Digital Archaeology
The Embodied Visitor Experience

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Cover picture: Photograph of the author wearing HTC Vive goggles, head phones and hand controllers at the virtual reality tour ANNO 1500 at Kulturens Hus in Luleå, Sweden. Picture was taken 2017-01-27.

Abstract

Archaeology is a field which has been impacted greatly by digital technology; the new technological instruments are developing both academic research and public mediation. Digital archaeology has been available at the museum for some time, but immersive technologies are recent introductions, which offer new experiences for museum visitors. Even though digital archaeology/virtual heritage have been studied for their technological virtues, the learning opportunities presented to the museum visitor has not yet been examined from a visitor’s perspective. In this dissertation, the visitor experience is the basis of analysis for determining how we can critically assess digital exhibitions using immersive technologies. This study examines if and how critical museology can be successfully applied to immersive digital displays; a detailed analysis of two case studies using VR (high immersion) and AR (low immersion) show that digital experiences are fully capable of communicating cultural content and that these multi-sensory technologies can successfully engage users in the creation of knowledge. The extent of sensory stimuli affecting the visitor is not accounted for in current critical museology, therefore the analysis of this study suggests a number of suggestions for future designs of digital displays using immersive technologies.

Key words: digital archaeology, digital humanities, critical museology, visitor experience, multi-sensory experience, virtual reality, augmented reality
1. Introduction

Digital archaeology is a rapidly growing field which has been receiving attention from several different disciplines. The discussions range from technical possibilities for documentation of excavated data to more theoretical examinations of how for instance these advances present new ways of engaging the public. Digital archaeology includes a number of different technological aspects, everything from scanners and cameras to 3D-models of artefacts. Digitally reconstructed sites and milieus, augmented and virtual realities, web-based virtual museums, are presenting us with new perspectives and new opportunities to analyze data. Being able to virtually step inside a tomb and study it from 360 degrees instead of merely observing photos or hand-drawn sketches will alter how we perceive and interpret it (Dell ‘Unto, Leander, Ferdani, Dellepiane, Callieri, and Lindgren 2013). Naturally this engages experts from several academic fields, not only archaeologists who work hands on with the material, but also researchers from history, anthropology, and also computer programmers/graphic designers who work with the digital results further down the line (Champion 2015).

Current discussions concerning digital archaeology can be generalized into two major groups: the first focusing on the technical and factual qualities of collected data, and the second group of these discussions focus on the communicative possibilities. These two directions are intimately connected, and discussions concerning one of them affect the other. When the archaeologist digitally reconstructs a milieu it will not only allow him or her to analyze the collected data from a new perspective, it will also present new ways of displaying the interpreted results to the public. In return the reactions of the public will induce researchers to create better digitalizations that are of higher quality both technically and informatively (Carrozzino and Bergamasco 2010).

The communicative direction of digital archaeology is the focus of this study. How the technology is used for academic research will be discussed in chapter 2, but the majority of attention will be paid on how the public can experience digital archaeology, particularly immersive technologies in museums. Many things can be included in the category of public digital archaeology, everything from screens with moving pictures to online platforms where you can visit a room in ancient Pompeii by simply clicking on a link in your social media stream. The concept of virtual reality has been around for some time, but it is only recently that this media has become available to the public on a larger scale. So far, the gaming
industry has really grasped the potential of these technologies and offer exciting experiences for players; the technology also present new possibilities for learning experiences (Champion 2015), which museums have started to introduce to their visitors. As a new multi-sensory experience it is interesting to see how it might affect the way we learn. What do we actually gain from digitalizing story-telling, and what is lost when we do it?

Researchers are scrutinizing quality of facts, work transparency, and guidelines are drawn to help those venturing into these new waters. Much attention is given to data, numbers, the technology, the challenges with these and so forth; but very little notice has been given to the people who will ultimately engage with the material: the museum visitors. A lot of effort is directed by academics to organize data and present it effectively for research, there are projects involving virtual museums and digital displays which are intended for the public, but the visitor experience itself has until now not been studied in depth.

Multi-sensory experiences can be analyzed from an embodied visitor perspective, which is easily explained as a museum visitor engaging with the displayed material using several senses and not only sight. There have recently been a number of museum exhibitions which use digital immersive technologies, which present perfect opportunities to ask questions about how we can critically examine exhibitions from a visitor perspective.

1.1 **The aim of this dissertation is to:** highlight the possibilities of digital technologies, as they are known in the academic community, and then evaluate how the public actually participates in them and what changes for a visitor when digital technologies become part of the learning experience.

1.2 **My research questions are:** How can we critically assess museum experiences which use immersive digital technology? What can digital archaeology offer the embodied visitor? In what ways can digital archaeology broaden how we learn?

1.3 **Method & Delimitations**

This dissertation is based on two case studies which use immersive technologies. The case studies are of different character and the level of immersion differs as well. The first case study is the virtual reality-exhibition *Anno 1500*, which offers full immersion, and the second case study is *Augmented History: Gamla Uppsala* which is an app installed in a tablet using 3D models, GPS and gyro, allowing the visitor to experience Old Uppsala in a new way. The visitor experience is analyzed using critical museology, and particularly the embodied mind-
theory, which is appropriate due to the multi-sensory nature of the digital exhibitions. These particular exhibitions were selected for their strong connection to museums, which allow them to be defined as museum displays. Consequently a wide array of research on museum exhibitions can be applied in the aim of evaluating how the public participates in the digital creation of knowledge.

The case studies will be analyzed on the basis of personal observations and experience. Particular attention will be paid to categories examined at traditional exhibitions:

- Architecture/Location/Setting
- Space
- Design/Color/Light
- Subject/Message/Text
- Layout
- Display types
- Exhibition style
- Audience and Reception

These categories will be discussed in depth in chapters 3 and 4 but shall be introduced with the issues which they present. This method of examining an exhibition is designed to be applied to physical features, actual buildings and display cases which are problematic features when discussing digital exhibitions. A visitor of said digital exhibition is simultaneously present in a physical and virtual setting, which requires an analysis of both and also the assessment of standing criteria due to the introduction of new elements.
1.4 Definitions

*Augmented reality (AR)* – is a live direct or indirect view of a physical, real-world environment whose elements are supplemented by computer-generated sensory input such as sound, video, graphics or GPS data.

*Virtual reality (VR)* – a complex technology creating a digital environment which users feel completely immersed inside, and which they may interact with.

*Digitalization* – conversion of information and/or data into digital form

*Digital archaeology* – can be described as the visualization of archaeological resources using digital technology

*Immersion* – the physical feeling of being in a virtual space

*3D-model* – a representation of a physical body using a collection of points in 3D space, connected by various geometric entities such as triangles, lines, curved surfaces, etc. 3D models can be created by hand, algorithmically, or scanned.

*HTC Vive* – is a virtual reality headset developed by HTC and Valve Corporation. The headset is designed to utilize "room scale" technology to turn a room into 3D space via sensors, allowing the user to navigate naturally, with the ability to walk around and use motion tracked handheld controllers to manipulate objects, interact, communicate and experience immersive environments.

*CAVE* – is an immersive virtual reality environment where projectors are directed to between three and six of the walls of a room-sized cube.
2. Research History

This chapter will first discuss how digital archaeology is used for academic research and what digitalization has done for the discipline, both as something unifying different scientific fields but also new ways of mediating knowledge to the public.

Next, this chapter will continue with discussing critical museology and what the embodied mind is; how are traditional exhibitions critically examined and in what ways can these theoretical instruments be transferred to a digital exhibition? How we learn as museum visitors and the creation of knowledge is an important aspect when considering multi-sensory experiences and what digital technologies can offer the embodied visitor. These topics will be discussed with reference to the experience industry and popular culture.

These issues are finally brought together and portray the current situation of a rapidly developing academic field that is exploring possibilities and gaining new knowledge, but in the midst of excitement forgets to critically assess the digital exhibition from a visitors’ point of view.

2.1 Digital Technologies

Digital archaeology can, as mentioned earlier, mean many different things and contains grey areas. The constant developments in technology present new possibilities, and thus the field is expanding and changing which consequently presents more features. A problem with this rapid development is that by the time the public has embraced and adjusted to the new technologies, there will soon be new devices, updated programs and so forth, leaving us forever obsolete seemingly no matter how we try to keep ourselves updated. The digital technology is moving so fast ahead that it is difficult to evaluate it before it has propelled to a new place. How can we assess something that is constantly changing?

Archaeologists have in the past been, and still very much are, good at recognizing the potential of digital technology. The advanced 3D-models and VR we encounter in archaeology today can be traced back to the enthusiastic researchers some decades ago. Initiatives like the *Archaeological Computing Newsletter*, or archaeological projects on early digital platforms like Çatalhöyük in Second Life (Morgan 2009) are only a few examples, but the progress we can observe in academic research within digital archaeology today started somewhere in a time when 3D included glasses with red and blue lenses. The concept of *virtual archaeology* was coined over two decades ago (Reilly 1990) and has since then
developed into a discipline with a number of different names: ‘digital humanities’, ‘virtual heritage’, and ‘digital archaeology’. Reading an article dating some ten years back will leave the reader confused of words like *virtual* or *immersion* since definitions change together with the technology (Pujol 2004). It is truly challenging to stay updated in a discipline which is constantly accelerating. This dissertation will with all probability soon also be included among these (‘old’) works, but will nonetheless provide a portrayal of the current research situation.

Documentation has proven to gain much by digitalization, and not only digital data storage and photos, but the use of 3D and GIS integration platforms when studying relations between landscape and architecture; it is an excellent instrument for spatial analysis (Börjesson, Dell 'Unto, Huvila, Larsson and Löwenborg 2016:6). The *Swedish Pompeii Project* has been the basis for a case study on digital reconstructions and visualizations in archaeology. The study shows that experts and specialists from different backgrounds were able to interpret the reconstructions of Insula V1 with great success and moving beyond discussions normally focusing on chronology and building structures. The visual context set in a digitally reconstructed site, in this case a room in ancient Pompeii, opened discussions for analyzing new approaches to how people led their lives in the past (Dell 'UNTO, Leander, Ferdani, Dellepiane, Callieri and Lindgren 2013). What new approaches could be presented to a visitor at a museum?

As the technical possibilities have been advancing, an initiative rose from the need for factual regulation and work transparency – this resulted in The London Charter-document. It was written and agreed upon to function as a guideline for people working within the field of digital heritage. The document is an attempt to protect the scientific value of digital programs. It is a necessary guideline that deals with some of the problems that come with the new field of digital heritage. How can we guarantee the quality of the knowledge produced? What theoretical basis has been used when interpreting the archaeological data? The purpose of this document is to provide transparency of the scientific process. It is completely possible for anybody with programming skills to design and create for instance a virtual museum, digital programs, and make them accessible online; so a document establishing the academic principles protecting their work is a valuable safety.

