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Feasibility of Utilizing VR for Virtual Exhibitions in the Museums of Satakunta

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The virtual reality (VR) industry has been rapidly expanding in the last few years. While the consumer VR market has primarily been focused on gaming, VR has been utilized in a variety of different methods such as training for first responders and human resources, virtual car showrooms by several car manufacturers and office work in some companies. Recently, businesses in the tourism industry began utilizing VR as well. The aim of this thesis is to learn the potential of incorporating virtual reality hardware and software for use in virtual exhibitions for museums located in the Satakunta region of Finland.

This thesis takes a deep dive into the VR industry describing key concepts, VR history, current VR hardware and a look into how VR is currently utilized in tourism. Additionally, the thesis investigates the Satakunta region as a tourist destination with a focus on the museums in the area. This dive includes, among other things, a discussion of museum categories and notable museums in the region.

For collecting the empirical data, the qualitative research method was utilized. The author reached out to museum staff in the region to conduct semi-structured theme interviews. Three interviews have taken place during the course of preparing this thesis and content analysis was the primary method utilized for analyzing the data. Based off the interviews, challenges, best applied VR usage and feasibility of utilizing VR in virtual exhibits emerged as the themes after content analysis was complete.

The interviewees have expressed interest in utilizing VR for virtual exhibitions. However, each museum in question faces a different set of circumstances that would need to be worked through to support this endeavor.

Key words
Virtual exhibitions, virtual tourism, utilizing virtual exhibitions in Satakunta

CONTENTS

1 INTRODUCTION

The virtual reality (VR) industry has been rapidly expanding in recent years. According to Road to VR (2021), a monthly survey conducted by Valve from a time period of June 2016 to July 2021 has noted an increasing number of users utilizing VR headsets on Steam. That number increased from around 100,000 in June 2016 to approximately 2,8 million in July 2021. For those unfamiliar, Steam, owned by Valve, is an online service that sells video games, allows users to play those purchased games and, more recently, equipment used for gaming including the Valve Index VR headset. Around the same time period, it has been noted that a majority of the headsets in use on Steam has been the Oculus Quest and the Oculus Quest 2 (Website of Steam 2022). With the ever-increasing availability of consumer and enterprise headsets and software, more people can experience what virtual reality is all about. This acceptance of using virtual reality equipment has been accelerated thanks to world events as of the time of this writing. For some, this equipment is the only way in which they can meet with family and friends.

This presents an opportunity for tourism. Some events have already taken place virtually such as concerts, festivals, and conferences. Additionally, some tourism businesses have also begun to utilize VR in interesting ways (ThrillSeeker 2021). The most common method of attending the aforementioned events have been with more widely accepted products like computers and mobile devices such as smartphones. VR has the potential of adding a new level of immersion that the more commonly used equipment has no ability to do.

Museums, in particular, stand at a point in time to potentially benefit from the use of VR. Museums already show an interesting perspective into their theme of choice such as history, art, and music through their exhibits, some of which are very creative with their approach. With VR, there could be a level of creativity for exhibits that could potentially be unmatched. Traditionally, tourism involves travel to a location for a

short period of time to experience the sights, sounds, feel, scents, and tastes of a destination or attraction (Website of UNWTO 2018). This by nature also provides a level of immersion. While being at the actual attraction or exhibit could provide a level of immersion that cannot be replicated, there is the opportunity for utilizing VR to provide a surprisingly deep immersion that other computing devices cannot provide by comparison. Exploring this could provide another avenue of revenue as well as sharing an experience that might not be possible for some otherwise. The objective of this thesis is to get closer to learning what place VR technology could be in the museums of Satakunta.

2 RESEARCH DESIGN

2.1 Thesis statement and questions

Given the nature of the idea that is presented in this thesis, this two-part thesis statement is as follows: With the advances that have been made in virtual reality in terms of its technology and accessibility, there is a market for virtual exhibits in the museums of Satakunta. Existing exhibits could benefit from having a virtual component in addition to the physical exhibit.

This statement has been the template for creating the research questions that is now being posed, beginning first with the main question. What is the potential for utilizing VR hardware and software in the implementation of virtual museum exhibits in Satakunta? To help answer the main research question, the following sub questions have also been created. Firstly, what could be the best applied use of VR for virtual exhibitions in the museums of Satakunta? Finally, what are the main challenges involved with implementing VR hardware and software for use in virtual exhibits and how can those challenges be met?

2.2 Aim, purpose, and delimitations

Answering the research questions above would be pointless without a general objective that one is aiming for. From there, the purpose can be visualized, and any applicable delimitations can be made. To get right to the point, the overall aim of the thesis is to increase the overall flexibility and attractiveness of museums in Satakunta.

It is important to note that with this aim, this thesis is in no way attempting to replace the traditional museum exhibit setup. The main purpose of this is to serve as an additional method of experiencing museum exhibits that can work in conjunction with the traditional exhibit.

The main delimitation concerning this research is the scope. The main focus of the coming research will be with museums in the Satakunta region. Additionally, while there would be interest to involve the larger museums of the region, the author believes that it would be more fruitful to focus the research on the smaller museums of the region. It is the opinion of the author that any benefit that the smaller museums can have will by nature extend to the larger museums of the region.

2.3 Usability and reasoning

The main benefactors for this thesis are the commissioner and the museums of Satakunta, the former of which will be discussed in the next subchapter and the latter in the following chapter. The previously mentioned world events have led to an increasing acceptance of VR hardware and software. With this, there is the possibility of interest with individuals who, at a different time, would not otherwise be interested in experiences involving this technology. This could lead to the potential of increasing revenue for the museums and, if future world events cause a disruption in travel, the museums could still have a method of generating revenue.

2.4 Commissioner

The commissioner for this thesis is Satakunta University of Applied Science's (SAMK) Center for Tourism Business Development (CTBD). The main objective of CTBD is to assist micro and small tourism businesses in being profitable while also utilizing sustainable and responsible business practices. To this end, CTBD offers tools, information, and support for these businesses to help them succeed. (Website of Center for Tourism Business Development 2022.) CTBD is working on a variety of projects both within Finland, Satakunta in particular, and internationally. The author's point of contact within CTBD is Jani Nevaranta.

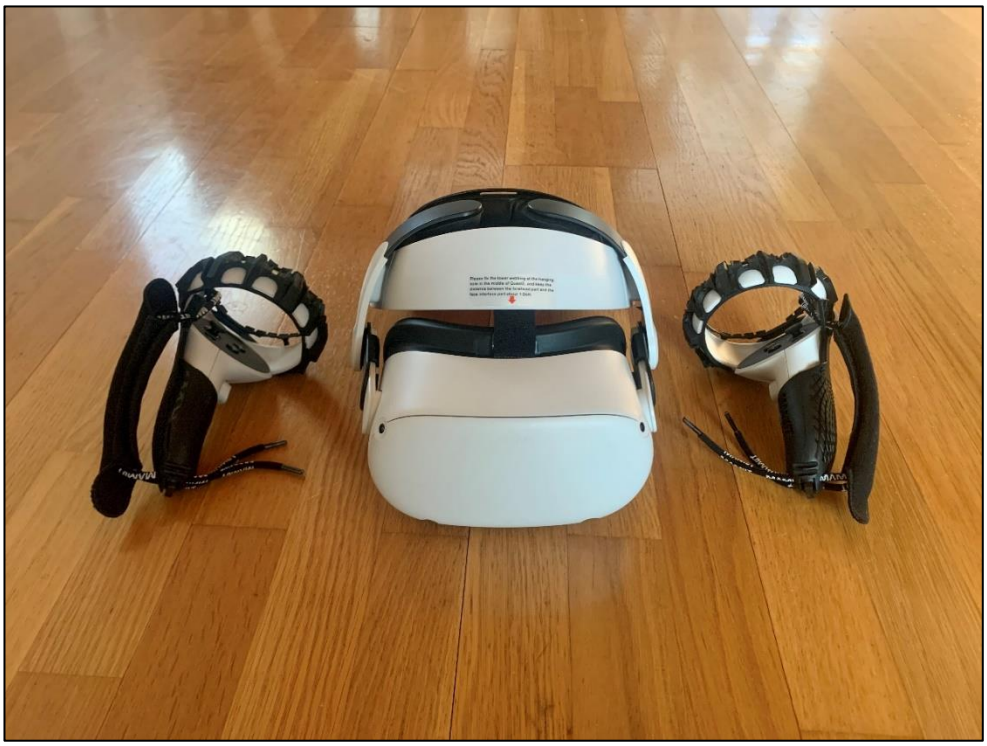
Full disclosure, the author had no contact with the members of CTBD prior to expressing interest in having CTBD as a commissioner for this thesis. However, this

topic does line up well with the objectives that the CTBD is attempting to achieve this year.

