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ART EXPERIENCE IN DIGITAL INTERACTIVE TECHNOLOGY



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ABSTRACT

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Digitally implemented interactive services are common in all areas today. Digital and interactive solutions are increasing in the presentation of art and thus also in cultural institutions. Information technology, software design, digital art, and the art experience include similar areas of research, but challenges can be seen in the development of common interactive solutions for these. Technological solutions are evolving in the field of art, but research on the subject is clearly scarce. This study seeks to explore the relationship between technological design and art and the implications of digital interactive technology for the art experience. The empirical part of the thesis is preceded by a review of the literature on related theory, which examines the overall picture of the use of digital interactive technology, art experience and the dimensions of digital interactive art. The empirical research section examined participants' experiences of participating in three different virtual art exhibitions. Survey data was collected from 128 respondents in the form of an online survey. The analysis was executed having art experience as an explanatory variable and the usability of the technology, experienced immersion, and negative emotional response as explanatory variables. The research data were analysed using regression analysis of the SPSS program and traditional perceptual methods of qualitative data. The results showed that the most significant impact on the art experience was the immersion experienced by the participants, which in turn was most strongly influenced by the usability of the exhibition site. Thus, it was found that the usability of the virtual art exhibition did not have a direct impact on the art experience of the participants, but rather, impacted on immersion that subsequently affected the art experience. In total, the research model and the chosen explanatory variables explained 54.5% ($R^2=0,545$) of the variation in the art experience.

Keywords: Digital interactivity, interactive technology, digital art, interactive art, art experience.

TIIVISTELMÄ

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Digitaalisesti toteutettavat interaktiiviset palvelut kaikilla alueilla ovat nykypäivänä yleisiä. Digitaaliset ja interaktiiviset ratkaisut lisääntyvät myös taiteen esittämisessä, esillepanossa ja täten myös kulttuurisissa instituutioissa. Informaatioteknologia, software design, digitaalinen taide ja taidekokemus sisältävät samankaltaisia tutkimusalueita, mutta näille yhteisten interaktiivisten ratkaisujen kehittämisessä voidaan nähdä haasteita. Teknologiset ratkaisut ovat kehityksessä taiteen alueella, mutta tutkimukset aiheesta ovat selvästi vähissä. Tämä tutkimus pyrkii tutkimaan erityisesti teknologisen suunnittelun ja taiteen suhdetta, sekä minkälaisia vaikutuksia digitaalisella interaktiivisella teknologialla on taidekokemukseen. Tutkielman empiiristä osaa edeltää aiheeseen liittyvää teoriaa käsittelevä kirjallisuuskatsaus, jossa tarkastellaan tähänastisen tutkimuksen kokonaiskuvaa digitaalisen interaktiivisen teknologian käytöstä, taidekokemuksesta ja digitaalisen interaktiivisen taiteen ulottuvuuksia. Tutkimusosiossa tutkittiin osallistujien kokemuksia kolmen eri virtuaalisen taidenäyttelyyn osallistumisesta. Tutkimusdata kerättiin 128 vastaajalta verkkokyselyn muodossa. Tutkimuksessa käytettiin selitettävänä muuttujana taidekokemusta, jonka selittävinä muuttujina tutkittiin teknologian käytettävyyttä, kokemuksen immersiota, ja negatiivista tunnereaktiota. Tutkimusdata analysoitiin käyttäen SPSS-ohjelman regressioanalyysiä ja kvalitatiivisen datan perinteisiä hahmotusmenetelmiä. Tulokset osoittivat, että merkittävin vaikutus taidekokemukseen oli osallistujien koetulla immersiolle, johon taas vaikuttivat voimakkaimmin näyttelysivuston käytettävyyttä. Havaittiin siis, että virtuaalisen taidenäyttelyn käytettävyydellä ei ollut suoraa vaikutusta osallistujien taidekokemukseen, mutta joka vaikutti immersion kautta koettuun taidekokemukseen. Yhteensä tutkimusmalli ja valitut muuttujat selittivät 54,5 % ($R^2=0,545$) taidekokemusta mittaavien muuttujien vaihtelusta.

Asiasanat: Digitaalinen interaktiivisuus, interaktiivinen teknologia, digitaalinen taide, interaktiivinen taide, taidekokemus.

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1 INTRODUCTION

Digitalization has reached many fields and business areas, as well as the art and culture world. Nowadays there are multiple methods and ways digital technology is used in creating, teaching, presenting, and marketing art and culture. These methods can be certainly as variable, separate and divergent as the art industry or digital technology in general.

Digital interactive and participation methods have become an important part of information technology (IT) and information systems (IS). IT research has also acknowledged that users are a beneficial part of designing and creating services and products, since customer co-creation process can influence positively the level of value of a technology design. Therefore, the user's point of view is now important to the outcome and success of service design. Additionally, it has been stated that properly executed digital content creation with the end-users improves the satisfaction and content of a design and creates solutions which are more suitable for the users' needs (Ranjan & Read, 2016). The effects of this kind of content creation can be mutual regarding interactive artworks. Even though creating art is not traditionally user or audience centered and is initially dependent on artists' intentions and motivations, a new form of collective art enabled by digital technologies aims to connect and co-create with the audience. This can be seen in the form of digital interactive technologies used in art exhibitions and singular artworks, such as an interactive video installation or digital artwork gathering audience's personal creations into one singular piece of art. In this kind of interactive art, the audience is seen as part of the artwork through the interactive actions of its audience (Oh & Shi, 2013). Regarding digital interactive art, it is argued that when people have the possibility to be part of and maybe even influence the content of an art piece, it gives the audience a more whole and diverse experience (Barbu & Militaru, 2019; Walmsley, 2016).

1.1 Motivation for the study

Commonly utilized theoretical models or methods that would be specifically used in cultural or artistic institutions have not been created yet. Digital participation and interactive methods have been studied previously. But theory and concrete research data is still lacking in the art field. This may be seen as creating a general or larger theory for both use and/or research purposes. There is widespread literature available in the related fields, such as relationship marketing and customer relationship management, but these kinds of studies rarely concentrate on the arts, and when they do, they rather tend to focus on segmentation strategies. Additionally, digital cultural solutions have already been developed especially by cultural institutions, although interactive art as a field tends to sometimes ignore the HCI methodologies, such as user experience and usability. (Walmsley, 2016; Höök, Sengers & Andersson, 2003).

Therefore, in order to create suitable solutions and technologies for presenting digital interactive art, the relationship between art and technology should be reviewed, since digital interactive art is an art form that utilizes areas from both fields. The relationship between art and technology has always existed, but in our human history the separation between them has not been that clear as it might nowadays be understood (Smith, 1970). An argument could be, why should this be studied, if there are already variable theories and models which present the central points of a technological software that bring the wanted result, and which are elements to enhance the usability of a software. The point lies in the combination of art studies and technology studies, where the link between them does not exist as strongly as it could. For example, only few studies have studied the evaluation of visitors' experience with interactive art, therefore technology design still needs to reflect on the aspects that support a meaningful digital art experience (Morreale & Angeli, 2015). Another argument could be, why should we even link these two fields together since they clearly aim for different goals and work with different rules. Traditional digital interaction and other technology design methods focus on usability, accessibility, user experience, whereas art experience curation more on subjective emotional and cognitive response (Morreale & Angeli, 2015). Despite these differences, the connection between these two fields does exist and is described as following:

Art and HCI may have different goals and approaches. However, they have core commonalities, which build a close relationship between the two and can benefit both. (Jeon, Fiebrink, Edmonds & Herath, 2019, p. 2).

This means that even though art and technology design are separate fields and have clear differences in what they are intended for and are constructed from, they still have similar areas such as subjective experience or visual appeal, and that is where these two fields collide. Thus, technology design and arts, as separate fields, can go further if they take advantage of the channels that reach

their audiences, this being enabled by mutual research. Therefore, this thesis tries to support establishing the link between these two fields and by arguing that both fields have the possibility to develop further with a proper dialogue between each other.

1.2 Research questions and structure

Along with the discussion of the possible benefits of mutual research between technology design and art experience, the aim is to study more specifically on what the challenges can be when designing and creating digital interactive environments used in art. This point of view is discussed by focusing lightly on the software design perspective. The aim is not to solely present the possibilities of digital interactive technology, but to additionally focus on how interactive technology design can support creating more meaningful art experiences. Therefore, the main research questions in this thesis are:

- **What is digital interactive art?**
- **How does digital interactive technology influence art experience?**

The structure of the thesis progresses from describing the technological aspects of the subject under investigation to the art aspects. Chapter 2 presents the base of interactive technology research and practical examples how interactive technology is utilized in different fields. Chapter 3 concentrates on explaining the definition of art, art experience and interactivity in art. Chapter 4 aims to present the combination of interactive technology and art. Chapter 5, 6 and 7 presents the empirical part of this thesis with methodology, results, and discussion sections. Finally, chapter 8 is a summarization of the evaluated findings.

2 DIGITAL INTERACTIVITY

This chapter concentrates on defining the concept and area of Digital Interactivity. This is due to the fact that it is important to specify what is discussed in the context of this thesis when describing the connection of art experiences and digital interactivity. It is also beneficial to introduce digital interactivity technology utilization in different fields and areas.

2.1 Concepts and Terms

Generally speaking, participation can be defined as, "the act of taking part in an event or activity" (Oxford Dictionary, 2020a). Interactivity, in turn, is seen as, "the process of two people or things working together and influencing each other" (Oxford Dictionary, 2020b). Furthermore, digitality in participation or interactivity adds an extension to these descriptions. The term Digital Participation (Seifert & Rössel, 2019) is shortly presented as:

The active involvement in digital society through the use of modern information and communication technology (ICT), such as the Internet. This participation includes access to not only the Internet but also various online services and content. (Seifert & Rössel, 2019, p. 1).

Over the years ICT has been created and designed mainly for human use or interaction. In other words, the motive for creating a technology is to have a human being in control of it (Dix & Finlay, 1993). Seldomly has a technology been designed to be isolated from human interaction and regarding digital technologies and systems in general. The basic idea is to interact with other technologies at least (Grudin, 2005), and the major part of a digital code primarily interacts with a user. Even from the basic idea of digital information and digital libraries, the structure platform of any digital information system, although created to gather information from different sources, users can be seen as actors who seek and retrieve data and information from the digital source.

These sources can be for example, file servers or databases, and may use different kinds of tools to browse, manipulate, reuse, and process the information. Additionally, when designing databases and digital libraries especially, the functions between the user and the system are presented as interaction (Rao, Pedersen, Hearst & Mackinlay, 1996). On the service design level, participation with digital environments is also referred to as various forms of online engagement which revolve around online-based interaction between parties most commonly referred as service users and service providers (Kuoppamäki, 2018). Therefore, interaction and participation are often integrated into both IT design research as well as IT service and product development. Digital interaction and participation are applied across research and industry using various terms from participatory design, co-design and co-creation to cooperative design and design thinking. (Dix & Finlay, 1993; Smith, Bossen & Kanstrup, 2017)

2.1.1 Interactivity

Interactivity itself was at least until the beginning of the 2000s, a wide concept that researchers had difficulties in defining. It was widely used to describe communication and general human action. Because of this, researchers developed three dominant sub-concepts to help define interaction more specifically for technology-related interactivity: human-to-computer tradition; human-to-human view; and human-to-content view of interactivity. (Gleason & Murschetz, 2019)

First, the human-to-computer has grounds in Human Computer Interaction research and defines interaction between a human and a computer as the most elementary form of interactivity. For example, considering online interactions between a single user and a remote cloud-based network application, interaction is understood as events between the user and the user interface. In other words, this kind of interaction architecture is perceived as individual interaction. (Gleason & Murschetz, 2019)

The human-to-human point of view represents interaction as a computer-mediated communication process between humans. This view refers to themes such as interpersonal interaction, symbolic interaction, and social interaction. For example, symbolic interaction sees that computers are symbol-processing machines and interaction with these is based on signs, and that humans are dependent on the recognition, understanding and correct application of symbolic interpretations in order to perform basic technology user interactions. (Gleason & Murschetz, 2019; Saariluoma & Rousi, 2015).

The human-to-content view sees interactivity as a human subject intentionally acting upon an object or another subject. Here, the creators of these objects modify their actions and reactions due to the actions by their interaction partner(s) (Jaekel, 1995). This way, interactivity can be understood as a subjective mode of perception and cognition, and a result of how the

receiver actively interprets and uses mass and new media messages. (Gleason & Murschetz, 2019)

Research on interactivity started with the Cybernetic Theory by Norbert Wiener in 1948. This theory presented the core components of interactivity as a conception of feedback where information receivers respond to information senders. This theory suggests that interactivity is a characteristic of the channel of communication of information flow, and that the functionality of a channel, machine, organism, or society depends on the quality of that transferred information. Bretz and Schmidbauer (1983) presented interactivity as user-to-system or user-to-document interactions. They found that these kinds of interactions can be predicted and followed a request based logical structure, unlike human-to-human interactions, which are often accompanied by emotions. Hence, interactivity in computer programs and similar technologies can be seen as easy to manipulate. However, as the information and communication technology advanced and transformed from standalone personal computers to connected networks with online communication, these definitions seemed to become redundant over time. (Weiner, 2019; Bretz & Schmidbauer, 1983; Nedumkallel, 2020).

Currently, digital technologies offer numerous ways of interactivity; user-to-user, between user and message, user digital platforms or media, and device-to-device. Therefore, researchers are questioning whether interactivity is a characteristic of the context in which information or data is exchanged, whether it is dependent upon the technology used in communication interactions or whether it is in the perception of the users, existing within their minds. (Nedumkallel, 2020).

It is also argued that interactivity is not merely a technological capability, but a process which involves two-way communication and consists of responsiveness and coherence between sender and receiver. Even though the media offers technological capabilities to accomplish these aspects, there can still be a state of non-interactivity, quasi-interactivity, and full interactivity. These are determined by the interest of the sender and the receiver. Much research has stemmed from this belief by examining the content of interactive media and thereby tested the effect of interactions on psychological and behavioral variables. (Rafaeli, 1968; Nedumkallel, 2020)

Nowadays, the variety of technological features for users is wide. Therefore, digital media that offers many interactive features is not necessarily as interactive as initially might have been planned. The degree of interactivity is presented to be determined in fact by the extent that these features are used by the user. Therefore, the user determines how well they experience interactivity while using the media service. Another point of view is that interactivity is a psychological factor which lies within the individuals attempt to use media. In other words, interactivity may be seen as being within the eyes of the beholder. Thus, a digital system or technology can be more or less interactive depending on how it is utilized. Especially in media technology, important dimensions of

perceived interactivity are two-way communication, responsiveness, navigability, speed range, telepresence, and connection. (Nedumkallel, 2020)

Despite this, the interactivity levels among these can vary substantially within individual perceptions. It has been argued that perceived interactivity in systems is likely to be confounded with the perceived usability of the system. Lower usability evaluated according to the skills able to use a system or a technology affects negatively to the perceived interactivity. (Nedumkallel, 2020)

Overall, interactivity raises challenges in technology design since there seems to be lack of specification about which technological elements in fact influence interactivity. In perceptual studies, one social media might be considered more interactive than the other, but the challenge lies in appointing why or what elements to segregate as factors contributing to interactivity. Despite being able to underline practical influential elements, interactivity has been defined as a feature or mediated environment created by information and communication technology, where parties communicate (one-to-one, one-to-many, and many-to-many) and participate in reciprocal information or data exchanges. (Nedumkallel, 2020)

Research literature seems to indicate that interactivity has a positive impact on the knowledge, attitude, and behavior of a technology user. However, the findings of how interactivity affects cognition are mixed. The perceived view of interactivity is considered to have a stronger influence on user behavior and experience than interactivity estimated objectively. Previous studies have attempted to understand the effects of interactivity before, yet there has been little effort to determine its effects on different types of digital media. This kind of research in the future is important since user orientation and their objectives differ according to the media in use. Moreover, the degree of interactivity varies across different kinds of media platforms. (Nedumkallel, 2020).