There is a need to unite the members of this new field and organize a strategy for the future. The London Charter is one example of this, and Archaeological Information in the Digital
Society, ARKDIS, is another. ARKDIS is the collaboration between several universities in Sweden; the aim of the project is to map the implications and opportunities of the digitalization of information in the domain of archaeology and material cultural heritage, and develop both conceptual and practical methods and procedures for enhancing work in the digitalized environment. In 2016 they held a conference and the invited speakers discussed topics focusing on the technical challenges and visions facing the archaeological community. The specific topics of the talks can be found online (http://arkdis-project.blogspot.se/). The topic of story-telling was raised by Bodil Petersson (Digitally enhanced museum communication – experimental approaches in archaeological exhibitions, paper not yet published) who wants to “discern in what ways the new possibilities for experimentation affect the contents, messages and communication in archaeological exhibitions” which are very interesting questions especially in regards to this dissertation. However, ‘the visitor’ does not appear to be the object of study, but rather how the stories told will change when using digital technologies.

Digital humanities (DH), is the intersection between digital technologies and the disciplines of the humanities. It is a fairly new concept/definition/scientific field (and has recently been introduced as a subject at the Linnaeus University); it is clear that digitalization requires the collaboration between disciplines but also institutions and even nations. Virtual Museum Transnational Network is a European project with 18 partners and 120 associate members funded by the European Commission’s 7th Framework Programme. The members and partners are made up of archaeologists, historians, architects, computer scientists, and communications experts. A project called Keys to Rome, which opened in 2014, introduced a virtual exhibition taking place in four cities simultaneously demonstrating how technology is developing and makes way for alternative mediation.

Scientists from many disciplines are readily engaging in this subject; digitalization proposes future changes for a large number of research fields. Of course, there are concerns as to how digital technologies can impact and alter the way we learn. The ALICE (Adaptive Learning via Intuitive/Interactive, Collaborative and Emotional systems) project is an example of the collaboration between pedagogy and computer science. ALICE was initiated and funded by the European Commission in 2010-2012; the project was recognition of the changes in learning for generations who are brought up in an environment with modern technology (so called “digital natives”) and concepts like e-learning and technology-enhanced learning were introduced (Capuano, Mangione, Pierri and Salerno 2013). This is an extensive study
conducting an experiment based on the problems faced by e-learners, particularly Millennials, who have high expectations on technology. ALICE contributed with improved engagement using different systems and instruments, focusing on “effective and efficient learning activities” (Capuano, Mangione, Pierri, Salerno 2013:162) in other words technology-focused solutions. Even though this study is concerned with education, and improving the standards for particularly e-based learning, (which can be very useful in critically assessing learning methods) these are not translatable to an immersive experience at the museum.

An excellent study is Critical Gaming: Interactive History and Virtual Heritage by Erik Champion (2015), which is part of a series covering a wide range of disciplines impacted by technology, especially the humanities. Topics cover ‘game-based history’ and ‘game-based learning’ which are valuable discussions because of their intimate connections to the research questions of this dissertation. However, the multitude of research on digital heritage is much focused on virtual museums (Barceló 2002; Barceló, Forte and Sanders 2000; Cameron and Kenderdine 2007; Cameron 2003; Levy 1998; Rua and Alvito 2011.) which is undeniably interesting, but does not discuss immersion as part of the visitor experience in ‘real’ museums. Champion mainly discusses how gaming can be used as a way of communicating heritage, he includes studies on immersive VR experiences, but they are not based on museum exhibitions.

It can be said with confidence that digitalization has sparked a multitude of experiments and studies within the academic world; is there any field not affected by technology? We can see that archaeology and the other humanities are involved in this evolution to great extent. The rest of Chapter 2 will focus primarily on the museum exhibition and the multi-sensory experience which digital technologies offer to the visitor.

The following figures are made by Carrozzino and Bergamasco and published in their article: Beyond virtual museums: Experiencing immersive virtual reality in real museums (2010). Their study is an analysis and presentation of immersive technologies for museums; their aim is to evaluate costs, usability and quality of the sensorial experience. Their study does unfortunately not include an evaluation of the cultural content of the programs, but provide useful instruments for evaluating the level of presence obtained using different immersive devices.
In their study, Carrozzino and Bergamasco found that VR successfully can mediate cultural content by sensorial feedback and is easily understood by users more familiar with non-linguistic codes. They also found that the appeal of this technology does attract younger people who have already encountered similar media (Carrozzino and Bergamasco 2010:453).

Figure 1 (Interaction) reads non-interactive from the left moving towards device based interaction in the middle, and natural interaction to the right. Different technical devices are placed accordingly to their corresponding level of interaction e.g. mouse keyboard to the left (non-interactive), touch screen (device based interaction), and speech recognition (natural interaction). The use of wires is also mentioned, reading desktop devices on the left (non-interactive) to wired sensors, wireless sensors, and finally no sensors (natural interaction).

This is an effective way of measuring the level of interaction, a key component in the creation of knowledge (a concept which will be explored further on). This in combination with the
level of immersion is a helpful way of determining the level of ‘presence’ gained by technology.

To measure the level of immersion the numbers of senses stimulated in combination with devices are analyzed. Figure 2 (Immersion) reads non-immersive from the left to low immersion in the middle, and high immersion to the right; visual, acoustic, haptics, and motion are outlined and technical devices can be placed on the scale according to level of immersion and what senses that are used. The devices are categorized as: desktop devices, wearable devices, and external devices.

To measure the level of presence, immersion and interaction are both taken into consideration. It is a useful instrument to reach the best possible experience for the museum visitor. The quality of the sensorial experience can be measured by the level of presence, which can help exhibition designers to make sound economical decisions regarding digital technologies.

However, the study does not take into account the actual content of the digital programs, what is the visitor seeing/hearing/touching etc. but focuses entirely on the technical aspects. The sensorial experience is indeed mentioned, but there is no attention paid towards the visitor experience, which includes more than sensorial aspects. The visitor experience and the

Figure 3 – Presence. Copyright of Carrozzino and Bergamasco
creation of knowledge contain further dimensions, and ‘presence’ has crucial impact on them both, even though it does not guarantee a valuable learning experience.

2.2 The Visitor Experience

Museology is a wide subject involving both material and text; it is a science of cultural heritage, a joint venture of the old sciences like cultural history, history, ethnology, and archaeology (Smeds 2010). The study of museums include the practical aspects of working with material and text (e.g. conservation, archives etc.), as well as the theoretical dimensions, such as for example the meaning and role of museums in society. Just like digital archaeology, the field of museology brings together experts from different disciplines, all working towards a common goal – to ensure the conservation and mediation of cultural heritage. The museum is one of the most influential institutions in Western society and is hence fittingly subjected to close scrutiny, scrutiny that has also been directed at the media and other educational institutions (Hooper-Greenhill 1992). Studying and examining the museums, one of our most influential educational and cultural corner stones, is necessary to ensure the ethical and scientific rigor of such an authoritarian voice in society.

A key recognition in museology is the study by Stephanie Moser, *THE DEVIL IS IN THE DETAIL: Museum Displays and the Creation of Knowledge* (2010), where she examines the museum displays and the visitors’ experience. What visitors learn at the museum they consider to be facts, therefore it is necessary that museums justify their choices of themes, messages, exhibited artefacts, and stories etc. which the public will ultimately consider to be true (Hooper-Greenhill 2007). This is a guideline similar in purpose as the London Charter document; it is a tool for assessing the scientific rigor on the production of knowledge, only this is from the perspective of the intended audience.

The creation of knowledge does not only happen inside universities and laboratories; it also takes place in museums by visitors. However, it is not only the collections that shape the way we learn, there are other factors that contribute to the learning experience namely: architecture/location/setting, space, design/color/light, subject/message/text, layout, display types, exhibition style, audience and reception (Moser 2010:22-30). These different categories combined will influence the learning experience for visitors and shape meanings not directly communicated by the objects on display. These categories are effective instruments for understanding how an exhibition could be structured to enhance the visitor experience. The
question is whether these categories are sufficient for examining a digital exhibition using immersive technologies?

The history of museum exhibitions tells an interesting tale where the visitor has had different degrees of freedom to move, interpret, and question the objects that are on display. Since the 1800’s we can see a dominant preference for textual communication and how the exhibitions of most museums are visually dependent. The visitor is expected to observe and read her way to information. Before this, museum visitors were able to touch and hold original artefacts, but the physical sensations of touch and smell gradually became culturally rendered less civilized, making ocular appreciation the most sophisticated manner of enjoying an exhibition (Classen and Howes 2006). The norm is still very much based on visual stimuli, but there are numerous studies conducted on exhibitions where visitors are encouraged to engage with the displayed material using the other senses. It is acknowledged that interaction between material and visitor create meaning and that the visitor is not just a passive recipient of information; the visitor is part in the creation of new knowledge (Basu and MacDonald 2007; Bouquet 2000; Cameron 2003; Cerulo 2015; Classen and Howes 2006; Herle 2006; Hooper-Greenhill 1992; Strathern 2009).

It is not an overstatement to say that digital technologies present great possibilities for the creation of knowledge. The ways that immersive technologies potentially could engage visitors, is only comparable to the multi-sensory experience offered at reconstructed open-air museums with live-action roleplaying all performing in harmony. Today it is possible to experience a multi-sensory virtual reality via a computer, where once an entire village was needed to achieve the same result. Of course, it is not the same as experiencing something in reality, but we are getting very close. A result of this is discussions regarding how we should consider digital heritage as ‘real’ heritage (Cameron and Kenderdine 2007), but that is a different subject all together.

Digital archaeology and museology have travelled down their own paths of development, but are now at crossroads; we see how museums are engaging in projects involving digital technology. What are the implications of combining these? Virtual archaeology has been known for some time, museum exhibitions have included digital displays in the past, but there are no guidelines for critically assessing the use of immersive technology in museums.

Now follows some final words on popular culture before presenting the case studies. Archaeology has a special place in the heart of the public. Numerous TV-shows and movies
are inspired by the ancient past, and even archaeologists themselves have gained almost heroic reputation. There is, however, always disputes concerning the authenticity and scientific value of the interpreted academic subject when translated into mainstream popular culture. Archaeologists have difficulties with allowing alternate approaches, focusing on errors rather than the apparent interest in the field displayed by the public (Holtorf 2005:12). The experience industry has a particular affection for archaeology; consider the amount of reconstructed villages in Northern Europe welcoming people to live a day or two as a Viking or medieval festivals celebrating the past. These ambitious projects are often struggling with establishing serious cultural influence, primarily because there is a gap between academia and public mediation, where enthusiasts are left without support to interpret research results (Petersson 2003). Despite this there are successful examples where archaeological experiments have gained the stamp of approval, for example Foteviken Viking Museum has become a recognized member of Swedish archaeological open-air museums after decades open to the public (https://www.sverigesmuseer.se). Introducing a new experience which is strongly associated with popular culture, modern technology and gaming, risks the repetition of the struggles known to the people just mentioned. How come popular culture has such difficulties with establishing serious cultural value?

