of creating their own applications from scratch have begun to rise. Using a platform has enabled adapting AR quickly into the company's operations. (Jouslehto 2017.)

Augmented reality has been utilised in the tourism industry as well. The first known AR application for tourist purposes was Tuscany+, a digital tourist guide available only for iOS. Apart from the digital guides, adventures including mystery solving and missions have been created to further immerse tourists into the city they are visiting. An instance of such an application is Urban Sleuth, where the users can also compete against each other or in teams. Applications that allow the visitor to visualise the destination in various historical eras - such as the StreetMuseum application in London - are also a popular type of tourism AR application. Three history-themed tourist applications utilising AR are introduced in subchapters 5.3–5.5.

The benefits for the tourist include meeting their particular needs with more personalised content, having an interactive and highly dynamic experience, and possible help in navigation as the application often work on mobile devices with GSP functionalities. (Kounavis, Kasimati & Zamani 2012, 3.) As tourism industry continuously seeks to improve the tourist experience, augmented reality offers exciting opportunities to both create an incredible experience and to interact with the tourist.

5.2 Wearable technology and launching the AR experience

At its best, using wearable AR devices could be somewhat intrinsic, should the operating system utilise humans' natural instincts, such as grabbing an item of interest (TED 2016). However, there are still flaws in the current wearable devices. As for launching the augmented experiences in a mobile device, many solutions exist. The options deemed most relevant for the application presented are introduced later in this thesis.

Apart from operating system, the user experience is greatly influenced by the technology, as the devices used comprise a significant part of the experience. Even though there has been some public interest in wearable technology, especially AR-wise certain issues hold back the devices' chances of becoming a household item. These include narrow field of view, which makes spotting the line between virtual and real objects easy, and the incomplete development of sensors, which causes the experience to be inconsistent (Gröhn & Nevalainen 2017). Should the issues be fixed, wearable devices such as Microsoft HoloLens (Picture 1) could provide more immersive experience, as they include both the display and the speakers in a single device worn over one's head, leaving the hands free for other use.

Picture 1 Microsoft HoloLens MR glasses have integrated speakers and sensors observing the environment and user's actions. Picture used under CC0 Creative Commons licence.

The weight of the current devices also proves to be heavy on a long-term use. This could possibly be solved with separating the screening technology from the device running the application. The problem of interaction with the wearable device (i.e. how to push the buttons or use a keyboard) can potentially be solved in the future with sensors that pick impulses from the user's wrists, using them to read what the user is touch typing into air. Gesture recognition is already used in HoloLens mixed reality smart glasses. (Gröhn & Nevalainen 2017.)

Although companies such as Meta have addressed e.g. the issue of the field of view by offering a field of view of almost 90° - the widest one available in AR - and the issue of interaction with the AR content by the ability to touch, grab, push, and pull the 3D elements, the price of the developed kit was $1,495 USD on 27th of December 2017, limiting the buyers significantly (Meta Company 2017). The company's strategy is that initially the technology is adapted by companies, and as consumers get acquainted with the device through their work, they want to buy one to domestic use as well. (TechCrunch 2016.) Even though Meta 2 AR device is state-of-the-art, in the footage of shot through the glasses some transparency issues are evident.

The development is continuous and some of the offered solutions bring many intriguing possibilities for immersive experiences, which would serve historical attractions well - especially as experiencing the history first-hand could serve notably the younger customer segments (Heino 2017). However, the issues presented above cannot be confidently predicted to be reliably solved within the next couple of years (Gröhn & Nevalainen 2017).

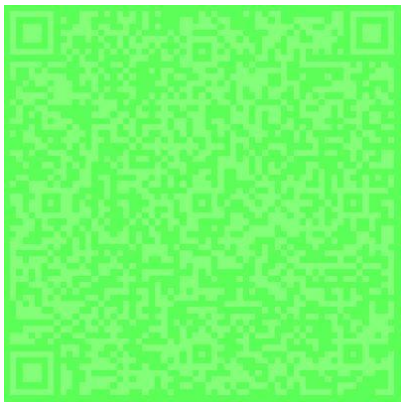
For launching the AR experiences, there are several solutions available. One way used to launch AR experience is to use scannable Quick Response or QR codes. Generally speaking, QR codes are e.g. a piece of text, an URL, or a contact card coded in a form of a picture. They can include up to 7089 characters, and apart from letters and numbers the content can be Kanji, Kana, Hiragana, symbols, binary, as well as control codes. In comparison to traditional bar codes they are more resistant to damage, they can be read from any angle, and the information can be divided and compiled of several smaller QR codes, if the printing area is e.g. too narrow to fit a bigger QR code. (Denso-Wave 2010.)

The durability and recoverability of QR codes have been useful in the original purpose of the QR codes, as they were developed for the needs of Japanese automobile manufacturer in 1994. However, similar features have caused trouble for marketers later on. In 2012–2014, a ketchup company used a QR code on its products' packages to direct the consumers to its promotional site. After the competition ended, the company did not maintain the domain, and it was bought by an adult entertainment site. In 2015 a consumer scanned the QR code and was directed to the website of the new domain owner, causing bad publicity for the ketchup company for not securing the domain for 1–2 years so that the products with the QR code package would have been out of consumption. (Gibbs 2015.)

Traditionally QR codes are abstract black-and-white pictures, but they can also be modified to have different colours or a simple picture such as a logo in the middle of them. However, using small contrast colours may make reading the code more difficult - therefore, the QR codes of pictures 1 and 3 can be easier

and faster to read than the one of picture 2 (see below). A QR code reader is able to read the information coded into the picture and proceed accordingly.

Picture 2 A traditional black-and-white QR code.



Picture 3 Low-contrast colours make the QR code more prone to reading difficulties.

Picture 4 The foreground colour does not need to be the darker one, as many generators allow the user to choose any colour they want for the background as well as the foreground.

QR codes have been praised to be easy to use for marketers. They are cost-efficient, as they can be created free of charge, and are versatile in the sense that they can be located on practically any item. (Morrison 2012.) For historical attractions this versatility is quite theoretical, as locating a QR code onto a historically valuable artefact would be irresponsible and against the values of preserving artefacts in their original state for the future generations. Thus, the QR codes would need to be located onto nearby objects.

Although easy to use for the marketers, the QR codes have received a fair amount of criticism as well and many developers of AR applications have not found them to be the solution they want to use in their applications. QR codes are not necessarily easy to use for the end users. Depending on the speed and steadiness of the internet connection, scanning the code can either be lightning fast or very slow and troublesome. The QR code also need to be scanned from a position close enough to the code, and the picture needs to be framed correctly. Even then a glare from a flash or a reflection can lead to the misreading of the code. (Charlton 2011; Morrison 2012.)

Another solution for launching the AR experience is image recognition. Image recognition using a high-contrast marker results in a more certain recognition. However, using a quite similar process, marker data can be created out of a natural picture as well, as long as the picture has enough individualising features. (Gröhn & Nevalainen 2017.) This means that the picture needs to have certain graphic liveliness to it. However, almost any natural picture works well in image recognition. The demands of graphical liveliness and individualising features are set by the limits and different nature of machine vision in comparison to human vision. An instance of this difference is the Japanese flag: a red circle in the middle of white quadrilateral - easily recognisable for human vision. However, the machine vision sees the borders of dark and light instead of seeing the colours. This makes the Japanese flag with its mere one border of light and dark a difficult target of recognition. (Jouslehto 2017.)

In comparison to QR codes, advanced image recognition is less sensitive to light and focus, and thus less demanding for the user. It can also be more esthetical, as nothing additional needs to be included - e.g. a photo from a catalogue can work as marker, and no code pictures need to be clued on it. (Escribano 2016.)

In the case of historical attractions, using a physical object instead of a mere photo could be even more immersive an experience, increasing the feeling of authenticity. However, without using a sensor for scanning the object and creating a 3D model out of it, the device has difficulties in deducing, whether the object scanned is the same one that should start the AR sequence. This is due to that the device deals with a 2D picture of the real world. Without the 3D model, the chance of error increases. Thus, at the moment the best option for launching the AR sequence based on a scan of a set physical object is to actually scan an external source attached to it. (Gröhn & Nevalainen 2017.) However, it could be more user-friendly to launch the experience based on the location of the user.

Albeit the GPS (Global Positioning System) can be quite accurate, with smartphones with GPS enabled typically measuring 4,9 metres accuracy under open sky, their performance is affected by blockages such as trees and buildings (National Coordination Office for Space-Based Positioning, Navigation, and Timing 2017). In addition, the optimal 4.9 metre accuracy is somewhat imprecise when speaking of smaller, more limited as well as indoor areas, which most historical attractions are. A solution to accomplish more accurate position is to use BLE beacons instead.

Beacons are small devices often attached to walls or ceilings. They send out a constant radio signal to nearby mobile devices using the 2.4GHz frequency. The small stream of data they send consists of a unique identifier (the part that prompts the device to listen and react to the data) as well as some customisable data (he part that elaborates information for the processing). Most of the current beacons send what is called hard coded data. Hard coded data is typically set once, and although it can be changed later, it does not change fre-

quently. Thus, the beacons are in sense dummy devices, as they send short identifiers and expect the application on the receiving device to react intelligently to these signals. The transmission is unidirectional, as the beacons cannot receive data from the user's device. (Olcay 2015.)

To transmit the data, beacons use BLE (Bluetooth Low Energy). Although BLE sends less data, this version of Bluetooth is also more sparing with its energy usage. One of the major benefits of BLE in comparison to using GPS for positioning is that BLE also works in indoors positioning (Koudas 2015). Most BLE protocols work on three different ranges of distance: far (the device can barely catch the signal), near (the device is in the same room), and immediate (the device is practically in touch with the beacon). The beacon signal can be detected from up to 70 metres of distance, but its detectability range is affected not only by its power levels but also by possible metal or brick walls[3] in its way. (Olcay 2015.) However, in general the 2.4GHz is a good band for passing through solid obstacles such as walls, as it uses somewhat long waves (Klein 2017).

Most modern smartphones support BLE, which separates it from many of its alternatives (Sanderson 2014). Newer Apple devices (on iOS 7 and above) are continuously on alert for BLE, recognising relevant signals when in range and initiating the corresponding application - even if the said application is closed. Android devices require that the application utilising BLE is running, at least on the background. Although there has been variation in the readiness of Windows and Blackberry devices in receiving BLE, most of the modern phones support BLE and can recognise them when the correct application is running (at least on the background). (Olcay 2015.) Even though iBeacon is natively supported by Apple devices, it is also detectable for Android devices. If the iBeacon is wanted to be recognisable for Android devices as well, it should be considered in the development, as it requires some additional effort. Having to scan and recognise iBeacon also somewhat increases the battery usage of an Android device. (Sanderson 2014.)

[3] How strongly the signal is obstructed depends on the thickness of the metal and brick walls. (Olcay 2015.)

This adaptability is due to the fact that when transmitted through BLE the data always uses the same format, making it interchangeable. It is also important to remember that the data sent is unencrypted, meaning that BLE cannot be used to transmit sensitive information. (Olcay 2015.) Theoretically, any BLE-ready device (practically any modern mobile device) can receive and correctly react to any BLE signal. As Olcay (2015) points out, it is still highly recommendable (and in fact necessary) to configure the application to the beacon so that the application would respond to the signal as intended.

Most of the criticism posed towards beacons revolve around their use in marketing, as points such as lack of beacon awareness, low percentage of Bluetooth users, and BLE's inability to be the lone solution to location-based marketing have been brought up (SnowShoe 2015; Sanderson 2014). In a case of historical attraction, the awareness issue is simple to solve locally with proper guidance to the use of the application. Nonetheless, one of the challenges brought up by a start-up company SnowShoe (2015) stands with the use of beacons in historical attractions as well: the issue of maintenance. The maintenance here refers especially to the batteries of the beacon.

The most common choice of most beacons is to use coin cell batteries often used in digital watches. Depending on their size, these batteries provide up to 1000mAh of power. Alkaline AA batteries familiar from TV remotes and such can also be used. Although AA batteries provide more power (around 2000mAh), they are also much larger in size than coin cell batteries. The battery life can be affected by taking into account transmit power and the signal emitting frequency when programming the beacon firmware. To avoid the battery issue entirely, the beacon can also be powered externally by using either a USB or wall outlet. (Koudas 2015.)

Apart from the maintenance issue, a possible complexity is that the beacon signal interferes with the Wi-Fi connection, as they both possibly use the same frequency of 2.4GHz. Despite this, it is not very likely to become a notable issue, as many household devices already use the 2.4GHz band without obstructing

the Wi-Fi connection. Beacons also use lower power levels and transmit the signal for tiny periods of time, often only for one millisecond. If the same area should want to utilise both BLE beacons and Wi-Fi network, to completely nullify the threat it could also use Wi-Fi on the 5GHz frequency. (Olcay 2015.) This could also be advisable, as the 5GHz band has less traffic and thus more stable connection and higher speed. Nowadays more easy-to-use solutions exist to solve the shorter effective range and less efficient solid obstacle penetration issue, as range extenders have been challenged by mesh Wi-Fi systems. Most modern routers already are so-called dual- or even tri-band routers - with simultaneous dual-band the router broadcasts on both bands at the same time, allowing flexible choice of the more suitable band for each device. (Klein 2017.)

Taking into account the wearable devices' state of being in progress, it is no wonder most applications are currently designed for mobile devices. With its roots firmly in the car-building industry, QR code offers efficient solutions but fails to recognise the shaking hands and inconsistency of the consumer-users. Image recognition helps in creating more seamlessly placed starting points for the augmented reality experience, almost as if someone had hidden Easter Eggs[4] so familiar from the gaming world into the real world. Nonetheless, location-based launch of the experience requires the least from the user: at most they need to open the application.

5.3 Example application 1: Wordsmith, Turku Cathedral

Wordsmith (originally *Sanan seppä* in Finnish) is an application created by the collaboration of the University of Turku, the Evangelical Lutheran Church of Finland and the Turku and Kaarina Parish Union. Through the application the user can follow a story presenting the effects of the 16th century church reform from

[4] Intentionally leaving hidden secrets such as jokes, photos, or messages is apparent in other media as well - e.g. Disney films, as many Youtubers have realised - but it has strong roots in videogames, as the first known Easter egg was planted in Atari game called Adventure already in 1979 (Yarwood 2016).

the point of view of a regular family. The eight scenes containing both fictional characters and real historical figures are scattered around the Turku Cathedral. The story features events based on the 16th and 17th century history as well as the total of 49 characters with their respective background information, which is accessible for the users. (Hyytiäinen 2016.) Based on the visitor's location, the application aligns the characters of the AR scenes into the authentic setting of Turku Cathedral, right beside the visitor.

The application was launched to celebrate the anniversary of the Protestant Reformation in Finland. It aims to support in its part the objectives of the anniversary, one of which was to encourage Finnish people to get acquainted with their cultural and religious roots. (Turun Sanomat 2016.) From the point of view of this objective, it makes sense that the application is free of charge. It can be downloaded to the visitor's own device, or the visitor can borrow a tablet computer from the Cathedral.

The use of the application does not require using QR codes, as the application uses markerless tracking technology. The scenes are run based on the location of the user. The coarse location is determined by using Bluetooth beacons hidden in objects with little historical value (such as lamps). Permanent cathedral structures serve as the basis for point clouds, which are visually tracked to enable exact positioning and tracking. (University of Turku 2017.)

Newspapers from both large Finnish media groups (Lännen Media and Uutissuomalainen, formerly known as Väli-Suomen sanomalehdet) published articles about the application. It also received publicity in the periodical of Finnish Museums Association. In Google Play Store (2017b) the application has gathered 100-500 downloads.

The usability, the markerless tracking technology used, and the possibility to borrow the device are some of the positive aspects of the application. In its part it uses story-telling as a powerful tool of education and entertainment. It turns the topic that may not strike the public as a particularly interesting one into a compelling story for all age groups.

However, the concern whether this type of applications will soon begin to feel like fancy audio guides with very little interaction remains. Although the access to extra information makes the experience more customisable and fitting for visitors of all levels of prior history knowledge, e.g. adding minigames, several narratives, mystery solving, or puzzles could add into to the replay/revisit value of the application and the cathedral. It is important to remember, however, that Wordsmith is currently in the frontline of AR applications in historical attractions in Finland.

5.4 Example application 2: Timetraveler The Berlin Wall, Berlin

There have been several augmented reality applications for the Berlin Wall. Back in 2010, Layar published a Berlin Wall layer developed by German layer developers Hoppala and Superimpose for the Layar application (Groenhart 2010). In 2014, Metaio and Timetraveler Augmented launched their own application called Timetraveler The Berlin Wall. This application aims to provide more diverse and broader content for its users. Apart from reconstructing the Berlin Wall and other demolished sites, the application features historical footage and real-life stories involving the Wall. (Donovan 2014.)

According to Google Play Store (2017c), the Timetraveler application has not been updated since September 2014. Its popularity has been quite modest (400-500 downloads in Play Store) for an application designed for one of the major attractions of one of the biggest European travel destinations: in 2016 Berlin had over 31 million overnight stays, over 5 million international visitors, and was chosen number 12 in the category of top 25 European destinations in TripAdvisor's Travelers' Choice Awards (Visit Berlin 2017; TripAdvisor 2017). However, its principles and ideas of adapting AR to certain uses make it a prime example of an AR application of a historical attraction.

The user can see the hidden content by standing in the correct location. Once the GPS recognises that the user is in the correct area, the optical tracking

mode is switched on. In this mode the application is able to recognise sites and display the content. (Donovan 2014.) The application is downloadable for smartphones and tablet computers (both Android and iOS) for a small payment. There is also a LITE version that is free of charge. (Google Play Store 2017c-d.)

The application has not received great publicity. Apart from the websites dedicated to applications, digital solutions, and their development, very few mentions pop up in a web search using the name of the application. This constitutes in part the number of downloads.