3 VIRTUAL REALITY AND ITS USE IN THE CONTEXT OF TOURISM

3.1 VR Hardware, software, and types of virtual reality

Before diving further, it would be prudent to define virtual reality as a term for the context of this thesis and describe the types of hardware and software that is currently on the market. According to Trahan, Smith, and Talbot (2019), virtual reality is defined as a computer-generated environment in which an individual can enter, move around in, and interact with in a similar fashion that one can in the real world. In most, but not all cases; the equipment used to allow this level of interaction assumes the form factor of a headset that one can wear on their head. Most headsets also come with a set of controllers that represent one's hands in the virtual environment. The below picture shows a type of VR device that is available to the consumer market.



Picture 1. Oculus Quest 2 Virtual Reality Headset and Controllers (Author's own photo).

There are three distinct categories of virtual reality: non-immersive virtual reality, fully immersive virtual reality, and semi-immersive virtual reality. The main difference

between each of these types is the degree in which the user feels as if one is “in” the virtual environment using their own senses such as sight and hearing. Non-immersive VR tends to involve only a couple of senses. An example of non-immersive virtual reality would be someone playing video games on a computer. (Tech Ardent 2018.)

Fully Immersive VR provides the deepest level of immersion in the virtual environment to the user. This type of VR utilizes equipment like what was shown in Picture 1 which allows for freedom of movement in the virtual environment and interactions with objects in the environment. The user would also be able to feel feedback from the environment, usually in the form of haptic technology. (Tech Ardent 2018.) In addition to the hardware, graphical software will be used in such a way that the human eye can see “depth” within the virtual environment (Anchan 2021).

Before describing semi-immersive VR, one should briefly note the differences between the terms three degrees of freedom (3DOF) and six degrees of freedom (6DOF) when virtual reality is concerned. According to the Training and Development Channel (2020), a VR system that utilizes 3DOF is one that allows a user to look around in all directions in a virtual environment from a fixed location; the user cannot move from that fixed point in the environment. 360 videos are an example of this. On the other hand, a VR system that utilizes 6DOF allows users to look around the environment in all directions and move around in the environment in all directions (The Training and Development Channel 2020). Many VR games utilize hardware that would be classified as 6DOF devices (Website of Oculus 2022; Website of Steam 2022).

Finally, semi-immersive VR is a type that utilizes equipment that would fall into non-immersive VR as well as equipment that falls into the fully immersive VR category. Primary examples of this include flight simulators, scenario training software that for example an HR employee or police might use, and training simulations that would be used by military and emergency services. (Tech Ardent 2018.)

3.2 A brief history of Virtual Reality

The roots of virtual reality go back to the 1950s. Morton Heilig, who has often referred to as the Father of VR, brought into fruition his idea of engaging more human senses in experiences by creating the Sensorama. (Mealy 2018.)

Compared to modern VR headsets, the Sensorama was quite large in the same vein that computers used in the same timeframe; it needed a decently sized room to house it. The Sensorama can be described as a box with an opening that can be enclosed for one's head. There, one would notice a stereoscopic three-dimensional (3D) display used to make one feel as if they are in the virtual environment. The Sensorama also had a couple of places where one can place their hands and a seat for the individual to sit on (Mealy 2018.) The main experience that users of the Sensorama would witness is a motorcycle ride that took place in New York. However, unlike the modern VR applications of today, one is only able to enjoy the pre-recorded experience. (Regrebsubla 2016.)

Before moving on, one term should be defined. Stereoscopic displays utilize a technique known as stereoscopy which is defined by Merriam-Webster (2022) as a technique that allows one to view the environment in 3D. In a nutshell, the display would display two images of the same object. One of these images would be taken at a spot a few centimeters to the left or right of the other image that would eventually correspond to the left or right eye accordingly. This distance taken between the left and right photos depend on how far the object is from the camera itself. The resulting image seen by the user appears as a three-dimensional image. (Reinecke 2013.) This is similar to how one can see the real environment through their own eyes in 3D (Lazarus 2021).

Additionally, the Sensorama was unique with the fact that it utilized multiple senses even when compared to standard VR hardware in use today. In order to make the experience more immersive, a fan was included that would allow the individual to feel the wind against their face. Additionally, one would experience the smells of New York such as the exhaust from other vehicles. (Regrebsubla 2016.) One will note that

with exception of some experimental devices, modern day users as of the time of writing this thesis are unable to experience different scents in virtual reality.

As one might imagine, the Sensorama was a device that might have looked strange to the average onlooker. However, it did have many features, some of which are still in use in the modern VR devices currently in use. In addition to what was described above, to help give the illusion of being a part of the virtual environment, the Sensorama utilized features such as a stereoscopic 3D display and stereo speakers. Additionally, the chair that the individual would sit on also provided some haptic feedback. After this creation, Heilig developed and patented what would become the first head-mounted display (HMD), the Telesphere Mask (Mealy 2018).

The Telesphere Mask, patented in 1960, was an HMD that, compared to the Sensorama, was much smaller in nature. Developed for individual use, this would be worn on the head, covering the eyes, nose, and ears of the user. (Mealy 2018.) It also features adjustments that allowed the user to adjust the lenses and earphones to better suit their facial measurements such as interpupillary distance (IPD), the space between the pupils of both eyes (Ismail & Pillai n.d.; Website of Canadian Association of Optometrists 2022).

Those familiar with modern VR HMDs will notice that the Telesphere Mask shares a similar form factor to the VR devices of today. Like the ones in use today, this device was designed to be worn on the face. It also continued the usage of the stereoscopic 3D display that was in use in the Sensorama. (Mealy 2018.) Additionally, unlike a majority of modern VR HMDs with PIMAX HMDs being the exception, one can see the virtual environment at the limits of one's natural peripheral vision. (Brockwell 2016; Website of PIMAX 2022.)

In the 1990s, Sega and Nintendo have made their own attempts at creating a VR device for use by consumers to support their video game consoles. Unfortunately, each of these attempts have been unsuccessful, albeit for varied reasons. The device being developed by Sega at the time was never released to the general public. During testing, the testers were noted to experience painful headaches and motion sickness. (Mealy 2018.)

Unlike Sega, Nintendo did eventually release a VR device, dubbed the Virtual Boy, to the consumer market, albeit with changes from the original design. It was originally intended to be a tracked headset. However, like the testing phase with Sega's product, there were cases of motion sickness among the testers. Additionally, there were further concerns regarding whether the device could potentially cause adverse eye conditions in children. These issues led to a redesign of the device. Ultimately, the Virtual Boy did not perform as well as Nintendo was expecting, and the product was discontinued after the first year. (Mealy 2018.)

Progress in VR technology between the late 1990s up until approximately 2010 has been minimal. In the early 2010s, Oculus, a then little-known company, released the Oculus Rift Development Kit 1 (DK1) after a successful campaign on Kickstarter in March 2013. This led to the eventual release of the Oculus Rift CV1 in 2016. (Website of Kickstarter 2022; Website of Oculus 2022.) According to Oculus (2022), this headset and controllers were tracked via external sensors placed around the "play space" that could detect the infrared sensors that have been placed on the headset and controllers. To note, since then, Oculus has released three more VR headsets as of the time of writing this: the Oculus Rift S, Oculus Quest, and Oculus Quest 2. These latest iterations went away from utilizing an external sensor-based tracking solution to utilizing a tracking design known as Inside-Out tracking. Each of these headsets utilize cameras placed in strategic positions on the headset itself that allow it to see not only its location in a play space, but also track the location and orientation of their respective controllers and, eventually, the hands of the user. (Website of Oculus 2022.)