To sum things up: digital technologies have become an increasingly valuable asset for the humanities; for archaeology this is true to great extent, and also for heritage studies which are perhaps more reserved. There is research on e-based learning, guidelines for making proper virtual museums, and the potentials of using games for learning are explored etc. The Digital Humanities are rapidly developing and it is at times difficult to remain updated due to the constant technological advancements. Museums are simultaneously becoming interested in digital technologies; it is an alluring concept to create virtual history where visitors can experience the past in new ways. Unfortunately, there is little research on the museum visitors’ experience which includes immersive technologies; this is understandable considering how modern it is, but there is still a situation where it is necessary to ask questions about digital displays in museums. How can we critically assess digital exhibitions, can critical museology provide the necessary tools for examination, or do we need to rethink the critical assessment strategy completely?
3. Case Studies

Two digital exhibitions have been selected for this study. They are similar because they are both using digital technology to create an experience for the visitor of the exhibition, the user of the devices. The case studies are also different because even though they have incorporated digital technology, they engage the visitor in their own way. The first case study uses VR, virtual reality, where the user wears a number of different devices, together creating a multi-sensory experience where the user can see, hear, and touch – interact with the virtual surroundings. The second case study uses AR, augmented reality, where the user can see an environment where certain elements have been digitally supplemented. The second case study also contains interactive features which require the user to move in a certain way.

The experiences in the case studies will be described from a first-person narrative; it is the most appropriate and effective way to communicate the multi-sensory experiences. This narrative also allows comments and reflections based on personal observations.

3.1 Anno 1500 - Church Town of Gammelstad, Luleå

The Church Town of Gammelstad Luleå is a UNESCO World Heritage site consisting of a stone church surrounded by 424 wooden houses forming a village that in the past was only used on Sundays and at religious occasions. This kind of church village could be found throughout northern Scandinavia in the 1500’s; they were created to house worshippers from the surrounding countryside who, because of difficult travelling conditions, could not return to their homes on the same day (http://whc.unesco.org/en/list/762). To celebrate the 20-year jubilee of becoming a World Heritage, the digital exhibition Anno 1500 was installed in central Luleå at Kulturens Hus (House of Culture). The exhibition was marketed as an opportunity to travel back in time, where the users could visit the 1500’s and experience the life and people of the Church Village. Anno 1500 was located in the center of Luleå and not at the world heritage site which it displays; however in the summer of 2017 the exhibition will be available at the Church Town Gammelstad so that one can first explore the reconstructed milieu virtually before exploring the actual place.

Anno 1500 is a virtual reality tour of Gammelstad; the exhibition took no more physical space than an approximately 4x4 m\(^2\) booth, inside which all the equipment was installed, and designed to look like a “time machine” as recognized from popular culture. The booth was
managed by personnel from the world heritage site, who explained the procedures of the tour and assisted the time travelers during their experience. The exhibition required the visitor to operate HTC Vive technology, which is a virtual reality headset consisting of goggles, head phones and hand controllers. Via sensors these devices turn the booth into 3D space, in which the user can navigate and walk around, and using the hand controllers to manipulate objects and interact with the digital environment. The programme was created using Unreal software, a graphic engine platform, which is often used to create games.

The HTC Vive headset, hand controllers, and headphones together create a digital multi-sensory environment where what you can see, hear, and touch, is a collection of interpretations of archaeological information allowing the user to step into the past and experience it from a first-person perspective. The programme was designed by the company Samuraj, who had creative liberty on the script, content and visual appearance. The content was checked by experts from different disciplines to verify the historical accuracy, these included archaeologists, historians, and linguistic experts. Some elements that proved archaeologically/historically incorrect were removed.

The equipment was installed in the booth in the entrance hall at Kulturens Hus in Luleå. To travel back in time you only had to purchase a ticket and get in line. After putting on the different devices and the instructor had moved you into the correct space inside the booth – the experience began.

**The Experience**

The combination of visual effects and sound instantly capture my attention. It appears that I am standing in a metallic cage with a panel covered with buttons and rods, a time machine, and I can hear a voice explaining to me that travelling through time requires travelling through space dimensions. The cage starts to accelerate fast. The sensation of moving fast through space makes me want to hold on to something, I fear I might fall over. Dramatic music is playing and I can see stars zooming past; my heartbeat is increasing. Suddenly a flying orb appears and introduces itself as my guide in the past. The orb explains that it will help during my stay in the Church Town. The orb seems to be quite confused, flying here and there, and makes half-hearted jokes.

The orb and I arrive inside a dark house. There are a few lit candles and when the eyes have adjusted to the dark I can see an elderly lady walking around the room, muttering to herself.
Even though I cannot hear exactly what she is saying I can tell she is in distress, anxious, but she does not appear to be aware of my presence even though I am standing very close to her. On the table is a basket with eggs that glow, this means that I can pick them up, which I do using my hand controllers, but I accidentally drop one on the floor and it breaks. The orb is talking about the woman, explaining that her husband is missing. I cannot answer nor pause the programme.

The programme transports me up on the roof where I can see the landscape. The stone Church is visible some distance away, and as I look around I see the wooden houses forming the Church Village. The weather is grey and the roads are muddy. The mood appears mellow and the voices heard from below in the village are somber, nobody is laughing. There is another basket but with fresh apples close to me. They are glowing which means I can pick them up, and I aim a few of them at the townsfolk below. Either I miss or the programme does not register hitting individuals with apples. The orb is stammering and trying to communicate information about the time I have arrived in, but it is difficult to concentrate due to the multitude of impressions; there is so much to look at and there is music playing. The orb does not strike me as an authoritative character, so paying attention to it appears optional.

Down on the road I am nearly run over by a horse and a cart. To avoid collision (of course, nothing would happen in reality) I jump aside and let out a little yelp as I turn around to stand face to face with a townsman. He does not see me. I am still a ghost and can move around without detection. I observe the people of the Church Village and it is clear that this is a meeting place for all social classes; there are men and women with colorful, elaborate clothes and there are others with more weathered looks. Children are walking around, as well as elderly people. What is unusual is the dramatic electronic music playing in the background as I stand on the muddy road. I would have expected perhaps some local musicians playing, but instead the soundtrack of some video game is played to my ears only.

The programme transports me to the local blacksmith. I can pick up and hold some sort of tool, but I don’t know what to do with it. The men gathered are arguing about something, but I missed the context, and as mentioned earlier I cannot pause or make them repeat what they just said. When transported again I find myself outside the church where two men are lying on the ground with their feet locked in some wooden device. The priest is standing on the church step and giving a sermon. I detect the elderly lady whom I encountered in the house earlier and she is crying. Apparently one of the men on the ground is her husband. Nearby a book is
glowing, is it perhaps the Bible? I hold it for a while, but it cannot be opened so I put it back. I am transported for a last time and I am standing in the middle of a group of men, the orb is with me and explaining in an agitated high pitched voice that something is wrong. The air seems to blur and looks momentarily pixelated, then I am no longer a ghost in the programme. The men notice me and start asking who I am, where I am from, what are those strange clothes I am wearing. They advance towards me and soon surround me, blocking all possible exits. Then the programme ends and everything turns black. There is a moment of confusion when I am uncertain if the virtual tour is over, am I “back in reality” or is this just a pause?

3.1.1 Analysis of Case Study 1

A successful critical assessment of an exhibition requires a holistic approach. The exhibition is a product of several factors, of course including that which is put on display, but also includes a number of things not immediately related to the exhibited material. However, these criteria, *exhibition details*, combined with the displayed material create the complete experience. The digital aspect adds nuances to exhibition details that are not recognized by the examination criteria for traditional museum displays. To identify these new aspects we shall first discuss what features the digital experience has in common with those stated in Moser’s guideline. What complicates the matter is that a digital exhibition is simultaneously virtual and non-virtual – real – which creates a situation where both must be evaluated. The visitor is in two places at once, which one should be analyzed as the location of the exhibition? Should only the virtual location be analyzed, or should the actual physical place be considered as well? The time machine booth at Kulturens Hus is the actual physical location, inside a real building, while the programme creates the other virtual space set in Gammelstad. Both factors shall be considered first, virtual and non-virtual, to conclude which one is to prefer, or if we need new kinds of guidelines, when critically assessing a digital exhibition.

**Architecture/Location/Setting**

*Anno 1500* was located in a modern building in the city heart of Luleå. Large windows and bright colors greet you when approaching the entrance; posters announce dates for performing artists and where to buy tickets for the upcoming events. A lot of people are moving in and about the building; this seems to be a place with high activity attracting people from all generations. The entrance hall is large, bright and has a high ceiling, parents with their children are coming down the stairs and some elderly ladies are studying a poster with an artist unknown to me. The coffee shop is open and the smell of cakes and sweets coming from
that direction is very alluring. The visual clues of this modern building is creating a contemporary feel, as opposed to some Neo-Classical museum traditionally symbolizing a “Temple of Learning”; I anticipate an unusual exhibition that challenges the old set ways of perceiving the past (MOSER 2010:24). The time machine is placed in the entrance hall close to a wall, it is covered in black/yellow “Danger”-signs, but there are no signs explaining what it is supposed to be, and I cannot see any posters concerning the time travel. I know what it is because I have come to visit for the sole reason of Anno 1500. A couple of chairs are placed by the textile booth and some teenagers are sitting there eagerly awaiting their turn in the “machine”. I find out that they have travelled to the 1500’s before, and this second time they want to explore things they missed the first time. One of the teenagers does not want to try it, somehow being seen by the others while wearing the HTC Vive headset is not an appealing thought. It does look quite comical when somebody is wearing goggles, headphones and hand controllers moving around in the tent, bending down and reaching for invisible objects. Of course, the user is “somewhere else” where all these movements make perfect sense; however, to some people this is not enough to compromise ones’ pride. Given the type of building, the location in the heart of town, and the tent-like booth in the entrance hall, I am expecting a fun experience rather than a course in local history.