Whether the user is keen on seeing the daring escape of Frida Schulze through an apartment window, the wall that divided the city and its people for almost 30 years, or any other feature hidden in 11 historical sites along the tour, the application has something to offer for them. The application has interesting features, such as the use of authentic historical footage and the reconstruction of past sites. (Timetraveler augmented 2014.) The use of the application requires a lot of holding the device appointed to certain direction. Watching videos reflected to a wall on your own device also poses the danger of feeling that there is very little difference between watching the video from a screen on the wall or from the screen you provided yourself. For one reason or another, the application also appears to have failed to gain attention. However, to fully understand whether the content is as diverse and interesting as promoted, and whether the interesting features have been properly executed, one would have to go on the tour and test the application on site.

5.5 Example application 3: Get to Know Moscow. Photo, Moscow

Get to Know Moscow. Photo is an application launched by the Moscow's Department of Information and Technology (DIT). It was inspired by Pokémon Go, but instead of catching Pokémons, in this application the user is hunting famous historical figures for the pure joy of finding them as well as for selfie-taking purposes. To further activate the user, the application does not show the exact locations where the characters can be found: the user must navigate to the loca-

tion with the help of the compass provided. The application needs to be downloaded to the user's own device. According to DIT, the application aims to emphasise the rich cultural heritage of Moscow. (Sputnik News 2016.)

The earlier version featured actual signs left around the city, but as the concrete signs were exposed to bad weather and vandalism, they were ultimately deemed unsuccessful and removed. In the new version the user's location will be registered through geotagging. (Sputnik News 2016.)

The application received some publicity. In addition to the Russian media, e.g. Rahul Kalvapalle of Trendhunter Tech (2016) wrote a feature on the application under the title of Augmented Reality History Apps. It also broke through in the news of the neighbouring country Finland – although only in an online article. In its feature Sputnik News (2016) expressed that the application was due to be launched in August 2016. However, no news articles can be found after July 2016 discussing the application, and it is non-apparent in the Play Store as well.

Get to Know Moscow. Photo approaches its objectives from an angle that may be largely taken from an existing hit game, but at least it is honest about it. It is not only a passive information screen that appears on the agreed-upon location, but a game that challenges the user to find the hidden characters – in the future possibly with changing locations (Sputnik News 2016). Without testing the application is impossible to address the concern, whether the application offers enough historical information to those who are interested in more than taking photos with the greats like Yuri Gagarin and Alexander Pushkin. The availability of the application is a major concern, as its current state remains unknown. However, hunting down historical figures and taking photos with them sounds like a fun idea not only for individual users but for a group of friends as well.

6 Augmented Reality Solution for an Attraction

6.1 Attraction: Joensuu Bunker Museum

The attraction chosen to be enhanced through augmented reality in this thesis is Joensuu Bunker Museum (also known as the Marjala Bunker Museum, referring to the district in which it is located), a museum built around the Salpa Line fortification structures and two bunkers made of reinforced concrete. The museum area consists of the reconditioned bunkers, trenches, and anti-tank boulders.

Larger exhibition items such as two 90mm light field cannons and nests for machine gun operators are located outdoors (see Picture 5). A recreation of a trench can be found in the area. Inside the bunkers there is an exhibition about Finland during its three major wars. The exhibition has items such as radios used, a recreation of the living conditions of a bunker, as well as items aimed primarily to the home front, such as postcards with reassuring messages. The museum was established in 1995 during the housing fair of Joensuu, and in 2003 the museum area was named Veteraanipuisto, Finnish translation for the park of veterans. (City of Joensuu 2016; Manninen 2003.)

Picture 5 Machine gun operator nest in the Joensuu Bunker Museum. Picture by Lotta Honkanen.

The Joensuu Bunker Museum was chosen to be the attraction to be enhanced for multiple reasons. Firstly, it is open for visitors only during the summer months (usually May–August, but the opening months for 2018 are to be announced in the beginning of year 2018), year 2017 being the lowest point in the sense that the museum was open only for July (City of Joensuu 2017b-c). The marketing and promotion of the museum is minimal, and the museum cannot be found in the English version of the webpage of Joensuu - even though already in 2002 out of the total of over 6,000 visitors, 500 were foreigners (Manninen 2003). One could argue that the museum is not meant to yield profits, since it does not even charge for the entry, and thus it does not require massive marketing either. However, as it is pointed out in subchapter 4.3, even non-profit historical attractions must secure their financing in the future.

Apart from the possible (presumably rather moderate) maintenance costs[5], the city of Joensuu needs to pay the salaries of the summer guides. Generally speaking, the workforce expenses are one of the major costs museums have (Heino 2017).

On a positive note, the Bunker Museum has its own Facebook page with diverse content with a lot of photos and links to articles relating to the presumable topics of interest for the visitors. Nonetheless, all the content seems to be in Finnish, the same way as is all the Bunker Museum related content on the webpage of the city of Joensuu.

The attraction is already quite popular. In 2003, it was estimated that the museum had 3,000–5,000 yearly visitors, with the exception of year 2002 when the museum was visited by over 6,000 persons (Manninen 2003). In 2017 the museum was open only for July, during which it was visited by 2,232 visitors - this sums up to the average of 86 daily visitors (City of Joensuu 2017c).

Secondly, The Bunker Museum meets the needs of the Theme and Action Programme for the Tourism of North Karelia for years 2014–2020, since it is a case in point of a product based on the local culture (e.g. war history) that should be directed, productised and marketed to the foreign travellers (Pohjois-Karjalan maakuntaliitto 2014, 12). As mentioned earlier, it already appears to attract a fair amount of foreign visitors. With proper marketing and well-timed launch of a new application, the Bunker Museum could be one of Joensuu's major international attractions.

Thirdly, the attraction also has a huge domestic potential. As was found in a study made about the historical awareness of Finnish people, the wars Finland was involved in during the World War II still have a great significance for the

[5] What keeps the maintenance costs of the museum quite low is the voluntary work of local reservist unions. For instance, in the May 2017, the volunteering reservists reconstructed the trenches of the museum. Typically, instead of paying to the reservists, a field lunch is offered, and they may receive equivalent days of military refresher course. As a member of the local reservist union, invitations to such restauration events have been sent to the author as well.

Finnish people: when asked for five most significant things in Finnish history, the Winter War was mentioned in 54.4% of the answers and the Continuation War in 39.2% of the answers, making them the number 2 and 5 most answered option in the survey. (Torsti 2012, 100.)

As mentioned in Chapter 2, the war history is also very present in the art that makes an impression to Finnish people. Apart from the Unknown Soldier, number 3 most mentioned piece of art that has impressed the Finnish people was Talvisota (The Winter War), a novel by the Finnish author Antti Tuuri and a movie based on it. Number 4, Finlandia hymn was composed to express Finland's awakening and will to fight, and it is based on a composition that formed a part of a tableau of Finnish history created as a protest against the decision of Tsar Nicholas II of Russian Empire to narrow the autonomous rights of Finland (Helsingin Suomalainen Klubi 2004). Number 2 on the list is Täällä Pohjantähden alla, (Under the North Star), a trilogy depicting Finnish history around and during the World Wars. (Torsti 2012, 108.)

Even though the war-time history clearly interests Finnish public, Salpa Line is not the most popular subject related to the time period. When documentary about the Salpa Line was published in Finland's 100th year of independence, it was only noted in papers with a relatively small circulation. This might have been partly due to the overall number of documentaries released in the anniversary year, but it cannot be ruled out that due to the lack of combat on the Salpa Line, it lacks drama that would make it an interesting subject for media. (Ahonen 2017.) The application can therefore underline the importance of Salpa Line in reducing Soviet Union's will to continue war against Finland, and bring much needed attention to the Salpa Line attractions overall.

Lastly, the Bunker Museum offers a great setting for different forms of use of AR. It has both outdoor and indoor areas, authentic constructions on their original locations, wide range of war-time memorabilia and artefacts, reconstructions, and even a couple of model WW2 Finnish soldiers laying on their bunks in fort service. The museum has an exciting atmosphere, and having visited it several times, the author has first-hand knowledge of its features from a visitor

point of view. Diverse areas offer possibilities to try different kind of features of AR, from different tracking techniques to different techniques of analysing the surroundings. Having multiple assets also offers more brain food for the innovation process.

6.2 Target audience

6.2.1 Personas as identifiers of the target audience

Whether talking about internet or face-to-face service, the needs and wishes of the user must be identified to create a pleasurable experience. For this application, two target audience personas have been created, as the application has two modes with very different game elements that appeal to very different type of players. These personas are introduced in the following subchapters.

Persona-based identification of the user has its roots in software development in 1980s. It is typically used e.g. in website design projects, and it helps to understand the motivations, needs and restrictions of real users through a fictional representative. Personas substitute the actual users and are identified with name and personality, and in many cases, a photo. They serve as reference points and assist in understanding deeper the actual needs in comparison to the things users ask for. The system of creating personas is also quick when compared to researching vast amounts of users and their needs. The use of personas is also simpler than mapping out needs of big user populations. (Calabria 2004.) When the target audience's objectives and needs are given a central role in the marketing, capturing their interest becomes significantly easier (Evans 2013). The application enhances the attractiveness of the historical attraction, and it must be targeted to meet the needs of a set prospect - or, in this case, set prospects. This does not mean to forcefully delimit the user base in any way: it is more a way to secure that at least the target users' needs are met.

6.2.2 Persona 1 - Allu

The first target audience persona for the application is Aleksi – or as his friends call him, Allu. He is a 27-year-old Finnish male, who has moved back to North Karelia after completing his studies. He has now lived a couple of months in Noljakka region of Joensuu. He has graduated as Master of Science in Technology, and as he is originally from Outokumpu, he was glad to find a job corresponding to his education in Joensuu, a city located about 40 kilometres from his family's hometown. He is single and does not have children. Like many of his peers, he has served as a conscript in the Finnish Defence Forces, and his current rank is Corporal. Due to this personal experience he is somewhat interested in anything military-related. He has some knowledge on military and military history that he has gained through not only his time as a conscript but from school, documentaries, movies and games as well. However, he does not consider himself an expert on the matter, and he has many other interests apart from military matters.

On his leisure time Allu likes to do sports. He goes to the gym more or less regularly, and he plays either badminton or floorball with his friends practically every week. He likes to watch movies and series mostly from streaming services. He plays video games usually online with his friends as well as with unknown players - mostly FPS or first-person shooter games, where he enjoys showing his skillset and outsmarting other players. Sometimes he meets up with his friends to relax, have a pint and play sports games together. Every now and then he plays by himself. On these occasions he usually selects more story-driven games or must-play novelties. He quite enjoys games where his choices affect the game. However, he does not usually care to spend a lot of time with games, unless they have an element of competition in them to spark him up.

Referring to player types introduced in Bartle's taxonomy in 1996, his primary player type is Killer, meaning that he likes to act on other players. Thus, he likes to impose himself on others, likes to showcase what he considers his supreme skills, taunt a little, and cause reasonable amount of distress to other players in the process. He is quite proud of his high skillset and the reputation he has built.

It is hardly possible to represent only one player type all the time, and in his test results Allu found out that he also had quite a considerable amount of matching answers with the Achiever player type. This means that he also likes to act in the world. Occasionally he does like to immerse himself into the game world and forget about the possible other players - this is when he turns to more story-driven games and leaves the FPS games to the shelf. On these occasions he wants to master the world and reaching the formal statuses of games satisfy him. (Bartle 1996.)

When examining the museum visitor types introduced by Falk and Dierking (2016, 39–41), Allu best fits the description of an Explorer. He visits museums to satisfy his curiosity and is very interested in the contents of the museum. He appreciates learning in general and wishes to continue learning even though he no longer studies. When he visits a museum, he usually uses other services found under the same roof as well - at least the gift shop and the café form an essential part of his visit.

Allu makes for a good target audience persona for many reasons, even though a typical Finnish museum visitor tends to be a female - to particularise: approximately 46–65-year-old woman, who is a white-collar worker, has a higher education, lives in Southern Finland, and visit the museum 1–5 times per year. It is notable, however, that some differences apply for visitors of special museums, such as the Bunker Museum. For one, the percentage of male visitors in special museums was 46% in the survey of 2011, whereas the percentage of male visitors in museums overall was only 38%. This has been speculated to be due to the multiple special museums that have traditionally masculine themes, e.g. the Police Museum, the Artillery Museum, and war museums. Although the percentage of visitors with higher education was the lowest of all the museums, they were still the majority with 39%. Over fifth of the respondents belonged to the age group of 36–45 years. For decades the majority of visitors of the museums overall have belonged to the age group of 25–44 years, and it was only in 2011 when the group of 45–65 years old people passed the younger generations. Although the age group of 25–44-years-olds was the second most common, the Museum Association’s representatives speculated that museums may

have failed to attract a new generation, which in its part explains why the visitor amounts have seized to grow. (Taivassalo & Levä 2012, 4–18.) As the older generations may not feel that new technologies are a necessary part of their world and are quite satisfied with the traditional exhibitions, younger target audiences may be a more natural target audience for the application. (Heino 2017.)

The application can potentially help in luring in more 25–44-year-olds, whose relative share has been decreasing. The added value for the museum visit may be greater in case of a generation who are more used to using applications and digital solutions in practically every aspect of their life. Allu lives close to the museum and could help to increase the visitor number during the low season as well, should the museum stay open for spring, autumn, or even winter. He could also form a part of loyal visitors vital to museum.

6.2.3 Persona 2 - Heike

The second target audience persona for the application is Heike, 50 years old German traveller. Her companion on her trip to Finland is her 52-year-old husband Klaus. They live in Bonn, a city in the state of North Rhine-Westphalia, western Germany - the very region most leisure trips from Germany to Finland are made (Finpro 2016, 68). Heike works as a researcher in the German Reference Centre for Ethics in the Life Sciences in the University of Bonn, whereas Klaus has made an extensive career in an internationally claimed confectionary company and is currently working in its headquarters in Bonn. Both of their adult children have moved away from home long time ago.

This year Heike and Klaus decided to spend their summer holiday touring Finland, and as they had heard good things about the beautiful nature and relaxing atmosphere of Eastern Finland, they decided to make a week-long tour in couple of carefully chosen towns in North Karelia and North Savonia regions. Although they would like to escape the hectivity and rush of a big city, they prefer not to spend their whole holiday isolated from people in a cottage. They rather

visit what they consider smaller towns and get to know the local culture and history.

On their common leisure time in Bonn, they like to make short day trips to surrounding cities and to visit both historical and modern art museums - albeit they do not consider themselves exactly aficionados of modern art, they find the museum atmosphere peaceful, and enjoy the reality escape the short breaks enable.

Heike and Klaus have traditionally considered videogames to be more of a children's thing. Through their own children, however, they have realised that adults play too, and as the smartphones have become common, they too have tried some pre-installed mobile games. Heike and Klaus have not continued playing any of the games for a long time, and even though they are at least partly open to playing, they had not found playing games very intriguing.

Recently Heike begun to play some Facebook games on her private account. The social aspect has kept her surprisingly active in these games. Thus, as a player, she is starting to find herself strongly in the Socialiser type, which means that the game serves her as a background and a tool for social interaction. Albeit she has been somewhat interested in the game world in her past experiences - suggesting her player type test would result she has some percentage of an Explorer in her as well - it was only after the social aspect was added that she became committed to a game. (Bartle 1996.)

Heike's museum visitor type is primarily a Recharger, as is her husband's. They enjoy the aesthetic experience, the sounds and the smells of museum, and the escape from their busy surroundings it offers. Visiting a museum restores their energy and facilitates coping with the every-day life. (Falk & Dierking 2016, 40.) They both find history appealing, but have little energy to study additional subjects on their leisure time, as they are both very dedicated to their work. Reading and evaluating long articles is not necessary the way they enjoy history the most, but they are always interested in documentaries and well-presented history facts. For them history, as well as art, is a fascinating and smart way of un-

winding. In the case of Bunker Museum, Heike's visitor type nears the Facilitator, as visiting the war-themed museum was Klaus' suggestion she accepted. Facilitators, as defined by Falk & Dierking (2016, 39–40), are typically e.g. grandparents, who take their grandchildren to a museum.

According to the German traveller segmentation by Visit Finland, Heike and Klaus are somewhat typical City Breakers. They are around 51–75 years old, travel with their partner, stay for a week, and travel during summer. They are interested in history and local culture and appreciate peacefulness and quietness. Safety of the destination and security in general are at least their subconscious concerns. Although they enjoy soft activities in nature, they do not seek challenging physical activities. In the survey it was found that 42% of the City Breakers would likely visit Finland. (Visit Finland 2017a, 4–5.)

As German-speaking Europe is also mentioned both in the national tourism strategy and in the North-Karelian tourism programme as one of the major target marketing areas, Heike and Klaus are a great fit for the target audience of Bunker Museum as well (Kauppa- ja teollisuusministeriö 2006, 22; Pohjois-Karjalan maakuntaliitto 2014, 9). The statistics show that in 2016 North Karelia attracted 3,769 Germans, of which Joensuu sub-region's share was 2,162. (See the following table.) There were 1,549 German arrivals in the city of Joensuu. In December 2017, the numbers for 2017 seem quite similar: 3,687 arrivals to North Karelia, 2,247 of which to Joensuu sub-region, 1,499 of which to Joensuu. (Visit Finland 2017b.)

Table 1 Yearly nights spent and arrivals by country of residence by country, region, year and data. 2017 is preliminary data. (Visit Finland 2017b.)