Even though interaction as a term is widely used in many areas such as clinical psychology and sociology, in this thesis, interaction as a term is limited to the scope of digital information and communication technology involving technology or media people use day-to-day or professional basis. The user point of view is examined as interactivity with information and thus can be seen as a communication process with content-based technology (Rousi, 2013).

2.1.2 Human Computer Interaction (HCI)

Human Computer Interaction (HCI) is a scientific field which looks closer into the interaction between human and technology. The term HCI has been commonly used only since the 1980s, though its roots go back to the last century where factories focused on the ways people performed manual tasks in conjunction with machinery. In this context, the focus area took a start as interest in user performance or cognitive issues when working with a machine. While technologies spread and advanced, the focus shifted more towards using the term interaction to describe the event in which humans utilize and encounter machines. (Dix & Finlay, 1993)

HCI as a formative study area is strongly related to the design of interactive and participatory systems (Collazos & Merchan, 2015). Therefore, HCI is an area of computer science and other technological fields. However, it has not yet been defined as a single discipline in universities for example (Gurdon, 2005). It collides with many fields such as psychology, computer vision, artificial intelligence, face recognition and motion tracking. Currently, the trends leading the direction of HCI seem to be to focusing on specifying the context of use, outlining usability specifications, prototyping, evaluating usability and overall user experience. User Experience (UX), being an area under HCI, studies more closely on user stimulation, user motives, emotional responses, and experiential factors (Hassenzahl, 2008). (Collazos & Merchan, 2015)

Recently, general interest towards the interaction between humans and computers has been increasing. However, HCI faces challenges in achieving the most effective and suitable approaches in practice. Previous studies have identified a gap in the knowledge of HCI among the software industry people, which is partly because HCI undergraduate and postgraduate studies offered are not applied in the software industry area. Hence, it can be understood that important knowledge and science of how technology should be designed in a way that truly creates value with minimized hindrances, is still not meeting the basis of technology and software design from an industrial perspective. (Collazos & Merchan, 2015).

Shortly, HCI places emphasis on creating and applying user-centered design techniques and iterative testing methods (Head, 1999), and is becoming one of the core aspects of system development process. It is utilized to improve and enhance system facilities, to satisfy users' needs and necessities, and to assists designers, analysts, and users to identify the system needs as well. Implementation of HCI can be perceived together with art and science, since it requires a comprehensive range of skills, including user knowledge, software engineering and graphical interface designing. The "Human" side in HCI focuses on communication theory, graphic and industrial design disciplines, linguistics, social science, cognitive psychology, and human performance, while the "Computer" side involves issues such as computer graphics, operating systems, programming languages and development environments. (Issa & Isaias, 2015).

Interaction studies can help HCI specialists and users simultaneously. Analysis of interaction can help HCI specialists to understand interaction and the challenges related to the whole concept more closely. It can also compare different interaction styles with specific difficulties in interaction processes, as well as which services users and their means-of-use are more suited to which technology. Making careful trade-offs between important factors, while supporting design principles and approaches, remains a challenge in HCI (Head, 1999). Therefore, most designers support co-creation design methods to follow successful technology development (Issa & Isaias, 2015).

2.1.3 Interaction Design (ID)

Interaction Design (ID) is another field that can be referred to when thinking about interactive systems. The main structure of ID is constructed strongly on the idea of reducing negative aspects of user experiences, and simultaneously enhancing positive ones. ID aims to design for user experiences and interactive solutions by developing interactive products that are easy, effective, and pleasurable to use especially from the user's perspective. Another important question in ID is how to optimize users' interactions with their systems, environments, or services. (Preece, Sharp & Rogers, 2015)

HCI and ID have similarities in how they approach interactivity between technology and users. But ID is presented as possessing a more widely spread angle on studying user experiences. ID looks more widely into the theories, research, and practice of designing user experiences, whereas HCI tends to have a narrower focus on designs, evaluations, and implementations of interactive computing systems. ID focuses on variable angles of user experience design, therefore terms such as user interface design, software design, user-centered design, product design, web design and experience design, interactive system design can be located under the scope of Interaction Design. Since ID has such many possibilities on what kind of interactive solutions to design and study, it is mostly carried by multidisciplinary teams which can consist of engineers, designers, programmers, psychologists, anthropologists, sociologists, or artists. (Preece, et al., 2015)

2.2 Digital Interactive Service Industry

Digital technology development has led converging phenomena which fades the traditional and simplified boundaries of computing and telecommunications. The Digital Interactive Service Industry (DISI) is a scientific area which aims to study the interactivity of different kinds of services and produce efficiency in the solutions invented for service deliveries. Service itself, is a large-scale concept which has been studied widely and additionally has undergone modifications in the understanding of the initial concept itself. (Low & Sloan, 2001)

DISI is linked with all businesses that generate value through the creation and delivery of digital content and use. The industrial scope is wide and includes businesses from the media, telecommunication, computing, and other industries. It is stated that the demand for new digital content is currently increasing and a niche for digital interactive services are becoming industry specific. This has created a situation where companies have now the possibility and challenge to expand into the content development sector. (Low & Sloan, 2001)

In general, the development of new interactive services for an organization, requires the understanding of a wide range of broad issues. While technology remains to be viewed as the enabler in businesses and services, it is no longer perceived as the main driving and shaping force of new interactive services. Therefore, the importance of confronting culture and business process issues are still emphasized prior to the use of technology as a support tool. In addition, progress towards a new developed interactive service is more often endorsed by the co-creation of a selected technology and market, which on a practical level can be seen as an endeavor to serve specific market or user necessities. (Low & Sloan, 2001)

The developing methods and angles on how technology should be viewed in an organization internally, new users of a technology are confronted with new information and communication technology (ICT) culture and work practices in general. Considering this, the crossroads where the initial needs of the users and suitable technology usability-wise should meet, creates an important but challenging target for technology designers. To overcome these kinds of challenges and to satisfy user demands for any new services, businesses need to concentrate on providing services which are based on adding value to their users. (Low & Sloan, 2001)

The main understanding in the DISI is that competitive advantage and long-term business survival are ensured by harnessing new opportunities and developing new interactive services supported and driven by fundamental business and end-user needs. Additionally, as the ICT markets continue to mature and demand more user-friendly and intelligent systems, it will require more in-depth studies in the future. (Low & Sloan, 2001).

2.3 Digital Modes of Participation

Nowadays, companies and different kinds of organizations provide services with various digital platforms and online environments to actively engage their customers. This sub-chapter aims to present a brief view of some of the current and past methods of how digital interactivity and participation have been used to involve users in the delivery of a service. The usual and most common digital platforms are currently designed to produce and consume personal data to manage various aspects of people's everyday life. Among people, the internet has come to be used for various daily purposes such as banking, news, social media, online content, information, health, nutrition, travel, and leisure. (Kuoppamäki, 2018)

2.3.1 Digital Displays

One common technology associated with interactive software, which includes the audience or users to a service is an interactive screen display device. Liquid

crystal display (LCD) is a common technology used in digital display signs and they appear across many market segments. As an example, digital menu boards are nowadays used as backlit menus in restaurants, information points for departures, arrivals, weather and other in airports, and important data providers in movie theaters, stadiums, malls, and other entertainment venues. By using this kind of display, the audience can interact with the screen and its content through pressing nearby buttons or physically hardened keyboards. This kind of interaction is preferred since these types of interfaces are familiar to people across a spectrum of backgrounds. (Want & Schilit, 2012)

Another example of using an interactive screen, is the touch feature, which is one of the most common technologies used in mobile devices and tablets. This kind of technology has become so widely accepted that people who see a non-interactive digital display tend to touch the screen to interact with it. This has advanced to a level where people are likely to try using multitouch gestures to zoom in and out on the display. This is partly a result of the development and public's familiarity with general desktop computer design and interaction mechanisms. (Want & Schilit, 2012)

The first touch-based devices connected to computer systems essentially replaced mouse-based input. Reliable multitouch technologies with commercialized solutions entered the field in the beginning of the 2010s. Recent advances in display technologies have enabled the spreading of large displays in public spaces. Although it is a widely recognized technology, these kinds of displays are still used primarily as one-way commercial digital signs. Future and existing display technologies are opening the opportunity to replace this passive single-purpose broadcasting with dynamic multipurpose interaction. (Müller-Tomfelde & Fjeld, 2012; Ojala et al., 2012)

Multitouch is already widely used in mobile devices, therefore it will become an industry standard for all touch-based interaction. The challenge of bringing multitouch to a larger set of technology is that it is costly, because it requires specific and precise engineering. It is argued though, that interactive approach in designing digital displays and screens can deliver appropriate content better than a passive sign would. In addition, interactive and versatile signs and displays serve both, the audience, and the content providers by more versatile and targeted content. With interactive displays, the goal is designing interaction. In other words, providing the best mechanism for average users, navigation, and identifying information suitable for the displays. The success of these solutions depend much on the engagement they offer, and the value users perceive. (Want & Schilit, 2012; Ojala et al., 2012)

2.3.2 Interactivity in digital journalism and news

Nowadays, networks provide audiences with all kinds of information, no longer separate text, images, audios, but with voice, video, animation, multimedia technology, movies, network games and so on. Considering media and content-dominated fields, digital newspapers need and utilize these

multimedia information and integrated information services in their content creation. Digital journalists are expected to work with technology that have not been traditional tools for journalists in the past, such as social networks, multimedia, big data, mobility and analytics. (Zelizer, 2019)

Additionally, news channels and newspapers are increasingly turning digital so that users can consume news any time anywhere using mobile devices. Many have their live broadcast through their websites and social media pages. The situation now gives the users the opportunity to interact with the news content using interactive features. (Li & Guan, 2011; Nedumkallel, 2020)

With the current web technologies, media can allow users to share their opinion and to act as newsmakers contributing to the content. It has been identified that perceived responsiveness and control among users have a significant impact on news credibility and enjoyment (Horning, 2017). Moreover, interactivity has been seen to increase users' perception of credibility towards news (Jahng & Littau, 2016). (Nedumkallel, 2020)

Frank Rebillard and Annelise Touloud (2010) studied digital user participation in digital journalism from a basic citizen and content viewer point of view. The study concentrated on how a regular person without any professional experience in journalism can participate in the journalism media nowadays through digital ways. They had the same aspect or motive in their research: How to include the non-professional and citizen journalists' participation of content and presentation in a field that is more or less dominated by professionals (Rebillard & Touloud, 2010).

The main digital method to include the reader or website visitor in the website news or articles, was through different comment or discussion sections linked to the article or news. This included a space where readers could see other people's comments or thoughts about the related topic and could commentate on them. Another method presented was personal blogs, which discussed the topics covered by the newspapers. Additionally, the study found that the authors were more or less directly linked to the newspapers themselves, which reveals that it is not that common for a regular citizen or audience member to participate. (Rebillard & Touloud, 2010).

Rebillard and Touloud (2010) argue in their study, that the general wave and discussion towards the citizen-dominant media had started around the time of their study. In recent years this has actualized as the rise of freelance and entrepreneurial journalism, where journalists (both individually and in networks) are producing news outside of established new organizations. Nowadays, the audiences are also involved in the news and media production processes by user-generated contents, such as blogposts and other crowdsourcing methods (Rebillard & Touloud, 2010; Deuze, 2017).

Meanwhile, there is discussion among the news media houses regarding whether it is beneficial to have users interact with the media they offer. The opportunities of digital interactivity in journalism and news media is mostly seen as a beneficial opportunity to bring journalism more accessible and closer to their audiences. However, digital interactivity has also presented to bring

increased workload pressure for reporters, uncivil communication environments on message boards and additional costs involved in maintaining interactive features. (Nedumkallel, 2020; Chung, 2007).

Expecting digital journalism to enhance participation is linked to the broader role in fostering public good of journalism. Assumptions are that highly engaged or participatory news users can be seen as responsible citizen. This supports the idea that digital participation and interactivity are important to journalism as well since interactive users are a major part of the whole field. However, having interactive audiences do not necessarily consider what kind of engagement methods are to be developed, nor does it address the full range of experiences associated with participation and interactivity, such as digital cues, ongoing digital feedback, digital conversations, and other online activity. Regarding the relationship of journalism and technology, it is argued that even though technology is said to be the one enhancing journalism as a field, like other enterprises that have been transformed by digital technology, such as education, the market, law, and politics, journalism gives technology a purpose, shape, perspective, meaning and significance. (Zelizer, 2019).

2.3.3 Interactive digital experience and examples from digital healthcare

In order to understand the multidimensionality of interactive digital technology in art experience, it seems beneficial to look towards other domains. Digital interactivity is being used in general healthcare services as well. Digital technologies and interactive features have increased general accessibility of health-related services and information, although research indicates that interactive elements of websites are yet not exploited in their full potential or even being regularly updated, since the primary contents provided in health support group websites are health-related advice and information (Harrison, Barlow & Williams, 2007). It is argued that interactivity can significantly affect comprehension and attitude towards health websites (Lustria, 2007). In addition, web-based interactive health videos have a significant effect on user's attention, interactivity, overall evaluation, preference, and engagement, and this effect is studied to be significantly higher as compared to when viewing static websites (Lee, 2011). A study on the effect of health website interactivity, where the operationalized website interactivity showed a curvilinear effect on perceived interactivity, revealed that an increase in interactivity features can lead to greater change in behavioral intentions to quit smoking (Oh, 2017). Furthermore, it was discovered that modality interactivity led to a more positive assessment and contributing to more favorable attitudes toward the website and antismoking messages. (Oh & Sundar, 2015)

Additionally, a study which examined a clinic visitors' influence on the clinic environment design by digital participation has been executed by Mackrill, Marshall, Payne, Dimitrokalı and Cain (2016). The clinic visitors were given a possibility to say what kind of waiting room they would like to see in the future in the same environment. The study's main aim was to gather

feedback from the current space and ideas on how to improve the space. The feedback data was gathered through an electronic device with a screen, where different pictures and comment spaces occurred to the user. This device was located in the waiting room, next to the seats for the clinic visitors. The device users were given an opportunity to write and draw on the pictures which presented the space to be renovated. The digital data collected showed that people gave quite diverse feedback and ideas on how the space could be improved. It seems that the digital drawing gave people more freedom to express their ideas, but additionally the written feedback supported the pictures as well. Hence, in this study the users were given the possibility to give their feedback and design ideas in a written or drawn form by using a digital device. The digital way of collecting feedback and ideas from the people proved to be a positive experience for the participants. (Mackrill, Marshall, Payne, Dimitrokali & Cain, 2016)

2.3.4 Digital Interactivity at live events

The space and ideas for digital interactivity in live events, entertainment and educational industries have also been created. Successful interactive technology, that has been applied so far, are generally based on providing one-way interactivity through the provision of multiple time-synced parallel channels of information. (Freeman & Ullman, 2006).