Space

Analyzing space in a digital exhibition is challenging because the exhibition is placed in virtual space, and the visitor is simultaneously standing in that virtual space and a physical room. The booth is not large and has no display cases or anything that will make the visitor think of a traditional exhibition; there is only a desk with a computer which is used to operate the VR-tour. In the middle of the room there is a metal-looking plate on the floor indicating where to place the user’s feet before the programme starts. There are a number of sensors placed around the booth which will register the user’s movements and translate them into the programme. If I turn my head, the goggles and sensors work together – the images seen inside the goggles will adjust, so that I am moving my head in the virtual space as well; this way I can look up, down, and around in 360 degrees.
In the VR I can move approximately 2 meters in every direction. The person operating the programme moves me back in place if I venture out too far. It feels quite strange to be touched by a real person when immersed. As described earlier, the tour has several stops, the first inside a house, second on top of a roof, the third on the muddy road etc. I spend about the same amount of time in every scene; however the scene by the church step where the priest was talking to a large crowd gave the impression of higher importance than the other scenes. Everybody was paying attention to what the priest was saying and the criminals who were being punished were very interesting. The programme was predestined to take me from certain scenes at certain times, I could not control what spaces I was moving to or from. I could not decide how long I would stay in the different scenes.

**Design/Color/Light**

Placing the time machine in the entrance hall with no advertising around, putting out a few chairs outside the tent-like booth does not emit any particular design features. If anything, this lack of attention to detail is giving the message of the entire thing being a nuisance. On the other hand, the technical equipment inside the booth is another visual clue for a very contemporary exhibition. It’s a pity it was not visible from the outside.

It is possible to analyze the design, color, and light of the programme, but these features are intended to regard primarily artefacts put on display in a museum (Moser 2010:26). The discussion on lighting in Moser’s text is focused on how objects have been subjected to natural light or artificial light, which is an unnecessary topic for this study, since nothing in the booth was on display and the digital artefacts are of course completely artificial and the light as well. However, the use of color and light in a context of creating a certain “mood for learning” in the programme will be discussed in chapter 4.

**Subject/Message/Text**

Text can have many functions in an exhibition; it can be informative, creative, and/or offer interpretations or provide an introduction of what lies ahead. Outside the time machine-booth on a table next to the chairs were a handful of brochures where one could read about the time travelling experience. The front page of the brochure depicts a young woman.
wearing the HTC Vive headset, head phones and hand controllers. In the background the Church of Gammelstad is visible. The slogan reads: “TRAVEL IN TIME” and the subtitle to Anno 1500 is “A UNESCO World Heritage VR Experience”. The back reads: “The Time Machine - The technique of Anno 1500 makes it possible for the visitor to become completely immersed in the experience. In the time machine you will use a top modern VR headset. If you own a computer with a high-quality graphic card and a pair of HTC Vive-goggles, you can experience Anno 1500 at home. You can download the experience from “www.viveport.com” (author’s translation). A graphic card capable of running this programme is quite expensive though.

It is clear that the World Heritage site is marketing this exhibition as something extraordinary and exciting. It is marketed as an experience rather than a historical exhibition. The technical equipment is in focus alongside the visitor’s experience.

When opening the brochure one can read about Luleå 450 years ago. The historical context is set so that the time traveler will know what to expect; it is an introduction that raises curiosity; the text hints of a “multi-cultural society” where “people speak several different languages and dialects” (author’s translation). As an archaeologist I find myself intrigued to soon encounter a past that promotes itself in this manner. What kind of 1500’s am I going to encounter?

Text can also convey the message of an exhibition and in this case it appears to be the promise of a new kind of learning experience. The text gives a presentation of the digital technique, the historical setting, and also a short introduction of the townspeople and the orb. The characters are marked as real or fictive, where real characters are based on historical people who are known from the time.
The orb was, according to the brochure, inspired by an archbishop who was eager to build the church back when Luleå was Gammelstad. The orb is described as high-tech with human features. It is further described as “not knowing what he is doing or where he is”, but nonetheless he is also an “educated guide” who will help the visitor understand the time and people. This is a contradictory description because the orb is described as a voice of authority, but is simultaneously described as confused and is supposedly to function as the comic relief. There is some irony here. A debate concerning the role of the expert in heritage work is a topic with several issues, to just name a couple; do we need experts (Graham and Schofield 2014) and does the allowance of visitors to make their own interpretations threaten the role of the curator as an expert (Carrozzino and Bergamasco 2010; Cameron 2003)? What is the role of the curator when there is no need for an expert interpretation? Introducing digital technologies to heighten the visitor’s experience drives this discussion even further; how much interpretational freedom should the VR-user be given, admitting that multi-sensory experiences increases the level of interaction and consequently how we learn (Cameron 2003:327)?

The situation and discussion is somewhat confused and it appears as if Anno 1500 is reflecting this very accurately having designed an expert that does not know where he is. It is also noteworthy that there is no possibility for the user to pause the programme, nor ask any questions. The interpretations presented in the VR-tour, which include the archaeology and history etc., are indisputable. In several ways the user has entered the imagination of the designer and the orb is an attempt to clarify the different interpretations/imaginings. It is unclear if the designers of the programme were aware of this debate, but it is quite interesting that the disputed role of the expert has seeped into the virtual museum space as well.
The brochure goes on to market the VR-tour as a brand new narrative, and that the tour is “close to reality”. The time travel will “let you live in the past and your view of Gammelstad will never be the same” (author’s translation). However, on the same page the brochure states that where historic references could not be obtained, the designers have had artistic freedom. This explains the palpable feeling of momentarily walking around in somebody’s fantasy of the past.

Layout

Moser discusses in *The Devil Is In The Details – Museum Displays and The Creation of Knowledge* the layout based on the assumption that there is a physical display with objects placed there for visitors to observe and admire. This is the standard concept in most museums and art galleries, and has been for decades, but in a VR-tour the layout must be assessed with a different approach. Using *Anno 1500* as a case study does not allow any generalizations, but it is an example of the direction that virtual exhibitions are heading. Of course there are virtual museums that are designed with glass display cases and art on walls, using all the familiar features that we know from a traditional museum. But this case study is different since the displayed objects are in fact an entire Church Town and nothing is placed in a glass case. The layout of this exhibition is completely different from that used in physical museums. Even though the marketing focuses completely on the technology, it is not the cameras and computers themselves that are of interest, it is what they can do. Therefore it is unnecessary to analyze the layout inside the booth in which all the equipment was installed. It is not the equipment that is regarded as the actual exhibition.

The layout of the Church Town is based on archaeological data, so the wooden houses cannot be considered arranged in a particular way by a designer; the houses have been placed as they are in the actual village. However, a number of other objects were singled out during the VR-tour, namely those that glowed and could be picked up using the hand controllers. We know that how the objects are displayed create meaning to the visitor. If an object is placed in the center of attention, singled out and purposefully placed so that the visitor will focus more on
that particular object, it can affect the perception of it, making it appear as an important representation of the entire collection (Moser 2010:27). *Anno 1500* draws attention to 1) eggs in a basket, 2) fresh apples in a basket, 3) a tool, and 4) a book, presumably the Bible. Unfortunately, there is no explanation provided (by the orb, nor anywhere else) as to why these objects have been selected or what the user is supposed to do with them. The user is free to do whatever he or she wants, but these objects do not appear to be part of a plot or important for the narrative. Perhaps the objects are possible to pick up simply to make use of the hand controllers? It seems unrealistic that eggs, apples, a tool, and a Bible are supposed to represent life in the 1500’s.

**Display types**

In a traditional museum an exhibition can use a range of display types. They can have different functions and present the exhibition theme in various ways. Different display types include for instance: original artefacts, 3D models, graphics (maps, photos etc.), storytelling/re-enactments and so forth. Interactive displays are also considered to be a display type and are usually assessed as a part of an exhibition. However, *Anno 1500* uses only this display type which makes this category difficult to assess, the entire exhibition is an interactive display since it uses immersive technology throughout the 12 minute experience. This will be compared to the other case study in Chapter 4.

**Exhibition style**

This technology-based exhibition markets history as an experience while simultaneously striving to be educational; it is ‘edutainment’, educational entertainment. A concept like this speaks volumes about this generation and their high expectancy on technology (Capuano, Mangione, Pierri, and Salerno 2013). Using Moser’s study, ‘exhibition style’ is an analytical category examining how the visitor is engaged in the material, or how the material is presented and encouraging different kinds of interaction. Some general styles are: discovery-based exhibitions, contextual, immersive, or atmospheric (Moser 2010:29). It is difficult to place digital exhibitions into one of these categories, since they include all styles; they are discovery-based, they are contextual, immersive and truly atmospheric as well. This category will also be discussed further in chapter 4.1.
Audience and Reception

Visitors bring their own expectations and perspectives into an exhibition, and these are factors contributing to the interpretation of the displays. The creation of knowledge is a multifaceted process which in a museum greatly involves the engagement of the visitor. The purpose, or message, of an exhibition will be received very differently depending on the biases and predisposition of the individual visiting. My interpretation of Anno 1500 might therefore be very different compared to the person being immersed right after me. The fierce marketing of this exhibition as an immersive experience, rather than a local history presentation, suggests that the intended audience is interested in the technology and perhaps not as much in the actual content of the programme. Even though the destination of the time travel is very clear (the 1500’s) as Figure 9 and 10 shows, the attention of the advertisement is primarily focused on the travelling i.e. the technological equipment. The learning possibilities of the exhibitions can only be anticipated.

The exhibition was designed to attract a younger generation (Engberg 2017.) with the aim of hopefully sparking an interest for history. If this was successful will be difficult to ascertain for some time, but this aim explains some of the features noted in the experience; for instance, the use of electronic music will be recognized by any person used to playing video games. The programme is designed to appeal to an audience familiar with the technology and contains several features recognized from games.
3.2 Augmented History: Gamla Uppsala

Old Uppsala is an important archaeological place which has received attention for a long time, due to the spectacular mounds and traces of buildings and a large hall dating back to the Iron Age. Old Uppsala is believed to have been a powerful center for the Iron Age community in Scandinavia (RAA). It is still an important place of culture; not least for the younger generation who celebrate the arrival of spring on the last of April every year by the mounds.

Old Uppsala is located some distance from the modern city of Uppsala, so for my excursion I arrive there by bus, and I am accompanied there by a group of school children all wearing reflexive vests. It is rather chilly out, so I am thankful it is not raining as well. I go inside the museum building to borrow the device which has the augmented reality programme installed on it. It is a touch screen tablet with GPS, compass, and gyro-function; the user’s position is therefore known and shows in the programme. When the tablet is turned the motion is registered and the screen adjusts its’ images accordingly. The software used to create the programme is called *Unity*, a popular platform used to create games. The tablet that I have borrowed is light and protected by a rubber frame, which makes it easier to hold in front of me and is probably very useful should clumsier hands than mine accidentally drop it. Before I go outside I am told by the museum staff that what I am about to see is all based on archaeological excavations and the milieu is set to be somewhere between 400-600 AC.