	NIGHTS SPENT			ARRIVALS			COUNTRY'S SHARE OF FOREIGN NIGHTS, %		
GERMANY	**2015**	**2016**	**2017**	**2015**	**2016**	**2017**	**2015**	**2016**	**2017**
RE POHJOIS-KARJALA	10,497	8,181	8,811	3,840	3,769	3,687	11.9	13.2	14.3
..SR JOENSUU SUB-REGION	6,329	4,396	5,764	2,296	2,162	2,247	13.4	13.3	14.9
....167 JOENSUU	4,982	3,170	4,056	1,918	1,549	1,499	13.2	11.7	12.7

The Germans stayed 8,181 nights – 4,396 overnight stays in the Joensuu region, out of which 3,170 in the city of Joensuu. According to the calculations made in December 2017, the number of German overnight stays in 2017 in North Karelia was 8,811 (of which 5,764 in the Joensuu region, 4,056 of them in Joensuu). Germany's share of foreign nights spent in North Karelia was 13.2% in 2016 and 14.3% in 2017. The corresponding number for Joensuu sub-region in 2016 was 13.3% and for Joensuu 11.7%. Like in the case of North Karelia as a whole, Joensuu and its sub-region also saw an increase in the relative amount of German overnight stays in 2017, with 14.9% of foreign overnight stays in Joensuu sub-region being German. 12.7% was the German share of the nights in the city of Joensuu. (Visit Finland 2017c.) Thus, Heike and Klaus are somewhat typical foreign visitors in the area.

6.3 The application: SALPA

6.3.1 Overview of the application

The application has two modes: Solve the Mystery and Know the Stories. In both modes the scenes are voice-acted in Finnish with optional subtitles in Finnish, English, Russian, Swedish and German. The user can choose the mode they wish to use. Although a rough draft of the storyline is presented in following subchapter, before executing the application, the historical facts it is based would still need to be verified and a more detailed script be made.

Having the soundtrack in Finnish has several advantages. It streamlines the process, as only one audio option needs to be created. Even though the lines need to be translated for the subtitles, subtitle translation and translation for dubbing have somewhat different demands. Subtitles must consider condensing

the essential core of the spoken message into short written message[6], whereas voiceover needs to adjust the translation into the same length of speech the original speaker has. Dubbing may cause the user a sense of unnaturalness and lower rate of authenticity. Even though the subtitles require space from the screen, overlapping the picture, they are a better option for the translations in this case. It has also been found that subtitles do not notably distract viewers or limit their view in the way that they would feel hindered. (Koolstra, Peeters & Spinhof 2002, 328–339.) However, in this case the subtitle length must be carefully considered, as some of the visitors use the application with their smartphones that have relatively small screens. Still, when subtitling, the issue of whether the same voice-actors can do the foreign language lines or not does not need to be considered.

The language choices are based on the national policy and the international target areas specified in regional and national tourism strategies. As a bilingual country, both official languages of Finland are offered (Finnish and Swedish). This may also help in standing out of the other attractions of the area, as not all North-Karelian operators have very broad Swedish contents to offer due to the geographical and linguistical distance to the natively Swedish-speaking areas. As mentioned in previous subchapters, German-speaking Europe is one of the target groups of Finnish and North-Karelian tourism marketing. Although Germans are willing to forgive the lack of customer service in their native language, as long as the contents are available in German (Visit Finland 2017c).

In Solve the Mystery mode the user can play an AR-enhanced whodunnit mobile game set on the Bunker Museum area. The story takes place in the time of the Interim Peace (1940–1941). The user follows the story as described in the subchapter 5.3.3 and tries to solve the suspicious accident in the set time limit.

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[6] The usual presentation rate is 10 characters per second, which tends to equal as two words. This is due to so-called six second rule: the longest possible subtitle shown on screen can be 64 characters, and it will be shown for six seconds – this in the case of e.g. a TV screen, as on smaller screen the subtitles have to be shorter (albeit the rate of around 10 characters per second can remain). In comparison, the average speech rate is a little over two words per second. (Koolstra et al. 2002, 328.)

When the time has run out, the user needs to prosecute someone and present the evidence. The user can also try to solve the mystery under the set time limit - however, if their accusation is deemed false, they are given a time penalty. Depending on evidence found, there are multiple correct solutions as to who did it (see subchapter 6.3.3). If the player presents the correct evidence to prove the guilt of the suspect, they win the game and get to write their name along with the time in which they solved the mystery and the name of the culprit on the leaderboards. The leaderboards also feature a statistic about which suspect has been found guilty most times.

Know the Stories mode is for less competitive users, who come to the museum to relax. The characters' background stories and the flashbacks created for the Solve the Mystery mode are available for viewing and accompanied by info boxes explaining the fiction's connection to real history. Using this mode also allows the mystery solvers to further deepen their knowledge and museum experience.

A tentative research about the construction of Salpa Line during the Interim Peace was made for this research, but as the final script is written, the historical accuracy of the storyline must be revised. Concerning the likeliness of Ilmari and Tauno working as paid workforce and not assigned as a part of their military service, few aspects need to be considered. In the plot as drafted the assumption is that at least by the end of the war, they were both reservists, not conscripts, and that they were demobilised before joining the Salpa Line fortifying. The fact that those obliged to work under martial law were discharged by the end of April 1940 suggests there was an urgent need for construction workers. However, to detail e.g. if the characters are working for a contractor, the individual case of Marjala needs to be examined - it has been documented that some individual tasks involving reinforced concrete were given to a constructor (Salo 2017, 59). As the negotiations for whether the construction firms could operate as independent contractors on site began in the beginning of summer 1940, and given the short time window as the Continuation War begins in the end of June 1940, the story likely needs to be situated into May 1940. Therefore, the whole contractor issue can probably be dealt with a remark of the

chance that the contractors will continue the work. It is well documented that the government sought to solve the unemployment problem through employing jobless workmen to the Salpa Line fortifications that on the other hand required a large quantity of workforce. (Aura 2017, 96–97.) At the highest point in 1941 up to 35,000 men worked as hired workforce on the Salpa Line construction (Ahonen 2016). By further immersing into the individual Marjala site history the setting of the story can also be further detailed. When the Continuation War started, two of the bunkers were ready, only lacking some final touches. The casting of the third dugout was left unfinished due to the war. (Salo 2017, 59.) Nevertheless, more research is still required as to at which state the construction site was when the obliged workforce left it in April 1940.

The name for the application, Salpa, is both the name of the defence line and a Finnish translation for bolt. It is short and easy to remember especially for domestic user, in addition to which it does not necessary require translation as it already works as a proper noun in the English translation of the name of the defence line. Similar letter combinations are also present in other languages (e.g. in English “Alps”, “alpaca”, “salt”; in German “Salbe”, “Alpaka”; in Spanish “salpicar”, “alpaca”) suggesting pronouncing the name should not be too arduous. Currently, search with entry “Salpa” does not match any applications in Google Play Store. This means that once the Salpa application is published, finding the correct application should be easy for users. The name also highlights that Marjala bunker is part of Salpa Line, which is not brought up in the name of the attraction (Joensuu Bunker Museum).

To summarise, the feasibility of the storyline and character backgrounds should be evaluated by an established Salpa Line researcher before the final script is written. The final script is a more detailed version of the storyline presented in the subchapter 5.3.3 that is formatted properly and that includes every possible interaction as well as all the cutscenes, memories and other story-telling aspects of the application.

6.3.2 Characters and their educational purposes

The application has three main characters, with whom the user can communicate. The characters are 3D models and reasonably realistic-looking, referring to that their features are not exaggerated but the memory usage intensity is kept in mind - it is recommendable rather decrease the details and aesthetics of the character than to build an application with long download times and high memory usage. Each of the characters has an educational purpose as they present different sides of Finnish war-time history. The characters' background stories are hinted in their speech, and some of their stories feature 2D flashbacks visible behind the character as they tell their story. The following is an introduction of the characters and their educational purposes.

Ilmari served as a combat medic in the Winter War of 1939. Prior to the war, he was a farmer in the Karelian Isthmus. He was drafted and his company was transferred close to the front line. While his company was waiting for the command, he used to help in the field hospital, where he met many wounded soldiers. He best remembers a soldier whose platoon had been hit by indirect fire. This gravely injured man suffered for a while, but nothing could be done for him. Shortly after, Ilmari's platoon received a command to advance – other platoon from the same company needed reinforcements badly. They reached the other company's station tired and hungry. Unfortunately, there was no time for sleep, as the following night the Soviet army attacked. After fierce combat, the Soviet troops seemed to retreat. As Ilmari was about to sigh in relief, the Soviet artillery began to fire. He pushed against the ground with all of his weight, praying silently. He lifted his gaze only once, and as he did, he saw his comrade slashed by a fragment of a shell.

He does not really remember much afterwards, but apparently the combat continued. Miraculously he survived the combat even though he zoned out. As the combat calmed down, one of his comrades noticed him and tugged him into safety. Ilmari could not speak, apart from repeating one or two words. He vomited several times and complained that he had a strong headache. As his condition seemed to get worse, he had to be evacuated from the front line.

He received a diagnosis of psychological reaction. He was quickly rehabilitated and sent back to the field, but the commanding officer of his new troops was unsure about his ability to perform in battle. This lead to him being assigned to carry the stretchers - a dangerous assignment, where he had to move around in the battlefield without being able to defend himself with a weapon. Even though the war ended, he still suffers from recurring nightmares and anxiety. He is also still ashamed and confused about what happened and actively tries to avoid discussing about it.

This character supports the modern way of interpreting the war. The overall change of view into approaching history from a regular person's perspective only affected the way Finnish war history was perceived in the 1990s and early 2000s. Both the setting where Ilmari was shell-shocked and his symptoms are somewhat typical. The most common setting for shell-shock was a situation where a soldier sees their comrade being hit by a grenade, having no physical damage themselves, but collapsing mentally. (Kivimäki 2013, 17–34.) Ilmari presents the devastating effect war can have on a human mind. He is by no means a coward or a deserter: even he is confused about his reaction. In a way he is quite sensitive, but during the war he fought his nerves and managed to win until the incident described happened.

Ilmari's purpose is to humanise the war experience and help in understanding that soldiers are human beings with certain physical and mental assets, too. He is also part of a larger discussion about the psychological effects of Finnish wars that has been provoked by Kivimäki's book of 2013 (Murtuneet mielet; Broken Minds in English) and the new filming of Finnish classic Tuntematon sotilas (the Unknown Soldier), amongst others.

Tapio seems to be everything an army could hope for in a soldier. A lumberjack by trade, he served in the Winter War of 1939 in the front lines. He was injured by a grenade fragment but was able to return to the field after a reasonable period in the military hospital, and the permanent damage caused to him was mostly esthetical. When the Interim Peace begun in 1940, he started job-

hunting and found out that he could earn significantly better money in Salpa Line fortification construction than in his regular job (Notkola 2006, 10). Besides, in this way he could proceed to show his patriotism and defiance towards those, who wanted to conquer his homeland. He was almost ranked out of the construction work due to the recommendation to avoid hiring those capable of doing forest work – however, he was able to prove his workmanship in concrete production and was hired (Notkola 2006, 10). Tapio in many ways fits the propaganda needs of any army, although he uses harsh language and is ready to bend the rules a little if it suits him. He provides for his family, and although he has had some issues with his wife after the war, he is very devoted to his wife and children.

Tapio's educational purpose is to educate the visitors about those who were employed to the Salpa Line construction sites and why. It is left unclear whether he actually had any significant workmanship in concrete production, but as he underlines that he had to prove this, the visitor finds out that Salpa Line constructers were carefully selected and were possibly obligated to prove their capabilities. It also deepens his character, and with his war-time stories of his successes it completes a picture of him as a quick-witted and self-reliant, competent fellow. His war time experiences and mentality contrasts those of Ilmari, and thus complete the picture of Finnish soldiers of the era. The difficulties between his wife and him reflect that the comeback from the war was not necessarily always unproblematic.

Annikki is a young lady, who is a member of the Lotta Svärd organisation[7]. She was on the field during the Winter War, taking care of the wounded soldiers. She became a Lotta after her fiancé was drafted. After receiving the message that her fiancé was killed in action, she processed her grief and anxiety by concentrating pedantically on her duties. Although a strong sense of purpose helped her stay calm and cold-headed even when faced with brutal war injuries and suffering men, her superior ultimately began to worry about the impact the

[7] The Lotta Svärd Organisation was an organisation for female to support the military actions. Members were called Lotta (plural Lottas).

loss of her fiancé had on her. During the fiercest battles every capable Lotta was needed on the field, but when the battles began to calm, Annikki was transferred to food services. In the Salpa Line construction site she works in the food supply, but she actively tries to get back to the nursing department. She predicts that a new war could begin any day, and when it happens, she wants to be back in field hospitals, where she feels she is needed the most.

Annikki demonstrates to the visitors what kind of a role Finnish women on field had during the war years. She also teaches about how Lottas continued their work during the Interim Peace. Her sorrowful fate introduces the visitors some of the departments Lottas worked in. She refers to her friends within the Lotta Svärd organisation that work in other assignments, e.g. at air-raid warning posts and in arming the troops. This will help in building a complete picture for the visitor about the Lotta Svärd Organisation. It also clears the role and importance of Lottas on the field. On a psychological level, it is obvious that Annikki has pushed the grief of losing her fiancé to be processed later. Her ability to efficiently focus on and successfully complete her at times demanding tasks she faced on the field is interesting food for thought for those interested in the psychological side of the matter.

6.3.3 Solve the Mystery mode

In the Solve the Mystery mode the user plays a whodunnit game situated in the Bunker Museum grounds. Their choices in the game affect their future options, mainly what they can ask from the characters and what the characters are willing to tell them. To find out more about the characters' backgrounds and to unlock discussion options with the characters, the player also needs to scan the museum exhibition items and pictures of them to receive "memories". The memories are 2D animated videos that can be replayed at any time. The memories as well as parts of discussion can be used as evidence to accuse the culprit.

The story development closely joints itself to the dynamic of the characters. Each work at the Salpa Line for their own motivations, and the user can find them in different parts of the museum area in their daily tasks. Apart from the main characters, the Supervisor character assists the player by guiding them in the beginning and by giving hints (when asked) during the game. The player is also one of the characters, and by making the right choices they can find out about their own character's history as well. The story begins when a mysterious new worker is attacked and knocked unconscious on the construction site. The player needs to take up the role of a sleuth to solve whodunnit.

The game begins, when the user arrives to the construction site on their first day. They are welcomed by their superior, who briefly summarises what their tasks are, then encouraging the user to find their work place. On site the user finds Tauno casting concrete, overhearing how someone points out a minor mistake he is about to make. After a conversation lead by player's choice of lines (the player is offered 2–4 options what he can say; these lines are on text and not voice-acted), Tauno remarks that the player should go to food suppliers and ask whether the lunch is already served.

When the user goes to the next location, they meet Annikki, food supply Lotta. She playfully reproaches Tauno for sending the user to ask for food. The user has two options: to either converse with Annikki, or to merely apologise for hurrying them up. One of the user's lines leads to a fruitful conversation with hidden clues for solving the upcoming mystery, one is a dead end, and the third (the apology) skips the conversation to the end. Ultimately, all the conversations end with the same line: Annikki telling the user that the food will be up for grabs in 15–20 minutes and adding a plea that the user would first go tell a fellow called Ilmari – just to hassle with Tauno.

The user now has two options: whether to tell Ilmari or Tauno first. Should they tell Tauno, they receive no additional information. In Ilmari's case the conversation continues for a little while, depending on player's choices, and they can receive from one to two pieces of useful background information in the process. In either case, the discussion ends with an advice to go to the food supply area.

When the player closes in, they begin to hear commotion and commands yelled out. The Supervisor is crouched above someone but rises and turns to stop the player. He explains that someone has been knocked out cold. It appears that the victim has hit his head to a rock peeking from the ground. Suspiciously enough, the victim appears to be hit in the face as well, so it is probably no accident – the player overhears one of the Lottas contemplating this. The Supervisor silences everyone and orders them to get back to their posts. The player now has two lines from which to choose. They can either volunteer to solve the case or try to leave to go back to their post. The first option offers additional information about the player's character, as the Supervisor then notes that the player used to be a private eye, who immensely helped in catching and accusing many deserters and war criminals during the war. The second option leads to the Supervisor stopping the player and ordering them to solve the case: "Seeing how as a new worker you have no prior… affiliations with others."

The part described above is mandatory for all the players. The part doubles as a tutorial, as the main game mechanics are introduced during it. The Supervisor character is used in the tutorial and his spoken introductions are complemented with texts and effects highlighting e.g. which part of the screen the user needs to touch to open the memory-discussion inventory. This texts and effects can also be used in the Know the Stories mode to help users handle the use of the application.

The tutorial part is summarised in the following chart (Figure 2). In this figure the "FS" stands for food supply, i.e. the area where the food supply events are located. "COMMAND" means that to advance the game, the player has no other options than do as the character has proposed: e.g. if they go to speak another character before completing the command received, they are given an automatic response, such as: "Sorry, can't talk with you. Some of us have to actually work here, you know." "SUGGESTION" refers to a proposal by the character to which there are several advancing actions: e.g. the player can choose, to which character they want to talk first. "Conversation available" refers to an interactive conversation during which the player can find out possibly useful information.

These conversations need not to be completed to advance, but having some of these conversations is necessary to solve the mystery.

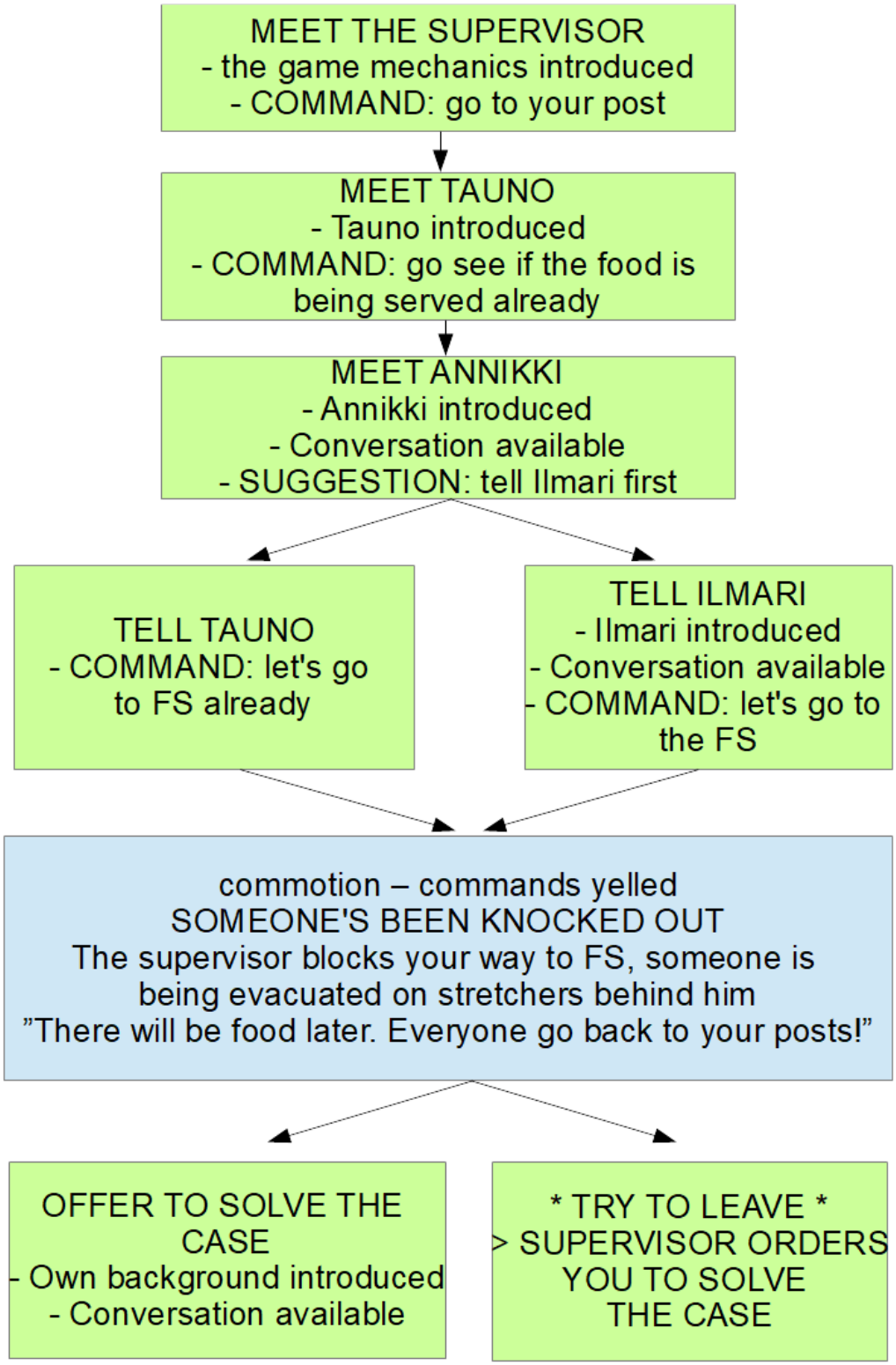

Figure 2 Chart summarising the mandatory tutorial/the part of the story that is somewhat same for all the players.

After this part of the game, the storyline and the final solution are determined by the player's actions, the evidence they find, and the deductions they make. This makes the game experience customised for each player but also makes the game's replay value higher, as the same player can get different results each time they play.

The standardised part of the ending is that the victim was an officer, who had come to the site to observe and report on the progress of the work. He aimed to work unnoticed, but a couple of times he could not control his character and made remarks that raised the curiosity of the workers. During the war he was indirectly responsible for the death of Annikki's fiancé, as he sent him to a suicidal mission after losing his temper with him for the last time. Annikki's fiancé had suspected the officer's allegiances, which ultimately cost him his life. The Officer's allegiances have been questioned silently by his friend and comrade from the training corps, but nothing has been proved thus far, and the Officer continues to enjoy high status in the Forces. After being shell-shocked, Ilmari was assigned to the Officer's troops. The Officer despised what he called Ilmari's cowardice, and ordered him to carry the stretchers, "Should that suit you – or would you like me to get a Lotta do that for you?" His continuous remarks and despiteful attitude began to affect the rest of the troops as well, making Ilmari's nightmarish experience even worse.

The possible endings with the culprits and their corresponding motivations as well as the progression of the assault are presented in the following table (Table 2). After finding out the culprit, the player can either let them go, launching a scene where the Supervisor is explained that the Officer fell and that the marks on his face had resulted from an earlier incident. Subsequently a letter is shown. The letter states that to keep his dubious allegiances hidden, the Officer is wise to agree with the player's testimony. If the player decides to report the culprit to the Supervisor, he is shown a scene where the Supervisor thanks him for his service and briefly mentions that the culprit will be "dealt with".

Table 2 Possible culprits, their motivations and the final solutions for the Solve a Mystery -mode of the application.

CULPRIT	MOTIVATION	DESCRIPTION OF THE EVENTS
ANNIKKI	Responsible for Annikki's fiancé's death	In his letters to Annikki, Annikki's fiancé had described how he was onto the Officer's shady dealings and how after the Officer found out about this, their relationship had become hostile. Annikki had still been in shock because of her fiancés death, when she had heard from her fiancés comrade that the Officer had assigned her fiancé a mission everyone knew would be practically suicidal. Months later, Annikki thought she had suffocated all her feelings regarding her fiancés death, but when she saw the Officer walk in to the Salpa Line construction site, pure rage took her over. She grabbed a shovel laying nearby and hit the Officer straight in the head. As the Officer fell, he hit the back of his head to a pointy rock peeking from the ground. Annikki's mind cleared, she quickly hid the shovel, and acted as she had just found the body lying on the ground.
ILMARI	The Officer knew his secret and had humiliated him before	When he saw the Officer in the construction site, Ilmari felt sick. He remembered how the Officer had degraded him into carrying stretchers: ”It's not like I can give that nervous wreck of a lunatic a rifle and take him into a real combat!” The Officer's repeated remarks had eaten him inside during the war, and ultimately the Officer's name-calling had caught on to even Ilmari's closest comrades, making him a pariah amongst the troops. And even now, as the Officer had walked in and noticed him, he had yelled out loud: ”Hey, make sure not to leave any more screws loose down there!” Ilmari knew he needed to take action to avoid the same depressive situation the Officer had created around him before. A private confrontation with the Officer took quickly a wrong turn, when the Officer had remarked: ”But why do I keep on wasting my time, talking about courage to a deserter like you?!” When he heard this, Ilmari was blinded by rage. He attacked the Officer, and as they fought to gain control of each other’s’ hands, Ilmari semi-accidently launched his forehead, hitting the Officer in the face. As a result of the hit, the Officer fell down and hit the back of his head to a pointy rock peeking from the ground. Ilmari panicked, and to avoid facing the court, he escaped the scene.
TAUNO	Avenge for Annikki	Having both served in mentally challenging assignments on field, Tauno and Annikki had quickly found that they shared the same attitudes and opinions and t hat they got along very well. They bonded, and a deep trust and friendship formed between the two. In the morning of the incident, Tauno had noticed that Annikki seemed odd. She explained that the same officer, who was responsible for her fiancés death, had just walked to the construction site. For the first hours of the day Tauno had observed the Officer. When the opportunity presented itself, he decided to teach the arrogant officer a lesson and to avenge for his friend. As he had neared the Officer, he had yelled out his name. The Officer had turned to face the straight left punch of Tauno. Tauno hit him straight to the jaw and the Officer dropped immediately, unfortunately for him hitting his head to a pointy rock peeking from the ground. Quick-witted as always, Tauno noticed Annikki nearby. To avoid making her accomplice, he snapped a dry twig to alert her. Tauno escaped the scene unnoticed, Annikki never knew Tauno was behind the assault, and the Officer kept his life.

PLAYER	Serving the country	Why would a successful private investigator work in fortification work? Surely the army has better use for a scout, who can blend in practically anywhere. The Officer's questionable allegiances had come forward and there was reason to suspect that he was working for the other side. However, there was no concrete evidence to prove it. Another officer, who had been at the same officer course as the victim, paid for the player to teach the Officer a lesson. To avoid being connected to the incident, he left all the details to be planned by the private investigator, who then, to keep their distance to the case, hired a goon to beat up the Officer. Apparently, the goon had been quite excited about the job, since the Officer had been knocked out, subsequently hitting his head to a pointy rock peeking from the ground. The next step would be to send a letter to the Officer to read in the hospital – if he knows what is good for him, this should be the last time we hear of him!

Collected memories and discussions had are represented by an icon in the "journal" of the player. When the player opens the journal, and chooses any icon from it, they can replay the memory or read the saved part of the earlier conversation in a text form. The player can accuse any of the suspects by choosing "Accuse" from the journal menu. Clicking "Accuse" opens a new window, where the player first needs to choose the suspect they want to accuse. After this player needs to choose from their journal inventory three key pieces of evidence that prove the suspect guilty. If the player chooses the correct evidence to blame the suspect, victorious scene A is played. If they choose incorrectly, they are shown scene B. With the proper evidence, any party can be proved guilty – including the player!

6.3.4 Know the Stories mode

In Know the Stories mode the user can find the same characters as in the Solve the Mystery mode. Instead of talking with the characters, they can choose which of their memories they want to watch. Each memory ends with short text describing the relation between the fictional memory and historical aspects it is based on. Apart from educating the visitor about the past, this also highlights the research done for each character and their background story. Additionally, the user is offered information about the historical aspects the character represents (see subchapter 5.3.2). When the player chooses the option "About the

Character”, the character introduces themselves. For instance, Annikki tells her name, that she is a Lotta, introduces shortly the Lotta Svärd organization and its different departments.

The user can also observe the set museum artefacts. Similar options are offered: review the memory created for the Solve the Mystery mode, learn more about the artefacts historical significance. If authentic footage or other media can be found, these can be utilised in this mode to deepen the user’s experience by tying it to historical material.

6.3.5 Technical and technological choices

The application is designed to be used either on a tablet computer or a smartphone, preferably using headphones for better audio experience. A request to use headphones is presented when the application is opened. Although the experience would be more immersive with wearable technology, it is improbable that the wearable AR technology will be in such a state that using it would provide an enjoyable experience for the user within the 1-2 years set as the time range in the chapter 1. (For the problems associated with the current AR HMDs, see chapter 4.)

Depending on whether speaking about the conversations or the memories, the augmented reality experiences are launched based on one of the two actions: the user being in the correct location or scanning the correct image. To achieve accurate location both indoors and outdoors, BLE beacons are used. Beacons power supply needs should be met by a regular coin cell battery. Using coin cell batteries allows to keep the device size smaller, and since no wall outlet is needed, the beacons can be situated more flexibly. The location-based launch is completed with image recognition used for scanning the museum artefacts, or rather markers close to them. Artefacts such as propagandist postcards can be used for image recognition directly, but for artefacts such as the medpack (see Picture 6), it is necessary to place a picture nearby for the machine vision to

scan. This picture is a simplified image of the artefact made with the machine vision's requirements and preferences in mind.

Picture 6 Medpack (in Finnish, lääkintälaukku) exhibited in one of the bunkers of the Bunker Museum. Picture by Lotta Honkanen.

Although an interaction with a 3D character with a sufficient graphical quality can be optimised so that the scene could potentially be executed using internal memory - meaning that no internet connection is needed - some features of the application presented suggest it may require fair amount of memory (Gröhn & Nevalainen 2017). Therefore, remote data storage must form a part of the applications storage. This also helps in keeping the application's size smaller. Most of the interaction with 3D characters takes place outdoors, and the interaction taking place inside the bunkers is mostly executed through image recognition. Nonetheless, there is no need to crop out interaction with 3D characters in the grounds of local memory usage, as by creating a Wi-Fi network e.g. using a mesh Wi-Fi system, remote storages can be accessed from concrete bunkers

as well. Before the execution it is necessary to evaluate whether the remote storage should be a server, a cloud, or some other solution.

Keeping in mind optimising the memory usage, showing several 3D characters simultaneously on the screen should be avoided if possible, as it increases the memory usage (Gröhn & Nevalainen 2017). It is important to notice that the devices' screens are also relatively small, so to leave space for the real world as well not too many virtual objects can occupy the screen at the same time.

6.4 Distribution, pricing and profitability

The operating system (OS) prioritised in development is Android. Although there are some aspects contradicting with the choice, due to its popularity especially in the attraction's domestic market, it is the recommendable option to begin with.

As demonstrated by the following graphic (Figure 3), globally Android devices' market share was nearly 82% by the end of 2016. After its launch to the consumer market in 2007, Android has grown to become the clear leader in the sales. (Statista 2017.)

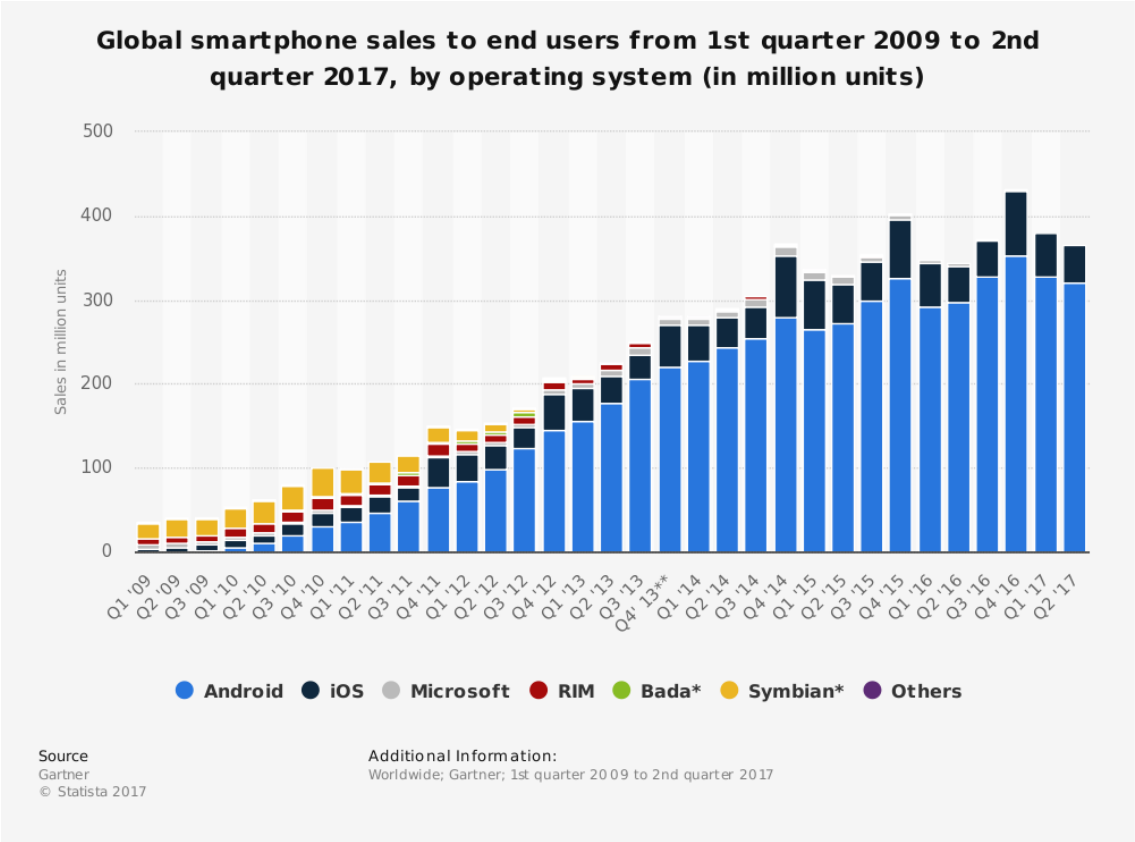

Figure 3 Android-based devices' sales have increased from the 2% in early 2009 to the remarkable near 82% in the end of 2016. (Statista 2007.)

It must be considered, however, that despite Google's efforts to shift important updates from OS updates to Google Play Services updates, Android devices continue to suffer from the issue of fragmentation of device base (Amadeo 2013). This means that whereas most Apple users are using the newest operating system version available, Android users are much more likely to use older versions of operating system. The fragmentation is shown in Figure 4. The newest Android OS in 2016, Marshmallow, had only 24.7% adoption rate, whereas the newest iOS, iOS 9, had overwhelming 89.6% adoption rate (Richter 2016). In 2017, the recently launched newest operating system Oreo (8.0) had mere 0.5% adoption rate - the same adoption rate as Ice Cream Sandwich (4.0.3–4.0.4), the second oldest system apparent in the statistics. Nougat 7.1 had the modest adoption rate of 4.0%, and the adoption rate for earlier version of Nougat (7.0) was 19.3%. Marshmallow (6.0) had 29.7% distribution, meaning that its adoption rate had increased only little over five percentage points from the 2016 situation depicted in Figure 4. (Android Developers 2017.)