As an example, there are features which provide audio and video interactivity within interactive television systems, where switching between multiple broadcast or cable channels based on the viewer selections provides the interactivity for the user. These features use technology to allow the user to decide and personalize their experience, by giving them the possibility to choose from multiple video streams, camera angles, integrated audio, and graphic segments for the presentation of the live event. (Freeman & Ullman, 2006)

This way the interactive technology gives an individual the possibility to act as if he or she were in control over how the program is directed or presented on their personal display set. In addition, games can be integrated with the live event to increase user interest. This as a whole feature can be presented as the freedom for the users to customize the content they are viewing, and as particularly suitable inventions for viewing live events. (Freeman & Ullman, 2006)

2.3.5 Digital citizen science

Scientific research as with other fields or businesses, has benefitted as well from different methods in gathering usable research data by mobile applications, crowdsourcing projects, and design co-creation. If the problem before efficient IT regarded how to gather enough sufficient data, current digital systems have answered this problem. Jennifer Preece (2016) presents a few projects where

scientific research projects have used public mobile applications to collect data for their research. This kind of scientific data gathering enabled by digital participatory solutions is presented as citizen science. The aim there has been to design a communication channel between the people gathering the data and the people responsible for the research. This offers an architecture to exploit the possibility for gathering ideas from the people involved, in order to form a versatile design for the project in question. Citizen science is strongly enabled by the wide availability of smartphones and other ICT used for collecting data. This is becoming a more common way to collect scientific data, which have resulted that more HCI researchers are focusing on the design, development, and use of these tools. Therefore, citizen science and HCI are also presented to benefit from each other as separate fields in the future. (Preece, 2016)

Overall, as presented in this chapter, digital interactivity is a widely understood concept with various methods how to utilize interactive methods in reaching wanted audiences and customers. In addition to the various ways digital interactivity can be utilized, interactivity is studied by many different scientific and technological angles. Considering IT studies, one of the most important aspects in digital systems is their usability, or in other words the ease of use of a platform. The system usability has always been associated with technology design by thus far, with the initial aim of efficient performance towards a wanted goal. One main challenge that occurs in interactive systems and the aim of involving users and user participation is maintaining the users with the service. This is what especially HCI and other interactivity studies aim to support, by strategizing technology decisions, overseeing data quality and overall encouraging collaborative design processes that involve participants through interaction. (Preece, 2016)

3 ART AS EXPERIENCE

In order to discuss digital participation and interactivity in art, it is important to acknowledge the concept of art itself. The definition of art is a constantly changing or evolving one and can be examined also from the subjective point of view. This chapter aims to present the concepts of aesthetics and art and how these can be approached particularly for this thesis' main study questions.

3.1 Aesthetics and Art

What is art and how can art be defined and recognized? Art as a form is naturally a widely discussed matter, and a general debate among people pertains to defining its limits. Generally, it can be said that art, as either a product or an activity, embodies alterable aesthetic value (Dissanayake, 2015). Therefore, aesthetics itself is an important matter or concept when discussing art in general and its functions in our society. On an individual level, much of aesthetics is based on the connection of a person and an art piece. What is considered aesthetic then? The 'rules' of aesthetics are formed inside or within a culture, and culture can be stated as an organized system created by living creatures of nature. (Määttänen, 2012)

An aesthetic experience itself is often compelling and holds powerful emotions. Therefore, an aesthetic experience is frequently described as a strong experience that exceeds an ordinary everyday life experience. One of the important trademarks of an aesthetic experience is when one's needs and desires come true in the perception itself. This trademark makes an art experience enjoyable, and one that an individual would like to experience again. Simply put, an aesthetic experience is one of the important forms where human's happiness and joy of life are realized. (Määttänen, 2012)

Aesthetic as a word originates from the Greek word, "aisthētikós", meaning sense perception, sensitive and perceptive (Merriam-Webster Dictionary, 2020). Aesthetic as a term is defined as the following:

A particular theory or conception of beauty or art: a particular taste for or approach to what is pleasing to the senses and especially sight. (Merriam-Webster Dictionary, 2020)

Considering this definition, it is understandable as to why art can be viewed from a cultural, societal, and individual point of view, and creates challenges if aimed to categorize too generally. Aesthetics can be understood as someone's *perception* of an object or activity. Something being aesthetic or enjoyable to one, might not create same experience for another.

Even though an enjoyable experience or pleasure itself is what people tend to seek from a variety of sources by which they are surrounded, such as art, the term "pleasure" is typically used as a somewhat simple concept, which refers to a response that can be characterized as a positive state. Regarding personally significant artifacts, whether they are music, images or architectural spaces, there are indications that pleasure as an experience is usually more complicated and includes conflicting emotional content as well. Considering aesthetics and the philosophy of art, the discussion of conflicting emotions created by an art experience originates from the Aristotelian theory of tragedy: People do not exclusively react to art with pleasure, nor do they necessarily avoid art experiences which generate negative or difficult emotions, such as violence, aggression, or sadness. Experiencing such varied difficult emotions encountering aesthetical art can be perceived rather rewarding. (Maksimainen, Eerola & Saarikallio, 2019)

In any case, social and cultural phenomena, like art, do not seem to be explicitly structured in society. This is good to keep in mind when they are under the scope of structuring and perceiving. Simultaneously, significations are not greatly structured or definite in the society as well. The definition of art is not only complicated by the fact that art exists as social and historical conventions. The variability and contextuality of the conventions in art and art speech, are one of the reasons art cannot be defined by essentialist definition that explains art's inevitable conditions. In addition, an aesthetic experience induced by an art piece cannot be examined regardless of cultural conventions. Since art does not have any clear boundaries or limits, it can also be linked to philosophy (Noe, 2016). Examining art binds it also to history and its contexts since history exists as humane conventions. This applies to acts and functions realized in different times as well. In our history, especially in Western culture, art has been described as skillful activity or handicraft (Dissanayake, 2015), which compared to how art is understood nowadays, represents the variability of the whole concept. (Määttänen, 2012)

Even if the definition of art is complex, it is assumed by the art world that a work of art has its own autonomous value, apart from being useful (or non-useful), skillfully made or impressively carved. It is globally argued and understood that an art object does not need to serve a certain purpose other than its own existence, and simply put comes down to the subjective vision and self-expression of an artist. Additionally, especially in the Western culture,

appreciation of art has become a special mode of human cognition and a regular part of life experiences. (Dissanayake, 2015)

3.2 Art as an experience

Nowadays, works of art are regularly encountered by millions of individuals across the world. Places are varied, the museum, the city-center, the internet. Regardless of the place where art is encountered, art is a regular part of human life. Art as an experience itself is unique and full of impact. When considering humans' fascination towards art or museums, individuals tend to describe their encounter with art as a mix of various psychological events. This means that viewing art creates emotions, evokes evaluations, physiological reactions and possibly even alters lives. Additionally, reactions can differ greatly between individuals and settings, or evolve within subjective experiences themselves.

As an example, art has been studied to promote an experience of enhanced quality and satisfaction in a hospital environment among patients. In practice, artworks can contribute to creating an environment and atmosphere where people can socialize and connect to the outside world, themselves, and inner spirits. Hence, it can be said that art contributes positively to health outcomes and subjective experiences in hospital spaces. (Pelowski, Markey, Lauring & Leder, 2016; Nielsen, Fich, Roessler & Mullins, 2017)

Pelowski, et al. (2016), studied six different models created to evaluate the phenomena existing when a human being encounters a visual art piece. These six models evaluate how a person can be affected psychologically by an art experience. The paper concludes with three main components from the models: (1) inputs that feed into the experience- inputs might include viewer's personality, social or cultural setting, background affective state and the artwork and its history; (2) processing mechanisms, which act on the inputs in specific stage; and (3) mental and behavioral consequences (outputs), that arise from the processing of the art piece. While the second stage involves the processing itself, it is the outputs that define the main goal of addressing art interaction. (Pelowski, et al., 2016)

Additionally, Pelowski et al. (2016) have stated 12 different psychological outputs which result from a person encountering an art experience. First, art can affect a person on a very physiological level: (1) affect, when specific emotions or moods are evoked by content or from the act of viewing; (2) physiology, such as heart rate, skin conductivity, or other autonomic nervous system processes; and (3) actions, such as gestures, eye movement or other physical movement.

Secondly, art has been linked to many aspects of perception and understanding: (4) appraisals or judgements (such as beauty or liking); (5) meaning-making and ability to strengthen conceptions, enhancing learning, challenging ideas, or leading insight; and (6) novelty, where art impacts what

we see by inducing changes visual or perceptual experience. (Pelowski et al., 2016)

Thirdly, there are more art-specific elements which are especially central in reports of art experience: (7) transcendence, which are feelings of sudden change, epiphany, or catharsis; and (8) aesthetic mode, which consists of aesthetic emotions and responses that might involve a state where one detaches from concerns or everyday life perceptions. These are often related to meditative thinking or harmonious enjoyment, as well as positive reaction to negatively valenced or troubling art; and (9) negative affect, where art can also evoke negative emotions such as queasiness or anger. (Pelowski et al., 2016)

Lastly, art has also been argued to create longitudinal impacts on a person. These include: (10) self-adjustment, changes in one's personality, worldview, cognitive ability, or in the relation between art and its viewer - also involving a deepened ability to view art or a more general improvement in visual-spatial abilities. (11) social, where art guides social behavior for example in rituals or institutions, or lead to social ends such as indoctrination or social cohesion; and (12) health - art can have an impact on health and wellbeing by reducing stress. (Pelowski et al., 2016)

The complexity of art experience has been studied by Muth and Carbon (2016). They have created a concept of Semantic Instability, which argues that art has the capacity to create a variety of potential meanings instead of, for example, merely positive or negative reactions. From this point of view, art offers opportunities for more rewarding insights since it creates various emotions and offers new perspectives. Muth and Carbon (2018) have also later continued their study by looking closer to art experiences and identified four clusters of Semantic Instability: integrative blend, multistability, indeterminacy and contrast to perceptual habits. These categories are meant to clarify and offer better understanding towards emotional variety of art experiences. (Maksimainen et al., 2019; Muth & Carbon, 2016; Muth & Carbon, 2018)

Overall, it can be said that various and conflicting emotions generated by art have been a debated topic in emotion studies, music psychology, art research and aesthetics. Negative emotions are however recognized to have a central role in art reception. Besides providing pleasure, movies, plays, music, visual arts can raise feelings of sadness as well. Such cohesion of negative and positive emotions is also part of contemporary entertainment, media content, and cultural artifacts in everyday life. This kind of emotional experience is often presented as the Paradox of Art, which is not limited to fine arts or any particular art forms. Paradoxical pleasure can be evoked by a painting of a violent scene, but the same kind of aesthetic emotions can also appear with less traditionally acknowledged art. Additionally, it is argued that art has the power to be boring to people as well, and not influence us after all (Noe, 2016), which applies to the general idea that art is its own separate construct outside any utilitarian value (Dissanayake, 2015). (Maksimainen et al., 2019)

Additionally, it has been studied that initially the perceptions of emotions in music influence how musical features impact emotions which arise in the

listeners. For example, self-selected music is studied to evoke more mixed emotions in listeners than experimentally selected music. These results demonstrate that perceptual processes are likely to play a significant role in understanding the ambivalence of emotional experiences of art (Weth, Raab & Carbon, 2015; Maksimainen et al., 2019).

Art as an experience is usually tied to a specific context. In the experience itself, different elements, features, surroundings and information, such as artwork title, historical facts or authenticity information have appreciable effects on one's response and evaluation of art. (Brieber, Nadal, Leder & Rosenberg, 2014)

In contrast to the awareness of how context affects an art experience, only a few studies have been conducted to examine how the physical context affects how a person views art. Physical context can be referred to as the space in which the artworks are exhibited, typically museums, galleries or exhibition rooms. The physical context is important when classifying an object as an art piece. Additionally, cognitive and emotional processes that occur during an art experience are always linked to the context surrounding it. Hence, differences in these cognitive and emotional processes are due to the differences within the context. (Brieber et al., 2014)

Locher, Smith and Smith (2001), studied pictorial features such as symmetry or complexity of artworks. The research participants saw the artworks both in a physical real-life form and as virtual copies. The study showed that the majority of the artworks utilized in the study were rated as more pleasant and interesting than when seen as virtually simulated. In other words, the hedonic value of the artworks was higher in their more traditional environment such as museums, and the art experience itself was enhanced in these surroundings. This proves that especially the environment as a context of an art piece is important when considering the experience, it creates for its viewer. Additionally, this explains the reason why people are more willing to invest time and money to visit museums and real-life exhibitions, than to participate in virtual tours with only virtual content. (Brieber et al., 2014; Brieber, Nadal & Leder, 2014)

In visual art, visual exploration is an active and dynamic process of collecting information about one's surroundings. Here, contextual and one's personal factors influence the visual experience. In visual experience, it has been studied that context can facilitate or hinder the recognition of the objects of the subject. On the other hand, a person's motivational, emotional, and cognitive state influences where to look and how long to look. Considering this, the visual examination and its duration has been proven to affect the whole experience of art piece, and vice versa. Therefore, the time taken to visually explore an object can inform its emotional relevance, level of interest, or aesthetic appeal. (Brieber et al., 2014)

3.3 The value of participation culture

Nina Simon (2010) writes in her book, that visitor participation has become a crucial part of cultural institutions and what they are strategizing to offer to their visitors and customers. In general, participation has been an interesting act to people, and it comes naturally for people to show their interest by interacting with their target of interest. Of course, there are always some amounts of people who do not want to participate regardless of the situation. But, even if it is a small amount, the culture of participation especially in arts, entertainment and media is currently getting stronger. This means there is an increasing number of people who feel more connected to their environment and to the content itself with creative activities and social connections involved. (Simon, 2010)

Simon (2010) mentioned participation inequality, which occurs in most environments and systems, where creative content is crucial. Participation inequality in practice means an uneven distribution between people who create the content and the rest of the people who view the content. It has been studied that 90% of people using technologies, which are based on content sharing and creation, are more interested in taking part in the content in the way of commenting or sharing, rather than creating the content itself. This means that in many platforms, such as Youtube, the majority of the people or users are people who would rather view and interact with the content shared by others, than create and publish some themselves. In other words, considering these kinds of platforms, especially digital ones, content creation and sharing is not the main point for their users. It is the participation of people that creates value itself. (Simon, 2010)

This is why it is crucial for cultural institutions to use digitization and accessibility in their strategies and content. Creating participation among their exhibitions or other content should be a priority to any cultural institution. It is also important to pay attention to the designing of these kinds of opportunities, since these kinds of inventions should not lean only towards the desire to have people participate. One of the most important things is to carefully design *why* this kind of interactive feature is to be added to an exhibition, for example. An interactive feature itself does not create value to the visitor alone if it does not serve the experience itself. (Simon, 2010)

3.4 Interactivity in Art

Interactivity in art can be seen in many different environments and purposes. Art museums and other cultural institutions are the main parties that take responsibility in designing interactive spaces for art especially. Currently, in order to attract more diverse audiences, encourage multiple visitations and to

enhance student learning, art museums are developing digital interactive spaces and exhibitions.

The general active concern with audience participation by artists became particularly strong in the 1960s, which was followed by most of the artistic work in interactive art (Edmonds, Bilda & Muller, 2009). Since the mid-20th century, the role of the museum has begun to move away from being a passive conservation mechanism and has also started to offer a way to understand the present development of interactive artifacts. The new perspective on the contemporary museum is based on the transformed relationship between contemporary society and the artwork. Visitors are now seen to be moving away from the traditional analytical and interpretative way to view art. The visitors and artistic communication together are seen as processes at the core of the transformation of museums, rather than the actual work of art. In fact, the role of visitors has changed in the last few decades, as they have become artworks themselves. The visitors are invited to interact with artefacts and artists through physical relationships, by participating first-hand and integrating themselves with performances and events. (Falco & Vassos, 2017)

Understanding the concept of interactive art, it is important to acknowledge that these kinds of artworks take on the shape of an event. In other words, in interactive art, the artist does not make the final, completed piece of art. Instead, the artist produces a space of activity for the audience, whose interactive actions bring the artwork to life. That is why it is misleading to view artists as the active and the audience as purely passive side of interactive art. This idea is also argued by Dewey (1934), regarding the initial and traditional concept of art. Dewey has posited that even in traditional art without interactive features, an artist never works in a vacuum, and that the creative process does not end when the artist 'completes' the making. Active engagement of the audience is required to completely realize any piece of art. (Dewey, 1934; Edmonds et al., 2009). Hence, the main idea is that regardless of what shape the final product of an artist's activity takes on, especially an interactive piece of art finds its final formation only as a result of interactive behavior of the audience. (Kluszcynski, 2010).