The Experience

When I hold the tablet in front of me I can see the familiar mounds, but the scenery is also very different. I can see wooden houses and fireplaces, none of the modern buildings are visible. I turn to see if the church is there, but there is no church in the augmented reality. The Iron Age in Old Uppsala is sunny and the mounds are covered in green grass and wild flowers can be seen in the fields. It is a lovely picture. As I walk around looking at the different types of buildings I notice that there are no people around. The programme has no audio, so I focus entirely on the moving
images. Furthermore, I also notice that it is possible to walk straight through the fences and houses; this is convenient because it saves me a lot of time not having to walk around corners and the like; on the other hand it is a reminder that I am not walking in a real world.

On the tablet I see a symbol that looks like a backpack, and there is also a collection of items on the bottom of the screen. It appears that these items can be found in the surrounding area and put inside the backpack. “Oh, a little quest” I think to myself. I click on the first item which is animal bones, and a kind of compass points to its’ direction. I start walking towards it, feeling rather excited to soon find Viking stuff. When I am close to the item the programme tells me so and I turn the tablet 90 degrees and face it to the ground; now something glimmering can be seen in the grass. I press repeatedly on the bones and it slowly comes out of the ground, it is almost like I am excavating it. Once up from the ground I can press a “learn more” sign which reads more detailed information on Viking Age animals and other archaeological facts. The items are created as 3D-models so they can be observed from all angles. One simply touches it on the screen and moves it around. After collecting this animal skull my quest continues to find a shield. I continue stomping around the fields to gather the rest of the items, which were a variety of artefacts for instance a helmet, other kinds of shields, brooches etc.

Besides sometimes fearing that I look rather silly walking around the windy grounds, it is very entertaining trying to find the next artefact. What shocked me was my reaction when I saw the great hall. I gasped and started running towards it. Right behind the church there is a plateau which in the programme had a magnificent hall on it. Outside the entrance stood lit torches and the door was open, looking very inviting.

Inside several fires were burning and the only person I saw in the programme was sitting in the middle of this hall, on something that very much resembled a throne. It was a woman wearing colorful clothes and jewelry, she looked about 30 years old and she was looking straight ahead. I was unsure if she could see me so I walked up to her and placed myself in her line of sight. For a moment she looked right at me, but then she turned away her head. I am
still not sure if she saw me and ignored me, or was programmed to sometimes look straight ahead and seemingly spontaneously turn her head…

When all the items had been collected I headed back to the museum building and turned in the tablet, the experience lasted approximately half an hour.

3.2.1. Analysis of Case Study 2

Architecture/Location/Setting

The museum in Old Uppsala is a grand wooden building with large windows facing the iconic mounds. Walking up to the museum and seeing the beautiful landscape in the background is a visual joy. The choice of using unpainted wood on the exterior walls, and the almost circular shape of the building, makes one think of something inspired by the Viking Age. The museum is clearly thematic and placed at this particular location because of its’ historical importance. There are also other buildings around, for instance a tavern and some residential cottages. This is a place with high activity, not only is there school groups visiting the museum, but the surrounding fields are utilized by joggers and admired by tourists who are also interested in the church close to the mounds. The Augmented History app is at the moment only possible to use on location at Old Uppsala. It will most probably be unlocked in the future, so that it can be used anywhere (Löwenborg 2017). It is however very pedagogical walking around the area seeing it in reality and augmented on the screen simultaneously; one can really understand what the place looked like over a thousand years ago.

Space

The space in which the app functions is the surrounding area of the museum. It is cleverly designed so that the items, which the user is trying to find, are arranged in such order so that you naturally get to walk around the entire area. Of course, the user has the possibility to select any item at any time, but normally reading from left to right, made me select the first item on the left. In Figure 10 this can be seen clearly. The items are visible on the screen on
the bottom right. They are lined up and the user must find one at a time. Starting with the item furthest to the left and then moving on to the next one creates a natural flow when walking the fields; one does not have to walk back and forth, instead the items sort of lead to the next one in line. On the other hand, if a person who is used to reading from right-to-left was to use the app, that person would have to walk quite the distance before reaching the first item. This would also be the case if a user were to select a random item from the line. Having the opportunity to search for any preferred object at any time gives the user great freedom to go look for whatever he or she finds the most interesting. If compared to a traditional museum exhibition, this is similar to a visitor knowing exactly what is put on display and being able to head straight to that without having to follow a certain path to get there. The space in *Augmented History* is unlimited.

**Design/Color/Light**

The design/color/light of the app will be discussed in depth in Chapter 4. To analyze the design of the actual museum would be difficult since the only time spent there was to borrow and return the tablet; also, the case study is focused on the exhibition (app) which was completely experienced outside of the museum.

**Subject/Message/Text**

The *Augmented History: Gamla Uppsala* exhibition was initially the result of an archaeological project conducted by researchers at Uppsala University (Löwenborg 2017) and was presented to the museum of Old Uppsala as something they might be interested to invest in. The message, or aim, of the app is simply to mediate archaeology to the public in a new fun way. The focus of the app was to present scientific research in an entertaining way, wherein the technology involved was merely an experimental project of doing so.

The experience included a large amount of text which could be read if the user wanted to. This text appeared when an item had been found. The text contained archaeological information such as: where the items had been excavated in reality, what their believed function was in the past, where the item is stored or put on display today etc. To read this was optional, but took approximately 2 minutes every time an item was found. In Chapter 2 we discussed how the favored way of communicating to the museum visitor is via text, and has been for a long time. Most traditional exhibitions use text on signs next to display cases, text on screens, text on walls etc. Text seems part of the museum tradition and traditions are
difficult to shake; it is in this view understandable that text made its way into this academic experiment. The use of for instance headphones could have incorporated voices telling a story to the user instead of using text. What about the hearing impaired? But then what about the blind?

The information about the different types of archaeological finds is informative in style; there is not much room for alternate interpretations. For instance, the animal bones are presented as a very typical find suggesting several things like what kind of food the people of this time period were eating or what animals they kept as pets etc. The information is presented as matter of fact and the visitor is faced with the words from an expert. Even though the information is well established in the archaeological research community, perhaps one might consider presenting information of this nature with a more speculative tone; not offer completely unlikely scenarios, but still allowing the visitor to make their own interpretation and thus create their own knowledge based on what archaeologists have discovered.

**Layout**

The layout of the programme was briefly introduced earlier when it was mentioned that the user is free to walk around the area as he or she pleases. The items do not have to be collected and put in the backpack, they do not have to be searched for at all; the visitor is free to walk around and collect maybe one item and then ignore the others or just look around and completely ignore the little quest. How the visitor makes use of the space is completely spontaneous and not controlled by ready-made paths or suggested routes. The layout is restricted by the physical features of the terrain at Old Uppsala. It might not be very pleasant to stumble through wild bushes, or walk on the very muddy patches in the grass, but it is not prohibited by the app in any way. The only clear restriction given is to not walk into land which is private property (the residential houses are situated very close to the mounds). Other than that, the visitor can explore the programme in any way desirable. If the user of the tablet wants to procure the items shown on the screen, it is easily done by simply pressing on the wanted item. The compass appears and points to the direction where it can be found. The items are placed in the ground in the surrounding area, and this naturally requires the visitor to walk in that direction, but there are no limitations as to what particular way the item should be reached.

There is one large object that demands quite some attention of (assuming) any visitor who comes near it in the programme – the great hall. It cannot be missed and even though it is
entirely optional to visit it, the overall appearance of the great hall makes it difficult to ignore. Like no other building shown in the app, the great hall exudes importance. First of all it is very large and impressive, second it is placed on a plateau which marks its’ presence in the landscape very pointedly; and thirdly the torches are lit outside and the doors are wide open. The great hall is like all the other buildings in the programme digitally reconstructed. We know that there once stood a great hall in that specific place because of the archaeological excavations revealing pole holes on the plateau. The building does not strike me as exaggerated even though it is grand. The other houses are however not nearly as impressive and do not apparently display any functions, as opposed to the great hall which instantly takes the mind to a seat of power. It becomes clear that this object is worth spending some extra time with.

The only person in the programme could be found in the great hall, and she was sitting in the middle of the room on a throne. The great hall is not only visually appealing - it contains some mystery as well. Who is this woman? Is she the ruler of Old Uppsala? Is this hall her governing center, is this “where it all happened”? The imagination wants to go in that direction. The walls are decorated with shields, several fires are burning, here and there are animal skins and furs…it does give the impression of a wealthy place. When the experience is all over and the tablet is returned at the museum, what lingers in thought is the great hall and the mysterious woman inside. This might not be intentional, but if it indeed was the aim of the designers to make the visitor reflect upon who might have ruled Old Uppsala, it was masterfully done.

Display types

The digitally reconstructed village surrounding the great hall is based on archaeological finds and the interpretation of those finds. Augmented History: Gamla Uppsala is a beta-version meaning a kind of “work in progress” and does not suggest that it is containing all the information available about the Old Uppsala region; it is a selection of that which is known about this time period and made comprehensible to both children and adults. Just like Anno 1500 it is an experience not commonly featured in museums (yet!), and is still being tested for public use. An augmented milieu is hardly a certain display type, if one does not simply describe it as a digital display, which is an understatement. The particular kind of mood created by the choice of weather and color, can however in comparison with Anno 1500 be the
starting point for discussing something not covered in *The Devil Is In The Details*, namely digital ambience; this will be discussed in chapter 4.

**Exhibition style**

*Exhibition style revolves around the communicative roles assigned to objects in exhibitions. [...] For instance, a distinction can be made between themed or idea-oriented exhibitions and those that are object-led* (Moser 2010:28, 29).

The app is the result of an idea for a project about mediation of archaeological research to the public; therefore it can be considered to be themed or idea-oriented. On the other hand the actual content of the app is object-led when considering the focus on archaeological artefacts and buildings. A themed exhibition is often seen as a collection of selected objects chosen specifically to tell a story (more interpretative), whilst an object-led exhibition is often seen as more descriptive, since more objects supposedly present a wider picture (Moser 2010:29). The app can be considered to be both of these because there is a limited range of objects “on display”, but the artefacts do present a wide picture since it is an entire augmented milieu. This differentiation depends on whether all the 3D models should all be considered as objects, including all the buildings and tools etc. or if only the items that the app user was supposed to collect should only be considered what is on display. Considering that everything that can be seen during the experience is consciously selected and digitally reconstructed it is reasonable to say that the exhibition is in fact object-led.