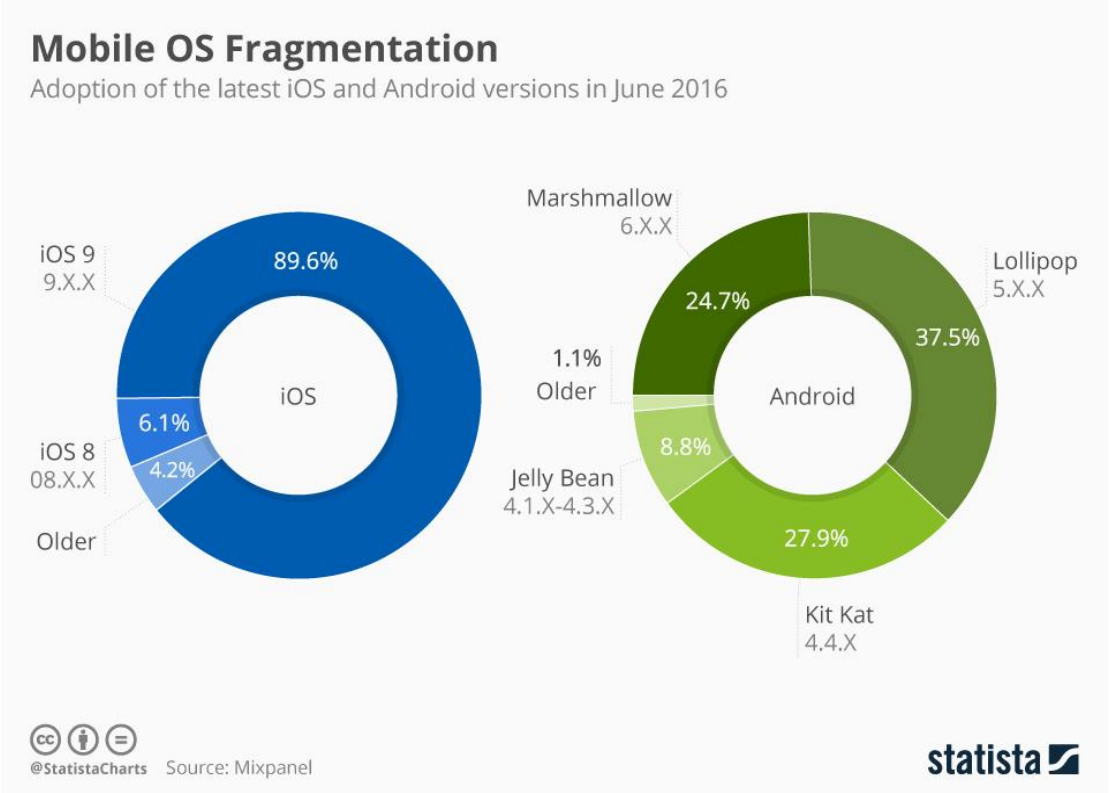

Figure 4 Chart demonstrating the adoption percent of the newest OS of Apple devices versus Android devices. (Richter 2016.)

The reasons behind the fragmentation include that Android is used not only in Nexus phones but other manufacturers' phones as well, and seeing how Android is an open-source operating system, manufacturers are able to customise its features up to a point where some features are so unique they are not automatically supported by the newest Android update (Rao 2016). From application development standpoint the operating system fragmentation offers several challenges, one of them being bug fixing (Moon Technolabs Pvt Ltd 2017).

Nonetheless, when examining the geographical distribution of Android and iOS, both Joensuu Bunker Museum's domestic market Finland and its foreign target market of German-speaking Europe appear to be predominantly Android-lead markets (Moon Technolabs Pvt Ltd 2017). Apple device purchases are more expensive, as is publishing for iOS: Apple developers are required to buy a membership with annual fee of $99 USD, whereas registering as an Android developer costs $25 USD. (Gröhn & Nevalainen 2017; Apple Inc. 2017; Google 2017.) Therefore, the resources should be focused on initially launching the ap-

plication on Android. If the success meets the objectives, and there seems to be demand for an iOS version, one can be developed.

To ensure accessibility of the application for all visitors, 5–10 tablet computers are purchased for the museum (more accurate estimation of the number of tablet computers must be made by comparing past daily visitor statistics – and if such statistic exists, the maximum amount of visitors the museum has had simultaneously). With the pre-installed application problems such as lack of free memory space and difficulties of downloading due to weak internet connection can be avoided. This way it is also possible to ensure the same ground for all users. (Gröhn & Nevalainen 2017.) Depending on the requirements set for the device, the price for a considerable Android device ranges from around 200–600 euros per device (Peckham 2017). Apart from using the museum tablet computers, the users can download the application to their own mobile device from Play Store.

When it comes to paying for mobile games, the trend appears to be that if the strong brands are excluded, it seems that games meant for masses need to be free to play in order to become well spread. The willingness to pay overall is quite low compared to many other fields: companies with the strongest brands, such as Final Fantasy, can charge several euros for their games, whereas others practically need to find other ways to finance their games (such as in-game advertising). (Gröhn & Nevalainen 2017.) World-famous brands such as Guggenheim are a big draw in the museum sector as well (Heino 2017). Unfortunately, the Bunker Museum does not currently have such a brand. Complicating the matter more, the museum needs to consider its educational purpose and its status in the public's mind, which could be compromised with advertisement that some may consider impropriate.

One solution could be involving sponsors. However, it is important to ensure that none of the sponsors have commercial interests that could affect the objectivity of the application's contents - just as the case would be, should a company wish to sponsor an exhibition (Heino 2017). Some of the costs can be covered with a rent charged for the use of the museum's tablet computers. According to

the survey, 69% of the special museum visitors would be willing to pay 4–7 euros for the ticket to the museum. 66% of the visitors of museums free of charge would also pay 4–7 euros for the access - although the visitors of free of charge museums were more likely to have visited the same museum multiple times during the year. (Taivassalo & Levä 2012, 13–18.) Therefore, the rent of the device could be five euros, leaving still willingness to pay for the voluntary entrance fee of the museum[8].

It is highly recommendable to cover the application's costs with the entrance fees and device rents. As the application only works on the museum grounds, its users are required to enter the museum area. Therefore, should the museum begin to charge non-voluntary entrance fee, all the users of the application would pay for the application through the entrance fee. Apart from advertisement-related issues discussed earlier in this chapter, currently the biggest growing trend of application monetisation seems to rather be in-app purchases than advertisements (Dogtiev 2017). Hence the in-app advertisement is not the most advisable monetisation model for the Salpa application.

As is the current case with the development, innovation and marketing in the Finnish museums, the development costs would need to be covered with money granted for development projects. This type of funding can be granted by e.g. the national government or the European Union. The EU has lately emphasised digitalisation in its funding decisions, so it would be the most probable financer for the project. (Heino 2017.)

To properly evaluate the profitability, it would be necessary to know the development costs and the exact amount of funding received. Most of the development costs would need to be covered with the project funding. The development costs include either the ready-made application or workforce needed for the application's coding, graphics, script, translations for subtitles, and voice-acting.

[8] However, the museum could consider charging e.g. 2 euros as an entrance fee to better cover the costs. Interpreting from the Finnish Museum Association's survey results, this should still be considered cheap (Taivassalo & Levä, 12–18).

Although some sound assets may be found free of charge, as the graphics and voice-acting play a key role in the application, they must be noticed in the budget (Gröhn & Nevalainen 2017.) In the best case, the application could accumulate resources for other development actions in future, or at least pay for its own maintenance. The application would definitely assist museums' core mission of advancing the cultural heritage to public, especially if marketed properly.

6.5 Notes

Even though plausible, some of the features of the application are somewhat complicated to execute, which should be considered when budgeting and scheduling the execution of the application. These features include the change in the user's options for further action based on their previous choices. For an estimation of the time and money needed, the executing parties must be contacted.

The application is not specifically aimed to children, but no graphic violence is shown, and the darker experiences of the characters are not scored off. However, as the topic is somewhat grim to begin with and e.g. the way Ilmari is hassled may cause anxiety in more sensible users. Due to the target of violence being a human, some mild curses, and theme that may cause some anxiety, 12 years would be a fitting age limit (PEGI 2017). Therefore, parents are advised to consider whether they would like to their children to use the application or not.

To distribute the application through Google Play Store, it needs to be rated. This is done by completing a questionnaire in Google Play Console. Apart from visible rating being a more ethically sustainable approach, it is also needed to avoid Play Store listing the application as unrated, which would lead to the application being removed from Play Store. (Google Play 2017.)

7 About the Research

7.1 Reliability and ethics

The premeditated possible ethics and reliability issues concerned using the expert-based system of acquiring knowledge, informing the interviewees about the objective of the interviews, correctly formatting the interviews, examining my own possible mental affiliations and subconscious attitudes, choice of language, and the threat of plagiarism. These concerns were addressed in the thesis plan, concluding with that most of these threats are best minimised by being aware of them.

To avoid outsourcing the thinking process, blindly believing and referring to an individual's respected comments - an apparent threat and a typical poor use of the expert-based method of knowledge acquisition - several actions were taken (Tuomi 2007, 17). Firstly, the interviewees were carefully chosen (the justifications for the selection of each interviewee can be found in the subchapter 2.2). Secondly, the interviews were conducted on the latter part of the thesis content writing process, so that the familiarisation with the different aspects of the topic was already done, and the evaluation of the given information was possible up to a better extent than in the earlier parts of the writing process. Thirdly, instead of a single interview, three were conducted: two of them partly overlapping on the field of AR and technology. These actions were found sufficient to ensure the reliability of the data acquired through the interviews.

The ethical sustainability of data acquisition was promoted by informing the interviewees beforehand about the objective of the interview: to gain data for the thesis. In the recorded interviews, a permission to record the interview was asked. To avoid misunderstanding and to further ensure the credibility of the data acquired, the interviewees were presented a summary of the interviews so that they could correct any possible misconceptions or questionable interpretations made. Integrity, meticulousness, and accuracy were core values throughout the research. They were apparent e.g. in choosing the resources and in in-

terpreting them. Data acquired from commercial, private parties was carefully chosen to avoid selecting partial data, whose primary purpose is to promote the party's own interests. Thus, it can be stated that the responsible conduct of research of the Finnish Advisory Board on Research Integrity was followed. This is vital not only for the sake of the integrity of the research made but also because the Karelia University of Applied Sciences has committed to these guidelines for good scientific practice (Thesis Committee 2014, 35). (Finnish Advisory Board on Research Integrity 2012, 30–31.)

How the good scientific practice was used in the making of this thesis can be further particularised through the possible ethical issues addressed already in the thesis plan. In the interviews, to avoid biased questions, most of the questions were formatted neutral: e.g. "Has AR become popular? Why/why not?" instead of "Why has the AR not broke to the public yet?" However, to keep the conversation flowing and to better encourage the interviewees to express their opinions, in carefully selected issues, the questions had a hidden attitude: "Why AR? What makes AR a good solution for organisations' marketing/virtual existence needs?" – the hidden attitude being that AR indeed is a good solution for these needs. (Instead of e.g. "What kind of solution AR is for these needs?")

In keeping with ethical sustainability, these hidden attitudes were not those of the author but rather those of the interviewees themselves - thus not pushed upon them. Exposing these attitudes so that it could be decided whether they exist in the interviewee or not, followed logical chains of deduction: if the company is based on using AR for commercial uses, the company and its co-founder must find it a good solution for commercial uses. Therefore, to avoid unnecessary circumlocution and possible frustration of the interviewee, and to spend the limited time more effectively, it was deemed justified to express some obvious attitudes in selected questions.

Issues regarding plagiarism - intended or unintended - were evaded by simple actions that the author had used successfully in prior cases during her studies as well. These actions are e.g. taking notes and writing down the core idea in-

stead of direct quotations, using resource material that is written in another language, and using multiple resources to comprise a full picture.

Although using English as the interview language was considered due to the fact that the thesis is written in English, ultimately all three interviews were conducted in Finnish. All the interviewees natively spoke Finnish, which meant that Finnish was also the language they could most naturally express themselves in. Although at least two of the interviews could have been conducted in English successfully in the sense that the interviewees surely could have translated all they wanted to say to English, the doubt whether the additional step of translating the thought would lead to them censoring some less finalised ideas ultimately lead to the decision of using Finnish. This decision also helped in making the atmosphere more natural and discussion-like.

As for the question why this thesis is written in English in the first place, instead of increasing the amount quality scientific publications in a minor language (Finnish), the justifications made in the thesis plan stand. Although as Mäkinen (2006, 121–122) implies, it is important to publish research results and analyses in Finnish so that the language could evolve with the science and would not lose its expressiveness, I found using English in the thesis justified. This is mainly justified with the internationality and rapid changes of the industries involved. Both tourism and ICT are inherently international industries, as they in their own ways aim to better communicate people around the world with each other. The development of AR technology is rapid, with new aspects rising all the time. As most of the resource materials are in English, it is simpler to write the thesis in English as well: with the scarcity of Finnish research on topic, if written in Finnish, a large part of the thesis would need to be justifications for certain translations plus their disambiguations. Writing the thesis in English potentially serves in reaching the author's future professional objectives as well.

7.2 Methods and methodology

The main source of knowledge used for this thesis is the literature and prior research made in the fields of augmented reality, tourist attractions, cultural tour-

ism, and marketing. These are brought together with the point of view of historical heritage that requires certain sensitivity. When innovating solutions, realistic limits to the use of AR technology are set with the help of expert interviews.

The research made specifically about the use of AR in enhancing historical attractions is scarce, if not non-existent. Meanwhile credible, professional and even ground-breaking research has been made for decades in the fields relating closely to the set thesis topic. For these reasons, the knowledge base for this thesis comes mainly from the quality research inherently adaptable to the topic. Three expert interviews were conducted to better ensure the plausibility of the solution innovated and the understanding of the historical attraction field today. These interviews complement the framework set for the thesis.

Reflecting to the methods of acquiring knowledge, as presented by Tuomi (2007, 17), the use of expert-based method will be applied for this thesis. As Tuomi particularises, the research finds data interesting in problem-solving, thus the methods of acquiring knowledge can be seen primarily as methods of problem-solving. While using expert-based or authoritative method, the justifications for one's opinions and theories are found in resources they find respectable. The expert-based method has two forms whose defining features are emphasised on the justifications of using expert-based method. The first form is to use the method out of necessity: due to the rapid cumulation of knowledge and the technological changes, it is not possible to gain all the knowledge personally. The second form is to appeal to authorities without ensuring the validity of the data provided by them. (Tuomi 2007,17.) The latter rises ethical questions addressed in subchapter 5.1.

In this thesis, the use of expert-based method is rationalised partly with the first form, referring to the rapid cumulation and development of especially the AR technology. Other affecting factors are found in the thesis instructions by the Thesis committee of Karelia University of Applied Sciences (2014). In these instructions it is stated that the thesis "-- has to be built upon a solid knowledge base". The thesis is referred as a study unit, suggesting it should involve learning processes. The amount of self-study is mentioned as a challenge, further

emphasising learning and deep immersion to prior research. (Thesis committee 2014.) To summarise, it was deemed that to build a credible knowledge base and complete the objectives set for learning, justifying the solutions and opinions with authorities is acceptable and necessary. It is also reasonable to assume this is typical in the publishing form used (thesis), as the considerate yet ample use of resources in justifying claims made is encouraged throughout the studies.

Scientific methods include multiple approaches on data acquisition. Some common features found in scientific methods are advancement (the idea of increasing one's knowledge base), self-repairability (the errors will be fixed sooner or later within the scientific community), publicity (the reasoning is available for everyone), and reasonability (the information is sufficiently reasoned). (Tuomi 2007, 17–18.) Using these features in defining scientific method, it can also be argued that the scientific method is used in this thesis, as it

1) aims to increase knowledge on applicability of AR in specific subcategory of cultural tourism,
2) is open for further research, which will point out the possible errors in deduction,
3) will be public and accessible for all readers, who can each on their own part read and evaluate the reasoning behind the solutions offered in thesis,
4) includes theory-based justifications for the solution offered to solve the research problem.

Although the methods used are quite traditional, philosophically speaking some features of post-modern criticism are apparent in the research. Instead of presenting the research results as absolute truths, they are seen at their best as justified opinions of the researcher. Method- and methodology-wise, the choices are made individually with each case, i.e. adjusting to the needs rather than following a strict restriction to certain methods. (Tuomi 2007, 86–87.)

The thesis (research) aims to create deductions (data analysis) within framework provided in the resource material (theory). In this sense, a theory-based analysis is used. However, when creating solutions for the use of AR in enhancing historical attractions, it is necessary to have some distance to existing solutions and theories to avoid repeating the same ideas instead of innovating new ones. In this sense, classifying the analysis as more of a theory-driven analysis seems more reasonable. In the case of theory-driven analysis the analysis units merge from the material (data), in this thesis from the innovations. These are processed up until certain point, where the framework provided by resource material (theory) is brought back to the analysis – e.g. comparison of the innovations to earlier AR solutions and their wider type categories. Instead of testing the theory, the emphasis is on amplifying the ways of thinking in collaboration with the theory. (Tuomi 2007, 121–122.)

A qualitative research in the field of human-sciences, the thesis relies up to an extent to an expert-based method of data collection. Justifying the arguments with a respected source seems to be encouraged in the UAS level studies, which is understandable from the point of view of learning (instead of merely recording one's existing knowledge and feelings). The thesis research also meets features describing scientific method. A philosophical aspect to this research is in many ways post-modern one, as it allows flexible use of different methods. When presented as antitheses, the research is rather theory- than analysis-driven. In reference to the OECD classifications regarding the meaning of the research, the research can be classified as applied research, as it has aims to a concrete application, is based on results of basic research and intents to create a change in a problem situation (Tuomi 2007, 120).

8 Discussion

The museums nowadays face multiple challenges. The budget left for marketing and development is minimal, the competition for people's leisure time tightens, and even with the visitor satisfaction of nearly 100%, the visitor amounts have

seized to grow. However, the museum sector has awakened and works to broaden its competence scale with adding marketing and business elements to its operations. At the same time, operators specialising in augmented reality look for stories to share through the new medium. The first steps to combine the two sectors have been taken, but more understanding of what can be done with the new medium and how the stories can be ethically portrayed is still needed.

Augmented reality offers an intriguing way of story-telling. It still holds novelty value, as it has not yet broken to the masses. The wearable AR technology still has to surpass some obstacles before it can become common in consumer use. Placing credible-looking virtual elements in the real world is a challenge of its own. However, the visual outlook pursued greatly affects how challenging it is to achieve the objectives set for the visuals. Enjoying an AR experience still typically requires scanning a picture and the watching the content. Nonetheless, interactivity with the content is due to become more common. With solutions such as GPS and beacons scanning a picture may be completely skipped.

During the research, the expert interviews not only provided interesting information but also helped in discovering and limiting the relevant viewpoints. The resource material often branched into several directions, offering alluring leads some of which were more relevant to the thesis topic than others. Arguably the research part of this thesis could be broadened into an even broader entity, but keeping in mind the research task and the purpose of this thesis, it is quite sufficient as it is.