It is also argued that art is not a 'thing' that merely affects a person. Art itself can be seen more like a technology that a person can use to learn more about him/herself, which reaffirms the thinking that audience in any kind of art is not passive and only in the receiving end of 'outputs', since the audience can have the potential to guide how they capitalize their experience. (Noe, 2016)

In practice, the term interactivity can present itself in a wide range of experiences in an art museum. As an example, many museums are using inquiry-based tour strategies that might include activities such as games, props, or touch baskets. Additionally, some museums have added a hands-on, creative art making experience to school museum tours. This development of interactive spaces in art museums can usually be seen as either separate or designated physical spaces within the permanent exhibitions where visitors can physically engage in art. Some of them designed more for children following a more

educational motive, and some of them constructed more as a purpose for the artist to engage visitors physically in the exploration or co-creation of the work. (Adams, Moreno, Polk & Buck, 2003)

When designing an art gallery in Kentucky, United States of America, interactive design for art played a central role when considering the exhibition space (Adams et al., 2003). The results of Adams and colleagues' (2003) workshop on interactive art, revealed that visitors from different age groups made shifts in their understanding and perception about art. The interactive experiences enhanced the visitors' art experience as well, and helped them to connect the activities, presented art and their personal lives together. (Adams et al., 2003)

In addition, the authors of this study made a few arguments about interactive art and challenges it creates in the process. Firstly, considering how context affects the experience of an art piece, they discovered that changes in an interactive experience such as environment, content and viewer age influence the entire reading of the artwork as well. (Adams et al., 2003)

Secondly, nowadays people seem to have already generally adopted the idea that in an interactive art space or exhibition there is usually a "hands-on" possibility of interaction. These kinds of preconceptions can be seen in the visitors in an art museum. Therefore, the assumption that an interactive art piece can be touched via a digital display or directly, already creates confusion if an art piece requires different kinds of interaction, such as physical whole-body-movement. This demonstrates that people are used to touch and use digital displays. Additionally, as mentioned in chapter 2, people tend to touch digital displays due to a formed custom already, even if the technologies or artworks do not offer this kind of interaction (Want & Schilit, 2012). It confirms that the culture of "hands-on" interaction is already widely adapted by museum visitors. (Adams et al., 2003)

Thirdly, when experiencing an interactive art piece, there is a risk that the focus transfers more towards the interactive part and its mechanics rather than the art itself. The authors mention this as the "game-over syndrome", where the interactivity overshadows the art. A scenario is also possible, where exhibition visitors engage in the interactive part of an art piece, but seem not to get a grasp on what made the whole experience a work of art. This is emphasized especially in engaging children with art, since for children, the interactive part makes art more understandable and interesting. There is a challenge though: How to make the difference in museum environments and exhibitions between engaging young audiences emotionally, intellectually, and physically as a whole, and creating merely an artistic playground for young audiences. (Adams et al., 2003)

Another point is that the way people approach interactive art depends on the self-absorbed skills on how to use technology in general. The scenario where the focus leans more to the mechanics is more common with people who seem to be comfortable in using technology. If a person is not that comfortable

or skillful using interactive technology in general, it decreases their will or likelihood to approach technologically interactive art. (Adams et al., 2003)

From an organizational point of view, when museums are engaging with and developing interactive art spaces, there seems to be three common issues: institutional commitment, design process and visitor expectations. In institutional commitment, museums face a challenge which might occur as misalignment between the interactive works or spaces and the main message the institution wants to communicate to the visitors through their exhibition. This can also create miscommunication between governmental officials and designers, resulting in spaces which are not synchronized with the general theme or message of the institution. This can also separate the created space from the other exhibition spaces, creating misaligned experiences for visitors. (Adams et al., 2003)

The challenge in the design process concerns the issues that arise within the intentions that are not carefully articulated or motives that are not aligned with the institution's main message. There can also be difficulties in choosing the right approach for the interactive space to address the wanted subject or art piece. (Adams et al., 2003)

Regarding visitor expectations, the challenges can also arise in the awareness of the expectations visitors have towards the exhibition or interactive space. Visitors in museums usually have variable interests and previous experiences from cultural institutions, which is why sometimes there can be a challenge in creating spaces that together consider this variability. Visitors usually want unique and authentic experiences in museums which is why there can be a challenge with standing out from other similar institutions with interactive spaces. Another challenge is how to assist the visitors who are not that interested or skilled in using technology in a way that encourages them to engage with the interactive art and to use the technology designed for it. (Adams et al., 2003)

3.5 Commercial Art

Art used for commercial purposes exists as well. Additionally, advertising has been acknowledged partly as art and is seen as capitalist realism. The rhetorics in advertising has different purposes compared to the art field. However, in the same way art influences and gives meaning to daily matters in life, advertising has a role in shaping the consumer culture and therefore the way we see our lives. More closely, art mirrors and challenges commonly understood truths, ideals and metaphors of a give society, as well as mirrors our popular culture. As art embodies universal fantasies, feelings and thoughts, advertising expresses the rational and emotional experiences, as well as the moods of consumers. Both art and advertising are also mainly influenced by the social context within which it originated. (Borghini, Visconti, Anderson & Sherry, 2013)

The spillover effects of art infusion exist especially between art and advertising. These effects are viewed as influences resulting from consumers' perception and evaluation of products because of the presence of visual art. This meaning, that art used in advertising has the possibility to influence how people react to advertising. In practice, it can be understood and proven that art can have a powerful impact on how customers view products. The presence of art itself in advertising, can for example provide a positive influence on consumer perception of brand image, resulting in favorable brand evaluation compared with advertising without art. This automatically influences the evaluation of the brand's products. This is a good example of how can two fields with extremely different groundwork benefit from each other. Therefore, similar kind of influence of art on IT design or user experience could possible as well. (Lee, Kim & Yu, 2015)

4 DIGITAL INTERACTIVE METHODS IN ART

This chapter is mainly constructed to look closer at how digital interactivity is seen in the creation of art, and especially how art experiences are designed involving digital interactive features. The main goal is to look beyond the interactivity in art, and especially study what digital technology provides the interactiveness of cultural institutions.

4.1 Relationship of Technology and Art

If looking back at the history of art, technology and science, the separation between each of them has not always been as clear as it might be described nowadays. From a sociological point of view, since the development of technology and art have both been strongly connected to innovation and creation, they have always had a link between each other. Neither of them would have been able to progress in a void. Artists have had an intimate and continuing association with technology. In turn, the attitudes, needs and achievements of artists have provided technological discoveries more possibilities to continue evolving. The artistic perspective has also been able to create scientific attention to aspects that reductionist science would have liked to ignore. (Smith, 1970)

The separation of actual art from arts and science seen before, influenced on how science was seen as more definite and increasingly useful to technology. This has gave precision to both, design and control of technological processes. However, considering the general position of art in our societies nowadays, the utility of art and its contributions to industrial design and advertising in a way has forced one of its most needed components out. In other words, today we are faced with the curious phenomenon of art being mainly a comment and much-needed protest, rather than a constructive suggestion of a way toward deeper understanding. Even though artists have found much to interest them in both

the scientific and technological world, and that there is aesthetic value in industrial commodities as well. (Smith, 1970).

Artistic curiosity has influenced the discovery of new techniques, but these discoveries occur more now in well-financed research laboratories and are increasingly dependent on science. The historical position of craftsman has transformed into technologist, which tells about a new level of complexity in technology. This in turn demonstrates that there is a need for a new level of social art. The awareness of the general relationships of artists is to enable the restoring of balance between social and individual needs. (Smith, 1970)

Even though art has become more like its separate field of expertise, the use of technology to create contemporary art is no longer seen as controversial as it might have been viewed before. Today, art and aesthetics are used by technologists in order to explore more creative and innovative media for software and mathematical structures, make computing more accessible to various people, and facilitate the personalization of computing structures at individual and group levels. Both fields use each other's perspectives to develop. Therefore, we can see constant mutual interactions between art/aesthetics and computing/technologies. On the one hand, art and aesthetic theory and practice have enriched computational design and technological development. On the other hand, computing and technology have enabled and supported new perceptual experiences. In other words, there is a clear beneficial link and relationship between these two areas. (Jeon, Fiebrink, Edmonds & Herath, 2019)

Previous studies relating to the use of digital systems and technology in the art field and cultural institutions, are relatively variable. Digitalization and how artistic and cultural institutions are creating exhibitions have been present in the recent conversations of art studies (Samis, 2018). Additionally, some amount of research for example, has focused specifically on the effects of art and aesthetics on computing and technologies (Jeon, Fiebrink, Edmonds & Herath, 2019). Vermeeren, Calvi & Sabiescu (2018), for example studied the current situation of museums, their line of work and future. In their book they go through how the procedures in museum experience design are changing during the current digitalization. Bailey-Ross, Gray, Ashby, Hudson-Smith, and Warwick (2017) studied how digital technologies create new ways for museum visitors to participate in the creation of the content presented in museums, what benefits and challenges does digital sources create with cultural content, and how crowdsourced digital content can be used as research material. Baker, Bakar and Zulfiki (2017) found 11 main elements essential for a Mobile Augmented Reality application: aesthetics, curiosity, usability, interaction, motivation, satisfaction, self-efficacy, perceived control, enjoyment, focused attention, and interest.

A big part of the interactive art studies have originated from studies where interactive art and HCI field collide (Costello, Muller, Amitani & Edmonds, 2005). However, museums for example have been forerunners in experimenting new ways of interacting with their visitors. Therefore, they are

recognized within the field of HCI as relevant institutions for designing interactive systems. HCI benefits from the various efforts of integrating interactive technologies into a museum context to make artworks more accessible and enjoyable. That is why it is evident that current digital technology is transforming museums into hybrid and complex spaces, where the virtual storytelling is blended with the physical culture. Digital culture itself in museums has developed along with the transformation of cultural accessibility, to the point that a virtual museum experiences may be a highly inclusive alternative to a more traditional one. (Falco & Vassos, 2017). However, as stated before, even though digital cultural solutions have been developed especially by cultural institutions, interactive art as a field still tends to sometimes ignore the HCI methodologies, such as user experience and usability. This is based on a mostly unstated belief that they do not measure aspects of interactive artworks that artists find interesting or relevant. (Vi, Ablart, Gatti, Velasco & Obrist, 2017; Höök, Sengers & Andersson, 2003).

4.2 Digital Interactive Methods used in Art

Art mediated by interactive technologies are argued to have the similar core conception than interactive art. There the participation or interaction of its audience utilize the technology solutions designed for interactive actions. In these kind of scenarios, a human being does not communicate between self and installation, but through self and contents. These contents can include the experiences of play, aesthetics, and acknowledgement, which include the human being is one part of in an artwork. In short, an interactive human is a relevant factor in digital interactive art. An interactive human performs within the artwork by his/her actions and therefore creates the contents by their choice. The action of an interactive human makes the narrative due to developing the digital narrative through interactive applications, whether in terms of new media art, social networking, gaming, or simulation and training applications. (Oh & Shi, 2013)

The role and value of human beings in interactive installations changes with technological developments. Human beings are not the main characters of the digital world anymore. They have become a part of a device and are one node on a string linking one digital installation with another. Interactive humans initiate the actions to implement interactive installations even before they are aware of it. (Oh & Shi, 2013)

There are multiple ways digital technologies are used in the process of presenting interactive art. Kluszczynski (2010) states eight different forms of strategies to use digital interactive methods in art. These are Strategy of Instrument, Strategy of Game, Strategy of Archives, Strategy of Labyrinth, Strategy of Rhizome, Strategy of System, Strategy of Network and Strategy of Spectacle. Each of these strategies have their own specific features which offer the audience the possibility to experience or interact with the art.

The strategy of Instrument suggests the audience to create a performance with the use of an interface that becomes a generator of events. An example of this kind of interactive art is an installation by Toshi Iwai: *Piano as an Image Media* (1995). In this work, an interface in the form of a standard computer trackball offered a possibility to use it as an instrument creating an audiovisual presentation. *Piano as an Image Media* represents a large group of installations that make it possible for the audience to create a sort of audiovisual concert by themselves. (Kluszczyński, 2010).

The strategy of Game organizes events becoming a work of art evolving around interaction itself in a form of a game. As part of interaction taking on a form of action within the game, the audience or the participants can face various challenges and tasks and the course of interaction may become a subject to evaluation. An example of an artwork is the *Can you see me now?* by Blast Theory group (realized in 2001 in cooperation with Mixed Reality Lab, University of Nottingham) that takes place between the Internet virtuality and physicality of the real world. The game is taking place in the streets of a city and online at the same time. The participants are equipped with hand-held computers, transmitters and GPS systems while chasing the other participants by finding them on computer screens. As a result this game initiates a cross-border relationship and hybrid interworld zones. (Kluszczyński, 2010).

The strategy of Archives focuses on information, audiovisual data gathered, organized, and made available to the audience. Here, an interface creates an area for data exploration. The accessed information can play an assumed role in the course of an experience. The structure of the interface does not play an important role in this strategy, since the audience is given the freedom to explore the content themselves freely. An example of this can be an archive of certain objects or virtual material in an exhibition or museum, where the visitor can choose which to explore more closely. (Kluszczyński, 2010)

The strategy of Labyrinth is based on the organization of information. Contrary to Strategy of Database, the audience does not have any base knowledge of the source of information or the structure of the work of art. Here the lack of knowledge about the experience is meant to create emotions and sensations of being lost or a challenge. Making decisions and undertaking activities, searching for answers become central attributes of this kind of interactive work of art. (Kluszczyński, 2010)

Works using the Strategy of Rhizome share features with the Strategy of Labyrinth of organizing information resources. However, this time the organization happens in the form of cybertext. The experience of exploration is also similar as in the labyrinth, but here the interface and the experience transform and develop multidimensionally throughout and as a result of interactive experience. There can be an open system architecture, which can be modified in any ways by the audience. (Kluszczyński, 2010)

In the Strategy of System, despite the dynamic processing, digital properties and the Internet, it does not create an experience of real interaction to the audience. The events occur mainly in the audience's inner technological and

digital world. Here the audience using the interface are used more as an input group, who create the presented material. Then the later output group is the audience, that views the work of art. The experience is not real interaction since the first group's experience is not the final form of the work. (Kluszczyński, 2010)

The strategy of Network creates, shapes and organizes relationships that link the participants of an artistic event. Therefore, it is the network of the interactions that create the work of art. These kinds of works are usually created using large public places and can be seen more as hybrid art. As an example can be seen as the MILKproject (2004-2005), realized by Esther Polak and Ieva Auzina with the help of New Media Culture Centre in Riga. Here the main idea was to follow the products of Latvian local milk and cheese industry, from their manufacture till their consumption. The technology used was GPS devices, for creating the map of the network of the dairy industry. (Kluszczyński, 2010)

Lastly, the Strategy of Spectacle realizes works of art that take on a form of a spectacle. The audience of these kinds of works have very limited possibilities of having any real influence on the course of the experience. The main interaction occurs in the decision starting and ending the event. This kind of art is still seen as interactive art, since the occurrence of events is still defined by the audience. An illustrative example of this kind of art is an installation of a Belgian artist Lawrence Malstaf's Nemo Observatorium (2002). In this work, the viewer is seated in an armchair placed in a cylindrical construction. The spectacle is started by using a button (connected to five fans and polystyrene foam particles) and causing (and finishing) an artificial typhoon or a cyclone that the viewer safely contemplates from its very center. (Kluszczyński, 2010).