Around the same time that the Oculus Rift CV1 was released, HTC released their first VR headset, the HTC Vive, to the public. Like the Rift CV1, the HTC Vive was also externally tracked, albeit with sensors known as lighthouses. (Website of Vive 2022.) A plethora of headsets from these and other companies have been released since then.

3.3 Locomotion and interaction in a virtual environment

While touched upon in chapter 3.1, locomotion and interaction within a virtual environment (VE) is a topic that deserves its own subchapter. Since the inception of VR, the problem of locomotion and interaction within the virtual environment has existed. Various types of locomotion have been attempted in VR from the very beginning, both physical and artificial. Because most of these types of locomotion are inherently different from how one would move about in the real world, those new to virtual reality can face a couple of issues depending on the type of experience one is participating in. According to Boletsis (2017), locomotion done by physically moving in a physical space is more intuitive and immersive whereas artificial locomotion is less immersive, requires more brain power and can cause motion sickness in many people. Motion sickness primarily comes about when the brain receives conflicting signals from the parts of the body whose job is to detect motion. A non-VR example of this would be of an individual getting carsick when reading a book while the car is moving. (Website of Cleveland Clinic 2022.)

As of the time of writing this thesis, there are eleven different types of locomotion within the VE. Table 1 below showcases the different types of locomotion currently available:

Table 1. VR Locomotion Types (Boletsis 2017).

VR Locomotion Types
Real-walking
Walking in place
Controller / Joystick
Gesture-based
Teleportation
Redirected walking
Arm swinging
Reorientation
Head-directed
Human joystick
Chair-based

Of note, the ones that are closest to how one would move around in the real world include real walking, walking-in-place, redirected walking, and reorientation. Real walking is exactly how it sounds; however, it comes at a cost of the size of the VE. In this case, the VE is limited to size of the physical space available to the individual. Redirected walking and reorientation makes attempts to allow the individual to still utilize movement as one would normally while also allowing for VEs larger than the physical space. This is done utilizing software techniques such as redirection and reorientation. (Boletsis 2017.) The latter technique allows for continued movement utilizing for example a Euclidean orbifold, which allows for the creation of "VE spaces" that can be overlaid on top of another space. Without getting into the complicated math, utilizing this technique allows the software to create VEs that are vastly larger than a physical space while still allowing the individual freedom to explore the space with their own body. (Cortés, Márquez & Valenzuela 2004, 27-29; Website of Steam 2022.) Tea for God is an experience that utilizes this concept (Website of Steam 2022). Walking in place is also just as it sounds. This method of locomotion requires a set of sensors on or near the feet or extra equipment such as an omnidirectional treadmill to provide the movement data needed to transfer that motion into forward movement (Boletsis 2017; Website of Kat VR 2022).

The rest of the locomotion techniques not mentioned in the paragraph above are more artificial types of locomotion that do not rely on the movement of an individual in a physical space. A few of these types of locomotion requires a controller or joystick to use such as the aptly named controller / joystick (also known as smooth) locomotion, teleportation and arm swinging. Gesture-based locomotion requires an HMD that utilizes hand tracking to allow the user to make hand gestures that translate into movement in the VE. (Boletsis 2017.)

Finally, head, human joystick and chair locomotion use the orientation and positioning of the HMD itself for the purpose of locomotion. The primary difference between these two is the method used for movement. For example, if using head locomotion, the user will tilt their head in the direction they want to move in their VE whereas in human joystick locomotion, the whole body is invoked in the tilt. The latter will require extra equipment such as a balance board for input. Chair locomotion operates on the same principle of human joystick locomotion in many cases. The difference here is the chair

itself is the input device. (Boletsis 2017.) In the experience of the author, many VR experiences allow for more than one type of locomotion. This allows a larger number of users to enjoy the experience. Additionally, some experiences can utilize a combination of these locomotion techniques.

3.4 Current application of virtual reality to tourism

There are a few instances in which VR is currently being utilized for tourism. There is one example of a city that has utilized VR technology extensively, Miami. According to ThrillSeeker (2021), in addition to VR arcades and VR business applications such as car showroom demos, The Immersive Experience - Van Gogh offers a VR experience as well. This experience allows the individual to experience several works of Van Gogh in a way that is not normally possible. This also complements the other exhibits that are part of this experience such as the immersive room which offers a 360-degree view of iconic artwork complete with lights and sounds. (The Immersive Experience Van Gogh 2022.)

A couple of VR experiences that are available in the consumer market include The Lab, found in the Steam (2022) storefront and the Museum of Other Realities, found in the Steam and Oculus (2022) storefronts. Within The Lab, there is an experience called Postcards that allows individuals to visit the tourist locations of Venice, Italy, Vesper Peak in the US, Snæfellsjökull National Park, and Raufarhólshellir Lava Tube, the latter two being located in Iceland (Website of Steam 2022). This is possible with the extensive use of photogrammetry. ClimaByte (2016) defines photogrammetry as the act of creating a virtual three-dimensional space of an area by utilizing overlapping photos taken by digital cameras. These photos are taken in such a manner that would allow for the proper measuring of distances in the real world, thereby allowing for the recreation of an environment virtually.

By contrast, the Museum of Other Realities takes place completely in a virtual environment. Set up like a typical museum, there is a collection of exhibits such as art exhibits that have been made in VR, other types of exhibits that explores the use of a combination of sound and artwork, and videos that can be viewed in VR. Some of

these exhibits allow the individual to see the “world” of the artwork by enable one to enter the painting. The exhibits themselves are updated regularly. (Website of Oculus 2022; Website of Steam 2022.)

In Finland, there are several museums that have utilized some form of virtual exhibits. For example, the Museum of Contemporary Art Kiasma has an art collection that is available online. Of note, this collection is only available online and covers a variety of art including works that have been inspired by gaming and VR videos. Additionally, some of these works invite the participants to interact as well. (Website of Kiasma Online Art 2022; Website of My Helsinki 2022.) The Theatre Museum in Helsinki is another example of a museum in Finland that offers virtual exhibits as well. Much like the Museum of Contemporary Art Kiasma, these can also be viewed from home. To note, at least one of their online tours can also be viewed through a VR headset. (Website of My Helsinki 2022; Website of Teatterimuseo 2022.)

4 SATAKUNTA REGION OVERVIEW

4.1 PESTEL analysis definition and application

To better understand how VR technology can be used for tourism in Satakunta, there is the need to perform an analysis for the Satakunta region itself. A tool that can be useful here is the PESTEL analysis. The PESTEL analysis is a method of analyze the macro environment of a target area PESTEL itself is an acronym that stands for the following: Political, Economic, Sociocultural, Technological, Environmental, and Legal. These categories represent the main areas that this analysis method will take a deeper dive into. In this case, this analysis will be used to showcase how the general environment in Satakunta, and Finland in the expanded sense, can affect how tourism operates. (Website of CFI 2022.) The table below will showcase the PESTEL analysis applied to Finland as a whole.

Table 2. Satakunta PESTEL Analysis

<table>
<tr><th colspan="6">Satakunta PESTEL Analysis</th></tr>
<tr><th>Political</th><th>Economic</th><th>Sociocultural</th><th>Technological</th><th>Environmental</th><th>Legal</th></tr>
<tr><td>Stable political environment</td><td>2022 GDP forecast: $280 billion</td><td>High life expantancy</td><td>Advanced tech</td><td>Known as "the land of 1000 lakes"</td><td>Freedom of speech, press, and religion is a critical component of the legal system in Finland</td></tr>
<tr><td rowspan="4">Neutrality as its political and security posture (before Feb 2022)</td><td>Export driven economy</td><td>Relative gender equality</td><td rowspan="4">High level of computer literacy</td><td>Large portions of Satakunta (& Finland) forested</td><td>Independent judicial system & transparent government</td></tr>
<tr><td>No statutory minimum wage</td><td>Respect of religious views</td><td>Many national parks, islands</td><td>Contractual agreements are honored</td></tr>
<tr><td>Main industries: Industrial & service</td><td>Housing crisis</td><td>Harsh winters</td><td rowspan="2">Employees entitled to many benefits</td></tr>
<tr><td>Main trading partners: Germany, Sweden, US, UK, China, Russia (prior to Ukraine conflict), Netherlands & France</td><td>Labor shortage</td><td>No mountains</td></tr>
</table>

There are a few main points to consider in this analysis that could relate to this thesis down the road. In the political portion of the analysis, Finland has utilized neutrality as its political and security posture for a long time. As most would already know, global events have caused a shift in this idea that also spread to other portions of the analysis. (Website of Yle 2022.) Having stated this, according to the CIA World Factbook (2022), Finland is part of the EU Common Security and Defense Policy (CSDP) and has also participated in several North Atlantic Treaty Organization (NATO) exercises and operations since 1994.

In 2019, Finland had a GDP of over 268 billion US dollars which grew in the following couple of years to approximately 299 billion in 2021 (Website of Trading Economics 2022). According to the European Commission (2022) and the CIA World Factbook (2022), while there has been some slowdown in GDP growth for Finland due to current events, Finland's GDP is projected to experience one point eight percent growth at the end of 2022. A large portion of that, approximately one-third of which, comes from exports in the industrial, manufacturing and service industries (Website of the CIA World Factbook 2022).

Of note, the main portion of the analysis that can be applied to this thesis is the technological section. Most people in Finland, including those in the Satakunta region, have smartphones that can be used in their daily lives for tasks including utilizing online credentials for logging onto many websites. Additionally, computers are utilized in the working and living environment. This also includes the use of VR in business, game development and training.

4.2 Museum categories and notable museums in Satakunta

4.2.1 Museum Categories

Before delving into the types of museums that exist in the Satakunta region, it would be appropriate to discuss the different types of museums in general. Much like the various types of themes present in museum exhibitions, there are different types of museums in general. According to Holloway and Humphreys (2016, 284), most museums fall into one of the following categories: national museums, independent museums, regional museums, local authority museums, and small private museums. It is important to note that the independent category is in actuality two different categories: independent charitable trust museums and independent non-charity museums, thereby making a total of six categories. (Holloway & Humphreys 2016, 284). The primary difference amongst all of the categories is determined by the type of funding the museums receive.

Holloway and Humphreys (2016, 284) state that museums that fall into the national museum category receive funding from the government of the country it is located in some form. Different departments of a government could provide the funding; this is usually dependent on the theme of the museum in question. The National Museum of Finland is an example of a national museum (Website of Kansallismuseo n.d.). The Ministry of Education and Culture is the department that approves funding for national museums and the requirements that have to be met to receive funding can be found as part of the Museums Act and Government Decree concerning Museums. (Website of Ministry of Education and Culture 2018.)

Independent charitable trust museums such as Emil Cedercreutz Museum in Harjavalta are not funded in the same manner as national museums. These types of museums usually get their revenue based on an accounting concept known as turnover (Holloway & Humphreys 2016, 284). Of note, the Emil Cedercreutz Foundation is the current owner of Emil Cedercreutz Museum (Website of Harjavalta n.d.). This method is a way to figure out how efficiently a business such as a museum performs. There are many types of ways to conduct a turnover such as working capital turnover and accounts receivable turnover. The bottom line is that all types of turnover are utilized to determine the efficiency of a business. (Website of Investopedia 2022.)

Independent non-charity museums differ from independent charitable trust museums. For one thing, there is no charitable trust involved. Museums in this category can get funding from various sources and can utilize both public and private funding. (Holloway & Humphreys 2016, 284.)

Regional museums such as Satakunta Museum do utilize public money but can also receive private money as well. The difference between this and national museums is the fact that this money is not approved at the national level. The amount received in most cases would also be less than the amount that national museums receive. (Holloway & Humphreys 2016, 284.)

Local authority museums like the Rauma Maritime Museum are typically owned or receive funding from their partners, groups, investors, etc. Some examples of this would be a maritime organization or a city council. Finally, small private museums are

museums that rely solely on private funding. One can infer that these museums are relatively small compared to those in the other categories. (Holloway & Humphreys 2016, 284.) Ahlström Voyage is a museum that fits into this category.

4.2.2 Museums in Satakunta

The Satakunta region is home to a plethora of museums representing a wide variety of themes. The majority of these museums are located in the wider Pori area, Rauma, and Harjavalta (Website of Google Maps 2022). There are others in the smaller towns and with some tourist attractions in the region. It has been noted particularly with the museums in the Pori area that summer is the busy season (Jakomaa, personal communication on 22.3.2022; Website of Visit Pori 2022).

These museums offer a wide variety of themes that can cater to a wide audience. In addition to the usual themes of art, nature, history, and culture that can be found in for example, Pori Art Museum, Nature Center Ark, and Satakunta Museum, other themes are also represented (Website of Visit Pori 2022). These include the maritime theme via Rauma Maritime Museum, lace making, showcases of key figures in history, and home museums. The latter three themes are represented by Rauma Old Town Hall, Emil Cedercreutz Museum in Harjavalta and Kirsti in Old Rauma, among others in Satakunta. (Website of Visit Rauma 2022; Website of Visit Satakunta 2022.) The region also has an important industrial heritage which is also a showcased theme. Ahlström Works, Leineperi IronWorks and the Rosenlew museum showcase this theme very well (Website of Ahlstromin ruukit 2022; Website of Visit Pori 2022; Website of Visit Satakunta 2022).

5 METHODOLOGY

While the author does have experience utilizing virtual reality both as a consumer and for scenario-based training purposes, the methodology that will be used for this thesis will be research based utilizing the qualitative research method. The research questions as they are written now would be best answered utilizing this type of research.

5.1 Qualitative research methods versus quantitative research methods

It is important to understand what qualitative and quantitative research methods are and what can be expected with each method. When looking at the term qualitative research, one could think of this as considering the quality of the data to be more important than the amount of data collected. A researcher that is doing qualitative research aims to gain a deeper understanding of their research topic. (Gori & Perez-Vega 2015, 108.) By contrast, quantitative research is more concerned with the quantity of the data. This is normally accomplished with a defined set of variables and numbers (O'Gorman & MacIntosh 2014, 155-157). With this method, more is better and in certain situations, this method would be good for seeing trends amongst a large number of respondents (Puusa, Juuti & Aaltio 2020).

To note, the methods one would use when utilizing qualitative research is different from the methods used in quantitative research. Since content and context is key in qualitative research, a primary method of obtaining useful information is through the use of interviews. The interviews used in this method are more open ended in nature, therefore providing opportunities for discussion between the interviewees and the interviewer. Other methods of gathering data include, but are not limited to, observations and letters. (Puusa, Juuti & Aaltio 2020.)

5.2 Interview type description and type selection for thesis

Since this thesis is utilizing the qualitative research method as the main method of data collecting, the author has decided that interviews would be the best method of

acquiring usable data. While both qualitative and quantitative research methods can utilize interviews, the approach to interviews in each is different. The content, in other words, quality, of the data is more important to the researcher in qualitative research whereas in quantitative research, more emphasis is placed on the amount of data which would require a slightly different setup for the interview. One can think of the latter more akin to a job interview in which the interviewer has a static set of questions for the interviewees to answer. (O'Gorman & MacIntosh 2014, 156.)

While the methods of conducting interviews are numerous including face-to face, online, and phone, the main types of interviews can be broken into three categories: unstructured, structured, and semi-structured. Unstructured interviews are exactly as they sound, interviews without a set structure. According to Lochrie, Curran and O'Gorman (2015, 119), unstructured interviews allow for the possibility of obtaining the deepest level of usable information at the cost of an increased amount of time and resources used. The interviewer using this type of interview should be one that is skilled at interviewing people. It is important to note that there is an additional possibility of bias being introduced by the interviewer. (Lochrie, Curran & O'Gorman 2015, 119.)

Structured interviews are quite the opposite of unstructured interviews. These interviews can be seen as being the most rigid of the different interview types. With this, there is no deviation from the set of questions that the researcher has developed, thereby providing the least opportunity for obtaining anything other than surface-level data. On the positive side, the chance for the introduction of bias by the interviewer is very small, though not non-existent. This interview type requires lots of knowledge by both the interviewer and interviewee on the topic at hand. (Lochrie, Curran & O'Gorman 2015, 119.)

Finally, the semi-structured interview is a blend of both unstructured and structured interviews. Like the structured interviews, there are questions made in advance. The difference here is that unlike the structured interviews, there is room for the interviewer to ask follow-on questions as the interview unfolds. In most cases, this is dependent on the answers of the interviewee. Additionally, this is usually done to dive a little deeper into the topic that is currently being discussed. While this type of interview will

take more time than the structured interview, it will take less time than the unstructured interview. (Lochrie, Curran & O'Gorman 2015, 119.)

Since this thesis is utilizing qualitative research, there is one method that the author will use collect the empirical data required to complete this thesis. Since this technology is still relatively new, the method of collecting this data will be through the use of semi-structured theme interviews. The interviews themselves will be split into four themes. The details, or to be more specific, the structured set of questions for these interviews and the respective themes can be found in Appendix 1. It is important to gain as complete of an understanding of not only any advantages or disadvantages of utilizing such technology in the museums of Satakunta, but also to learn what challenges could potentially exist in the incorporation of this tech and possible methods to approach when attempting to solve those challenges. These interviews will be transcribed for content analysis purposes.

5.3 Content analysis

Since interviews were the only method utilized to gather data, the interviewee answers were transcribed for the purpose of content analysis. Qualitative analysis will be the method used for this purpose. This is useful in this case due to the type of data that is being collected. The main purpose is described in the name of the method itself; it takes a deep dive into the answers given by interviewees. This would allow the researcher to further process the data to gain more knowledge and can possibly lead to several conclusions depending on the subject researched. With these interviews, there is no real numerical type of data being collected that could be used for analysis purposes; this data is primarily the words, sounds, body language of the interviewees as well as the pertinent surrounding environment. (Adams, Khan & Raeside 2014, 159.) Therefore, methods utilized in quantitative research do not apply here.

According to Adams, Khan and Raeside (2014, 159), a main component of content analysis involves significant words that have been used frequently by interviewees. The research questions posed by the researcher serve to point towards these important words.

For content analysis to work, there are several steps that need to be completed that include identification, categorization, tabulation, and illustration (Adams, Khan & Raeside 2014, 160-162). Identification is the most obvious first step involving choosing what one will analyze such as interviewee answers. Categorization is a two-step process. First, the researcher would need to determine what the categories the collected data will fall into. It is important that these categories are relevant to the topic being researched and consider all possibilities.

Coding is the second step in categorization. While the actual codes will be generated after data collection, the codes themselves will fall into the open category for this thesis. According to Sang and Sitko (2015, 141), codes in the open category are used to help define important concepts. This would require the perusing of the data to find the noteworthy bits. These would then be added to the appropriate categories previously set. The tabulation and illustration steps formally put the data into tables, charts, or illustrations in a way that others can hopefully understand (Adams, Khan & Raeside 2014, 162).

Given the research questions discussed earlier, the objective of the data collection would be to determine a few key things. From the interviews, the author wishes to learn about the participants' virtual reality experience, general perception amongst staff regarding virtual reality, where the interest exists for the implementation of VR exhibits, perceived and actual challenges in implementation of VR exhibits and, most importantly, how to best utilize this technology for museums.

6 DATA PREPARATION

As of this writing, the data preparation and collection process will be conducted utilizing a variety of sources. Initial preparation and collection, not including the author's own experience with this technology, will be done utilizing online sources for example, websites, other theses of similar topics, online article journals, VR news sources, forums, etc.

Another source would be interviewees. The commissioner itself could be a potential source, however, interviewees that do not work for the commissioner would also be desired. These could be museum managers in the Satakunta region for interviews and potential target customers for the survey. Additionally, obtaining an interview from an individual(s) who develop VR hardware and software could help to gain a deeper understanding on the technological side.

Sampling is an important part of qualitative research. When utilized properly, the researcher can have an easier time finding potential candidates to help in conducting their research. According to Merriam-Webster (2022), sampling is defined as the ability of an individual to search for representatives within a population that fall within a set of parameters that can help accomplishing the task the individual wants to complete. Sampling is not quite as straightforward as one would think. Additionally, sampling can potentially be applied in different ways between the qualitative and quantitative research methods. While the author is utilizing qualitative research, it is still important to have a bit of familiarity on how sampling is used in quantitative research to better understand the difference. Hence, there will be a brief discussion of sampling in the quantitative context first.

In the context of quantitative research, sampling falls into two main categories: non-profitability sampling and profitability sampling. While both categories have subcategories associated with them, discussion into these subcategories is not required for general understanding of sampling. Probability sampling can be thought of as this: an individual using this method gives everyone in their sample an equal chance of being selected. By contrast, an individual utilizing non-probability sampling does not

give everyone in the sample an equal chance of being selected. One should note that out of the two categories, probability sampling has the higher chance of being unbiased due to the way it works. (Etikan & Bala 2017, 1-2; Website of Key Differences 2022.)

For qualitative research, sampling can be completed in a slightly different way although it is important to note that probability sampling, also known as random sampling, can also be used here. The various ways one can utilize sampling in qualitative research includes random sampling, ad-hoc sampling, snowball sampling, maximum-variation sampling, typical-case sampling, theory-guided sampling and finally, negative or deviant-case sampling (Easterby-Smith, Thorpe, Jackson & Jaspersen 2018).

While random sampling has been briefly touched upon in the second paragraph of this subchapter, more details will be added here. According to Acharya, Prakash, Saxena and Nigam (2013), random sampling can be further broken down into subcategories including simple random sampling, systematic random sampling, and stratified random sampling. Random sampling is done utilizing the same method that was discussed in probability sampling in the second paragraph in this subchapter. In other words, this can be done by, for example, drawing a random number from a hat that corresponds to a particular individual on a table that the researcher has created or by using a program utilizing a random number generator (RNG) or other similar method (Acharya, Prakash, Saxena & Nigam 2013, 330-331). The difference between this and systematic random sampling is the way in which participants are randomly selected. The initial selection is completed using the same methods as just discussed, however, follow-on selections are done via math. The researcher here will take the number of candidates in the sample size and use the process of division to determine subsequent candidates. The dividing number in this case is equal to the number of participants that the researcher wants. Stratified random sampling takes this a step further and uses identifying factors like gender to create additional groups. (Acharya et al. 2013, 331; Etikan & Bala 2017, 2.)

Ad-hoc sampling is useful when the researcher is seeking answers to a particular question (Website of Statistics How To 2022). In a lot of cases that utilize this method

of sampling, time may be of the essence. Therefore, it might be prudent to select individuals that are available and relatively easy to get to.

Snowball sampling begins as random sampling at the outset. The difference here comes during the actual data collection process, which in the case of this thesis, would equate to the interview. During this time, the researcher can take note of information acquired from the interview that could potentially lead to another interview candidate. (Etikan & Bala 2017, 2.) Maximum-variation sampling means exactly as it sounds. The objective of this sampling method is to generate the widest range of variables that can be used to answer the research questions developed by the researcher. (Easterby-Smith, et al. 2018.)

Typical-case sampling is a method used to learn the most likely scenarios for a given topic. This method works best for the individual looking to learn what is the most probable outcome or answer to their question and would not work well for one utilizing for example, maximum-variation sampling. Those utilizing research based on theory could potentially lean towards using theory-guided sampling. In this case, theoretical concepts are used to help the researcher determine potential candidates for further contact. Finally, negative-case sampling, also known as deviant-case sampling, can be utilized in many situations. One can think of the goal of this type of sampling as finding candidates that would "play devil's advocate": these candidates are those most likely to provide a counter argument for a theory or idea that the researcher is seeking to learn more about. (Easterby-Smith et al. 2018.)

For the thesis, my main target for the interviews were museum staff and VR professionals, with a focus on museum staff. With some guidance from the commissioner, the author found the appropriate people to contact for interviews. The author targeted at least 3 interviewees.

Within museums, the author initially focused on the smaller museums in the region. This decision was based primarily so that there would potentially be a brief exploration of funding. This also ran on the assumption that if the smaller museums can get through any budgeting constraints should they attempt to incorporate virtual reality into their exhibits, then the larger museums should be able to as well.

To that end, the author has been able to obtain interviewees from three different museums in the Satakunta region, Tiina Rajala, Manager of Guest Relations at Ahlström Noormarkku, Johanna Jakomaa, Acting Director of Satakunta Museum and Anni Venäläinen, Acting Director of Pori Art Museum. The researcher has utilized a combination of ad-hoc and snowball sampling. The prerequisite requirement in place for obtaining these interviews were that individuals need to be museum professionals in the Satakunta region.

Ahlström Voyage is an exhibition that is a part of Ahlström Works in Noormarkku. The aim of the exhibition is to show the history of Ahlström and the large role that the company has played in Finnish industry, architecture and art (Website of Ahlstromin ruukit 2022.)

In addition to being a history museum that primarily showcases the history of the region, Satakunta Museum, located in the city center of Pori, also hosts a variety of exhibitions. Additionally, three other museums in the area also fall under the umbrella of Satakunta Museum: Renovation Center Toivo, Nature House Arkki, and Rosenlew Museum. All these museums, except Nature House Arkki, showcase a different aspect of the history of Satakunta. (Website of Visit Pori 2022.)

The Pori Art Museum is also located in the city center of Pori near Satakunta Museum. The focus of the museum is to display exhibitions of contemporary art from domestic and international artists. The museum also supports a variety of themes. (Website of Pori Art Museum n.d.)

7 RESULTS

7.1 Categories and codes

After interviewing staff from three different museums in Pori and Noormarkku, the resulting answers to the research questions have been rather interesting. These questions will be answered in the conclusion, but right now it would be prudent to discuss what was discovered from the interviews.

From the interviews, the researcher has determined several categories and codes useful in answering the research questions. The categories themselves are in line with the research questions posed by the author. These categories include challenges, possible solutions, best applied use and feasibility of VR use. The codes will be depicted in Table 3 below.

Table 3. Codes.

Codes
VR Exhibit length
Staff perceptions
Customer mindset
Timeframe for changing museum exhibitions
Locomotion / motion sickness
In-house technical knowledge base
General attitudes / culture about trying new things
Learning methods
Chasing the new shiny object
Technological advancement vs. bureaucratic advancement
VR headset comfort / experience quality

As one can see, the interviews have brought about a variety of codes. The answers from the interviews given that corresponds to these codes generated surprisingly intricate answers to the research questions posed. In order to best showcase the results of the interviews, it would be prudent to see how the codes for the various responses fit the themes discussed throughout the interviews.

Out of all codes discovered, the ones that the interviewees have been mentioned the most are the timeline for changing museum exhibitions, staff perceptions, general attitudes / culture about trying new things. While these have been the most mentioned, it is important to note that there are a few things in the other areas that have a much larger impact in the grand scheme of things.

7.2 Details within the codes

Starting with the VR Exhibit length code, a couple of points were brought up during the interviews. During the interview with Rajala (personal communication on 8.9.2022), there was a discussion regarding the amount of time that a potential VR exhibit should take. While no solution was discovered, the general thoughts were that the time would fall between five minutes and thirty minutes depending on the type of content being showcased. This was echoed during the interview with Venäläinen (personal communication on 30.9.2022) alongside the conversation regarding HMD comfort. That being said, she had expressed more of a desire to keep the length shorter due to a previous experience using VR.

All interviewees had some comments to share regarding staff perceptions. One main point that has been brought up from each of the interviews is the thought of some members of their respective staff asking some form of "What does this mean for me?" During the interview with Rajala (personal communication on 8.9.2022), there was also the counterargument to this question, especially concerning the guides employed there. While both the guides and the potential upcoming virtual exhibit could go over the same things, the methods utilized for each are different enough that guides will not be replaced. She emphasized that while the daily work life may change a little bit, there is still a need for guides. This is especially true for those looking for more of a group dynamic that touring with a guide would provide; this is something that one cannot really provide in the current usage of the virtual exhibit. (Rajala, personal communication on 8.9.2022.)

During the interview with Jakomaa (personal communication on 14.9.2022), it was perceived by the researcher that the thought of "What does this mean for me" was

more muted compared to the interview with Rajala. There was the thought that the staff may be thrilled at the opportunity to utilize VR for an exhibit. There will, however, also be the thought of not knowing if the use of VR is worth the amount of upfront work that would be required to get the exhibit operational on top of the usual work needed for a standard exhibit. Jakomaa emphasized the thought that there would need to be a clear vision of what the virtual exhibit would be. Additionally, in the case that the exhibit would not be successful, there most likely would not be another attempt for quite some time. (Jakomaa, personal communication on 14.9.2022.) In the interview with Venäläinen (personal communication on 30.9.2022), the researcher noted a perception that current use of VR technology in use in exhibits that she has experienced have been rather clumsy with some technical issues. Details about this will be spoken to later.

Customer mindset when considering VR is a code that one would think that makes the largest impact for the success or failure of the virtual exhibit. Additionally, this is the code where the age range of the customer base in question can be useful in gaining solid data about this code. All interviewees have noted in one form or another that the younger customer base would be more likely to participate in a virtual exhibit. In this manner, this goes hand-in-hand with the learning methods code. Jakomaa (personal communication on 14.9.2022) noted that because the school kids of today are born into the digital world, the use of virtual exhibits could be a way for school kids to learn something in a way that they might not learn otherwise. This is not to say that older customers will not participate in virtual exhibits. This especially rings true here since the use of technology is so pervasive in Finnish society.

The following code, timeline for changing museum exhibitions, is the code that generated the most variety amongst the interviewees. This is especially true when combined with the code technological advancement vs. bureaucracy. To note, the latter code will be discussed later, but one should keep the information provided in the timeline for changing museum exhibitions code in mind when reading that section. The researcher noted here that the museum type such as a regional museum or a small private museum plays a critical factor in the time and process needed to change or create a new exhibit. This is also an indicator of how much flexibility the museum can or cannot utilize in the process.

Starting off with Rajala's interview (personal communication on 8.9.2022), Ahlström Voyage is a small private museum that is in the process of getting a new building built. During the interview, Rajala had stated that there can eventually be a virtual exhibit at the museum. She also notes the possibility of starting out with augmented reality. The researcher noted here that there appears to be a high level of flexibility in the process of creating a virtual exhibit. There was no mention of difficulties "due to the process" for hiring, exhibition creation or cooperation. It is important to note that as of the time of the interview, the extent of Ahlström Voyage cooperation is in the form of artwork loans. (Rajala, personal communication on 8.9.2022.)

In the interview with Jakomaa (personal communication on 14.9.2022), quite a lot was learned in this code. Because Satakunta Museum is a regional museum that receives its funding through public money, there is more involved in exhibition creation. For them, all exhibition ideas must be submitted for approval to the city. As one can expect, there is a deadline associated with this. For many of these applications, there is approximately a five-month period from the initial submission of an exhibit idea to receiving a decision from the city. This is also the same time that any funding decisions are made. If approved, then the museum can begin preparations for the exhibit itself. When it is all said and done, the process can take anywhere from nine months to two years depending on the type and size of the exhibition. (Jakomaa, personal communication on 14.9.2022.)

The Pori Art Museum also uses public money for its exhibitions. Unlike Satakunta Museum, the Pori Art Museum receives a lot of exhibition ideas from the artists themselves. Venäläinen (personal communication on 30.9.2022) has noted that for them, exhibition approval is completed in-house, meaning that they do not require approval from the city in the same way that Satakunta Museum does. These exhibit ideas do need to fit into the current or planned future theme of the museum.

Compared to other codes discussed up until now, comments fitting into locomotion and motion sickness were not spoken to as much. Jakomaa (personal communication on 14.9.2022) and Venäläinen (personal communication on 30.9.2022) spoke about their experiences using VR for some virtual exhibits. In Jakomaa's case, the experience

involved the Center of War and Peace exhibit in Mikkeli. It was noted that, for this experience, locomotion was done utilizing one's own body and there was no mention of motion sickness. (Jakomaa, personal communication on 14.9.2022.) In Venäläinen's case, she had experienced a couple other virtual exhibits. At least one of the exhibits utilized teleportation locomotion and another utilized movement of one's body on top of a physical mat. She had noted on one experience the onset of motion sickness within a virtual flying experience. (Venäläinen, personal communication on 30.9.2022.)

As one would expect based on interviewee answers, when it comes to virtual reality, the museum does not have a lot of staff with the technical knowledge needed for setting up and utilizing VR hardware for virtual exhibits. Therefore, for many cases, cooperation with entities in-the-know would be required for initial setup, training and maintenance of VR hardware and software. The level of cooperation required would also depend on the type of exhibit and what the museum believes the best type of VR hardware should be utilized for said exhibit. One interviewee had noted that one might not know where to look to find the technical know-how.

Comments falling into general attitudes and culture regarding trying new things code is something that has been both spoken and unspoken. During the interviews, there were conversations about the costs of VR hardware. As of the time of this writing, VR hardware is still fairly expensive. It has been mentioned on more than one occasion during the interviews of the experience or fear of VR equipment not working when one attempts to experience the virtual exhibit. Additionally, because VR can be viewed as a radical departure from the normal exhibition, there can be hesitation amongst people in general for attempting a virtual exhibit. This was also noted in previous code discussions. Jakomaa (personal communication on 14.9.2022) had particularly noted that there can also be hesitation if one feels that they do not have the skills to work with virtual reality technology. In that case, the individual would believe that one should not attempt this kind of endeavor. There was an additional comment stating the fact that there may need to be a member of museum staff by the VR exhibit to help those who want to experience the virtual exhibit as needed.

There is also the danger of having an unsuccessful VR exhibit due to chasing the new shiny object. All interviewees have noted that the content of VR exhibit is more important than the fact that VR hardware is utilized for the exhibit. Therefore, it is important to recognize that one should not decide to do a virtual exhibit simply to be able to state that the museum has a VR exhibit.

The technological advancement versus bureaucratic advancement is the code that was particularly spoken to during my interview with Jakomaa. VR technology is developing at a rapid pace. That being said, bureaucratic processes are not updating at the same speed. An example of this is noted in the process of exhibition application for museums that are using public money. As discussed in the timeline code, decisions regarding funding are also done during the exhibition application process. When funding is provided, there are some rules that pertain to how one can use the funds for the exhibition. One of these rules stipulates that the funding cannot be used for basic functions of the museums. As of the time of this writing, the creation of museum exhibitions is considered a basic activity. (Jakomaa, personal communication on 14.9.2022.) The issue that can arise from here is if the museum is attempting a virtual exhibit for the first time, the upfront costs that come about are not insubstantial. Therefore, it can be argued that in this case, an exhibit going this route is no longer a basic activity.

Finally, VR HMD comfort and experience quality code received some comments from the interviewees. As previously stated in a previous paragraph in this subchapter, the quality of the experience is incredibly important for exhibition success. This was noted by all interviewees. Venäläinen (personal communication on 30.9.2022) has noted that current VR HMDs are bulky, heavy, and otherwise uncomfortable. All interviewees showed confidence that the hardware will improve over time.

7.3 Checklist guide for VR exhibit creation

With all this information known, there is no “one-size solution” that can be applied to all museums. A variety of variables exist that can alter if and how museums can apply the use of VR for exhibitions. However, regardless of museum type, there are some

things that can be done by all interested museums. This checklist was created utilizing information learned from the interviewee responses and serves to guide interested museums in this endeavor. It is important to note that this is not an all-inclusive checklist due to the nature of the issue and the different types of museums that could potentially create a virtual exhibit. This checklist can be found below.

Table 4. Checklist.

Checklist
VR Exhibit Plan
Build the relationships
Application and setup of exhibit
Market exhibition
Open exhibit
Monitor
Assess performance of exhibit and note lessons learned

While this appears like a simple checklist, there are things that one should consider. The initial step, the VR exhibit plan is the most important. Within this step, one should consider what type of virtual exhibit will it be. For example, would it be in the form of a 360 video, is there the desire for the end user to interact with the environment, would you want the end user to have the ability to move around in that environment and so on. Answering these questions can help guide the museum towards what version of VR technology can be used. If for example, one wants to use 360 videos, then the technological requirements for that is substantially less than it would be for an exhibit involving locomotion and interaction. In that case, one could potentially utilize the older, cheaper technology like Google Cardboard or the Oculus Go.

Additionally, a vision or objective of the exhibit should be at the forefront. With this in place and planning actively working towards that vision or objective, there can be a higher chance of success in not only getting the exhibit application approved, if that is needed, but also having a successful exhibit. Finally, when planning, not only is it important to consider the initial costs of VR hardware, but one should also consider the costs of VR software development needed to create the experience.

During the planning phase, one should note what technology one is lacking that is needed for the exhibition. This is where the building relationships portion of the checklist comes in. There may be the possibility that one does not know who to contact. This is but one area where entities such as CTBD can be helpful for museums. Regardless of what entity is chosen, it would be prudent to get contact with key personnel there early in the process as the insight from these key individuals can help in the following checklist point.

With the insight and plan in place, the process of applying and preparing the exhibit can begin. This step can potentially take some time for museums that have an approval process that must be followed. This is where those built relationships will also help. While this should not need to be stated, this is also the opportunity, once the exhibit is set up, to test it. This can be with the other staff, a previously established test group, a group of eager students, and so on. Issues noted during this phase should be fixed prior to opening the exhibition. During this time, marketing should be done for the exhibit if needed. The detail of marketing is beyond the scope of this thesis, but good marketing via the correct channels will go a long way towards getting interest in the exhibit.

The next two items on the checklist should be done concurrently. Opening the exhibit to the public is straightforward, but monitoring the exhibit is an important part of the checklist. A couple of the interviewees have noted the need for having a staff member present by the exhibit. The viewpoint given by both was to help customers who may have issues getting set up for the experience. An additional benefit here is what the author is referring to from monitoring. Having a staff member by the exhibit presents an opportunity for feedback on the exhibit, not just for moments when the exhibit is not working. Not all customers may do a survey, but one could be able to see reactions from customers while in and after the exhibit is complete. This should also be weighed against how many staff members are available and some forward thinking may be required if the situation dictates it.

Finally, as time goes on, there is the need to assess the performance of the exhibit and take note of lessons learned. Ideally, this would cover the whole life cycle of the exhibit from the planning phase to the eventual end of the exhibit. This should also be

documented so that new staff have a point of reference they could use when the data is needed the next time. These should also be updated as required.

8 CONCLUSION

Before beginning, an important caveat must be given for the following information: Given the limited number of personnel available for interview, the results discussed earlier cannot be utilized as a complete assessment of the posed research questions. What is known for sure however is that the category that a museum falls under such as national museum and small private museum, plays a big part in answering the research questions. For writing this conclusion, the sub questions will be answered first followed by the main research question.

For the final sub question: what are the main challenges involved with implementing VR hardware and software for use, in virtual exhibits and how can those challenges be met, the author has learned from the interviewee responses that there are three facets that would need to be addressed: money, human resources and the technology itself.

As mentioned by all the interviewees, money is one of the main issues that museums face. This is especially true for museums that use public money, as noted by Jakomaa. Unlike private museums, those using public money in a lot of cases would need to apply for funding for exhibitions. Additionally, there may also be more strict guidelines on what that money can be used for. Human resources can be an issue regarding technical expertise or just the number of the staff normally employed. Finally, as referenced earlier, the technology itself is still fairly expensive and set up intensive. Additionally, there is the technological advancement versus the bureaucracy piece to consider.

A couple of comments have come up about solving these issues. One note for museums utilizing public money is the idea of redefining what a basic museum function is. This redefinition can potentially solve the problem of funding for at least the initial virtual exhibition. Cooperation with other entities could help in the planning phase for human resources. However, during the open exhibit phase, they might not be available. Taking the opportunity to learn some troubleshooting techniques for VR technology could help mitigate this issue. With the technology, the statement has been made from one

of the interviewees that one could wait until the technology becomes more advanced before attempting a virtual exhibit.

For the other sub question, “what could be the best applied use of VR for virtual exhibitions in the museums of Satakunta”, the answer to this really depends on a few variables based off the responses given. Firstly, the museum type such as the regional or small private museum could potentially determine what can be done. This is especially the case if outside approval is required. Secondly, the amount of space available inside the museum can also affect what can be done as well as whether the exhibit would take place on the premises or can be viewed online at one’s home. The bottom line here is that there is no one answer that can be applied to all museums. This is something that must be decided during the planning phase of the exhibit.

Finally, we have the main question of what is the potential for utilizing VR hardware and software in the implementation of virtual museum exhibits in Satakunta. Based off the responses given, the short answer here is that the potential is there. There are already museums elsewhere in Finland that have virtual exhibits, so there is an established proof of concept. The long answer is this: depending on the museum and museum type, the potential can be varied. Based on responses, a few things would need to be addressed. One long term issue to address would be cultural. Having people on board with trying something new and not be afraid of failure is one thing that cannot be solved overnight. This could also potentially be addressed as the technology itself becomes cheaper and progresses a bit more. Overall, there is a bit of nuance towards this question and potential benefits must be weighed against the potential costs for interested museums to fully answer this question.

9 RELIABILITY AND VALIDITY OF RESULTS

Reliability and validity are two very important concepts involved with thesis writing. For the results of a research to be reliable, certain criteria would have to be met. According to Klenke, Martin and Wallace (2016, 38), for qualitative research, there are a couple of points to consider for reliability and validity, internal and external validity. Internal validity deals with relationships. In other words, internal validity involves the concept of cause and effect as it relates to relationships. On the other hand, external validity is seen as a variable that would describe how the result of a study, thesis or other type of research can be applied to a broader audience. In order for a set of results to be reliable and valid using external validity, the original research should be able to be applied in a new area, which would also provide a new set of samples. Both of these together will show how replicable the results can be. (Klenke, Martin & Wallace 2016, 38-39.)

In addition to internal and external validity, there are a few other qualities that would affect how one can judge the reliability and validity of the results. These qualities are credibility, transferability, dependability and confirmability (Klenke et al. 2016, 39). It is important to note that these qualities refer to internal and external validity while offering more detail into how one can view research results. Credibility, while it can be self-explanatory, is a value that reflects how trustworthy or believable the data is to an individual. For research results to have transferability, the results must be able to be utilized in other situations. If a different researcher can obtain the same results utilizing the same research method and area, then the research results can be said to have dependability. Finally, confirmability refers to idea of research results is acceptable by individuals other than the researcher. With all these variables in place, one would be able to determine the reliability and variability of research results. (Klenke et al. 2016, 39.)

As one has read in previous chapters, the research done here utilized semi-structured theme interviews of staff from three different museums in Satakunta utilizing interview questions in Appendix 1. The author made attempts to not interrupt the interviewee while the interviewee was answering questions to get their unfiltered

responses. All but one of the interviews took place in person at the interviewee's place of work; the final interview was conducted online. Additionally, all interviews took place during normal work hours. It is important to note, however, that interviewees are people with different opinions. If a different researcher would attempt the same interviews, one should not expect to receive the exact results that this thesis has received since these opinions could change. Also, virtual reality technology is developing at a rapid pace, so advances in this field can also affect interviewee answers given.

While there was a focus on being as unbiased as possible, it is important to note that there will be some bias regardless of whether that bias was intended. In the case of this thesis, cultural differences have the potential for bias as well as the author's experience with virtual reality. At the end of the day, the reader is the one who determines whether the research results are reliable and valid, not the author.

10 REFLECTION AND FEEDBACK

10.1 Reflection from the author

The thesis process was a good opportunity to learn and apply the theory that was taught throughout the degree program. While this is far from the first time working with another entity in the form of a commissioner, this experience is particularly great because it is one of the times in which the author has worked with those from a different country than the author's home country. Additionally, this thesis has been helpful in learning more about the professional work environment in Satakunta. This was especially relevant in scheduling and conducting the interviews.

While the thesis focused on the museums in the Satakunta region with respondents from the greater Pori area, for future research, it would be prudent to expand the respondents to other museums in the region. As noted in the conclusion, these results, while can be applicable to museums in other areas, show only the perspective of a small area in the region. There exists the possibility that a more nuanced result can be gleaned if more interviewees from other areas in Satakunta were available.

While the overall process was positive and the author was able to gain some valuable insight, there are a couple of points that could have been emphasized a bit more for the author. For example, while the topic of VR exhibition length has been discussed, there was no question dedicated to this topic. The same could be stated for the topic of price, which would include the price of VR hardware and the costs associated with required software development for VR exhibits. Overall, the thesis has allowed the author to learn more about the inner workings of museum exhibition creation and the role that new technology can have when utilized in this industry.

10.2 Feedback from the Center for Tourism Business Development

Overall, the thesis is really good. The interview breakthrough section is clear and clearly points to the possible pains and benefits each interviewee had in mind. Thank you to the author for sticking to the schedule deadline despite difficulties and providing a checklist guide. This will be helpful to the Center of Tourism Business Development should a museum seek some cooperation in developing their own virtual exhibit.

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APPENDIX 1

Theme Interview Questions

Introduction to the interview:

My thesis topic is to explore the feasibility of using virtual reality hardware and software to create virtual exhibitions that museums in the Satakunta region can utilize. In order to explore this topic, I would like to interview museum staff to learn what challenges the museums that have attempted this in the region have faced when implementing VR technology and the best use case of utilizing VR technology in support of the museum's theme. For the museums that have not implemented this and are interested, I would like to explore the possibilities of utilizing this technology. The results from this research will be utilized by the thesis commissioner, the Center of Tourism Business Development, to support interested museums in their VR exhibition development. The interview will be recorded for transcription purposes for the thesis. This recording will be kept until the thesis has been published; afterwards the data will be securely erased. Do I have your permission to use your personal information (primarily name and position) in the body of the thesis? If you are uncomfortable with this, I can anonymize the data.

Theme 1: Background Information

- For the record, what (job) position are you currently holding? (Only if permission given to use their name, and job position in the thesis)
    - How long have you been working at the museum?
- What is your experience with virtual reality?
    - Do you know if other staff members have any experience with this?
- Have you experienced any virtual exhibits in other places?
    - If so, how was the experience overall?
    - Did it feel like it was an experience that would not be able to be replicated in a traditional type of exhibit?
        - Why/why not?
    - Were there any challenges involved in getting it to work e.g., technical difficulties?

Theme 2: Virtual Reality (VR) Utilization Challenges

- Has the museum attempted to have a virtual exhibit in the past?
    - Why/why not?
- Have there been virtual exhibitions used in this museum in the past?
    - What did visitors think of those exhibits (If the previous answer was a yes)
    - Were there challenges noted by visitors?
    - If unable to do it, what difficulties did the museum run into?
    - What kind of coordination, if any, did you have to do with for example tech companies in support of this exhibit?
        - How was the experience of setting up the virtual exhibit overall?
        - How have the costs of implementation compared to traditional exhibits?
            - Has the museum been able to at least break even after implementation?
- *If the answers to the first two questions were No:* If you had an exhibition like this, what would you think the visitors would think about it?
    - What kind of challenges might they come up with?
    - With those challenges, are there any possible solutions that would come to mind?
        - If so, what would they be? How would this solution affect available resources such as time, coordination efforts, etc?

Theme 3: Best Applied VR Use for Museum Exhibitions

- If the museum did have a virtual exhibit, what was the theme and how did it fit in with the overall theme of the museum? Has the virtual exhibit had a positive effect for the museum's overall theme?
- What type of virtual exhibit was it? (Some examples, which do not include all possibilities include 360 video and interactive and non-interactive storytelling)

- Locomotion questions (discuss types of locomotion that exists in VR); Should there be locomotion in this type of exhibit for this museum? (Ask ONLY if interviewee is well informed with virtual reality technology)
    - How much open floor space would be available for the VR exhibit?
    - Relate this to theme of museum: ask about the museum's theme currently
- If you had a virtual exhibit in this museum, what would the theme be and how would it fit in?
    - Do you think it would have a positive impact?
        - Why/why not?
- What type of virtual exhibit would you be interested in trying for the museum?

Theme 4: Feasibility and Interest in Using VR for Museum Exhibitions

- Do you know the general thoughts of other staff towards VR?
- Do you know if the museum has worked previously with other companies such as multimedia, software development or technology companies in the creation of its exhibits?
    - If so, can you describe what those exhibits were and what kind of technology was utilized?
    - How well did the museum and the other companies coordinate?
- If there is a strong desire to incorporate VR use for museum exhibitions, what would happen if the attempt were unsuccessful?

Miscellaneous thoughts and closing the interview:

- Do you feel that there is something not mentioned that museums interested in utilizing VR technology can do?
- Is there anything else that you would like to add?