The great hall is thus a major piece in the exhibition and could be analyzed as laden with a hidden message to the visitor, based on the assumption that this “object” is supposed to receive more attention than the other objects encountered. What meaning is the great hall supposed to give the visitor? Instinctively the great hall suggests that Old Uppsala is primarily a place of governing and high status, and that the surrounding buildings and animal bones are less important and mere props. A possible message is what we already know about Old Uppsala: it was an important place during this time period and it was a seat of power. Inside the great hall the visitor can see shields hanging on the walls, several fires burning and something that reminds one of a throne – these details put together gives the visitor the impression that this is a room connected with governing and power.

**Audience and Reception**

The intended audience for *Augmented History: Gamla Uppsala* is everybody who visits the museum at Old Uppsala. There has been no marketing prior to the launch of the app, mostly
because the launch date was set when the high season at the museum was over. A similar, improved, app is soon to be launched which displays the Cathedral of Uppsala; it is also intended to be used by anybody who is interested, but according to one of the developers it is hopefully a media which will attract a younger generation (Löwenborg 2017).

Time will tell how the digital exhibitions are received by the public on a larger scale; it is inspiring to see the efforts put into engaging young people in history and archaeology. From this aspect gratitude towards popular culture is appropriate. The concept of time travel, which is a phenomenon acquainted to us by decades of movies and TV-shows liberally using the concept; is familiar to an extensive audience and can be used for marketing an educational experience (Holtorf 2007; Holtorf 2010; Petersson 2003:285.).
4. Discussion

The case studies have revealed that digital archaeology can result in very different types of installations. The analysis was based on Moser’s key work on critical examinations of museum displays. Examining the case studies using Moser’s categories proved successful in several aspects: subject/message/text, architecture/location/setting, and, space. Other categories were found in need of adjustment to better suit a digital display: design/color/light, layout, and audience/reception. Some categories are unfortunately not suited for application on digital displays: display types, and exhibition style.

This chapter will first discuss the categories which can be transferred from traditional exhibitions to digital experiences; some comments on areas of improvement will be included. Secondly, a discussion on the categories which need adjusting will follow. Next the categories which are not adaptable for digital experiences will briefly be commented on, and finally two new categories will be presented in chapter 4.1.

These new categories can be considered as suggestions for critical assessment of digital displays using immersive technologies for future designers of digital experiences intended for museum visitors. It is my wish that these additions will prove helpful as a guide to anybody working with public archaeology and particularly digital displays of immersive character.

Subject/Message/Text

The case studies use text in opposite ways. The experience of Anno 1500 did not require any reading at all; the only words communicated were via audio by the orb, which was light and humorous. This decision proved effective because the attention of the user could instead focus on the material in the programme: the church, the houses, the people etc. Adding text to these rich visual scenes might have disturbed the immersion. Besides, the experience was promised to present a new approach to history, and this it truly did, when text-based learning normally is given considerable attention in exhibitions in traditional museums.

Contrastingly, Augmented History: Gamla Uppsala uses text in a very traditional manner. When an object is encountered by the user, an option to read about it appears, which is exactly the standard scenario at a museum – next to the display is a sign describing what you are looking at. The app does precisely this, but you have digitally excavated the artefact yourself moments earlier instead of normally just observing it through a glass case.
What effect does the different use of text have on the visitor’s experience? Reflecting upon both of these case studies, the obvious note is that both programs wish to communicate verbally with the visitor. Both programs have made use of an expert, one active and visible and the other passive and invisible. We see it in the VR orb and the little signs in the app. If you decide to include an expert in an immersive programme, be it a talking orb or signs, the features of these clearly matters. If the expert is easily dismissed as silly and comical (at moments interfering with the general experience) the potential message of the exhibition risks being lost. When the expert is presented as factual, providing the visitor with options to pause and reflect or continue without stopping, it signals to the user that there is more information within grasp here – there is an opportunity to learn more. The experience translates into entertainment with depth.

Things to consider when creating an expert in a digital exhibition can include: should the expert be passive or active? For example: should the expert be pushing information to the user or can the user decide to gather it? Could the expert be interpreted as potentially interfering with the visitor experience, or is the expert enhancing it? If the expert is disguised (for instance as a friend or helpful guide) is it possible for the user to ignore or ‘turn it off’ without lessening the experience? (Remember the helpful paper clip in ‘Word’ back in the day?)

**Architecture/Location/Setting**

The physical surroundings of where a digital exhibition has been installed give important visual clues as to what a visitor will encounter during the experience. The placement of the digital exhibition may also indicate the extent to which it is valued as a serious cultural experience. *Anno 1500* was installed in a tent-like time machine in the entrance hall in The House of Culture. No signs or posters marked the experience which had been so well advertised online. Had I not known it would be installed there I would have missed it; I noted several visitors did not even glance in its direction; they headed straight to the reception desk straight across the entrance hall. Why was the time machine placed there? Were all the rooms in the building already occupied, or was the entrance hall the most appropriate place because of the rich flow of visitors? What effect does the location and setting have on the visitor’s experience?

In an interview with one of the creators of the programme, it was communicated that how the time machine was presented in textiles was not particularly appreciated. Also, there was some sorrow expressed over the choice of placement within the building; he would have
appreciated a room devoted for the VR. Kulturens Hus appears to have executed these decisions regardless of the designer’s wishes. These decisions might have influenced the anticipation of the visitors, signaling to them that the time travel is modern and accessible, but not significant enough to gain access to the ‘real’ cultural sphere; it may only inhabit the threshold of The House of Culture, but is not completely welcome inside of it.

Is there still a distinction between high culture and popular culture? The case studies point to a definitive: yes. The digital technology is appealing to a young generation, they are familiar with the media and as consumers of entertainment they are most probably allured by the shimmer of a new product promising new adventures. The hope was to inspire an interest for local history (this is finer culture), but when presenting this educational content in a time machine (interpreted as low culture, the gaming industry being popular mainstream entertainment) this digital exhibition is restricted from entering the exclusive cultural repertoire of Kulturens Hus. One might wonder why bother with producing such an exhibition at all, if it does not secure a ‘real’ place amongst the other cultural activities within the building? Was it merely an experiment to investigate potential visitor groups?

The Museum of Old Uppsala, on the other hand, is also neglecting to make the app known to their visitors, but the institution is most eager to maintain the exclusivity of the app by keeping it locked to the location. This reveals some pride and claim of ownership. Why is this experience not shunned by the cultural elite like Anno 1500? It is possible to argue that the traditional form of the digital displays, especially the text-based information, which is very similar to what is found within the museum building, creates a bridge between the established mediational frame of the institution and the futuristic technological media. The experience of Augmented History: Gamla Uppsala is modern just like Anno 1500, but differs in this aspect. Even though the user of the Old Uppsala-app is introduced to new perspectives, they are presented using familiar instruments, the favorite among museums: text. Perhaps the time machine was too extreme and the app in the tablet was considered modern enough.

**Space**

Analyzing the case studies in terms of ‘space’ and how the visitor was able to move within the programs was effective. However, the spaces for the digital experiences were created using geographical locations/archaeological material, which is not how this category originally was intended to be used. ‘Space’ in a traditional museum exhibition is a matter of objects in glass cases, art on walls, how some objects have been singled out and displayed apart from the rest
of the collection etc. This is not an issue in the immersive programs, but the concept of space is interesting to note from other perspectives, for instance how it can be utilized by the visitor in the immersion. The phenomenon of the user being simultaneously present in VR and in a physical location must be acknowledged. It is necessary to remember that both spaces play equal part in the creation of knowledge; digital technologies do not imply that the physical spaces related to the experience can be neglected or forgotten. It is still important to pay attention to both spaces accepting that the visitor will take them both into account when interpreting the material.

The degree of freedom in mobility produces different sensations for the user; a higher degree of liberty to move creates an exploring mood and consequently an eagerness for discovery. It is interesting to note how less devices (an iPad, although containing very sophisticated software) was able to engage the visitor more than a complete immersion with HTC Vive goggles, headphones, and hand controllers.

Forced transportation of the user during the experience is not to be recommended, but if it is necessary it should be cleverly concealed with actions taken by the user prior of the transportation – it must appear as if the user causes the transportation. For example: if it is necessary to move the user to the next scene, make the visitor get on a wagon which takes the visitor there, instead of turning the screen in the goggles black and suddenly be turned back on in a new scene. The result is risking immobilizing the visitor, making him or her in-active, assuming that engagement is futile since the programme “acts on its own” regardless. If there is limited time per user, a suggestion could be the opportunity for visitors to select a preferred scene in the beginning of the programme. This would eliminate the sensation of moving inside somebody else’s imagination; selecting a scene provides the user with options instead of being ‘pushed around’ by the unknown designer of the programme. If curious, the user could be immersed several times and explore every scene individually. This would provide the visitor with more liberty to pursue their personal interests in the Church Town of Gammelstad and eliminate the rather discomforthing sensation of walking in a movie.

The categories which have been discussed until now have proven to be useful analytical instruments for critically assessing digital experiences using immersive technology. However, the following categories require some modification for digital displays, but are nonetheless effective topics to include in an assessment.
Layout

The use of layout in combination with the visitor freedom of movement within the programs is another example of how the case studies represent opposites. *Anno 1500* limits the visitor to move within very limited space while *Augmented History: Gamla Uppsala* offers free range. The different approaches result in strikingly different experiences. It could be compared to the sensation of walking around freely in a dream world, or moving inside another person’s fantasy. The difference lies in how motion is registered or manipulated in the programme. The GPS and gyro in *Augmented History: Gamla Uppsala* allows the user to move within great distances, while *Anno 1500* restricts the user to move approximately 2 meters in every direction, and (perhaps having the most crucial effect on the experience by) virtually moving the user from scene to scene in the programme.

The app and the VR are both intended to be used by a large number of people. In Old Uppsala the tablet was to be returned within half an hour in order to prevent queues, of course they keep several tablets, but in a scenario with many interested visitors one must return the tablet so that the person in line does not have to wait for hours. In Luleå there was a similar situation where only one person could be immersed at a time, the programme lasted about 12 minutes, which is a necessary time limit also intended for preventing queues.

When designing the layout of an immersive virtual environment, or augmented reality, it is useful to consider the visitor’s freedom of movement. Can the users select their own paths? Is forced transportation necessary to maintain the story-line and/or effectively used as a story-telling instrument? An example could be the consequence of touching/eating something poisonous, fainting (all turns blurry) and waking up in a different scene, or perhaps walking through a magic portal which moves the user to another place? Forcing transportation (using black intermissions) without the user performing any actions, so called ‘spontaneous’ changes of scenery (which occurred in *Anno 1500*) risks making the user passive because the change of scene is not a response to what the user does – the programme make things happen despite the users’ actions. There is a sensation of powerlessness which does not encourage interaction.

It is important to consider the consequence of the user’s potential actions, the necessity of predicting beforehand (when programming the experience) what the user might do in different situations. If the user can pick up apples, what can the user do with them – throw, drop, squash, put them back in the basket – what is the response? – if thrown, the apple must make
thud-sound or if thrown at townsfolk they should in turn react, if dropped it should break (like the eggs did) etc. audio is important to enhance the experience. If nothing happens there is no real interaction between the user and the technology.

**Audience and Reception**

*Anno 1500* was intended to attract a young audience and has several features that will be familiar to especially gamers. The marketing focused on the technology and the programme itself resembles most games set in medieval inspired worlds. A potential problem with this is the lack of distinction between VR experience and games; how much of *Anno 1500* is digitally reconstructed and what parts of the programme are pre-made sets of objects and milieus bought for the program? Visitors come from different backgrounds and have individual perspectives, and when creating VR for educational purposes it is not safe to assume that everybody can differentiate between what is real and what is not. If some objects or features of the VR are not marked as fictional they risk being interpreted as truly medieval. Even though the time travel is marketed as a fun experience, it is still claiming to display the 1500’s. Using ready-made chairs or dried herbs may seem harmless, but if these objects are encountered later in a fantasy game, the user might believe that the game is using ‘real’ medieval details, when in fact it’s the other way around. When a museum, or World Heritage Site, puts their stamp of approval on something, it will read ‘educational’ and ‘trustworthy’ by the public. Therefore, it is extremely important that the audience is informed about what parts of the digital displays are actually reconstructed artefacts/buildings/landscapes/etc. and what is not. The app of Old Uppsala also contained several everyday objects, including fireplaces, furniture in houses etc. but the feature of excavating artefacts from the ground was clearly signaling that these particular objects were indeed archaeological finds and not just decorative. The accompanying signs with text described how the 3D models were created by archaeologists. These artefacts were given considerable attention during the experience and were clearly explained to be copied from original finds.

**Design/Color/Light**

Digital displays are of course completely artificial, every detail being composed by programmers, designers, and reviewed by a number of experts from in this case archaeology and history. In a traditional exhibition this category of analysis assesses the design of an exhibition, looking at for instance how the theme is communicated by choice of material and colors. Simple examples could be the use of the color red in an exhibition about China, or
using recycled material in an exhibition about the environment. How the exhibited material is displayed creates meaning to the visitor, which is naturally also true when the visitor experiences digital displays. The difference is that these case studies are not set in virtual museums, inside a building where these details can be analyzed effectively; the case studies are both set outside or at least in a digitally reconstructed environment. Even though color and light play an important part in the perception of the 1500’s and Iron Age, these features will be discussed in chapter 4.1, where they are placed alongside other similar visual traits. These features will be included in a new category, since they are very valuable for examining any exhibition, traditional and digital.

As stated in the introduction of this chapter some of Moser’s categories of analysis were proven ineffective when translated for digital exhibitions. ‘Display types’ is a category comparing different ways of displaying objects, it could for instance be the use of replicas or photos, but as these case studies use such a variety, combining several in VR, it is a topic better discussed as part of other features. An example is the use of 3D-models by Augmented History: Gamla Uppsala versus the pre-made objects purchased for Anno 1500 and the potential consequences. ‘Exhibition style’ is another of these categories which would normally categorize digital displays and reconstructions as contextualizing objects to their original function, which is obvious, but again: the digital experiences are not displaying objects using a particular style. This is therefore an issue also included in a new category, where the virtual environment is analyzed in regards of ‘digital style’ or setting/’mood’.

4.1 New Categories

4.1.1 Mood

The category ‘Design/Color/Light’ would in a traditional exhibition pay attention to details such as for instance: what material the display cases are made of, are they wooden or metallic, is the room decorated with tapestries or are all the walls white etc.? These little features will together create an atmosphere in which the message of the exhibition might come across more clearly (Moser 2010:26). The interesting situation with a digital exhibition, such as Anno 1500 or Augmented History: Gamla Uppsala is that everything the visitor observes is created with purpose. There are no walls, no glass cases with objects and so forth, but still the visitor senses ‘digital style’. We can analyze the museum building and the location of it, we can analyze the use of text, but everything in a virtual programme has once been a blank slate, there is no need to compromise or adjust to a gallery or amount of space in a museum, the
virtual space is free. Usually when designing an exhibition there are physical parameters to consider and negotiate with – digital technology eliminates this aspect. Both case studies in this dissertation have based their layout on archaeological finds; the designers know for example where the houses were located and the surrounding landscapes of Luleå and Old Uppsala. But this is what is exciting about the digital technology, the exhibitions are no longer restricted to artefacts in cases, it is now possible to step into another place and explore not only objects but entire ancient communities. The designers have the possibility to create any kind of atmosphere they find appropriate, including color, light, and style but adding more complicated aspects like: time of day/year and weather.

Anno 1500 displays a village during the fall. The sky is grey and the roads are muddy, the visitor experiences a cold, rainy afternoon. Of course, the real physical temperature is not altered by the immersion, but the visual clues signal a recognized atmosphere – barren nature, summer with all its’ joys is long gone. The people in the programme look grave and are going about their business; the visitor understands that this is a rough place. Added to this setting is the church, the reason why there is a Church Village at all, where people are being publicly punished for their crimes. The visitor is not only observing all this, these details create a mood, a feeling, emotions and affect are actually increasingly recognized as important mediators of heritage experiences (Smith 2011; Smith and Campbell 2015).

Why have the designers chosen to depict this time and place from this perspective and not another? What is gained by adding to an existing stereotype – the dark middle ages? In an interview with one of the designers it was communicated that stereotypes are not easily challenged and that this was not the aim of the exhibition. In the same interview it was made clear that this experience would hopefully inspire new enthusiasts for local history, particularly young people. Is that not a perfect opportunity to create new perspectives and challenge old prejudices? When creating a virtual grey and dark mood in the programme, it is communicated to the visitor that this historical time was not a happy place. Even though there might have existed smog in cities, as an archaeologist analyzing Anno 1500, it is rather unwillingly added to the large fraternity of grim past portrayals.

Augmented History: Gamla Uppsala displays a summer day. The sky is blue and the sun is shining. The visitor can see flowers and green grass covering the landscape. There are no people in the village, but there are traces of activity. It is a pleasant picture. Where are the raving and violent Vikings? It has been mentioned previously that the only person seen in the
programme was sitting in the great hall, a woman who appeared to be the ruler of this tranquil place. There was no information about the woman on the throne, but she was intriguing. Did a woman rule the Vikings in Old Uppsala?

The experiences are again opposites, and it is possible to conclude that the weather and choice of season and time of day are fundamental elements for creating influential atmospheres for the visitor. These factors are important aspects to consider when designing an immersive experience set outside; the choices made by the designers have great effect on the visitor, not only presenting an overall color schemes/style but strong emotional connotations connecting the experience with personal memory and association. The designers of the case studies have selected these features with their respective motives, but ‘mood’ defines a category which critically assesses the details of ambience and emotion.

4.1.2 Presence

There was a moment during the immersion of Anno 1500 when the programme had just ended and there was only darkness; for some seconds I was confused of where I was. The experience was over, but my mind was still immersed and I was still wearing all the devices. Somehow I was caught in virtual time and the present. This moment only lasted for a few seconds, but I was made aware of a void, a transitional time, where I was not in VR but not quite “back in reality” either. I was in a void between the 1500’s of Gammelstad and the 2000’s of Kulturens Hus in Luleå. This phenomenon can be explained using the concept ‘liminality’, which is a period of time usually applied to cultural passage rituals, for instance when a boy transitions into a man by undergoing a series of events or specific actions are taken (TURNER, VW., 1977). This time between the starting point and goal is liminal, and during a digital experience it occurs when the user is immersed but in a non-active experience.

The level of immersion and interaction calculates the level of presence, which is a useful instrument to determine the effectiveness of the experience (see Figure 1, 2, and 3). When the immersive experience is high (Anno 1500 uses HTC Vive headset and hand controllers, which place them somewhere between device based interaction and natural interaction, and since the programme makes use of both wearable devices (headset, headphones and hand controllers) and external devices (CAVE) it places the exhibition in ‘high immersion’), the user will find him or herself in a liminal space during some point. The sense of confusion can be lessened if this moment is anticipated by a previous notification; a suggestion could be for instance the use of a countdown or similar signal to alert the forthcoming end of experience. If however
the immersion is low (*Augmented History: Gamla Uppsala* uses a touchscreen which would categorize the exhibition as a ‘device based’ interaction, however the touchscreen is wireless with GPS and gyro so it does register movement (gestures) which could be compared to whole body motion interface (but is not actually this type of technology) or a motion platform (but it is not really this type either) however, based on the experience itself the most suitable category is ‘low immersion’) there is little or no risk of creating a liminal space for the user because the level of presence remains low, even though the interaction is high.

To clarify: a high level of immersion and interaction creates a high level of presence – this can be concluded of *Anno 1500*. A low level of immersion combined with a high level of interaction still creates a low level of presence – this can be said of *Augmented History: Gamla Uppsala*.

A high level of presence does not however guarantee an increased learning experience. The cases studies represent opposites concerning ‘presence’ and furthermore are also examples of opposite learning experiences. Digital technology does not automatically empower the user with new learning possibilities, there is still much to take into consideration when designing a digital display – the devil is still very much in the details.
5. Conclusion

*What can digital archaeology offer the embodied visitor?*

The case studies have shown that the embodied visitor has much to gain from digital archaeology; multi-sensory experiences can effectively communicate cultural content and as this study has shown: stir emotions as well. Immersive technologies that display environments including weather and seasons have the potential to shape a perception of the displays linked to the visitor’s associations with reality. The digital exhibitions studied in this dissertation use archaeological data as the basis for their displays, but the designers’ choices of details concerning the setting/atmosphere has dramatic effect on the visitor’s perception of the exhibited digital environments. Digital archaeology has the potential to challenge existing prejudice regarding the past; the dark Middle Ages could become lighter without altering archaeological content, but by selecting a digital display of spring instead of fall, which the visitor could associate with more positive emotions. A small detail like this alters the visitor’s perception of the displayed material. Larger details can also be communicated with major interpretational possibilities, for instance the ‘violent Vikings’ can be living in a calm and peaceful place, perhaps not governed by a bearish chief but by an assertive woman. It can be concluded that digital displays require careful considerations due to the potential interpretations by visitors.

The objects on display can be described as collections digitally put in their original contexts, it is however necessary to make the visitor aware of what objects are original and what objects are merely decorative. In a traditional museum exhibition it is clear to the visitor that the display cases themselves are modern, but the content might be thousands of years old; in a digital exhibition where the visitor is walking in a digitally reconstructed milieu it is vital to clearly state which objects are based on archaeological finds and which are not. If this distinction is not made, there is a risk of the visitor assuming that everything in the virtual reality is a 3D model of an artefact.
In what ways can digital archeology broaden how we learn?