Human senses are also considered when looking closer at an art experience, since a person using her/his senses is her/himself interacting with her/his environment. Despite this, vision and hearing senses have been the most dominant ones studied in HCI, when touch, taste and smell have been categorized as secondary or lower ones. HCI researchers have however started to be more fascinated by what different opportunities touch, smell and taste can offer for the field. Additionally, museums and galleries have usually been the first institutions to integrate and stimulate human senses in order to explore new ways of representing art and increased people's interest towards it. (Vi et al., 2017)

4.3 Approaching Digital Interactive Methods in Art

In HCI, there is a lack of consensus to adequately define pleasure or positive emotional response in relation to use of technology. It is also difficult to predict, apply and measure, what will be the emotional response for a specific design. While it is easy to identify products or designs that engage us enjoyably, as the results from the studies focused on emotional response to art show, the human responses to artistic artifacts can be much more complex. There are various

things however, in an individual experience that will reduce discomfort or negative responses. Understanding these causes and emotional experiences in general is beneficial for designers from an intellectual and commercial point of view. To comprehend and predict emotional resonance that products or systems may have for the people using them and affected by them gives the designers the possibility to develop better human experiences, and naturally better services. (Jeon et al., 2017)

It is challenging to define and understand interactive systems without evaluation or feedback from observing people interacting with those systems. The fundamental motive for interactive art is to invite the audience to engage and participate in the realization of the work itself. In digital interactive art, artworks are realized through a process of exchange or dialogue between an active audience and an digital interactive art system. Additionally, as interactive art, digital interactive art is also a form that focuses on the experience over singular static objects. There is little empirical or on-site research on the audience experience of this art form. To understand digital interactive art experience better, it is useful to gather information on interactive behaviors by analyzing and learning from various audience experiences as they occur in real life and not only in laboratory conditions. (Edmonds et al., 2009)

An interactive art system can be evaluated from different points of view, and its design and usability might differ depending on the point of view. Figure 2 presents three different viewpoints an interactive art system might have in the process; the artist, the evaluator and the curator. The artist is working with the artwork itself and its functioning with the art system. The artist's main focus area pertains to how to connect the art system with the piece of art. The curator is primarily concerned with facilitating the experience between the artwork and the audience. This includes supporting both the artist's and the audience's process of making and perceiving the work. The evaluator focuses on the behaviour of the system in its context in order to understand the important aspects of human behaviour and human art experience. (Edmonds et al., 2009)

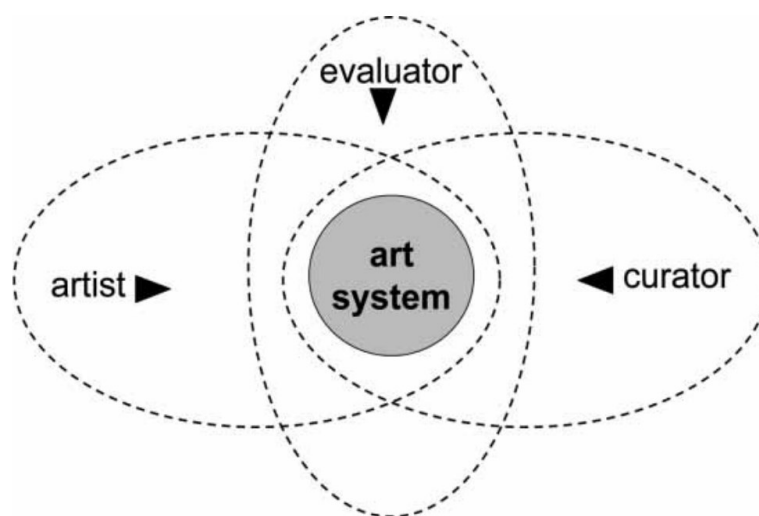


FIGURE 1: Three viewpoints on evaluation of interactive art systems. (Edmonds et al., 2009)

Enabling artists to observe their interactive artwork in action and real context help in the design and creative process of interactive art. There is also a need to provide methods that help artists to learn from these observations. When designing interactive art systems it is important also to consider and balance between the usability and complexity of the system. High complexity can make it challenging for the audience to exactly grasp how to actually use these systems. The evaluation techniques should be more understood by artists since these can help them to realistically assess their work of art and their communication with the audience. This brings richness to the design process and helps the art curators reduce the 'gap' between the artist's vision and the actual presented work. It is important to acknowledge that there are no simple or single descriptions of audience engagement. There is also more than one way of interpreting, reading or evaluating artwork and art which can be experienced in multiple levels is more interesting as an experience. (Edmonds et al., 2009)

4.4 Designing Digital Interactive Methods in Art

Technology can generally be stated to open doors for broader public participation. However, making clever technology investments or development choices can be challenging not to mention costly resource-wise. The most important questions to ask, when strategizing a technology design are: Who will use the technology; What will they use it for; and Where will they use it? This is because a user of any system goes through the validation between the realistic value they receive from it and the effort they are required to spend on it. This also goes for the participation design in interactive art or culture. Having the possibility to participate, without offering any real value to the viewer, is not a stimulating experience and can resemble a numb art experience. Successful participation by the audience in art and culture depends on designing. A well-constructed interaction process creates a more variable and flexible relationship between artists, artistic institutions, and their audience. This is because interactive possibilities enable a much larger and variable group of people to express themselves and communicate within the art world. (Preece, 2016; Simon, 2010)

Additionally, there are arguments against digitizing engagement. Even though effective digital engagement has been repeatedly demonstrated to enable and support co-creation of meaning and value, it has also revealed to be a potential cause of facile interaction and connection. Moreover, it is mentioned that people should be much more discriminating about the kind of technology we use. (Popat, 2016; Walmsley, 2016)

Aforesaid, Brieber, Nadal and Leder (2014) stated in their paper that people are more willing to invest their time in real life museums instead of experiencing them in the form of virtual tours. This suggests that merely digitizing art and culture is not what gives ultimately more value to people. Additionally, in IT, a system design without true value to its user, is largely

studied to be a failure. This is important to understand when combining digitality with art and culture, since mere digitization might lose the actual value of an art piece, which originates from its context, size, feel, taste or viewer. (Brieber et al., 2014)

Another important aspect regarding a successful digital interactive system in art, is how it creates value to its user and how it offers the interaction for an experience. Although participation with the content is interesting for most people, a platform which offers constraints with participation instead of open-ended opportunities for self-expression, is concluded to be more satisfying for the audience. This is a follow-on for the argument which claims that considering digital media, most people prefer to participate than create the content. The suitable constraints require design principles based on the supporting creative experiences. At the same time the constraints should be designed with balance between limiting the creative possibilities and enabling them. (Simon, 2010; Walmsley, 2016)

There are other challenges in bringing together two fundamentally different study fields as well. A major conflict between artistic and HCI perspectives on interaction is that art is inherently subjective or tied to its concept, while the HCI point of view with science and engineering has traditionally strived to be objective. While HCI evaluation is often approached as an impersonal and strict test of the effects of a technology, artists tend to think of their systems as a medium that they can use to express their ideas to the audience and provoke new thinking and behaviour. When artists do use studies, they are likely to see the user studies as part of communication through the artwork. (Höök et al., 2003)

The subjective point of view of artists means that artists do not build systems for 'normal' or 'average' users. Instead of creating a generally usable systems, artists are more interested in the richness and complexity of unique, individual users, cultural contexts, and the resulting variety of interpretations and experiences of their system. In other words, the goal for a user experience might differ from the traditional point of view in HCI, since HCI usually is focused on creating pleasant and smooth interactions. This is why despite the fact that studies for digital interactive arts have been conducted, the results might not be universally or generally applicable in art studies. (Höök et al., 2003)

It can be understood that HCI and art studies have differences in how they view interaction. But it can also be seen that both fields have the possibility to benefit from each other's view points. This cohesion in studies investigating digital interactive art, shows that both study fields have the audience's experience in focus. However, traditional HCI studies for effective and user friendly interfaces might be invalid to use in art, since the experience of art is sometimes not meant to be effective and user friendly. Since art means to provoke, create ideas, change thinking, challenge behaviors, norms in society the technological design in interactive differs somewhat with traditional HCI design. However, there can be a consensus, since interactive art interfaces do

want and need technology which supports the message of the artist and the artwork.

Overall, digital features and systems used in interactive art seem to offer novel ways for creating and presenting art, giving the audience the possibility to experience art in new ways if compared to traditional art or interactive art without technology. With these new ways of creating and presenting art, there is enhancement in the ways people way they perceive and see art. There seems to be a struggle with the same challenges as IT in terms of the process of designing and creating wanted solutions for users. This comes naturally with the cohesion of IT and art. Additionally, there seems to be a need for studies looking closer towards the actual experiences people have when engaging in digital interactive art and the practical solutions of how IT could be used to support art and artists. (Jeon et al., 2019)

As a summary, the following Table 1 includes all the key concepts, main findings and references presented in chapters 2, 3, and 4.

TABLE 1 Main findings from chapters 2,3 and 4

Chapter	Key Concepts	Main findings	Main References
Digital Interactivity	<ul style="list-style-type: none"> • Human-Computer Interaction (HCI) • Interaction Design (ID) • Digital Service Industry • Digital Interactivity 	<ul style="list-style-type: none"> - Study areas focusing on interactivity include user experience and usability. - Digital Interactive methods are widely used in many business areas and fields of study. 	<ul style="list-style-type: none"> - Low, B. & Sloan, B. (2001). A perspective on the digital interactive service industry for building professionals. - Preece, J., Sharp, H. & Rogers, Y. (2015). Interaction Design: Beyond Human-Computer Interaction.
Art Experience	<ul style="list-style-type: none"> • Aesthetics • Art Perception • Interactive Art • Commercial Art 	<ul style="list-style-type: none"> - Art Experience is strongly connected to its concept and creates a wide range of emotions and other effects on its audience. - Interactive art happens in the form of an event - Commercial Art has the potential to influence customers consuming behaviours. 	<ul style="list-style-type: none"> - Maksimainen, J., Eerola, T. & Saarikallio, S. (2019). Ambivalent Emotional Experiences of Everyday Visual and Musical Objects. - Pelowski, M., Markey, P., Luring, J. & Leder, H. (2016). Visualizing the Impact of Art: An Update and Comparison of Current Psychological Models of Art Experience. -Simon, N. The Participatory Museum.
Digital Interactive Art	<ul style="list-style-type: none"> • Relationship of IT and Arts • Digital Interactive Art methods • Designing Digital Interactive Art 	<ul style="list-style-type: none"> -Relationship between IT and art is complex, but has the potential to benefit both points of view. -Digital interactive art utilizes digital features in various ways. -The audience of digital interactive art have an active role in the art work -Challenges lie in designing suitable solutions for digital interactivity in art. 	<ul style="list-style-type: none"> - Adams, M., Moreno, C., Polk, M. & Buck, L. The Dilemma of Interactive Art Museum Spaces. - Edmonds, E., Bilda, Z. & Muller, L. (2009). Artist, evaluator and curator: three viewpoints on interactive art, evaluation and audience experience. - Kluszczynski, R. Strategies of interactive art.

5 METHODS

The used research method and data collection is presented in this chapter, with further explanations of the components chosen to be used in the study.

5.1 Research motivation and background

The trajectory for the current thesis was the need to more closely examine how the utilization of ICT in art influences art experience. The research was conducted with the Arilyn company, specialized in Augmented Reality (AR) software development used in art experiences. The company had recently developed and published a set of virtual art exhibition sites, which offered a possibility for exploring virtual 3D exhibition spaces with artworks by different artists. The chosen company and technology used in this research was chosen partly because of the limiting times of the COVIC-19 pandemic, but also since it offered a suitable technology which was initially developed for art exhibition experiences. The technology designed by the company had the main idea to be used in multiple virtual exhibitions. Three exhibition environments were chosen for this study. Three were chosen as, it was considered that this number would give a more comprehensive result if there would be responses from three different kinds of exhibitions, but that had all utilized the same kind of technology. This way the results would present a more comprehensive image of how interactive technology usage affects subjective art experience and vice versa.

The three virtual art exhibition environments all had a similar layout architecture, but their visual outlook and content differed according to the exhibition. In other words, they were three different exhibitions with the same basic construct. The environments had been designed to resemble real life exhibition spaces with exhibition rooms and places for artworks on the wall. One of the spaces mimicked an actual atelier in Finland (Halosenniemi,

Tuusula). By using these three virtual exhibition spaces, it was an apt opportunity to study the experiences people have during their visits.

5.2 Data collection

The data was gathered through an online questionnaire which was publicly distributed to different digital channels. This seemed to be a commonly used method for similar kinds of studies and was chosen to be used in this study as well. An online questionnaire was also seen as a suitable method, since due to the COVID-19 pandemic different kinds of data gathering was seen as challenging.

First, the questionnaire was created and built according to previous studies created for similar kinds of purposes. Looking through the academic research papers, it seemed challenging to find a singular one which studied closely enough similar kinds of questions as this thesis. This is why the questionnaire was built on regarding multiple studies that focused on art experiences, technology user experience cases or interactivity.

The goal for this questionnaire was to support the theoretical research in the previous chapters about how digital interactivity affects human art experience, and how could these be composed more suitable in the future. In other words, the questionnaire aimed to ask the participants about their subjective experience. Therefore, the questionnaire was constructed with multiple choice and open-ended questions. Multiple choice questions were aimed to evaluate ratings more specifically in six different categories, and open-ended questions were meant to give the participants an opportunity to explain themselves in their own words. This supports the evaluation of a subjective experience.

Before answering the questionnaire, the participants were advised to visit one of the listed virtual exhibition sites privately as long as they felt comfortable. After visiting the chosen exhibition, the participants were asked to continue by answering the questions presented in the questionnaire sheet.

At the beginning of the questionnaire there were questions which were meant to consider different factors that might affect the participants' responses - in other words, their background information. For example, the questions about the participants' skills and interest in using ICT was seen as an important background factor, since classifying people by age, gender and education is not enough if their emotional reactions or subjective experiences are to be studied. Especially, when studying the experiences linked to HCI it is important to consider the participants' understanding and interpretation of technological culture as well. (Höök et al., 2003)

Additionally, the level of expertise, knowledge, experience, and interest towards art was considered another important background factor regarding the experience. Leder, Gerger, Dressler and Schabmann (2012) argued that there is a strong link between cognitive aesthetic judgements and aesthetic emotions and

found out that expertise and education in art has a positive influence on one's art experiences. Hence, it was concluded beneficial to survey what background the participants have in art and estimate its impact on the overall responses. (Leder, Gerger, Dressler, Schabmann, 2012)

There were six different categories that were chosen to be asked from the participants regarding their experience using the exhibition sites: enjoyment, visual appeal, usability, experience, thoughts, and emotions.

Enjoyment had questions from similar studies (He, Wu & Li, 2018; Mathwick, Malhotra & Ridgdon, 2001), which had an intrinsic enjoyment as one measure to examine individual experience value.