As for the process of creating the interview questions, it produced quite well-functioning frames. However, the order of the questions probably could have been more logical, as I had possibly put too much emphasis on the estimated difficulty level of the question and not enough emphasis on how the question links with the previous one. This caused one or two times some confusion on whether we were still continuing discussion about the previous topic or not. However, for most parts the questions followed each other logically, and apart from one or two exceptions, the difficulty levels seemed to have been accurately estimated. Proving that another question order would have definitively been bet-

ter appears to be a formidable challenge, as it is impossible to redo the interviews for the first time with the same persons. As the answers satisfy the needs of this thesis, such discussion hardly seems indispensable.

Ultimately, the thesis process lasted longer than planned. During the scheduling I had not acknowledged enough the challenge of fitting schedules of the interviewees together with my schedule. I had reserved two weeks for conducting and analysing the interviews, but ultimately two out of three interviews were held a week after the deadline I had had for the interview section of the thesis. I failed to sufficiently take in account the coincidental events that affected the schedules of the interviewees, such as the start-up event Slush and the hurry of UAS in the end of the year. Nonetheless, the thesis process was also postponed due to its expansion: the original plan of the thesis structure and the estimation of the length of chapters and number of subchapters were more constricted than what came to actualise. The application planned also extended from the intended, as instead of one mode it came to have two. Relating to this, the number of target audience personas also became two instead of one.

As suggested above, the interviews as well as other reference material also brought up aspects that I had not considered while planning the thesis. Some of these aspects were too crucial to ignore. Discussing these aspects grew the length of the thesis and therefore the thesis process. However, I feel they complete the thesis, and their added value to the thesis justified the deflection from the original plan.

Should something be done differently, I would prepare for the interviews differently. As mentioned in subchapter 2.2, the question order could have been better optimised. I would also rehearse how I would present the questions. In one of the interviews I could have posed the questions with less explanation - going through the exact lines beforehand could have eliminated this problem. Nonetheless, I was content with my performance in two of the of the interviews, and as covered in subchapter 2.2, the results of the interviews were more than satisfactory.

The thesis succeeded in contemplating various aspects of developing an application for a historical attraction. It takes into consideration the distinctive nature of historical attractions that requires a respectful approach and a meaningful message for more entertaining solutions as well. The thesis underlines some of the issues that need to be considered when developing an application, such as what kind of technological and technical solutions need to be made, what kind of competences are needed to execute the ideas, and what needs to be regarded about the distribution and pricing. Bringing forward marketing point of view, it comments on the importance of having target audience and presents one tool for mapping the needs and desires of target audience.

The importance of target audience was apparent in the application developing process as well. The full picture of the application only begun to compose after I had created the first persona of target audience. Before that there were only scattered ideas of features that would be fun in an application. All the ideas did not lead anywhere before the persona tied the useful ones together, and the Salpa application begun to come together.

The thesis does not distinctively comment on whether digital solutions such as the one innovated are financially cost-effective or not. This aspect could be further particularised to evaluate the feasibility of the application not only from a technological but also from an economic standpoint. To do this it would be necessary to have access to certain specific statistics, to know how much outside funding the application gets and to evaluate the actual execution process (whether to buy the application ready-made or to hire the necessary personnel). Therefore, it would be recommendable to do the research about an application actually in development. To properly evaluate which execution option is more economical, sending offer requests to several companies and finding out the exact composition of the team are needed.

Developing and executing an augmented reality application for an attraction would be a fascinating topic for practice-based thesis as well. Many intriguing subjects for further research can also be found in the thesis' research part: e.g. more particularised definition of a historical attraction, what advantages or dis-

advantages does categorising certain attractions historical have, and defining the difference between a natural scenery that is a historical attraction and other that is not. Regarding historical attractions, it would be interesting to research whether this identification can assist in managing them. The marketing of historical attractions is an intriguing topic as well. John Falk has written several books on museum visitor experience and understanding it so that the museums can attract more visitors. How this could be transferred to other historical attractions is worthy of its own research. Based on Falk's ideas, creating a marketing/visitor experience strategy or guide for a set museum would be both useful and enlightening, as it would bring the ideas presented to a concrete surrounding with its limitations and serve in developing museums.

Another interesting topic would be whether it is cost-effective or not for museums to employ digital solutions that require purchasing both the programme (or the workforce and tools needed for its creation) and possibly new devices too. As the funding decisions encourage museums to adapt digitalisation to the exhibition as well, research on the profitability of digital solutions could provide valuable points on how digitalisation can be brought to the museum exhibitions in an efficient, intelligent way, instead of creating digital solutions for their own sake. Focusing more on mobile applications, research concerning the pros and cons of using 3D graphics in mobile games, an evaluation of different AR sequence launching methods, and varying forms and evolution of human-machine interaction could offer food for thought for developers and designers.

An update for the research with the same exact topic as the thesis has can be done probably in 3–4 years, as the technology evolves rapidly and grows rather in leaps than in steady growth. A single successful solution can change the whole AR landscape once and for all, in the same way a single finding can change the way we perceive history once and for all. Therefore, both these subject endlessly provide us with subjects for research.

As for the research task of investigating the current use of augmented reality in historical attractions and creating a feasible application design, the thesis has completed its task. Based on the expert interviews and resources referred, the

application should be plausible to execute even as of now. The thesis also presents technical and technological aspects that can assist historical attractions when considering using AR (or other digital solutions as well) and points about the special nature of historical attractions that need to be considered when introducing new elements and competences to the sector.

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Summary of the Interview with Iiris Heino, Carelicum

The interview was conducted on 27th of November 2017 in a meeting room located in the Joensuu tourism centre Carelicum. The interview was recorded and transcribed. The total runtime of the recording was 51 minutes 52 seconds.

Iiris Heino began her post as a curator responsible for exhibitions in 2003 as a substitute for the permanent curator. In 2005 her post was made permanent. During her service on the city of Joensuu she has expanded her competence by working on other tasks for set periods, most notably as a curator in charge of regional work. For the past five years she has been working in her regular post. Regarding her academic background, she has a degree of Master of Arts and she has studied general history as her main subject. Additionally, she has studied Finnish history, museology, ethnology, social science, and Estonian language and culture, amongst others. Although she currently works in Joensuu, eastern Finland, she has studied in Jyväskylä (Central Finland) and Helsinki (southern Finland/the capital).

Back when Heino graduated in 1996, there was no public discussion about technologies such as augmented reality. However, around that time multimedia was a big thing, and she has completed a multimedia screenwriting course in the Theatre Academy Helsinki. This made the electronic world more familiar to her already in the latter part of 1990s. Heino adds that due to her work she tends to follow what kind of solutions other museums have applied, in addition to which she has participated in training days organised by the Finnish Museum Association that have discussed the possibilities of augmented reality and virtual presentation of history. Despite this, Heino reckons that because AR is such a new technology, there is still much more to be learned about it. Some of the interesting themes she underlines are in which manner AR can and should be used, and whether to create a fictional story or a realistic presentation of the past as we perceive it today.

Heino elaborates that the Finnish Museum Association organises couple of training days per year, usually in the capital city Helsinki. This year training was also organised in a more northern part of the country, in the city of Kajaani. The training day organised in the Kajaani University of Applied Sciences was a gamification course, where the participants designed a small game. During the course the game, where the player needed to escape from a virtual version of the historic Kajaani prison, was presented. The prison was designed based on old blueprints of the actual prison, and the experience was completed by using the virtual reality (VR) glasses. Although the game still had some bugs in it – e.g. Heino was able to walk through a wall while testing the game – she found it quite impressive.

Currently Heino participates in a project called ENI Interactive History. The expectation for the project is to create a working application, and with the help of the project funding, to gather competence necessary for its creation by employing new personnel. Heino finds that considering which solutions are worthwhile for the cause can also be done after hiring the necessary personnel. At the time the plan is to present a virtual history of the Utra region in Joensuu in two formats. First would be a mobile application, which recognises a marker in the environment and presents the relevant information to its user: e.g. 100 years ago, there was a fish weir in this location. The second application would be used in the museum and would be more of an augmented reality one, and it would aim to immerse its user in the past so that the visitors can experience history instead of merely traditionally admiring photos and beautiful artefacts in a museum.

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The target group for storytelling as such could even be elementary school aged children. Heino ponders how the industrial region of Utra has a fascinating history, of which very little concrete evidence has survived. The region's industrial society was in a way quite closed community, and although the history is still visible in the street names and the few buildings that have survived, Heino deems it probable that most people rarely think of the region's industrial past. The small number of concrete evidence - photos, buildings, artefacts - has proven to be a challenge in developing the application. In the museum context, another challenge is to make the application attractive enough for the user, and not to get too stuck on staying too strictly in the known facts instead of letting the imagination fly.

From a financial standpoint, Heino admits having calculated that the workforce probably generates the most costs. Although the project plans are not yet very advanced, as the funding decision is not yet officially made, Heino speculates that at least a screenwriter, a programmer, and a graphic artist are needed, possibly a game designer as well. Initially more money was planned to be used in devices and programmes, but due to the financial structure of the project, these costs had to be reduced. Heino reiterates that as the mobile versions of applications can be uploaded for distribution practically free of charge, the personnel will probably be the largest single cost.

The project is a co-operation between the North Karelian museum Hilma and a couple of Russian museums with similar challenges: each have a location with lots of historical events but very little surviving evidence. One of the project's challenges is to find a common solution to the problem.

In Heino's opinion the most important feature the digitalisation has offered to the museum sector is the digitalisation of collection management, i.e. collection databases. She is especially delighted about how e.g. with the help of Finna search service, the collections are becoming more and more public. Exhibition-wise, she finds that the only limit is imagination. As an example of an interesting pilot, she mentions a virtual cloister produced for the Luostarinmäki museum area in Turku, south-western Finland. In the pilot the visitors were given a tablet computer with the pre-installed application. In the augmented reality application, characters were situated into the real environment, and the user had to solve a mystery presented. Heino evaluates that the application suits very nicely a museum-site such as Luostarinmäki, as the visitors can learn about the life in the area as they wander around it. She reckons that the project was executed with the University of Turku and possibly other parties as well, mentioning that for the Finnish museums pricey pioneering works, such as the Luostarinmäki application, are probably possible only with project funding.

In addition to the Luostarinmäki cloister and Kajaani prison games, Heino mentions a feature executed in Kuopio, eastern Finland. With VR glasses, the visitor could see how the view from the tower of Kuopio Cathedral has looked in different time periods. Heino found the application very practical and simple, and she thinks that the impression was quite different than what she would have had watching a photo of the past landscapes.

One way the North Karelian museum has brought more effect to its exhibition was when "Linnut lennossa" (Flying Birds) exhibition from Tampere visited the museum. The exhibition had a virtual 3D feature, so that the viewer could see the landscape from a bird's perspective by wearing 3D glasses. Although the feature was somewhat short and cannot exclusively be categorised as storytelling, it worked very nicely in its con-

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text. Heino underlines that as long as there are money and competence, there are possibilities as well. She emphasises that if the possibilities are not known, they can be missed, even if the money is there. In the trainings provided by the museum sector it has come apparent that whereas the museum sector has a bundle of subjects and stories, the competence to actually execute them as digital solutions is in some place different.

Heino feels that one of the challenges the modern-day museums have in customer obtaining is a minuscule marketing budget. Other challenge is the lack of competence, as the museum personnel is traditionally more academically than commercially educated. She also points out that there is a high level of competition of people's leisure time. To be victorious in this competition, more visibility would be required, as well as creating a spirit that museum is a must-go place for at least once a year. For North Karelian museum, the question of identity (the museum versus the tourist centre Carelicum) has been problematic as well. The museum has had so many conflicting policies about whether they use the name North Karelian museum or the name of the tourist centre that the public has been left confused and unsure about the actual name of the museum. For a while the word “museum” was faded from the publicity, but for two years now the museum has consistently used the name North Karelian museum Hilma. Although the name has been consistent now, every now and then Heino receives compliments for the exhibitions of the Joensuu art museum Onni, so it appears that the museum’s identity sometimes still get confused in public's mind. When complimented about the name-choices Hilma and Onni, Heino admits that initially the name Hilma came around through a joke[9].

Heino estimates that augmented reality could help in obtaining younger visitors, because a successful application could help in transmitting the experience. However, with older visitors Heino doubts it would not be necessarily an attraction, as the older visitors may not appreciate AR in the same way, and they may rather enjoy the old photos and artefacts as they are. Heino speculates that for older people AR may not feel like a part of their world. Contemplating about AR and the role customer obtaining in museum operations, she also reminds that even though they obviously wish to attract lots of visitors, the core of the museum operation is to forward the cultural heritage to all people - and that if this can be done through AR, then of course using AR is fine.

Continuing with economic standpoints, upon request she elaborates on the funding of the museum. The North Karelian museum is a state-funded museum, so the state directs money to the museum through the city of Joensuu. The museum complements its finance through project-funding. Some of the costs the museum has is rent, electricity and wages. Research is done to complement the background of exhibitions, but as Heino - part of whose profession it is to do said research - points out, often she would like to do more research than she has time for. After all the other costs, very little money is left for development, marketing, and such.

A recurring finding in visitor motivation surveys has been that especially adults tend to answer the thirst for knowledge as the reason of their visit. The museum personnel has also speculated that visiting a museum with a friend is a way of passing time. Heino also believes that the presentation of the exhibition matters as well, and that although people do come to seek knowledge, they actually want to also receive experiences,

[9] “Hilma ja Onni” or Hilma and Onni is a humorous song well-known in Finland.

Summary of the Interview with Iiris Heino, Carelicum

feel nostalgia or have something they can identify with within the exhibition. She is certain that the museum could be made more tempting and it could attract more visitors with consistent campaigns that would last for several years, instead of having small splashes of marketing whenever a new exhibition is opened.

She also mentions the possibility of branding the museum incredible, like Guggenheim has done. When discussion continues about huge international museums such as the British Museum and some museums in the United States, she cites an older wise man of the museum sector, who compared the exhibitions of some museums to mere bulges on the sides of the gift shop, café and restaurant.

Heino finds that the exhibition work has developed even during her own time as a curator. Easy electronical medias have become more common, and they have become a simple way to supplement the actual artefacts. She has also noticed that the museums nowadays pay more attention to the presentation of the artefacts, and in Finland some interior designers have already specialised in museum exhibitions. This has led to that instead of just exhibiting the artefacts on a vitrine, the museums now consider e.g. colour schemes of the room and the compatibility of the artefacts. With the development of the printing technique, recycled cartoon can be turned into pieces of furniture to help create liveliness into the presentation. She believes that digitalisation-wise there is a lot of unused potential in the current technology as well, and that this potential could be harnessed with sufficient resources and competences. She remarks that one of the advantages of new presentation methods is that they provoke curiosity in the visitor, who after being attracted to the vitrine by the curious presentation may then proceed to see the actual artefact as well.

A conflict of interest present inside the museums regard the amount of information given to the visitor. Heino has noticed that nowadays it seems as if there existed a doctrine prohibiting all text in museums. She admits that large text entities translated into three languages can be quite heavy in the middle of the exhibition, but also reminds that there are history enthusiasts and other visitors, who would like to learn more about the subject. She speculates that digitalisation could be a solution to this problem, as the visitors interested in knowing more could scan more information for themselves with a digital application. Heino brings up the curiosity that while another visitor may spend two and a half hours seeing one floor of the exhibition, other may go and see only a few artefacts, and the person who practically walked through the exhibition is as likely to have enjoyed the exhibition as the one who spent hours acquainting themselves with it.

Although Heino underlines that museums - or any other cultural organisations, including theatres, orchestras and libraries - could not survive purely under the terms of market economy, she brings up that there has been discussion inside the Finnish museum sector about introducing more commercial elements to the museum sector. At the same time, some actors inside the sector emphasise the museum’s role as an educational institution and a keeper of common cultural heritage. Heino articulates that a museum should not be run like a commercial enterprise - not unless the structure of the Finnish museum field would be entirely reconfigured - but that she is open to welcoming some commercial elements to the sector. Marketing and focusing on brand image, as well as pricing, service design, and targeted productisation are some of the features she finds useful for the museum sector too. She mentions that personally she would like to spend more time especially on developing service design - e.g. how the visitors could be received/told goodbye before and after the guided tour - and packaging - e.g. including to the tour a cup of coffee and a moment of chat with the guide in the cafeteria.

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When discussing about typical visitor behaviour during the tour, Heino agrees with that Finnish customers are often very quiet during the tour and that they even ignore guide's encouragements to ask anything. However, Heino adds that usually every tour has one person, who very fondly shares their own stories with the group. Sometimes these situations require special competence, as the tour needs to keep on going on schedule.

Heino has found the co-operation with operators outside the museum's own discipline very fruitful. Often the suitable co-operator is determined by the theme of the exhibition: e.g. the next changing exhibition will be about the children's books and youth novels, and the co-operator will be the library. The past co-operators include multiple disciplines from the University of Eastern Finland, Ursa Astronomical Association, and the Centre for Economic Development, Transport and the Environment. The challenges faced in working with other organisations have been mainly that the public officers are often very busy, especially after the cutbacks to the administration. Therefore, not everything that the different parties would have wanted to execute has been possible to execute. In this sense the library has been an ideal co-operator - since it belongs to the city of Joensuu as well, office hours etc. are compatible with those of the museum personnel. Heino expresses the importance of projects in getting in contact with the Russian colleagues and particularises that the co-operation accross the border has continued after the projects as well.

Heino expresses that the museum could collaborate more with the private companies as well. Theoretically, should a company sponsor an exhibition about its own history, it would be problematic, as most companies have a less favourable history as well, e.g. with notable cases of unemployment. Heino emphasises that they have not yet encountered this kind of problems, as their co-operation with the companies has been purchasing products or services, not sponsoring exhibitions. An example of service bought is purchasing IT competence.

When presented with an open question, Heino elaborates on how using AR in enhancing historical attractions is an interesting topic, as many buildings may not serve their original cause anymore, and as more ancient eras - such as pre-historic era - have very little artefacts and other concrete evidence left for our generations. In these cases, she thinks that AR can be the key in that a person even realises, what lays hidden in the landscape. For example, in Ilomantsi there are hills that are actually an ancient hillfort. Similar case was found in Sortavala with buckles inside the hillfort as a proof of its ancient use.

In the final change of thoughts, the thought of ability to modify the buildings re-created in AR provokes further ideas in Heino. She notes that even after researching practically all the stone castles and their structures and making one's own deductions based on the research, the decision about what the Kajaani Castle (for example) looked like is a horrible one to make. The dilemma is whether to scrutinise over the topic or whether to unwind slightly and accept the partiality of the work and openly present an interpretation that is partly a figment of imagination.

Heino finds it intriguing that even though she is not necessarily very profoundly connected to the world of digitalisation, she has already recognised that the virtual applications are surely more and more part of the future. She sees great potential in them, as long as they are properly executed. Heino emphasises that transforming everything into a virtual form is not an end in itself - there needs to be a message to be delivered, having people come to museum just to play around cannot be the objective! Heino reckons that the EU funding currently somewhat favours projects involving digitalisa-

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tion, which in its part encourages utilising digital solutions. She sees that the arrival of virtuality to the museums has created a need for new kind of competence in the museum sector: the traditional museum posts have quite strictly defined requirements about the academic education, but during the past 5–7 years Heino has begun to notice that more and more museums advertise that they are seeking a marketing expert, a shopkeeper, a public person, a person with strong IT competences, and so forth. She believes it will do good for the whole museum sector to expand the scale of competence.

Summary of the Interview with Anssi Gröhn and Seppo Nevalainen, Karelia UAS

The interview took place on 4th of December 2017 in the office of the interviewees on Wärtsilä campus of Karelia University of Applied Sciences in the city of Joensuu. The interview was recorded and transcribed and it lasted in total 50 minutes 56 seconds.

Lecturer of Game Programming in the Karelia University of Applied Sciences, Seppo Nevalainen began his studies in the University of Joensuu in 1997, graduating around the year 2001. He continued with postgraduate studies and graduated as a Licenciate of Philosophy, after which he continued for a while in the university until the opportunity to start as a part-time teacher in Karelia UAS presented itself. He has completed postgraduate studies especially in the psychology of programming, i.e. how to help people to learn programming better and faster e.g. with visualisation.

Anssi Gröhn, Lecturer of Game Programming in Karelia UAS as well, graduated with a Bachelor of Business Information Technology degree from the North Karelia University of Applied Sciences in 2002 and as a Master of Sciences from the University of Joensuu in 2007. The topic for his master's thesis was designing and executing a 3D motor. For a year he organised virtual basic studies in the University of Joensuu. Gröhn then moved to the North Karelia University of Applied Sciences, where he began to launch degree programme for game programming, and has stayed in the Karelia UAS ever since. During his studies in the university he participated in Netwoark Oasis project, which aimed to build a remote working environment to the Joensuu Science Park. However, he reckons the project was 10 years too early.

Nevalainen finds his background with augmented reality somewhat modest. Gröhn mentions working with AR within the framework of Network Oasis, where one of the objectives was to build a mixed reality environment. For his Bachelor's degree thesis, he wrote about co-operative virtual environments, i.e. applications and the solutions for co-operation over the internet. Later he has participated in a project that aims to facilitate SMEs' (Small and Medium Sized Enterprises) recruiting possibilities through virtual reality. One of the viewpoints in this project is to create an interaction with technology emphasising digital presence, which utilises augmented reality and mixed reality solutions. The objectives are pursued through mobile environments, whether it shall be smart phones, tablet computers, or wearable devices.

When discussing about the costs of developing an application, Nevalainen points out that the costs depend on the approach. Developing for Android is practically free, as the tools and publishing an application are free of charge. There is only a nominal fee for registration as an Android developer. Gröhn particularises that in order to make Google Play Store a distribution channel for the application a registration with a fee of roughly $25 US dollars is required. A fee reasonable even for a private person, Nevalainen adds. Having the sufficient know-how to create applications enables making them practically free of charge, Gröhn elaborates, but should it be necessary to hire someone to do the work for you, the cost estimate depends on the project, as it is hard to comment at what price someone is willing to do and what. Moving from Android to iOS, the costs grow, as Apple has an annual developer fee of around $100 US dollars (in comparison to Google's $25 per infinity). Apple devices are also more expensive to purchase. However, after investing to the devices, the application generators do not cost extra.

Nevalainen reminds that the costs depend on what kind of application we are talking about – is it necessary to hire a programmer, does the software need graphics or audio? Sound assets are somewhat well available online free of charge, whereas graphical assets fitting one's own needs can be harder to find without generating any costs.

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nonetheless, everything depends on the particular needs of the application: if for instance the sounds or the graphics play a key role in the application, it is necessary to have someone do them just for the application, and the costs grow significantly. Gröhn conforms that content production is possibly the largest cost, if the content cannot be created without professional help.

When viewing applications primarily through mobile games, Nevalainen reckons that the need and costs of maintenance and updates largely depend on the application type. Some games do not have much need for updates, whereas currently many games require continuous updating to keep the users playing the game. The amount of people needed for the update depends on the size of the application. Gröhn adds that in case of an operating system update for the mobile device, an extra inconvenience may be caused, if rebuilding the application to support the update is needed. Nevalainen answers to why games such as Clash of Clans need constant updates with that due to their revenue generation model, they need to get users to play the game daily and for a long time. Unless they continuously push out new updates - new units or new buildings, theme items like jack-o-lanterns on Halloween or gifts on Christmas - the users get bored and find another game to play. To make profit, it is necessary that the users open the game several times a day, and this can be achieved through adding new things to do, so that even if the player quickly purchases everything they can, they can still find something new every time they open the game. Gröhn adds that even if the game does not have microtransactions and it makes its profit e.g. through advertisements, it is still necessary to get the users to open the game and watch the advertisements. Nevalainen summarises that most mobile games are nowadays free to play and strive for continuity, although as an exception there is a minority of more story-driven games that are meant to be movie-like entities.

Both Nevalainen and Gröhn regard that the consumer willingness to pay for applications is quite low. Apart from fans of strictly defined subgenres, or fans of a strong enough brand, most mobile games need to be free to play to attract players. Gröhn brings up adventure games as an example. Although adventure games are not very popular anymore among the masses, they have their own small group of players that are willing to pay more for quality. Nevalainen mentions Final Fantasy series and EA Sports games as instances of brands that can still charge several euros for their mobile games.

As for augmented reality specific costs, the interviewees agree that apart from possible AR devices other than smartphones and tablet computers needed for testing and running the application, using AR does not generate any additional costs as the development process does not considerably differ from that of any other type of application. The interviewees contemplate about whether the prices of wearable AR and VR (virtual reality) devices are still high or not. Gröhn expresses that currently several thousands of euros are needed for buying an AR device, and there does not yet exist a single superior device for the entertainment use of the consumers as the technology is still in progress. As a comparison, the cheapest VR devices cost from a hundred to a couple of hundred euros or even less, and even the more state-of-art devices such as HTC Vive cost around 600 euros. However, Gröhn reminds that AR for devices other than HMDs is cheaper, as the only device needed is a sufficiently high-performance tablet computer with a camera and proper software.

When asked whether the AR has broken to the public or not, Gröhn and Nevalainen are unanimous that the answer is negative. Gröhn regards that one of the problems with AR is that although the existing sensors are somewhat easy to integrate to the de-

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vices, the solutions that would work notably well as a whole do not exist, so the experience is not yet constant enough. Although better solutions for the display technology are due in the near future, for now the devices' (e.g. HoloLens') field of view is very narrow, making it easy to spot the limits of a virtual object. To make virtual 3D models dropped into the real world appear realistic, analysation of e.g. sources of light and their effects on the object are needed. As for surface detection, Gröhn finds that the issues regarding it have practically already been solved, and that a virtual object can be somewhat reliably put on a location in which it also stays without wavering around. He is somewhat satisfied with the way the application work with the physical world and virtual objects. However, the development needed to solve the still existing problems takes in Gröhn's estimation at least couple of years, albeit he underlines that it is very difficult to estimate the timeframe for the progress.

Nevalainen mentions that both AR and VR have been in discussion earlier as well, but that thus far AR has failed every time for one reason or another. Gröhn reminisces that the very first augmented experiences date back to 1950s, when Sensorama launched a movie experience featuring smells. In the 1980s there was a lot of buzz around AR, even though the technology was not ready yet. Big manufacturers seemed to have decided that the time was right, and they invested in AR so heavily that it could not fail, Gröhn summarises his view. Ultimately the consumers' interest was smothered by the load of experiments made.

As applying AR to senses other than seeing is brought up, Gröhn specifies that the certain type of lasers, which can be used to project pictures on smoke, can also simulate the sense of touching up to a certain point. As the finger reaches a set point, the laser sends a short impulse to the finger, signalling that the finger is touching something. Gröhn emphasises that the simulated touch is obviously not strong enough to stop the hand in the air. As for smells and tastes, he reminds that the taste consists mostly of smells, which creates a fair amount of possibilities to simulate tastes as well. He refers to an experiment, where a sensor was placed into the edge of a drink glass. The water drunk by the participant was first coloured with the light to a certain colour, after which it would release a certain smell: this caused the participants to conceive that the water had a specific taste. He adds that it is beyond his estimation when will it be possible to create virtual objects that would feel e.g. hairy when grasped, but speculates that this is still quite a long way to the future.

To make an application recognise a place, a location, and a direction to a set physical object to project an element on it, some aspects need to be considered. Gröhn reminds that a clear picture is a relative concept for a machine. Markers work more reliably, as they are high-contrast, definite black and white pictures. As the set marker elements are found on the correct locations, the machine can easily ensure that it is viewing the correct marker. Albeit the process of creating a marker data out of a natural picture is somewhat similar process as in the case of black-and-white markers, the issue with a natural picture is whether it has enough individualising features the machine can recognise. Therefore, the picture needs to have some contrast and pattern - a mere grey plot is hard to differentiate from a wall. Even so, the recognition is always only the best guess the machine has.

Whether a physical object could serve as an object for recognition, Gröhn notes that it would need to be tested to say for sure. However, room for error is left, as it is quite difficult for the machine to deduce whether the object it is viewing is the correct one. This is due to that the machine views 2D image of the world. To form a 3D model out of its surroundings, the machine would need a sensor for scanning. Gröhn underlines that

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the best option for the recognition at the moment is to attach an external source to a physical object.

Addressing the use of internal memory, Gröhn estimates that an interaction with a fictive character using pre-set options the user can choose from should be possible to fit to a smartphone memory - as long as the interaction is not very ample. He reminds that tens of gigabytes of storage can be downloaded from a device's memory card. If the interaction is in a text format, its broadness is practically unlimited.

Nevalainen continues about the significance of the format used. The memory usage varies greatly whether the scene in a text format, executed using 2D graphics, made with 3D models, or consist of video clips. The closer the execution is to the text-format, the bigger amount of dialogue can be saved in the device's memory. If the communication uses videoclips so that the answer for the user's line is chosen from a videoclip bank, the memory usage is quite high, and the lack of memory can become an issue.

Regarding interaction with 3D character, Gröhn notifies that the memory usage is affected by the visual delivery of the character. Nevalainen points out that the scene in which the interaction takes place is another affecting factor: is the character in an empty space, or does the environment have multiple 3D objects in it? Gröhn contemplates that if the set quality for the graphics does not demand examining each button on the collar of character's shirt, it should be possible to optimise the scene so that its memory usage is not intensive with respect to the device. Therefore, such an interaction with a 3D character should be feasible using local storage as well - although, as Gröhn underlines, this must be evaluated separately for each case. Nevalainen reminds that how each mobile phone is used otherwise affects as well. If the phone memory is full of videos and pictures, it cannot fit a single larger application more. Gröhn and Nevalainen reckon that in that case it comes down to the choice of priority anyway.

Neither Gröhn nor Nevalainen have faced any illusions about augmented reality. As for the development of AR, Gröhn highlights the advancement in display technologies. Wondering whether Magic Leap turns out to be vapourware[10] or not, he mentions that Magic Leap approaches superimposing augmented and mixed reality contents in different manner. Although in a way it has been able to do this, but the device itself is still the size of a freezer. As the objective is to have a portable device, the product is still in progress. Albeit billions worth of money has been invested in the company, no demonstration of the product has yet been made. Gröhn finds it hard to estimate whether Magic Leap breaks so that it becomes a household device, and if, when. Nevalainen reckons that at least the lack of money invested will not be an obstacle.

Gröhn thinks that AR has its own uses where it works and where it does not. The question is whether AR is practical enough to substitute existing solutions. As an instance Gröhn mentions that before smartphones the same things were done using different tools, but as having the possibility to make phone calls and access internet on the same device is practical, smartphones have become very common. Should the technology evolve so that people can be projected in real-time in different places, a new way for negotiations could be offered, which could assist in growing the popularity of AR.

[10] Software/hardware that is much advertised but fails to ever come available.

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The next theme of the interview was multi-disciplinary co-operation. Nevalainen deliberates that in multi-disciplinary co-operation the worlds collide in a way: a person with a technical mindset has somewhat different way of perceiving the world than a person with a more holistic mindset. Therefore, it is necessary to find a common language to combine the two ways of perceiving the world. As for the importance of co-operation, Gröhn notes that no technology should be used only for its own sake and that all technologies need a use that comes from humans. In this way, applications that people actually use can be created. If technology is bent to do something just for the sake of doing it - e.g. taken to the museum, because we think it would be cool - the application usually fails.

Gröhn underlines that a plenty of ideas can be discussed and all of them can probably eventually be executed, but the issue usually is in which time and with how much money they can be realised. Some ideas that seem simple to build have behind them solutions that e.g. require creating a process to examine an issue to find the answer and the tools to execute the solution. To give a clear example by exaggerating, something that may be wanted to be ready for Christmas may actually need 15 years more of development. Nevalainen elaborates that some things that are easy for humans are hard for machine and vice versa. What is wanted and what can be executed in which time and with what kind of money need to be pieced together. The same goes for what the machine can do and with which investment versus what the human wants it to do.

As to what kind of appealing factors AR has psychologically, Gröhn considers that technology is technology, and although it is fine if someone is interested in it for its own sake, to have people use the technology for something, it must provide a solution that brings added value for doing something. He particularises that instead of approaching the question only through the device itself, we must first have the context in which it is applied: the application must provoke a feeling that it is just what the user wants, and the user no longer wishes to use other applications for doing the said thing. As a theoretical instance, he presents looking down to a navigator application on phone that causes neck pain versus putting on glasses with a navigator, allowing the user to observe the environment at the same time as they follow virtual arrows and instructions to reach their destination. In other words, everything starts with the user experience.

Apart from appealing through novelty, Nevalainen deliberates that AR can enrichen an experience. He ponders that if information about the destination can be reflected with AR glasses to a temple wall, or if someone visiting grave of Jim Morrison or a famous poet is shown their history and works, the experience becomes more powerful and multidimensional than it would be if the visitor would read the same information from travel guide prior to the visit. Gröhn compares the AR situation to the 3D movies nowadays: when the 3D movies premiered, the effect was used somewhat incorrectly, and the illusion of 3D was easily broken. If used correctly, 3D is quite indistinguishable and creates a distinct perspective. In the same way, augmented reality has uses where it works very well, but it should not necessary be hyped all around.

Going back to discussing wearable augmented reality devices, Gröhn reflects that purchasing devices for a larger company or organisation is probably simpler, as they can invest more on the devices. The devices probably serve their cause better when given to the visitors to use in a delimited situation. He predicts that this may be the case for a while longer too, as in this way a certain type of user experience can be ensured. By borrowing the tested, working devices to the visitors the problems such as

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whether the application works on visitors' smartphones or whether they have a working internet connection can be avoided.

At the moment, the AR glasses are still quite heavy, and the idea of working for 8 hours wearing the glasses is not necessarily very tempting. Neither Gröhn nor Nevalainen has tried to wear the glasses for 2–3 hours, but Gröhn's best guess is that the weight of the glasses begins to bother the user if used for such a long time. Gröhn predicts that when the technology and subsequently the devices become smaller and lighter, using the glasses for longer times becomes easier. He sees a cordless display technology that could be integrated into regular eye glasses as a possibly as well. In that case, the weight of the device would not matter so much as it could be kept e.g. on a table or backpack.

Gröhn would recommend insuring the devices meant for public use, because they most probably will break at some point. Commenting the durability of the current AR devices, he reckons he would not try whether HoloLens breaks when thrown to the wall, but e.g. a company called Osterhold Design Group manufactures more durable mixed reality glasses for industrial use. These glasses are roughly the size of sunglasses, and although their field of view is not too broad, they can endure objects weighing up to several kilograms dropping on them without damage. As Gröhn points out, the visual aspects versus the durability is apparent in other modern technologies as well. E.g. most flagship smartphones nowadays are practically made of glass, and if they fall from the height of one metre, the screen breaks in one way or another and needs to be changed - and yet these products are bought in large numbers.

When presented with an open question, Gröhn brings up ways of interaction. Using a keyboard while wearing VR glasses is quite challenging. Sensors worn in wrists to measure impulses and to deduce what is being written when touch typing are currently under development. Similar technology, where objects connected with a string could read what the person is typing without the need to use touch typing, is being planned. Another way of interacting, the gesture recognition is already used in HoloLens. When using gesture recognition, objects can be grabbed and moved around to provoke reactions. Gröhn predicts that these kinds of solutions of interacting with virtual objects that do not require external device will advance.

Summary of the Interview with Emmi Jouslehto, Arilyn

The interview was held on 7th of December 2017 with the CEO and co-founder of Arilyn, Emmi Jouslehto. The interview was conducted on phone. To minimise the chance of error due to an inadequate recollection, the answers were typed to a text document in brief during the interview, and a more coherent summary of the interview was written immediately after the phone interview. The interview lasted 39 minutes.

Although Emmi Jouslehto graduated from the University of Oulu as a planning geographer, already during her studies she orientated to geoinformatics. In 2000 she started working in a small software company, who worked on an online map service for municipalities - back then Google Maps did not exist yet. After a couple of years, the company was purchased by a larger one called Suomalainen Insinööritoimisto Oy (which later became Sito Oy). Jouslehto continued her career in the new company and worked in total 10 years mainly in assignments regarding geographic data and information. She complemented these tasks with e.g. environmental consultation.

Her next employer was CGI, with whom she worked couple of years as a salesperson of the department of geographic data and information. Jouslehto then continued as the leader of a consulting team and as the leader of a technical production team, until she began thinking about starting a company of her own. With her associates she found a start-up company called Arilyn in 2013. In 2014 the company employed the entrepreneurs full-time.

Initially augmented reality (AR) was not a part of the entity the founders of the company had in mind. The plan was to create a social media map service. An idea of using holograms lead to the establishers finding out and getting excited about AR, and Arilyn's business idea changed entirely. During the winter of 2013–2014 other features were deemed tools and AR became company's central point.

Some of the tools the company utilises are Location Intelligence (LI) and interactive media. As location is an essential part of AR, geospatial data and information goes well with AR. With the help of geodata, it can be determined which kind of experiences the user receives in which location. The content received by the user can be very different depending on the location of the advertisement. This enables execution of very local features as well as execution of treasure hunt type experiences. As for interactive media, the interaction is becoming more and more essential part of AR. The Arilyn application already allows the user to share their pictures to selected channels with the desired hashtag. AR experiences can also be complemented with links to whichever destination desired. With the interactive buttons the user can affect in which way the experience evolves.

Apart from AR, an intrinsic part of Arilyn's brand image is its source of inspiration that lays in the spirit of Nordic nature. This means that even though the company is very much a technical one, it wishes to cherish certain mysticism, and its base of operation is in supporting a new kind of storytelling with the set tools. Instead of using augmented reality as a mere marketing gadget, Arilyn aims to lift AR to the status of a real media, where interesting content allures the user to come back to the experience again and again. To achieve this, the content producers are offered good tools for virtual storytelling. In a sense Arilyn wants to be a mystic spirit of nature that changes whatever surfaces it touches into an interesting media surface.

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From technical perspective, the Arilyn application is quite simple. It has limited amount of features, which makes its maintenance easier. Although it is possible that system and device updates require updates for the application as well, the objective for Arilyn is to rather be leading the evolution of AR through updates for their backup system Arilyn Manager than to be catching up to other parties' updates. Updates for the background system require updates for the end-users' Arilyn application as well.

The application's visual recognition is entirely an image recognition, meaning that it does not require hidden codes such as the logo of Arilyn to launch the experience. Jouslehto acknowledges that practically any photo works well in image recognition, albeit certain graphical liveliness is necessary. As an example, Jouslehto mentions the Japanese flag, recognition of which is easy for human eyes but hard for machine vision. This is because the machine vision does not recognise colours but rather the borders of light and dark. The flag of Japan only has one such border, which makes the possibility of error higher.

Jouslehto emphasises, that the pretension is that the client (a company) buys the licence to Arilyn's background software (Arilyn Manager) and creates itself the campaigns and experiences for the consumers. The client is not necessarily the brand familiar to the consumers but often a marketing agency. Sometimes Arilyn needs to help the clients with the initial use of the Arilyn Manager, and they may even assist in creating the first campaign. The main way how Arilyn interacts with the end-user is through the application. Although in the light of its user numbers the application has not received much feedback, Jouslehto notes that the possible bug reports reach the company quickly. Most of the feedback can be found in the comments of an article or a share in social media, and the feedback has been mainly positive. Jouslehto underlines the high channel awareness of their clients, i.e. the clients' awareness on what kind of material they can show, when and where.

When asked about virtual existence, Jouslehto acknowledges that it is somewhat a new concept for many enterprises. Nonetheless, there has been notable increase in the organisations' interest towards virtual existence. Sometimes the clients have already seen some examples of how virtual existence could be executed, which sometimes leads to somewhat far-fetched ideas. When put together with the restrictions of time and budget, the actual executable idea is realised. Often Arilyn has to assist the clients to make themselves clearer, how these clients want to present their story in the new media, taking into account their own project and their own target group.

Jouslehto estimates that the foreign clients tend to begin creating their own experience independently more easily than the domestic clients. This is due to that in the relatively small Finnish business life circle it is easier to bump into each other and change ideas directly with the clients. In total, Arilyn has clients in more than 10 countries. Some of Arilyn's foreign clients have found the company in a trade fair, whereas other have read about the company in an article and decided to contact them.

For one reason or another, Jouslehto has noticed that the museums and cultural organisations have been willing to apply AR sooner than the private companies. Cultural organisations began to show interest in AR already in 2016, whereas private companies have begun to contact Arilyn more in 2017. Otherwise there is not that much difference between the public and private sectors, as both have very similar cases from Arilyn's point of view.

Summary of the Interview with Emmi Jouslehto, Arilyn

From time perspective, the processes behind the campaigns vary significantly. The quickest campaign-creating process (from idea to publish) have lasted around 2 weeks, whereas longer campaigns may require several months even before the actual execution begins. As using Arilyn system is straightforward, if the client has their own materials ready, new campaigns are easy and quick to pilot on the Arilyn platform. Arilyn wishes to encourage companies to try out this kind of new pilots.

Arilyn operates in the fields of marketing, media and entertainment, so when asked about why AR is advantageous solution, aspects typical to these fields spring into Jouslehto's mind. One of the most important advantages Jouslehto mentions is customer engagement – i.e. that the customer becomes attached to the brand, product, or experience. What makes the customer to return is something interesting, informative, or a new aspect they receive from the experience. The added value of AR is its strong memorability.

As for whether using AR is cost-effective or not, Jouslehto reminds that we would first need to determine, which other action/cost would produce the same result. Campaigns are observed and monitored e.g. by measuring how many times the campaign has been viewed, how many unique users have visited it, and on which dates (and how many times) the application has been used. In the case of Arilyn, Jouslehto mentions that they often bring up how their platform allows the client to use a continuously developing platform with a reasonable monthly payment. Thus, the client only pays for the use of the service, instead of paying for the development. The platform also allows easy monitoring and modification of the campaigns, and it can be used long-term.

Augmented reality has been used in institutes for over a decade. Commercially it has been used for a long time as well. Albeit different features and possibilities of AR are in Jouslehto's opinion utilised already, she thinks that we are on the edge of a breakthrough as large companies Apple and Google have begun to invest in AR. Earlier this year (2017) Apple launched its own AR expansion for application developers (called ARKit), and Google is already developing its equivalent to its own developers. Investments such as these have affected Arilyn's clients as well, and they have become aware of that they too should invest in AR. The use of the technology itself is still in somewhat early stage, as most of the experiences still follow the same pattern: scan, see the experience, and maybe have a modest interaction within the experience. Larger experiences, such as an AR entity as a complementary track to a movie, are yet to come, although Arilyn has already begun to experiment creating longer stories in AR (such as the winter adventure of Stockmann or the Tamagotchi-like virtual cat found in milk cartoons that can be taught tricks). Jouslehto does not remember encountering any illusions regarding AR, although sometimes the clients' ideas can be quite extravagant.

Jouslehto thinks that augmented reality has not yet broke to a public but is about to do so. A crucial point that determines, whether AR breaks or not, is the contents produced. The added value of astonishment cannot keep up the public's interest for long, so target group specific content plays a key role in AR's future. Producing new experiences works especially well, when the brand already has a loyal fan group behind it: e.g. the fans of a sports team. These kind of fan groups clearly enjoy receiving more material for their admiration.

Summary of the Interview with Emmi Jouslehto, Arilyn

According to Jouslehto, the reason for enterprises' different levels of interest and varying attitudes lays in finding their own viewpoint. Finding the viewpoint determines whether the enterprise still needs time to consider about using AR or whether it is ready to get started.

Jouslehto is certain, that augmented reality is the future. She envisions that AR is the next big mass media already within couple of years. She reminds that back in 1993 there were not much to surf in the internet, but already 2–3 years later practically every kiosk had their own webpage. The same repeated with the mobile optimised services. She is convinced that the same phenomenon is about to happen and that this time it will be the transition to the world of augmented reality. This is facilitated by that the people are becoming more and more familiar with that AR can be found from practically anywhere and with that it offers new, interesting things to be seen. She predicts that in near future all the best stories will be augmented reality ones.

Jouslehto is excited about applying AR to senses other than seeing as well. She underlines that sounds are an essential part of an experience, claiming that sounds account for at least half of the experience. As an example of how the sounds create an atmosphere she poses two scenarios: one, where Santa Claus appears in front of the user and begins to talk mutely (in text format), and other, where Santa Claus speaks out loud, jingle bells tinkle in the background, and Christmas carols are played. She points out that the sounds are also somewhat easy to add to the experience, as they can be played with the same device as the visuals (e.g. a mobile phone). Smell and other senses are important for the experience, but rather challenging to add. Adding these features would require a carefully planned tour or destination, where the necessary appliances could be located in the area.

Jouslehto emphasises the importance of the next couple of years in the development and generalisation of AR. In addition to ready-build AR experiences, both Apple and Google are planning new publications that would allow end-users to place AR features around themselves. She brings up the effect AR can have on people. It already has moved people on both physical and emotional level. After all, Pokémon Go did make over 70 million people run around chasing imaginary monsters – such mass movements are rare if not non-existent during peace time!

Interview Questions

Interview questions have been translated from Finnish. These are the initial questions, and some of them may have been modified or left out of the interview. The colour code is a reference to the estimations of the difficulty experienced by the interviewee(s)/amount of pondering needed to answer, green being easy (basic) and red being difficult (lots of reflection). Each interview ended with an open question about whether the interviewee(s) would like to add something.

INTERVIEW 1. Curator Iiris Heino / North Karelian museum Hilma

1. Please elaborate on Your background?
2. What kind of relationship do you have with AR?
3. The North Karelian museum has applied funding for a project about cultural attractions and AR. What kind of expectations have been set for AR through the project?
4. What kind of challenges the use of AR has in the museum context?
5. How cost-effective do you estimate using AR is?
6. How is digitalisation present in the museum sector?
7. What kind of challenges do museums nowadays have? What kind of challenges can be met with AR?
8. What are the objectives of a museum? (Profits, educational goals, keeping the cultural heritage…)
9. Why do people visit museums?
10. How have the museums developed?
11. How are the museums in future?
12. Should museums be run like a private company?
13. E.g. to use AR in the museums one must collaborate with parties from other sectors. What is this collaboration like?

INTERVIEW 2. Game Programming Lecturers Anssi Gröhn and Seppo Nevalainen / Karelia UAS

1. Please elaborate on Your professional history?
2. What kind of a relationship do you have with AR?
3. What kind of costs do applications in general have? How much of these costs are generated during the development/programming?
4. What kind of maintenance do applications require?
5. Do AR applications generate more costs/require more maintenance than applications in general?
6. Is AR applicable for senses other than seeing? What kind of technology would it require? (REFERENCE HERE)
7. What kind of features does AR have, and how well are these applied currently?
8. How can the application recognise a set object to launch AR features? What kind of objects these can be (e.g. milk carton)? When speaking of larger areas and buildings, is a location recognition necessary, e.g. with GPS or Bluetooth beacons?
9. Should the intended place of use be such, that devices have hard time finding connection there – e.g. a bunker – can the effects of connection problems in user experience be avoided? Are there challenges that can prevent the use of offline features in such a case? (Maybe just provide a WiFi connection?)

Interview Questions

10. What kind of challenges are related to programming an application? (A challenge above others?)
11. Are there any common misconceptions about AR? What kind?
12. Has AR made its breakthrough to public? Why or why not?
13. How has AR developed?
14. What kind of trends can be predicted for AR? What kind of development can be expected?
15. Is AR staying, or will it fade away? (Possible become a crude version for something far better to come: fax vs email)

INTERVIEW 3. CEO & Co-Founder Emmi Jouslehto / Arilyn

1. Please elaborate on Your professional history?
2. What kind of a relationship do you have with AR?
3. Other terms mentioned on Your webpage include ”Location Intelligence” and ”Interactive Media”. What do these mean in Your company’s context?
4. Which aspects are emphasised in Arilyn’s brand image?
5. On Your webpage it is stated that Arilyn is inspired by the spirit of Nordic nature. How is this apparent in Arilyn?
6. What kind of maintenance does the Arilyn application require? (Update frequency)
7. How the visual recognition work (used for launching the experiences)? How easy/difficult is it to make the recognition work? (Reliability of the recognition)
8. Your campaigns often involve at least three different parties (Arilyn, B2B client, consumers). What is the co-operation like?
9. You offer solutions for companies/organisations to enhance/create their virtual existence. What kind of challenges do the organisations usually have with virtual existence?
10. What kind of processes have been time-wise? (Which parties are involved, time-wise short/long…)
11. Why AR? What makes AR a good solution for organisations’ marketing/virtual existence needs?
12. Is it cost-effective to use AR for marketing/virtual existence? How can this be measured?
13. How well are the different features and possibilities of AR utilised nowadays?
14. How and how fast has the use of AR developed? / What does the future of the use of AR look like?
15. Have You faced any misconceptions about AR?
16. Has AR broke to the public? Why/why not?
17. What kind of attitude/interest do companies have towards using AR? Has it changed?
18. Is AR the future? What kind of obstacles are in the way of AR becoming more common?
19. Can AR be adapted to other senses as well? How?

Simplified Comparison of XR Concepts

In the following tables some of the XR (Extended reality) concepts are compared to help the reader better understand the core differences between the concepts. Note that the descriptions are rough, and the table is rather a tool for differentiation than a source of precise definition. For more detailed definitions, see Glossary and subchapter 3.3.1.

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	Reality	**AR / Augmented reality**	**AV / Augmented virtuality**	**VR / Virtual reality**
Environment	Real world	Real world	Virtual world	Virtual world
Augmenting objects	Real-world	Virtual	Real-world	Virtual
Integration	Physical objects in physical space	Virtual objects appear to exist in physical space	Video from physical space/3D models of physical objects in virtual world	Virtual objects in virtual world
Notable consumer applications	-	Mobile game “Pokémon GO”	-	VR glasses “Oculus Rift”

	XR / Extended reality	**MR / Mixed reality**
Relation to reality-virtuality continuum	Covers all the concepts involved	Covers the concepts between the two extremes (complete real vs. complete virtual)
Examples of concepts covered	AR, AV, VR, MR	AR, AV

Some of the combining features for all concepts presented:

- **Immersive technology**: The line between virtual and physical world is faded: physical objects may appear to be present in a virtual world, or vice versa.
- **Development of human-computer interaction (HCI)**: Advanced HCI supports the immersion.
- **Consumer unfamiliarity**: Albeit many of the XR-aided applications have been present and in development in fields such as healthcare and military technologies, the commercial applications have only recently begun to gain public’s attention.

State Funding of Museums Based on Man-Years 2012–2013

Year	Tentative Calculation Based on a Man-Year Decision (€)
2013	36 679 325
2014	36 753 295
2015	35 685 684
2016	34 146 834
2017	32 792 933
2018	33 606 361

Based on decisions by Ministry of Education and Culture of Finland. The amounts presented in the table are tentative calculations of State funding based on man-years of museums rather than final decisions on funding. These amounts are sums of all the museums listed in the decisions given.

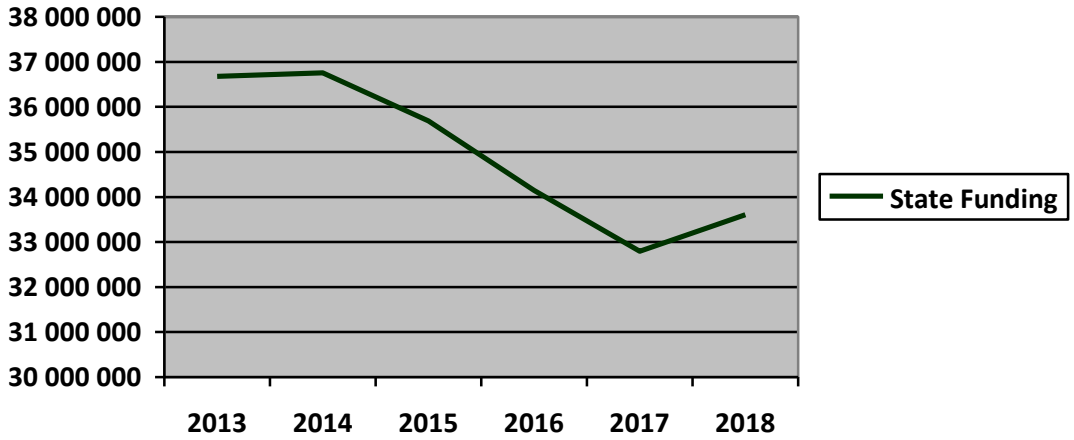

Figure 1 The development of State funding based on tentative calculations based on a man-year.

For full decisions and further info in Finnish, see http://minedu.fi/museoiden-valtionosuudet .

SWOT Analysis of Historical Attractions

Strengths	**Weaknesses**
Keepers of (common) cultural heritage Mysterious, new knowledge surfaces (development), captivating Stories that are both true and intriguing Meanings given by visitors (nostalgia) Advanced display of artefacts Public's positive perception (museums)	Passive content (lack of interaction) Assumptions of the visitors' pre-existing knowledge base or understanding Multiple objectives: aims to educate as well, not only to entertain Lack of marketing or commercial competence
Opportunities	**Threats**
Growing cultural (sustainable) tourism International interest, new target groups Intrinsic motivation towards learning Projects with new interest groups Interest in trying out new medias	15-minute-span on content focus Focusing only in educational or scientific objectives Becoming unalluring to an average person Competition about consumers' leisure time

The analysis is based on resource materials, the author's observations and the interview with Iiris Heino, the Curator of North Karelian museum Hilma.