Experience-based learning, or edutainment, is an extension of ‘learning by doing’, which is indeed broadened by digital archaeology. The use of immersive VR and AR can without hesitation be categorized as such experiences, but should not be denied their educational values. The case studies have shown that engagement of the visitor can be induced by multi-sensory interaction; the potentials of VR including audio, visuals, and the sense of touch all in combination with narrative welcomes the creation of knowledge and visitor interpretations. AR was in this case study similar to a traditional exhibition in several features, but offered nonetheless a new experience engaging the visitor to walk around and exploring a place discovering hidden treasures. The case studies have shown that it is possible to maintain a familiar style when using new technology and that it is also possible to create new types of narrative if that is desired. Both digital experiences are striving to engage the visitor by motion, which is a step away from the historically preferred means of communication via text.

The association between digital archaeology and popular culture provides potential, it has capacity to raise interest in new groups when offering modern experiences; but it also has the capacity to make old groups aware of new media and, hopefully, bring popular culture into the high-culture sphere and display how education can be entertaining.

How can we critically assess museum exhibitions which use immersive digital technology?

This dissertation demonstrates that it is possible to apply critical museology on immersive digital technology. The case studies reveal that the analysis of a digital exhibition can be approached using the same analytical instruments as for a traditional exhibition; however, a number of analytical categories need adjustment before application on digital displays. This study also demonstrated that it is necessary to formulate new analytical categories for optimizing a critical assessment of exhibitions using immersive digital technology. These new categories are formulated based on the experiences which the dissertation has used as material; with high probability these categories would be increased if the material studied had been more extensive.

Digital exhibitions which are set in museums, not virtual, can be critically assessed as museum displays and their surrounding details can be examined as part in the creation of knowledge. The content of the digital experience needs the addition of a number of details to successfully analyze the complete exhibition; currently some features are not covered by key
works in museology. However, it is worth noting that the Digital Humanities are formulating guidelines for their research, hopefully these guidelines will soon be extended to include visitor experiences in museums.

With all this being said, who knows where digital archaeology will venture next? The outlook is exciting and it will be a treat to participate in the development of this field. I am optimistic that digital technologies will continue being a helpful instrument for education, entertainment and everything in between.
6. Summary

This dissertation is a study of two digital exhibitions which use immersive technologies; the study was conducted from a museum visitor’s perspective with the aim of highlighting the possibilities of digital technologies for creating a valuable learning experience of the past. The research questions focused on the difficulties of critically assessing a digital exhibition on the basis of existing examination instruments currently used in museology, where these are applied to traditional museum displays. The case studies present the new media which are being introduced in museums today: virtual reality and augmented reality; these are advertised as opportunities for new experiences of the past to museum visitors and are aiming to attract a younger public focusing on the technology. These technologies are known to the academic field, as they are increasingly used to document, visualize and analyze archaeological data by archaeologists. Unlike the field of public mediation, the researchers utilizing these technologies have the benefit of regulatory guidelines, which have been agreed upon to maintain the scientific rigor and transparency for those working with digital heritage. How can we as academics critically examine the digital experience used in museum displays?

The case studies are examples of different levels of interaction, immersion, and presence. The first case study is *Anno 1500* which was exhibited in Luleå, Sweden as part of the jubilee celebration of The Church Town of Gammelstad becoming a world heritage site; the digital exhibition allows the visitor to “travel back in time” via a high level of immersion experience of the Church Town in virtual reality. The second case study is *Augmented History: Gamla Uppsala* which was exhibited in Old Uppsala, Sweden as an opportunity for visitors of the Old Uppsala Museum to experience the ancient surroundings of the museum via low level of immersion in augmented reality. For the analysis of these digital exhibitions, a key article by Stephanie Moser, *THE DEVIL IS IN THE DETAIL: Museum Displays and the Creation of Knowledge*, provided effective analytical instruments of critical museology. The analytical categories included: architecture/location/setting, space, design/color/light, subject/message/text, layout, display types, exhibition style, audience and reception.

Experiencing the past using immersive technologies constitutes great possibilities for creating knowledge, but also requires further analytical dimensions if they are to be thoroughly examined. The case studies showed that some categories used in critical museology are ineffective when translated to digital exhibitions, much due to the virtual setting which eliminates physical aspects of examination such as: ‘display types’ and ‘exhibition style’. This
dissertation presents new analytical categories which include aspects introduced by the digital media. These categories are: ‘mood’ and ‘presence’ which take into consideration the virtual atmosphere created by the designers of the digital programs, and also the sensation of being free to roam in the virtual space.

The embodied visitor interacts with digital displays in similar ways as during a traditional exhibition, however when immersed in a virtual setting outdoors the visitor can experience additional elements created by digital weather and the choice of season set by the program designers. These factors contribute to not only sensational stimuli (visual, audio and motion) but also on an emotional level due to the associations connecting the virtual setting with memories of said atmosphere. This is an effective instrument of communicating information beyond archaeological data, functioning rather as an interpretation of the quality of life in the past.

It is possible to discern a strong connection to the gaming industry; both case studies used in this dissertation have used gaming platforms as foundation for the virtual and augmented settings. There are issues with the usage of pre-made 3D objects in an archaeological context, it is necessary to clearly state which objects are indeed archaeological artefacts digitally reconstructed, and those that are not. There is otherwise a risk of visitors accidentally assuming that all objects on display are based on archaeological finds, which would be unfortunate were they to happen upon the same objects in a fantasy game.

The results of this dissertation can be used within digital humanities for those working with immersive technologies in public mediation. Although further studies are necessary to completely cover all aspects of exhibition details and the creation of knowledge in regards to digital varieties, this study can provide a couple of helpful instruments to consider when creating a digital exhibition with archaeological content.
6.1 Swedish Summary

Denna uppsats är en studie av två digitala utställningar som brukar nedsänkande teknologier; studien utfördes genom en besökares perspektiv med syftet att lyfta fram möjligheterna med digitala teknologier i skapandet av meningsfulla lärande erfarenheter av det förflutna. Frågeställningarna fokuserade på utmaningarna med att kritiskt granska digitala utställningar med utgångspunktten att använda grundläggande analytiska verktyg som nytglas inom museologin och appliceras på traditionella museiutställningar. Fallstudierna presenterar det nya mediet som introduceras på museum idag: virtuell verklighet (VR) och förstärkt verklighet (AR); dessa marknadsförs som ett tillfälle för besökaren att uppleva det förflutna på ett nytt sätt och riktar in sig hos en yngre målgrupp med fokus på teknologin. Dessa teknologier är kända inom akademin då de brukas alltmer för dokumentation, visualisering och analys av arkeologiskt material. Till skillnad från publik förmedling så har dessa teknologier inom forskning riktlinjer som tydliggör den vetenskapliga rigorositeten och transparensen för de som arbetar med digitalt kulturarv. Hur kan vi då som akademiker kritiskt granska den digitala upplevelsen som används inom museiutställningar?

Att uppleva det förflutna med hjälp av nedsänkande teknologier medför stora möjligheter för skapandet av kunskap, men kräver också utvecklade analytiska dimensioner om de (de nedsänkande teknologierna) skall kunna fullständigt utvärderas. Fallstudierna visar att några kategorier inom kritisk museologi är ineffektiva när de översätts till digitala utställningar, mycket på grund av den virtuella miljön som eliminerar de fysiska aspekterna av utvärdering som till exempel: skyltningstyper och utställningsstil. Denna studie presenterar nya analytiska kategorier vilka inkluderar aspekter introducerade av det nya digitala mediet. Dessa kategorier är: stämning och närvaro, vilka tar i beaktning den virtuella atmosfären skapad av tillverkarna är de digitala programmen; samt känslan av frihet att kunna röra sig obehindrat i den virtuella rymden.

Den förkroppsligade besökaren interagerar med de digitala skyltningarna på snarliga sätt som på en traditionell utställning, däremot upplevs nedsänkningen i en virtuell miljö utomhus till större utsträckning på grund av digitalt väder och årstid. Dessa faktorer bidrar till fysisk stimulering av sinnena (syn, hörsel, rörelse) utan även på ett känslosmässigt plan då associationer mellan den virtuella miljön och besökarens minnen är oundvikliga. Detta är ett effektivt instrument för kommunicering av information utöver den arkeologiska datan, det fungerar snarare som en tolkning av livskvaliteten i det förflutna.

Det är möjligt att utröna en stark koppling till spelindustrin; båda fallstudierna som undersöks i denna uppsats har använt sig av spelplattformar som en grund för den virtuella och förstärkta miljön. Det finns problematik med användandet av färdiga/inköpta 3D-modeller i arkeologiska kontexter, dessa bör tydligt markeras för att klargöra för brukaren av digital teknik vad som är baserat på arkeologiska fynd och vad som inte är det. Om detta förbises finns det en risk att besökaren av en digital utställning antar att alla objekt som visas är arkeologiska fynd, vilket skulle vara olyckligt om samma föremål påträffas i ett fantasi-spel.

Resultaten från denna studie kan användas inom digital humaniora och då särskilt för personer som arbetar med nedsänkande teknologier i förmedlingssammanhang. Vidare studier är nödvändiga för att alla aspekter av en digital utställnings detaljer ska inkluderas, detta för att skapa en helt övergripande möjlikhet att skapa kunskap via digital förmedling; denna studie bidrar med två nya analytiska instrument att överväga vid formgivningen av en digital utställning med arkeologiskt material.
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<td>Presence.</td>
<td>CARROZZINO, M and BERGAMASCO, M</td>
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<td>4</td>
<td>HTC Vive Headset, headphones and hand controllers. Private photo</td>
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<tr>
<td>5</td>
<td>Front and back of brochure, “Anno 1500 UNESCO World Heritage VR Experience”</td>
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<td>6</td>
<td>Brochure, “Luleå 450 years ago”</td>
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<td>7</td>
<td>Brochure, “Meet the people of Anno 1500”</td>
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<td>8</td>
<td>Brochure, “Close to Reality”</td>
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<tr>
<td>9</td>
<td>Advertisement for Anno 1500 on social media (Arkeloggen) “New digital Technology Enables Time Travel to Church Town Gammelstad”</td>
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<td>10</td>
<td>Advertisement for Anno 1500 (NSD) “The time machine starts when you put on the goggles”</td>
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<td>11</td>
<td>Augmented History: Gamla Uppsala. Copyright Disir Productions</td>
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<td>12</td>
<td>Augmented History: Gamla Uppsala. Backpack and artefacts. Copyright Disir Productions</td>
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<tr>
<td>13</td>
<td>Augmented History: Gamla Uppsala. The woman in the great hall. Copyright Disir Productions</td>
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