Visual Appeal was to be measured, since visual aesthetics play an important part not only in artistic experiences, but in technological designing as well. From a user point of view aesthetic quality can make technological services easier to accept and adopt, and positive aesthetics is a strong determinant of pleasure experiences by the user during interaction (Lavie & Tractinsky, 2004). The measures for this category were based on a study by Lavie and Tractinsky (2004), which argued that these three qualities can be used to measure aesthetic quality in personal experience.

Usability was decided to be included in the questionnaire as a category, since in the same study discovered a positive correlation between perceived usability and aesthetic value in digital products (Lavie & Tractinsky, 2004). The main motive for this category was also to question if usability affects the overall experience of people using a platform mainly focused on offering virtual art experience. Or on the other hand, does the perceived usability get influenced by some other factors occurring during the experience.

Experience itself was measured by questions focusing on escapism and feelings of interactivity, which were presented in the study by Mathwick and colleagues (2001) as well as Höök and colleagues (2003). Both studies used these questions to measure experiential value and defined escapism and feeling of interaction as part of one's artistic or user experience.

Thoughts as a category aims to examine whether the exhibition or the artworks evoked thoughts in the participants. This category was previously studied and presented as one of the cognitive and affective aspects of aesthetic processing (Leder, Carbon & Ripsas, 2006).

Lastly, *emotions* was chosen as a category to focus on the emotional response participants might have during the experience. The importance of tracking emotional responses is to understand the overall art experience and user experience at the same time. This was evaluated by asking if the participants experienced a feeling of connection with the art works (Tröndle & Tschacher, 2015), or if the exhibition or art had evoked any emotions in them (Leder, Carbon & Ripsas, 2006; Höök, Sengers & Andersson, 2003). The questions presented some of the basic human emotions separately (Dalglish & Power, 2000), and in addition, the participants had an opportunity to explain their emotional responses in their own words.

All the chosen categories were selected to create a comprehensive picture of the experience from the art experience and technology usage point of view. It was found important that the questionnaire has parts which consider the experiential evaluation as an art experience, how do the participants experience the art and the exhibition, and as a user experience, what is the participant's experience in using the virtual exhibition environment and the web site per se. The multiple-choice questions were followed by a set of open-ended questions which focused on asking the participants to describe their experience further and specifically in their own words.

The open-ended questions were built more towards the overall experience of the participants. This is why the questions such as "Describe your experience in your own words", were chosen so that the audience would explain and open their experience personally.

5.3 Data analysis

Data analysis was started by cleaning the data and checking that each response was complete and applicable for the official data analysis process. Since the data was gathered by quantitative and qualitative survey questions the data analysis was performed in two parts. The questions chosen for the questionnaire are presented in Appendix 1. The multiple-choice question responses were analysed as quantitative data, and the open-ended questions as qualitative data. Quantitative data gathered by questions 1-15 were first classified by their mean, median and standard deviation values. Afterwards, the multiple-choice data were analysed by factor analysis and regression analysis run by the SPSS-software in order to find the explanatory factors towards the art experience represented in the study. Qualitative data gathered by questions 16-21 were analysed by finding recurring themes and responses from each question separately. Each theme was scored by its occurrence related to the number of responses to each question, and a percentage was calculated to define the overall strength of occurrence. After a separate analysis processes, the results would then be combined to form a unified result. The overall results are presented in the following chapter.

6 RESULTS

The questionnaire was created by using an online survey platform Webropol, and the responses were gathered automatically. Overall, 128 acceptable responses were gathered with a response rate of 18% of 693 times the survey link was opened. The number of responses might have resulted from the convenience of answering and the possibility to win a gift voucher.

Table 2 presents the demographic information gathered from the participants. The year of birth tells that most of the responses are represented by people born in the 1990s. This occurrence is explained by the fact that the questionnaire was mainly distributed through university emailing lists.

TABLE 2 Demographic information of the participants

		Frequency	Percent %
Year of birth	2011 or later	0	0,0
	2000-2010	5	3,9
	1990-1999	79	61,9
	1980-1989	18	14,1
	1970-1979	9	7,0
	1960-1969	12	9,4
	1950-1959	3	2,3
	1949 or earlier	2	1,6
		Frequency	Percent %
Gender	Female	82	64,1
	Male	42	32,8
	Other	2	1,6
	I prefer not to tell	2	1,6

Table 3 presents the background information asked from the participants. According to the results, over 98% of the participants evaluated their personal skills in using ICT as average or better, with the most common answer being 'good skills'. Interest towards art was calculated as an average of the two questions about general interest towards art and how often the participants take

part in art experiences. The frequencies demonstrate that most people seemed to have little interest towards art, but 'moderately interested' and 'quite interested' were also fairly represented. Education and professional experience in art was calculated for each participant according to their highest level of education or professional experience level related to art. Additionally, most people did not have any previous education or professional experience in art. About one third of the participants reported that they have participated in a short-term art education such as separate courses or clubs.

TABLE 3 Background information of the participants

		Frequency	Percent %
Evaluated skills in using ICT (ICT skills)	No skills	1	0,8
	Satisfactory skills	9	7,0
	Average skills	34	26,6
	Good skills	50	39,1
	Excellent skills	34	26,6
		Frequency	Percent %
Interest towards art	No interest	12	9,4
	Little interest	43	33,6
	Moderately interested	35	27,3
	Quite interested	27	21,1
	Very interested	11	8,6
		Frequency	Percent %
Education and professional experience in art	No education or experience	80	62,5
	Short-term education	42	32,8
	Degree or professional experience in art	6	4,7

Table 4 presents the distribution of the responses among the three virtual exhibitions. The distribution was considered quite successful, since the responses were somewhat equally distributed, and that all the exhibitions were explored by a satisfactory number of participants.

TABLE 4 Response distribution among the virtual exhibitions

		Frequency	Percent %
Chosen exhibition	Jani Leinonen, virtual gallery	48	37,5
	Kalevi Helvetti Gallery	30	23,4
	HALO, Open Atelier	50	39,1

6.1 Multiple-choice questions

The main hypothesis for the quantitative study section of this thesis was to assume that the experienced usability of the digital interactive environment affects the overall art experience.

- H1: Usability of the digital interactive environment affects positively on the art experience.
- H1a: Usability positively affects the whole art experience.
- H1b: Usability of the digital interactive environment affects positively on the enjoyment of the art experience.
- H1c: Usability of the digital interactive environment affects positively on the thought and emotional response

The second main hypothesis is about the visual appeal and the experiential value, and its positive effects on the art experience.

- H2: Experienced immersion affects positively on the art experience.
- H2a: Experience immersion positively affects the art experience.
- H2b: Experienced immersion the digital interactive environment affects positively on the enjoyment of the art experience.
- H2c: Experienced immersion of the digital interactive environment affects positively on the thought and emotional response

The third main hypothesis is about how usability affects the experienced immersion of the participants.

- H3: Usability of the digital interactive environment affects positively on the experienced immersion.

Table 5 presents the mean, median and standard deviation of the responses for each question in the questionnaire. Some of the answers contained selections of the "I don't know" option. Therefore, these selections were coded as missing values so that the values would not disturb data analysis. Additionally, the responses in the "Using the platform was confusing to me" (Usability 3), were diverted in order to have a more uniformed data outlook on usability.

It can be observed from the results that there are no significant differences between mean and median values regarding questions that evaluate the art experience according to the same theme. One exception to this being questions focusing on emotional responses. However, this can be seen as understandable since some of the questions focused on general emotional response and some on specific emotions.

TABLE 5 Mean, median and standard deviation values. (1 = I strongly disagree, 5 = I strongly agree)

Question	Mean	Median	Std. deviation
Enjoyment 1	3,50	4	1,23
Enjoyment 2	3,41	4	1,15
Enjoyment 3	3,33	4	1,16
Visual Appeal 1	3,47	4	1,12
Visual Appeal 2	3,19	3	1,19
Visual Appeal 3	3,86	4	1,13
Usability 1	3,58	4	1,36
Usability 2	3,59	4	1,28
Usability 3	3,65	4	1,28
Usability 4	4,17	5	1,28
Experience 1	2,86	3	1,32
Experience 2	3,09	3	1,17
Experience 3	2,85	3	1,32
Thoughts 1	3,55	4	1,33
Thoughts 2	3,70	4	1,12
Thoughts 3	3,15	3	1,29
Emotions 1	2,49	2	1,26
Emotions 2	3,44	4	1,22
Emotions 3	2,94	3	1,30
Emotions 4	2,18	2	1,18
Emotions 5	1,83	1	1,13
Emotions 6	2,95	3	1,37
Emotions 7	2,04	1	1,30

Overall, the responses demonstrate that the average participant found the experience slightly pleasant. Responses according to all themes present that on average the experience was found pleasant slightly above neutral, slightly visually pleasing, quite easy to use, neutrally or slightly less experiential, somewhat thought awaking and with not much emotional response. Additionally, negative emotions such as anger and disgust were mostly neutral or absent.

6.1.1 Factor analysis

The data analysis was followed by a factor analysis run with the SPSS software. The analysis was executed using the principal axis factoring and direct oblimin rotation to allow correlated factors. The communalities on each item remained at acceptable range (over 0,3), thus each item was kept in the analysis set.

Table 6 presents the pattern matrix created by the factor analysis. The matrix shows that four factors were extracted from the data. The table also displays the factor loading values over 0,3. The pattern matrix and extracted factors differed from the initial study plan, therefore modifications in the analysis were made.

Firstly, the initial number of extracted factors was planned to be based on Eigenvalue (more than 1), but with this setting the calculated pattern matrix was created for five factors. Therefore, the factors were then chosen to be manually set for 4, since with five factors three items (Visual Appeal 2 & 3, and Emotions 6) loaded unevenly on a fifth factor which did not support the initial analysis or item structure and was considered to disturb the overall analysis.

Secondly, there were some items that did not distinctly distribute on one specific factor. These items were then chosen to be included in the factor that they had the highest loading for. As an example, Enjoyment 1 had quite an even distribution between all four factors, but still had the highest value in the first factor. This was considered the best option in order to follow a qualified research pattern. Additionally, some of the items did not load on the same factors as their counterparts. For example, Enjoyment 3 did not load strongly enough with enjoyment, hence it was considered to be included in the fourth factor.

Because of the challenges in the factor analysis with the data, another major modification made within the factors saw the items Enjoyment 1 and 2, as separate variables in later analysis. This was due to the fact that they seemed to have uneven distribution in the pattern matrix and measured art experience from a slightly different angle than the items focusing on thoughts and emotions. Additionally, since item Emotions 3 measured the feeling of joy, it was considered best to represent enjoyment with items Enjoyment 1 and 2. Also, even though visual appeal and experience were initially planned to be separate factors, they were decided to be combined as the pattern matrix had calculated them. Instead of separate visual appeal and experience, the combined factor was decided to represent immersion, since all questions in this combined factor were related to themes influencing immersion in virtual environments (Hudson, Matson-Barkat, Pallamin & Jegou, 2019). Lastly, the items considering negative emotional response ended up being another new factor differing from the initial research plan.

After making the modifications within the factors, a cronbach's alpha test was run on each factor or variable to ensure that they were qualified to be used as variables in the later analysis. Table 7 presents the cronbach's alpha values, and according to these results the chosen factors and variables could be taken to the later analysis.

TABLE 6 Factor analysis, pattern matrix

	Factor			
	1. Art experience	2. Usability	3. Negative emotions	4. Immersion
Enjoyment 1	,417	-,321	-,307	,348
Enjoyment 2	,392			,375
Enjoyment 3				,576
Visual Appeal 1			-,482	,586
Visual Appeal 2			-,353	,501
Visual Appeal 3		-,448		
Usability 1		-,879		
Usability 2		-,784		
Usability 3		-,522		
Usability 4		-,595		
Experience 1				,670
Experience 2				,541
Experience 3	,299			,500
Thoughts 1	,805			
Thoughts 2	,716			
Thoughts 3	,896			
Emotions 1	,733			
Emotions 2	,574			
Emotions 3	,524			
Emotions 4			,494	
Emotions 5			,610	
Emotions 6			,569	
Emotions 7			,831	

TABLE 7 Chosen factors and variables with Cronbach's Alpha value.

Factor/Variable	Items	Cronbach's Alpha
Art Experience	Enjoyment 1, Enjoyment 2, Thoughts 1, Thoughts 2, Thoughts 3, Emotions 1, Emotions 2, Emotions 3	,882
Enjoyment	Enjoyment 1, Enjoyment 2, Emotions 3	,751
Thoughts and Emotions	Thoughts 1, Thoughts 2, Thoughts 3, Emotions 1, Emotions 2	,872
Usability	Visual appeal 3, Usability 1, Usability, 2 Usability 3, Usability 4	,796
Negative emotions	Emotions 4, Emotions 5, Emotions 6, Emotions 7	,724
Immersion	Enjoyment 3, Visual appeal 1, Visual appeal 2, Experience 1, Experience 2, Experience 3	,759

6.1.2 Regression analysis

After defining the usable factors for this study, regression analysis was run to calculate the definite impacts on the participants' art experience.

First, the effects of the background information or control variables on the art experience was examined. Table 8 presents the effects on enjoyment, thought and emotional response, and the whole art experience. From this model, if looking at the adjusted R-square (0,229), the control variables did explain only little variance in the overall art experience. Control variables did not have much effect on enjoyment or thoughts and emotions per se. However, when combined the overall art experience was strongly influenced by the level of interest towards art. Closely divided artistic interest was especially strong towards the thought and emotional response, but not that strong towards enjoyment. Another important finding was that evaluated the ICT skills also had quite a strong effect on the overall art experience, and more closely in relation to enjoyment, and not that strong in thought and emotional response. Hence, it can be concluded that ICT skills had a greater effect on how pleasant the art experience was, and the level of art interest more on thought and emotional responses. The level of familiarity with virtual art exhibitions seemed to have a significant effect on thought and emotional response ($p=0,015$), and therefore on the art experience. However, since the R-square value is less than 0,3, which is considered the minimum value for a possible adept explanation, it can be assumed that these variables do not explain the art experience in a significant way.

Other control variables did not have any significant or recordable effect on the art experience. In other words, in this model, participants' age, gender, familiarity with virtual exhibitions, previous experience with art, or exhibition choice did not affect the measurements of overall art experience.

TABLE 8 Regression analysis model 1 (control variables)

Art experience			Enjoyment		Thoughts and Emotions	
Control variable	Std. coefficients	Sig.	Std. coefficients	Sig.	Std. coefficients	Sig.
Year of birth	-,100	,294	-,067	,487	-,068	,479
Gender	-,136	,116	-,100	,256	-,134	,124
ICT skills	-,238	,008**	-,235	,010*	-,192	,033*
Art interest	,392	,000***	,315	,002**	,367	,000***
Familiarity	,192	,035*	,085	,355	,215	,015*
Art experience	-,043	,630	-,001	,991	-,100	,271
Exhibition	-,092	,284	-,006	,945	-,153	,079
R square	,276		,186		,258	
Adjusted R square	,229		,137		,210	
***p < 0,001, **p < 0,01, *p < 0,05						

Table 9 presents art experience as a whole is divided into enjoyment and thought and emotional response. The analysis was run with the other created variables.

Looking at the control variables, the ones that seemed to have connection towards the art experience were ICT skills, interest towards art and familiarity with virtual exhibitions. Considering the independent variables, immersion revealed to be the strongest factor influencing enjoyment as well as thought and emotional response (std. coefficient=0,494, std. coefficient=0,601, std. coefficient=0,494, $p < 0,001$). When calculating enjoyment separately, negative emotional response seemed to affect it slightly (std. coefficient=-0,141, $p = 0,046$). Thought and emotional response seemed to be slightly affected negatively by usability (std. coefficient=-0,156, $p = 0,039$) and positively by negative emotions (std. coefficient=0,167, $p = 0,029$). The differences in the art experience were compared within each exhibition as well. This was calculated as having the Kalevi Helveti and HALO exhibitions as dummy variables in the regression model. According to the model, it seems that the art experience was significantly less powerful regarding emotional and thought response (std. coefficient=-0,341, std. coefficient=-0,283, $p < 0,001$, $p = 0,002$) and significantly less pleasant (std. coefficient=0,261, std. coefficient=-0,219, $p = 0,001$, $p = 0,008$) in these two exhibitions compared to the Jani Leinonen one.

TABLE 9 Regression analysis model 2 (control and independent variables)

Art experience			Enjoyment		Thoughts and Emotions	
Control variable	Std. coefficients	Sig.	Std. coefficients	Sig.	Std. coefficients	Sig.
Year of birth	-,089	,224	-,074	,315	-,045	,568
Gender	-,016	,809	-,004	,955	-,015	,841
ICT skills	-,138	,048*	-,125	,072	-,113	,130
Art interest	,380	,000***	,299	,000**	,360	,000***
Familiarity	,170	,018*	,073	,305	,200	,010*
Art experience	-,007	,923	,059	,389	-,077	,302
Kalevi Helveti	-,332	,000***	-,261	,001*	-,341	,000***
HALO	-,275	,001***	-,219	,008**	-,283	,002**
Independent variables						
Usability	-,133	,058	,036	,603	-,156	,039*
Neg. Emotions	,042	,549	-,141	,046*	,167	,029*
Immersion	,579	,000***	,601	,000***	,494	,000***
R square	,603		,583		,534	
Adjusted R square	,560		,540		,483	
***p < 0,001, **p < 0,01, *p < 0,05						

Since immersion was found to be such a strong influencer on the art experience, regression analysis was run with immersion as a dependent variable as well. Table 10 presents the explanatory factors regarding immersion. The analysis

was run as art experience as a whole and enjoyment, as well as thought and emotional response separately.

Considering the independent variables, the most significant effect on immersion seemed to have usability and the strength of the art experience. Usability (std. coefficient=0,299, $p<0,001$) and Art Experience (std. coefficient=0,664, $p<0,001$) values had statistically a very significant positive effect on immersion. While having the art experience divided into enjoyment and thought and emotional response, it seemed that especially enjoyment explained immersion significantly (std. coefficient=0,501, $p<0,001$). Additionally, the difference between each exhibition on immersion seemed to be significant as well in Kalevi Helveti Gallery (std. coefficient=0,238, $p=0,005$) and in HALO Open Atelier (std. coefficient=0,411, $p<0,001$). Therefore, HALO Open Atelier scored highest on immersion. And finally, interest towards art seemed to have an effect, but in a negative direction on immersion (std. coefficient=-0,240, $p=0,006$).

TABLE 10 Regression analysis model 3 (control and independent variables)

Dependent variable: Immersion				
Control variable	Std. coefficients	Sig.	Std. coefficients	Sig.
Year of birth	,047	,550	,037	,627
Gender	-,050	,491	-,051	,465
ICT skills	-,022	,768	-,015	,837
Art interest	-,240	,006**	-,229	,006**
Familiarity	-,038	,622	-,017	,820
Art experience	-,019	,793	-,033	,652
Kalevi Helveti	,238	,005**	,233	,004**
HALO	,411	,000***	,394	,000***
Independent variables				
Usability	,299	,000***	,218	,003**
Neg. Emotions	,042	,579	,093	,227
Art experience	,664	,000***	-	-
Enjoyment	-	-	,501	,000***
Thought/Emotion	-	-	,251	,015*
R square	,545		,575	
Adjusted R square	,495		,525	
***p < 0,001, **p < 0,01, *p < 0,05				

6.1.3 Result interpretation

Table 11 presents the results of the regression analysis models compared with the set hypothesis. According to the results, usability of a digital interactive

environment does not affect the overall art experience, which did not support the initial hypothesis (H1). Usability did not have any significant effect on experienced enjoyment either but had a significant effect on the thought and emotional response. Therefore, it can be said that the regression analysis supports hypothesis 1 only from the thought and emotional response point of perspective.

Hypothesis 2 (H2) was supported by the regression analysis, since the experienced immersion did affect the art experience as a whole, as well as enjoyment, and thought and emotional response.

Lastly, hypothesis 3 (H3) was also supported since the evaluated usability did affect positively on the experienced immersion (std. coefficient=0,299, $p<0,001$).

Figure 2 presents a simplified model of how the results support the initially set hypothesis and how can the effects of a digital interactive environment influence can be seen in this scenario.

TABLE 11 Hypothesis results

Hypothesis	Std. coefficients	Significance	Supports hypothesis
H1: Usability of the digital interactive environment affects positively on the art experience			
H1a: Usability of the digital interactive environment affects positively on the overall art experience	-,133	,058	No
H1b: Usability of the digital interactive environment affects positively on the enjoyment of the art experience	,036	,603	No
H1c: Usability of the digital interactive environment affects positively on the thought and emotional response	-,156	,039*	Yes
H2: Experienced immersion affects positively on the art experience.			
H2a: Experienced immersion affects positively on the overall art experience	,579	,000***	Yes
H2a: Experienced immersion affects positively on the enjoyment of the art experience	,601	,000***	Yes
H2b: Experienced immersion affects positively on the thought and emotional response	,494	,000***	Yes
H3: Usability of the digital interactive environment affects positively on the experienced immersion.	,299	,000***	Yes

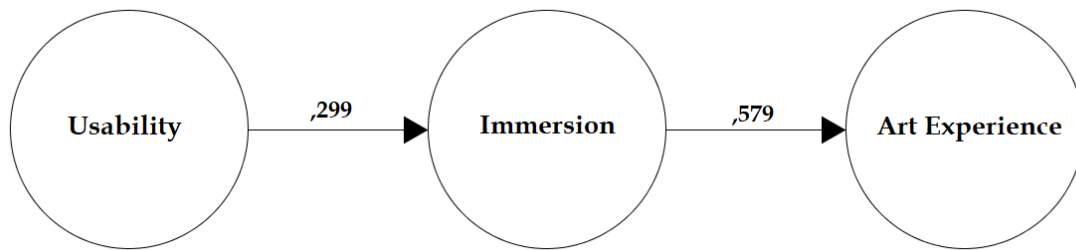


FIGURE 2 Model representing the effect of usability and experienced immersion on the overall art experience

6.2 Open-ended questions

After analysing the quantitative data, the qualitative responses were to be examined. This sub chapter presents the main occurring themes and patterns observed from the qualitative data.

6.2.1 Emotional response

The first question measuring the qualitative data was about the participants' emotional responses. The participants were asked to explain their emotional responses further after asking them to rate their experience according to some general basic human emotions. Overall, 25 approved responses were gathered for the question which asked the participants to clarify their emotional response towards the art works or the experience itself. Strongest similarity in this question was found from 28% (6) of the responses that praised the exhibition experience or the artworks, which can be understood as a response of joy. This was expressed by words:

"Halosenniemi is absolutely wonderful virtually experienced as well."
(Female, 1960-1969)

and

"It was nice to see art works by an artist I have only read about in the papers. Joy is now the main feeling especially because of the sharp way the artist had expressed his thoughts." (Female, 1960-1969)

The second strongest similarity was in 16% (4) of the responses which mentioned that the exhibition did not raise much or any emotions. This was expressed by saying:

"My feelings were not that strong because my interest towards this exhibition was not awoken." (Male, 1949 or earlier)

and

"At least on my side the exhibition did not raise any emotions one way or another."(Female, 1990-1999)

Two other similar responses were gathered where the participants explained that the experience was vapid or distant to them. Third and the last noticeable theme was frustration with 12% (3) of the responses. Frustration was mostly connected to technical difficulties while using the exhibition space. Other singular mentions of emotions were joy of recognizing the artworks, disinterest, dullness, amusement, nostalgia, peacefulness, confusion, disgust, uneasiness, and fear.

6.2.2 " Describe your experience in your own words"

This question ended up having the most comprehensive answers since it was marked as obligatory to complete the questionnaire and it specified people to express their experience in their own words. The aim was to gather responses that would describe the participants' overall experience, and which rest of the questions were to support and provide additional details.

The strongest theme that occurred in the responses were various difficulties and challenges in using the website or virtual environment. These difficulties were for example navigating in the virtual environment, directing the screen view, viewing the art works close enough and others which created confusion in the participants. Overall, 22% (28) of the answers contained a mention on some level of technical and usability difficulties or that the participants did not understand how to use the site:

"First, I did not realize that the view moves along the phone, and I did not understand why the view is pointed downwards and why can't I see the artworks... My bad, but pretty awesome experience that you can really be in a (virtual) exhibition and move your view so realistically."(Female, 1980-1989)

"Better usability would have improved the exhibition experience. Beautifully built space was a little wasted." (Female, 1980-1989)

Some of the responses had a mention regarding difficulties especially in the beginning of use, but this was followed by adjustment, since after the participants were able to try out the movement and other commands, they reported that the use was more fluent for them:

"It was a little confusing to operate in the beginning, but it went along fast and then the technics were forgotten" (Female, 1949 or earlier),

"Learning how to move around was distracting in the beginning."(Female, 1960-1969)

Some of the participants had also reported that these kinds of difficulties in use negatively affected their ability to enjoy the experience:

"Did not work well technically, so did not get much out of it." (Male, 1980-1989)

However, even though most of the responses related to navigating or technical difficulties were negative, some of the responses reported the exhibition site easy to use:

"My exhibition experience was good. The exhibition site loaded quickly and using the site and moving around was surprisingly smooth. All of the artworks were visible, even the videos, for which I am positively surprised. Moving around in the digital exhibition space was implemented pretty well." (Male, 1990-1999)

The next most frequently occurring theme was found to be general interest. Interest was mentioned towards the virtual exhibition, art works or the overall concept of this kind of technology. This occurred through the words "interesting" or "fascinating". Approximately 18% (23) of the responses contained these words. More closely observed, the factors that awoke participants' interest were for example the art works, the overall experience and new experience exploring a virtual exhibition:

"Interesting and a new experience, but it did not get me interested in art any more than before. Visual appearance and implementation were great though and felt pretty realistic." (Female, 1990-1999)

Some participants explained that even though they found the website difficult to use, they found the exhibition interesting.

The third strongest theme occurring in 12% (15) in the responses were equally "pleasantness" and "surprise", in other words they could be seen equally often in the responses. Surprise was mainly described as positive, since the virtual exhibition was mentioned to be a new experience for them and some of the participants had written that they were positively surprised by what kind of virtual exhibition they had encountered, possibly because of expectations or previous experiences.

The fourth theme was found to be deficiency. Approximately 10% (13) of the responses had a mention that the experience was felt to be lacking something or overall deficient. As an example, feelings of deficiency were described as:

"The experience was considerably vapid compared to an authentic one. It was more difficult to focus on the art because of the computer screen and the digital environment. A high-quality-picture of an artwork would have been a more pleasant digital experience for me." (Male, 1990-1999)

Other examples of deficiency were:

"I would not visit again. The exhibition was too digital and 'unreal', and navigating was difficult. Maybe I could visit an exhibition with an interesting theme" (Female, 1990-1999),

"The experience stayed very vapid because of technical reasons" (Male, 1980-1989),

and

"The experience stayed a little lukewarm. I would have wished for a more realistic picture of the place and more clear instructions how to use the website." (Male, 1990-1999)

The fifth observable theme was described as difference. 8% (10) of the responses had a mention that the experience was "different", however, since most of them did not have any further explanation for this description, it cannot be declared what specifically did the participants find different. Other similarities that occurred in 8% (10) of the answers were appreciation towards the music used in one of the exhibitions and that the experience was described as "Good".

Other ways the experience was described were confusing (9), ambient (7), authentic (7), easy to use (6) and game-like experience (6), and lastly, 3% (5) of the responses contained mentioning from each of these: Participant would have wished for a larger exhibition, the exhibition was thought provoking, participant was not interested, exhibition space was too dark, participant prefers live exhibitions over digital ones, and participant appreciated the virtual exhibition.

6.2.3 "What did you like or not like about the exhibition?"

This question was created to understand what the participants liked or did not like about the exhibition or the experience. The strongest repetitive mention was related to the atmosphere which was seen positively. Thirteen percent (7) of 53 responses contained positive mentioning about the ambience and looking more closely all of them were from participants who chose the HALO, Open Atelier exhibition. This was expressed for example as:

"I specifically liked the cozy ambience, the log-fire and the surround music." (Female, 1990-1999)

The next repetition was related to the space lighting, which was mainly mentioned from a negative angle. Eleven percent (6) of the responses mentioned that the dim lighting disturbed their experience, but two responses explained that the dim lighting was a positive matter and part of creating the cozy atmosphere in the virtual space. As an example:

"The lighting was a little dim, it was difficult to see around. Although, I assume this might have been the point, to retell a cabin lighting." (Female, 1990-1999)

All these mentions related to the lighting were also written by participants who explored the HALO, Open Atelier.

The following similarities were equally found from 9% (5) of the responses: Some of the participants specifically enjoyed the artworks and some found the exhibition too short or concise. Other mentions represented by 7% (4) of the comments emphasized that some did not enjoy the artworks of the exhibition or some found the videos especially entertaining. Five percent (3) of the responses mentioned that they did not understand the presented art.

6.2.4 " How would you improve your experience?"

This question was added to the questionnaire, so that the overall experience of the participants would get more detailed information. Asking the participants what they would personally improve in order to encourage a better or more pleasant experience thought to give a more targeted answer that might shed light on the elements that negatively affected their overall experience.

The strongest similarity occurring in this question from 60 responses was that the participants would have given the audience a possibility to view the artworks more closely. Twenty-two percent (13) of the answers had a mentioning specifically about technical improvements on how to view the artworks, such as:

"I would have wanted to see the artworks more closely" (Male, 1949 or earlier),

"It should be possible to view the details, which is what I do in real art exhibitions" (Female, 1949 or earlier),

and

"The artworks should be much clearer. Now the detailed image of the artwork is lost. It felt like watching a brochure of some exhibition. There was a picture of an artwork, but it did not give anything more than that." (Female, 1990-1999)

The possibility to examine the artworks more closely was supported by suggestions that there should be a possibility to see the artwork in full-screen mode, which occurred in 8% (5) of the responses:

"I would like the possibility to open the videos in full-screen more instead of trying to focus the phone-view with a shaking arm for many minutes, while I still had to look the picture sideways. Also, the possibility to open the other artworks straight to the screen with a stable view, and for example zooming

would be advisable, if the artworks were a little more detailed than in this exhibition, for example if you tap the artwork the angle of view would move straight to it, so that you would not need to prance to the right spot in the virtual space where precise navigating is difficult." (Female, 1980-1989)

The next strongest improvement was the wish to move around in the environment, occurring in 13% (8) of the responses. Challenges in moving around were mentioned, especially related to moving in front of the artworks or how the screen-view was directed:

"The way the screen-view is directed and moving around should function better." (Male, 1990-1999)

Two other themes regarding improvements received an equal 8% (5) of the responses. Lighting was wished to be brighter, and the exhibition was wished to have more content or a larger environment to explore:

"Absolutely the lighting so that the artworks would be properly visible. Although now the itch to see the artworks in real life stayed" (Female, 1949 or earlier),

and

"If possible, it would be nice that the space had more rooms and artworks. Then you could spend more time there and truly forget yourself in the virtual world." (Female, 1990-1999)

6.2.5 Themes of technology and art

Separating the responses to themes related to technology or digital interactivity features, it seems that the strongest theme was the difficulties in navigating or moving in the exhibition space and other technical difficulties while using the exhibition space. This seemed to be the technical aspect that made the people most frustrated according to the question focused on emotions. Another strongly occurring difficulty was that the art works were not as easy to access or visible as the participants would have wished for. Therefore, it can be understood that the technicality related to the quality and ability to examine the artworks was not seen sufficient enough. Deficiency in the art experience was also linked to technicality, since mainly the deficiency was seen as a cause of the digital environment by the participants.

Regarding themes that can be linked better to the artworks or the exhibition per se, the strongest theme according to the responses was the interest that the participants experienced towards the artworks or the whole experience. This could be seen in the comments regarding emotional responses, where the joy raised by the artworks was the strongest occurrence. Other reactions related to the experience art-wise were that the exhibition did not

raise any emotions in some participants and that the exhibition was seen as pleasant and surprising.

7 DISCUSSION

After opening the data, the results were evaluated to support the theoretical findings of this thesis and the research questions stated in the beginning. The discussion regarding how the results serve the research question is argued in this chapter. Additionally, the questions of possible limitations and further research opportunities are also presented.

7.1 Digital interactive features in art experiences

From the perspective of the current research question “How does digital interactivity affect art experiences?”, it is important to look at the factors which had the strongest effect on the art experience variable. Through evaluating the results from Table 9, it can be observed that the most significant effect on art experience were participants’ interest towards art and their experienced immersion. Immersion can be said to have the most significant effect on the overall experience from the research question point of view, since it had a strong effect on both the enjoyment, and emotional and thought response, and it is one of the main factors related to the technology used in the exhibitions. This can be understood as the more the audience found the exhibition space visually appealing and were captured by the experience, the more they enjoyed the exhibition experience and the stronger subjective response they experienced in terms of thoughts and emotions. From the open-ended questions, it could be seen that even though the artworks were found interesting, pleasant, and thought provoking, higher immersion made the audience experience the art in a more powerful way. This supports the study executed by He et al. (2018), which argued that higher virtual presence, therefore immersion of the virtual environment where the artwork is presented creates a more richer and meaningful experience for its viewers.

Looking closer at the art experience, usability did not seem to have any significant effect on enjoyment, but surprisingly had a slightly negative effect

on how strongly the experience raised thoughts or emotion in the participants. It can be understood that the more people found the experience easy to use the less emotions and thoughts participants reported. The effect does not seem strong enough to reveal anything legitimate or significant in terms of the results, but it does raise questions, such as in terms of whether people who found the site easier and simpler to use were less immersed with the experience, or whether some of the emotional responses reported by the participants related to the frustrations caused by difficulties in using the site.

Immersion again was very significantly influenced by the overall art experience and the experienced usability. Even though usability was not presented as a significant effect on the art experience, it seemed to influence the exhibition immersion instead. Therefore, the easier the exhibition site was to use, the stronger immersion was experienced by the participants. According to the open-ended questions, the most challenges affecting experienced usability were the difficulties in moving in the exhibition space and watching the artworks closer. These factors can be seen to have influenced the usability, and therefore the immersion in a negative way.

Probably, the most interesting and relevant result in this study was that according to all regression analysis models, usability had a direct effect on the immersion but not a calculatable effect on the art experience. This suggests that the usability of a virtual art exhibition space does not affect the way the audience experiences the content or the artworks in a linear way but affects the art experience indirectly through immersion.

Considering the background information, the other significant influence on the art experience was found to be the participant's interest towards art. This can be understood as that in terms of the more the participants rated themselves as being interested in art, the more powerful their art experience seemed to be. This does seem to be a logical result since people tend to resonate more with things and events they mentally engaged with. This also supports the study by Leder et al. (2012), which evaluated that people's interest towards art significantly affects the understanding and appreciation of an art piece. However, the results of this thesis differ with the same study, which also claimed that the level of expertise in art influences understanding and appreciation as well. This is probably because the people with professional art expertise or education were represented only by 4,7% of the participants. Therefore, a larger sampling with people with art expertise might have given a more similar result. Overall, it seems that majority of the audience found the experience more affective the more they like art in general and how often they participate in art experiences in their daily lives.

An opposite result, where art interest would have affected negatively on the art experience might have been reasonable as well, since this kind of virtual exhibition is not a traditional way to present art and might have been displeasing to people who are more used to art being presented in real life exhibition spaces. This was not seen in the regression model evaluating art experience but was seen in the model evaluating immersion instead. From the

open-ended questions, a couple of responses did mention that they prefer art presented, "in real life" rather than as "virtual copies". This suggests that the matters that people focus on in traditional real-life exhibitions, is what they focus on digital ones as well. Evaluating the quantitative and qualitative data, it can be seen as to why the interest towards art might especially negatively affect immersion. Considering the responses regarding what would people improve about the experience, some people stated that the possibility to examine the details of an art piece was clearly missing. It cannot be stated here that people who evaluate being more interested in art, would focus on the details of an artwork in exhibitions more, but it can be seen as a possible explanation for why interest towards art negatively affected the sense towards immersion, yet not the overall art experience. For people who tend to look for details in an artwork the lack of that possibility might have broken the immersion for them in a significant way.

Other background information such as IT and art expertise did seem to have some influence on the art experience, but in a less significant way compared to the level of interest towards art. Familiarity can be seen to have a somewhat similar influence in relation to interest towards art, since people who were familiar with digital art exhibitions might naturally be more interested in art than those who were not.

Answering the research question, how digital interactive technologies affect art experiences in this case: Digital interactive technologies support art experiences with creating new ways of presenting art and which do seem to awake people's interest towards them. However, according to the results of this study, it seems that the usability of these technologies has the possibility to influence negatively or positively on the immersion created around the experience. This in turn has a direct effect on how people enjoy the art, or how strong their experience is emotionally and/or mentally.

7.2 Towards better digital interactive features

Reading the results and discussion regarding this study, at least according to these kinds of virtual art exhibitions that offer the possibility to interact with the exhibition space and artworks, it could be concluded that art seems to have an intrinsic value in these kinds of experiences. This is despite how the art is presented.

Some possible future improvements could be gathered from the open-ended responses, where the participants had written about the experience. It seemed that for some participants the possibility to view or examine the artworks more closely and in a more detailed way was one of the main aspects that made the experience vapid for them. Based on how people had explained their experience, it can be understood that some people seem to enjoy the artworks nevertheless. But for some, the artworks should resemble the physical artefacts to give a more authentic and richer exhibition experience. This

supports the studies, which have concluded that people still prefer real-life exhibitions to virtual ones, if the value of that virtual space does not offer at least the same kind of details presented in a real-life exhibition or something unique that only a virtual space can create (Brieber et al., 2014). This was mentioned in one of the responses gathered by the participants:

"The created space was nice in my opinion, it reminded me of an old videogame. I could imagine myself visiting a similar kind of space in real life, so the space felt authentic. The digital possibilities could have been used more in my opinion. Of course, nothing should be done just because it is possible, but digitality could enable more interaction. Now the experience was like a traditional: Artworks on the walls, information next to them, and couple of videos to stop and view. The only different thing was the male character that was like a hologram. But I could not come up with a function or a special meaning." (Female, 1990-1999)

This response describes quite aptly how the virtual environment was expected to utilize more unique features for digital designs. The possibilities for imaginative or creative solutions in virtual worlds are much more accessible, affordable, versatile, and flexible. This is why they could be utilized more widely and courageously, if the goal is to create valuable, competitive, and meaningful virtual experiences specifically to explore art. Additionally, the goal should not be to mimic traditional art experiences, but rather to take the idea of art exhibitions further.

Another important way to improve these kinds of virtual interactive spaces for art, is through the technical aspects related to the actual utilization. Since the experienced usability had an effect on the created immersion, and since flow while using an interface can be disturbed by technical diversions (Pilke, 2004), any possible difficulties in using a virtual art space should be minimized if strong immersion is to be created. For example, the difficulties in moving around, focusing the screen-view, and other difficulties in viewing the artworks in the chosen virtual exhibitions for this study, could be understood as factors reducing the enjoyment and strength of the art experience. This is a challenge, which is studied more closely by usability studies, but that especially explains why technology design is as important to the virtual interactive experience design as art creation and exhibition curation.

Thinking more closely about user experience and art experience studies or design methods and coming back to the initial claim of this thesis, both have similarities in their core ideas. Although, user experience includes other factors such as usability, user value or logicity, and art experience focuses more on the subjective experience and meaningfulness, both points of view still consider areas such as emotional response, enjoyment, aesthetics etc. in their evaluations. Furthermore, both should exploit the other when creating functional virtual art designs or aesthetic and meaningful information technologies. Then considering the immersion evaluated in this thesis (initially evaluated by visual appeal and escapism values), a more comprehensive understanding of

immersion could be utilized from video game research that focuses on player immersion in virtual environments.

7.3 Possible limitations and further research

The study and the results of this thesis give explanations on how digital interactive technologies work with virtual art experiences, but it has some aspects which require evaluations from the side of possible limitations.

As mentioned earlier in this thesis, creating a singular model for a working digital interactive technology to use in art experiences is challenging if not impossible. This is due to the fact that since art experience generally is not tied to a certain method, idea, or structure. The art experience studied in this thesis focused on a virtual art exhibition space, with some interactive elements. Therefore, the results of this study might only apply to similar kinds of ways presentations of art or digital design. The digital art exhibitions in this study represent art experiences only from one point of view, which is why the concluding results from this study may not apply to other art forms. Additionally, since all of the chosen exhibitions were created by same company, they represent the way a singular enterprise has designed and utilized virtual exhibition environments. Therefore, further research is needed specifically to study the interactive features and how they influence the art experience.

Additionally, the art exhibitions' interactive features did not include the audience too much inside the artworks, but rather focused on the overall exhibition experience. Actual interactive digital features in singular artworks should be studied further in order to receive a more advanced view on how the audience could get involved in creating the art within the art experience itself, and what are the effects on the audience's experience in these scenarios. This can be seen as an important research area solely in IT interactive technology design, since knowledge of what specific digital interactive features give a positive experience for the users can also be seen as lacking (Preece, 2016). Due to the COVID-19 pandemic, these kinds of interactive artworks were difficult to access or even find. Furthermore, considering the current circumstances of development of media or art platforms, digital art exhibitions were evaluated as a logical area to study digital interactive art experience.

Another important point for limitations is that the exhibitions did differ in content, exhibition structure and visual design. The main technology and construct were the same, but differences could be noticed. This gives the study a more comprehensive view on similar technology based virtual exhibitions, but then again, does not give coherent results based on one exhibition.

Also, the calculated R-square values of the regression models do not reach an extremely explanatory level on any model. It can be understood that the variables used in this study might not fully explain the art experiences or answer the research question. However, to support the reliability of the results, the area focused on in this study can be seen as a high complex one and similar

to sociological studies. Hence, a slightly smaller R-square value can be seen as understandable and the results still reliable.

Finally, the challenges in creating the initial factors used to create the questionnaire could be seen in the factor analysis, which did not follow the initial structure that was planned to be used in the whole study. This implies that the questions should have followed a more coherent form of evaluating singular factors. By stating this, it is meant that the elements informing art experience could have been more carefully broken down and analysed conjunction with tangible technology usage related factors and design factors – possibly those that have been rigorously studied in relation to user experience. For future research, the way the art experience is evaluated should be more clearly stated in terms of being more specifically studied in relation to technology usage and features.

8 SUMMARY

Digital technology with interactive services are common in many business and cultural fields, art field included. Digital interactive solutions are increasing in terms of art creation and presentation, and thus in cultural institutions as well. Even though digital technology design and art experience are separate fields and differ greatly in terms of their main focus areas, they still have some similar areas in their scopes. Creating effective and suitable digital interactive technology has its grounds within the collision of these two fields, however research focused on this focus area are few. This thesis aimed to study the relationship of technology design, how digital interactive features influence art experience, and how these could be designed and utilized better in the future.

First, the literature review aimed to present the theoretical view of the digital interactivity from information system research point of view, with explanations on how interactive elements are used in different areas. Then the concept of art and art experience was examined and explained, with some studies which have studied human reactions to art. The last theoretical chapter aimed to describe recent research focusing on evaluating digital interactive technologies used especially in art.

The empirical research component of the thesis reported a study performed by evaluating 128 participants' responses to a questionnaire, which was created to study people's reactions to three different virtual art exhibition sites. The results were analysed by using both quantitative and qualitative analysis methods. The quantitative data was analysed by using SPSS-software. The main quantitative results revealed that the main factors influencing virtual art experience were induced immersion, interest towards art and the usability of the site. However, according to the regression analysis models, it was calculated that usability did not directly affect the art experience, but instead it affected immersion, which in turn affected the art experience. In addition, according to the qualitative data, the main factors influencing people's experience were the difficulties using the exhibitions site and the interest towards the exhibition itself.

The limitations regarding this study were the challenges in gathering coherent data for each theme initially set for the research plan. Additionally, the study results represent a small sampling for a wide and unstructured area of study, therefore the results should be evaluated by critical caution.

Overall, the literature review and the results suggest that art itself has an intrinsic value for people, but the created immersion has a significant influence on how strongly the people enjoy or respond to the presented art. Digital interactive technologies support art experiences by creating new ways of presenting art and which seem to awake people's interest towards them. However, it seems that the usability of the utilized technology influences the immersion created around the experience, which again has a direct effect on how people enjoy the art, and how strong is their experience emotionally and cognitively.

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APPENDIX 1 QUESTIONNAIRE FORM

1. Year of birth *

- ☐ 2011 or later
- ☐ 2000-2010
- ☐ 1990-1999
- ☐ 1980-1989
- ☐ 1970-1979
- ☐ 1960-1969
- ☐ 1950-1959
- ☐ 1949 or earlier

2. Gender *

- ☐ Female
- ☐ Male
- ☐ Other
- ☐ I prefer not to tell

3. How strong do you estimate your skills in using information technology? *

No skills	Satisfactory skills	Average skills	Good skills	Excellent skills
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4. How often do you use information and communication technology during your free time? (Smartphone, computer, smartwatch, softwares and applications) *

I don't know	Less than once a week	Once or twice a week	Daily	Multiple times per day
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

11. Visual appearance *

	I can't say	I strongly disagree	I somewhat disagree	Neutral	I somewhat agree	I strongly agree
The experience was aesthetical	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The design of the environment was creative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The exhibition environment seemed clear	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12. Usability *

[illegible]

13. Experience *

Vastaa vaihtoehtoihin koko näyttelykokemuksesi perusteella.

[illegible]

14. Thoughts *

	I can't say	I strongly disagree	I somewhat disagree	Neutral	I somewhat agree	I strongly agree
I found the artworks fascinating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The artworks or the exhibition awoke thoughts in me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt I understood the meaning of the artworks or the exhibition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. Emotions 1/2 *

	I can't say	I strongly disagree	I somewhat disagree	Neutral	I somewhat agree	I strongly agree
I felt connected with the artworks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The artworks raised emotions in me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt happiness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt sadness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt anger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt confusion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt disgust	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. Emotions 2/2

If you wish, you can explain your emotional response more here:

17. Other remarks regarding you answers to previous questions:

18. How would you describe your experience in your own words? *

19. Would you like to describe more specifically what did you like or not like about the exhibition?

20. How would you improve the exhibition experience?

21. Other possible remarks or comments:
