AALBORG UNIVERSITY

DENMARK

Transmedia Exhibition

Exploring Production Criteria for a Transmedia Experience in an Exhibition Context

Selvadurai, Vashanth

[Link to publication from Aalborg University](#)

TRANSMEDIA EXHIBITION

EXPLORING PRODUCTION CRITERIA FOR A
TRANSMEDIA EXPERIENCE IN AN EXHIBITION CONTEXT

BY
VASHANTH SELVADURAI

DISSERTATION SUBMITTED 2019

AALBORG UNIVERSITY
DENMARK

TRANSMEDIA EXHIBITION

EXPLORING PRODUCTION CRITERIA FOR A TRANSMEDIA EXPERIENCE IN AN EXHIBITION CONTEXT

by

VASHANTH SELVADURAI

Dissertation submitted

AUTHOR CV

Vashanth Selvadurai received his Bachelor in Medialogy in 2010 and Master in Interactive Digital Media in 2012, both from Aalborg University, Denmark. From 2013, he was employed as a graphic designer at North Sea Oceanarium up to the start of his Industrial Ph.D. program in 2016 at the Department of Communication & Psychology at Aalborg University, affiliated with the research centre for Interactive Digital Media & Experience Design (InDiMedia). His research interest is transmedia experiences, especially in regard to emerging digital technologies with a user-centred design approach.

During the last five years, Vashanth has been supervising and teaching bachelor and master students at Aalborg University. Furthermore, he has disseminated the contributions of his Industrial Ph.D. research at international conferences and industry stakeholders.

In his Ph.D. thesis, Vashanth studies the use of transmedia experience in an exhibition context to identify key variables in design, implementation, and evaluation of the converging area of transmedia experiences and exhibitions.

ENGLISH SUMMARY

The research was an industrial Ph.D. project partly funded by the Innovation Fund and has been carried out in collaboration with the Danish aqua zoo North Sea Oceanarium in Denmark. The host was Department of Communication & Psychology at Aalborg University, where the project was associated with the research centre Interactive Digital Media (InDiMedia) and Experience Design. This project was further associated with the national research program 'Our Museum', which consisted of 13 research projects in collaboration with five Danish universities and eight museums. Part of the research was conducted during the research stay at Royal Melbourne Institute of Technology (RMIT University) in Melbourne and at Griffith Film School (Griffith University) in Brisbane.

The area of interest was transmedia experience in an exhibition context, and the general purpose of the thesis was to investigate this domain. As such, the value sought was to generate new theory, methods, and techniques for designing, implementing, and evaluating an involving and educative transmedia experience in an exhibition context, which bridges the pre- and post-experience with the actual visit. This objective was formulated as the following research question.

What are the theoretical, methodical, and analytical conditions
for designing, implementing, and evaluating an involving and
educative transmedia experience in an exhibition context
pre-, during- and post-visit?

Sequentially with the study of this, the aim was also to generate knowledge regarding the organisational implementation. As such, the research was conducted through active participation with practitioners in practice. The value sought was to identify key variables within the area of interest through a series of individual studies that collectively expands the existing body of knowledge. The scientific contribution to the domain extends into the field of exhibition design, experience design, and experience economy with a transmedia approach, which can be utilised in organisations that have a physical exhibition. Specifically, the generated knowledge covers a significant empty space in the scientific and practical arena of bringing a transmedia experience into an existing exhibition.

DANSK RESUME

Dette er en industriel Ph.D.-projekt delvist finansieret af Innovationsfonden, udført i samarbejde med Nordsøen Oceanarium i Danmark. Den faglige vært var Institut for Kommunikation og Psykologi på Aalborg Universitet, hvor projektet var tilknyttet Center for Interaktive Digital Media (InDiMedia) og Oplevelsesdesign. Dette projekt var desuden også tilknyttet det nationale forskningsprogram 'Vores Museum', som bestod af 13 forskningsprojekter fordelt på fem danske universiteter i tæt samarbejde med otte danske museer. En del af forskningen blev udført under forskningsopholdet i Royal Melbourne Institute of Technology (RMIT Universitet) i Melbourne og på Griffith Film School (Griffith Universitet) i Brisbane.

Interesseområdet for nærværende projekt er transmedia oplevelser i en udstillingskontekst, og det overordnede formål med afhandlingen var at undersøge dette område. Således er der skabt nyt teori, nye metoder og teknikker til design, implementering og evaluering af en involverende og lærerig transmedia oplevelse i en udstillingskontekst, der forbinder præ- og postoplevelsen med det aktuelle besøg. Projektet tager udgangspunkt i følgende forskningsspørgsmål.

> *Hvad er de teoretiske, metodiske og analytiske betingelser for design, implementering og evaluering af en involverende og lærerig transmedia oplevelse i en udstillingskontekst før, under og efter et besøg?*

Sideløbende med undersøgelsen blev der også skabt viden om den organisatorisk implementering. Derfor blev forskningen udført gennem aktiv deltagelse i praksis. Målet var at identificere nøglevariabler inden for interesseområdet gennem en række individuelle undersøgelser, der tilsammen bidrager med viden indenfor området. Det videnskabelige bidrag på domænet strækker sig over udstillingsdesign, oplevelsesdesign og oplevelsesøkonomi, set igennem en transmedia linse, som kan udnyttes af organisationer med en fysisk udstilling. Konkret bidrager projektet med resultater der understøtter implementering af transmedia oplevelser i en eksisterende udstilling.

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

TABLE OF FIGURES

PREFACE

This thesis is written in partial fulfilment of the requirements for a Ph.D. degree from The Department of Communication and Psychology at Aalborg University. The thesis comprises six original papers and a linking text. In the produced work, I expand upon transmedia experiences in an exhibition context through designing, implementing and evaluating transmedia experiences at the aqua zoo facility North Sea Oceanarium.

LIST OF PAPERS

PUBLISHED PAPER BEFORE PH.D. RESEARCH

- **PH.A.N.T.O.M**
  Jensen, K. L., Krishnasamy, R., & Selvadurai, V. (2010). Studying PH.A.N.T.O.M. in the Wild: A Pervasive Persuasive Game for Daily Physical Activity. In Proceedings of the 22nd Conference of the Computer-Human Interaction Special Interest Group of Australia on Computer-Human Interaction (pp. 17–20). ACM.

APPLICATION

- **Smartphone Application: [Aratag App]**
  Aratag - Mobile Exhibition Experiences

LIST OF REPORTS

- **Report 1: [Hunters] – (Appendix 4.3)**
  Ydesen, K., Selvadurai, V. (2017). Hunters of the North Sea (Exhibit Manual). Denmark: North Sea Oceanarium. Language: Danish
- **Report 2: [Target Group] – (Appendix 4.4)**
  Selvadurai, V. (2017). Oceanarium's Target Group (Target Group Report). Denmark: North Sea Oceanarium. Language: Danish
- **Report 3: [BOW] – (Appendix 4.2)**
  Vistisen, P., Selvadurai, V., & Krishnasamy, R. K. (2018). Big Ocean Window: BOW (Technical Report No. 1). Denmark: Aalborg University. Language: Danish

Reprints of papers and technical report are included in a resized format to fit the layout of the thesis without alterations to content or layout. The Aratag application is available on Apple Store for apple operating systems and Play Store for Android operating systems.

THESIS OUTLINE

This linking text is divided into eight chapters. Chapter one introduces personal, organisational, and political motives for the research project which ends with two working hypotheses. Chapter two reviews the literature on transmedia, elaborates experience design and state-of-exhibitions, which leads up to the presentation of transmedia in exhibitions. Chapter three unfolds the research framing and presents the research question and the derived work questions, that together spans the foundation for the research approach elaborated in chapter four. In Chapter five, the five individual studies conducted during the project period, are presented. Chapter six details the contributions of research, which leads to the conclusion in chapter seven. Finally, further perspectives of research are presented for future research areas to be explored in chapter eight.

CHAPTER 1. INTRODUCTION

The research was an industrial Ph.D. project partly funded by the Innovation Fund ("Innovation Fund,") and has been carried out in collaboration with the Danish aqua zoo North Sea Oceanarium (hereafter Oceanarium) in Hirtshals, Denmark ("Oceanarium,") as place of employment. The host was Department of Communication & Psychology at Aalborg University, where the project was associated with the research centre Interactive Digital Media ("InDiMedia,") and Experience Design. This project was further associated with the national research program 'Our Museum', which consisted of 13 research projects in collaboration with five Danish universities and eight museums ("Our Museum,"). Part of research was conducted during the research stay at Royal Melbourne Institute of Technology (RMIT University) in Melbourne and at Griffith Film School (Griffith University) in Brisbane.

1.1. DISSERTATION PURPOSE

The area of interest is transmedia experience in an exhibition context, and the general purpose of the thesis was to investigate this domain. In the study of this, the research was conducted through active participation in social context with practitioners at the Oceanarium. The ambition and value sought was to identify key variables within area of interest through a series of individual studies that collectively expands the existing body of knowledge. The scientific contribution to the domain aimed to expand into the field of exhibition design, experience design, and experience economy with a transmedia approach that can be utilised in organisations with a physical exhibition. Concretely, the generated knowledge covers a significant empty space in the scientific and practical arena of bringing a transmedia experience into an existing exhibition.

Following sections details the three motives that laid the foundation for the research in the area of interest. The first section details my personal motive, continues with the organisational motive, and ends with the political motive. Together, they form the working hypotheses.

1.2. PERSONAL MOTIVE

My personal motivation for storytelling across platforms and experiences started when I was six years old playing small character roles in my father's theatre troupe and continued when our family got a small handy camera when I was ten. I used almost all my spare time making videos of family and friends, especially on trips to theme parks and exhibitions. I spent a lot of time editing these series of unconnected footages on a VHS machine so as to have an overarching narrative, that I could show people. These two platforms for narratives (theatre and video) generated the initial

interest in storytelling products such as theatres and films. This interest was further amplified by having an uncle who had a Tamil movie rental store, where I had access to all kinds of Tamil movies. Access to storytelling content and platforms are the cornerstones that spanned the runway for my departure to explore a world of experiences. The journey has so far resulted in three Tamil feature films released worldwide with me as the lead actor, film editor, and music composer, see figure 1.

Figure 1: Tamil feature films with Vashanth Selvadurai (2019). On left 'Pookkal' (2004), in the middle 'Ilampuyal' (2009), and on the right 'Uyirvarai Iniththaai' (2014).

With the accumulated interests in my backpack, I choose Medialogy at Aalborg University for my Bachelor's education in 2008, which had a major component consisting of audio-visual media, filmmaking, and storytelling. Medialogy is Bachelor of science, but also includes humanistic perspectives focusing on understanding and designing for human and computer relations and a human perception and interface design (HCI – Human Computer Interaction). Through Medialogy, I got a technical insight into digital media platforms and how they can contribute to the society through unique experiences (Appendix 8.1). Thus, my bachelor project focused on motivating inactive people to exercise with a smartphone game that used the real world as a platform and storytelling as a stimulating factor (Selvadurai & Krishnasamy, 2010). The result of this project was published in OZCHI 2010 proceedings (K. L. Jensen, Krishnasamy, & Selvadurai, 2010). It was during this project I was introduced to transmedia storytelling that was, and still is for me a fascinating phenomenon with great potential.

For my master's degree, I made a jump to the master's study of Interactive Digital Media at humanities at Aalborg University, to explore the potential of interactive digital media platforms and social media for cross- and transmedia experiences. The study started with the seventh semester project focusing on expanding the Danish travel plan service ("Rejseplanen,") with a location-based smartphone experience using game mechanics in a non-game context. This concept won the award for 'the technically most advanced idea' by the service provider in 2010 (Selvadurai, Andersen, Nielsen, Krishnasamy, & Vistid, 2010). The focus of eighth semester was to create a pervasive smartphone game with transmedia storytelling to add a digital

experience layer for the Danish amusement park, Faarup Sommerland ("Fårup Sommerland,"). Ninth semester was a preliminary study for masters' thesis exploring an alternate reality game (ARG) concept with transmedia storytelling that integrated social media platforms to communicate and use smartphone as the main interacting device (Selvadurai & Nielsen, 2011). Finally, the masters' thesis was a culmination of previous projects resulting in a handbook with a set of guidelines for creating transmedia experiences that make use of both physical and digital media platforms (Selvadurai & Nielsen, 2012). See appendix 8.2 for these projects.

With an appointment as a graphic designer and marketing employee at the Oceanarium, I was a part of the development of several exhibits at the exhibition. These exhibits often had a stand-alone characteristic, with limited links to each other and the exhibition itself. With the acquired knowledge of transmedia experiences through my education, I could see the benefits in applying a transmedia approach to interweave the exhibits and their content to provide a more coherent exhibition experience for visitors. I presented the benefits of a transmedia approach to the management and proposed exploring the potential on a larger scale. This was the starting point for my personal motive towards a Ph.D. project focusing on transmedia experiences in exhibition context.

1.3. ORGANISATIONAL MOTIVE

The Oceanarium is a non-profit organisation with an aqua zoo facility in Hirtshals that focuses on dissemination of wildlife in North Sea, and people's sustainable use of the surrounding area through a combination of learning and entertainment. The aqua zoo is approved by the government and therefore receives an annual subsidy from the ministry of culture, which along with income from ticket sales, constitutes the economic basis for activities of the facility. To this point, the most important economic key performance indicator is the number of tickets sold each year. 35 full-time employees keep the place running all year round, where high seasons are reinforced with additional 35 seasonal employees. Every year, there around 160,000 visitors, of whom approximately 60% are Danes, 35% are from Norway, Sweden and Germany, and the last 5% are from rest of Europe.

Over the years, the Oceanarium has undergone major renovation, retaining, however, the element in the exhibition that creates an illusion of being below the sea. In 2009-2010, the facility was renovated with a new experience universe – The Expedition of the North Sea (Appendix 1.3). The ambition was to create the aqua zoo of the future, by rethinking the way in which exhibitions, aquariums, and interactive elements play together. Thus, among other things seven destinations were designed to show wildlife in seven different areas of North Sea. A metaphor was also implemented; namely, that visitor's exploration of these destinations is an expedition on which the visitor embarks with a crew consisting of five fictional characters: Captain, researcher, fisherman, diver, and chef, see figure 2. The characters have a mediating role

communicating the life in and on the North Sea through signages, posters and videos at various exhibits.

Figure 2: The five characters in the experience universe of the Oceanarium.

The entire concept of the experience universe was developed and implemented by an external bureau, where the Oceanarium had to sustain the experience universe by following a design guideline provided by the bureau. The Oceanarium had great ambitions for the implementation of the narrative around the five characters in connection with the launch of the interactive exhibition in 2010. However, the Oceanarium experienced that their visitors did not engage with the narratives and did not respond positively to the characters as well. The staff also had complication in including the designed narratives in the general dissemination to visitors. As such, the ambition of the experience universe and its characters was greater than the resources to sustain the designed concept and, to some degree also prevented staff from take ownership of the experience universe. Therefore, over the years, the experience universe and its characters have been phased out and are now only represented in parts of the physical exhibition. The exhibition has also been expanded continuously with several exhibits that offers different experiences (Appendix 1.4), which in some degree complement the seven main exhibits, but which are not directly related to them.

Over time, the exhibition has become more inconsistent without any clear direction. Therefore, in 2015, The Oceanarium prepared a ten-year strategy plan to redefine the experience and form the basis for development and realisation of new initiatives (Appendix 1.1). The overall purpose of the strategy plan was to reinforce a complete, coherent and uniform exhibition and visitor experience. The strategy plan defines the organisation's mission, vision, and values, which together represents a picture of the company's business structure and gives a valuable insight into the strategic intention.

Mission
"Communicating knowledge to the public about life in North Sea and increasing the awareness of a sustainable use of it."

Vision
"The North Sea Oceanarium is an internationally recognised zoo. The North Sea Oceanarium must be known for unique, involving, and challenging visitor experiences, that are world-class."

Values
"We are an aqua zoo facility. We disseminate the North Sea marine life. We are hosts and provide good service. We are committed. We have the visitor as a goal for our knowledge. We are personal. We are trustworthy and convey factual knowledge."

These initiatives are based on three development principles for types of experience categorised as: involving, unique, and challenging (Appendix 1.1, p. 25-39).

Involving Visitor Experience
This development principle is based on the creation of an involving visitor experience. The principle specifies that experiences in the Oceanarium must contain one or more of following defined elements: touch, concentration, empathy, problem solving, and/or activation of senses. These elements are intended to ensure that a visitor feels part of what is happening, on the basis of consideration and active participation. The goal for this type of experience is to create wonder, decision making, touch, and participation by incorporating experiences in all elements or just partly in connection with dissemination, the exhibits, and the building construction (Appendix 1.1, p. 27-29).

Unique Visitor Experience
This development principle is based on creation of a unique visitor experience for individual visitors. To ensure this, the Oceanarium performs field work at institutions located both inside and outside the zoological world to illuminate other experiences and problems within the genres of experience and service industry. It is important for the Oceanarium that visitors independently create their own experiences, which is why the facility encourages them to improvise their way through the exhibition, in order to seek out and explore. The Oceanarium also wants to convey the same messages on several different platforms in the facility, to ensure an understanding for all visitor segments (Appendix 1.1, p. 31-32).

Challenging Visitor Experience
This development principle is based on the creation of experiences that in one way or another challenge the visitor experience. These are physical challenges, intelligence-related challenges, ethical and moral challenges as well as emotional challenges. These elements are included by incorporating challenging experiences into all

elements or just partly in connection with dissemination, exhibits or the building construction. The goal of this type of experience is to add emotional and physical reactions as well as teaching-based elements that together contribute to the creation of a richer and more active visitor experience (Appendix 1.1: p. 37).

* * *

In a visitor survey conducted in 2016 with 8987 respondents over the age of 18 focusing on families with children, 78% associated learning with the Oceanarium and 79% associated the facility with learning for the whole family. This complement the strategy plan and substantiates visitors' expectations of educational experiences at the Oceanarium.

Like many other aqua zoo facilities, the Oceanarium had to strike a balance between offering exciting, fun experiences and disseminating knowledge. The Oceanarium acknowledge itself as an exhibition with the greatest focus on dissemination of knowledge, but they also acknowledge the need to focus on the experience aspect. However, the challenge for the Oceanarium is how to balance the two elements to provide an exhibition experience that is both involving and educative.

The inclusion of above-mentioned requirements and expectations means that all elements of the experience shall be coherent and based on unique exhibits that encourage learning and active participation that, in one way or another challenges visitors' knowledge. Thus, the strategy plan and the guidelines for the exhibition henceforth have many areas that coincide with what a transmedia experience basically consist of and could provide. To this point, the perspectives of a transmedia experience in combination with commercial and competitive advance, motivated the organisation to embark on the industrial Ph.D. project.

1.4. POLITICAL MOTIVE

Museums, exhibitions, zoos, aquarium, and art galleries etc. have existed for 400 years, gradually shaped by their environments and the changing tides of culture. In the last century, these institutions have evolved enormously and often independently, where studies indicate a subconscious co-evolution (Coe, 1986; Greenhill, 1992). The contemporary world of exhibitions, such as museums, art galleries, science centres, libraries, and cultural institutions etc. have entered the experience economy and are directly competing with an array of other commercial organisations for visitors and tourism (Macdonald, 2002; Rudloff, 2016; Skot-Hansen, 2008, 2009).

In Denmark, tourism and the experience economy contribute broadly to growth and welfare throughout Danish society, with, for example, a wide range of jobs. To this point, there is great focus on the area, where public authorities actively participate in maintaining and strengthening the Danish tourist and experience economy by

regularly publishing growth plans. The Government's vision for the growth plan is that Danish tourism and experience economy must achieve growth rates of at least the same level expected in other European countries by 2020 (Ministry of Business and Growth, 2014).

In the growth plan, the Government concludes that growth for tourism and experience economy has stalled in recent years in Denmark, even though Europe is experiencing an increase in growth (Ministry of Business and Growth, 2014). Denmark has thus lost relative market share to its competitors in Europe. In order to reverse this development, there is a need to strengthen the experience industry.

The price of experience services is globally an important competitive parameter, but since Denmark will not compete on wages and working conditions, competitiveness must be based on other parameters such as good experiences, high quality, good service and being in line with the technological development (Ministry of Business and Growth, 2014).

The technological development and population's demand for new digital experiences has changed and is constantly changing. Today, the experience economy is no longer a new concept in Denmark. Thousands of companies, cities, regions, and organisations of all types have integrated focus on experiences and the market for experiences in their strategic perspective. As such, with continuous arrival of new technologies, the focus has been on developing experiences that can create new forms of engagement, knowledge dissemination, and interaction.

Digital technologies are one of the most important facilitators for growth and development in both public- and private sectors. New digital technology offers great opportunities for those that manage to incorporate the technology. It is, however, worth noting, that it is rarely the digital technology itself that adds value. The value, on the other hand, can be argued to be hidden in the organisational ability to utilise new digital technologies (Dijk, 2005; Krishnan & Prahalad, 2008).

Digital technology is progressing rapidly and what is impossible today will be possible tomorrow. Therefore, companies and organisations in general must be prepared to handle this dynamic by constantly being able to incorporate and test emerging digital technologies. The rapid development creates a high complexity, uncertainty, and many factors that companies must include in their assessment of applicability of emerging digital technology in relation to where, when, how, and why it must be implemented (Matt, Hess, & Benlian, 2015; Niehm, Tyner, Shelley, & Fitzgerald, 2010).

Danish companies are at forefront when it comes to well-known digital technologies, but lagging behind when it comes to the use of newer, advanced digital technologies (Ministry of Business, 2018). Should Danish companies be digital pioneers that

manage to utilise the many opportunities new digital technologies offer, more knowledge is needed to improve the organisation's process of adapting, developing and utilising emerging digital technologies and solutions (Ministry of Business, 2017). This also applies to the experience providers that are unaware of the full potential of emerging digital technologies. Therefore, it is important to ensure that emerging digital technologies come into play in development of new service- and business models in a way that creates maximum value.

Based on the report 'FORSK2025 – promising future research areas' by the Danish Agency for Research and Education (2017), the Danish government presented a strategy in December 2017 to develop and support the field of digital technologies through research (Ministry of Education and Research, 2017). In January 2018 came the report 'Strategy for Denmark's Digital Growth' (Ministry of Business, 2018), which describes 38 initiatives that will ensure that in future Denmark can utilise the many new and advanced digital technologies to create growth, employment and increase prosperity. The strategy is based on recommendations from the Ministry of Business' digital growth panel (Ministry of Business, 2017) and input from the government's disruption council (Danish Disruption Council, 2017; Ministry of Employment, 2017). The first step in realising the strategy was taken in May 2018 with the establishment of 'Digital Hub Denmark' (2018), where over DKK 100 million has so far been allocated to make Denmark a digital front runner. This course has further been supported by the Innovation Fund Denmark investing DKK 100 million for the research project 'New Technological Opportunities' (2019).

The massive investments being made in digital technologies from both public and private funds, is an expression of immense importance of digital technologies in organisations. New digital technologies bring new opportunities, but also entail structural challenges of a different nature. Organisationally and administratively, new demands arise for work processes, technical equipment and their resources, and managements'- and employees' competencies in the digital field (Rosenstand & Ivang, 2018). The processes are resource-intensive, which often complicates and considerably increases the process costs (Borum & Christiansen, 2006). It is rarely the technology that limits what is possible. Therefore, when new digital technology is used and implemented, the focus must increasingly be on innovation, meaning creation, and organisational changes, as implementation of new technology cannot avoid changing and influencing already ingrained processes and routines (Perez, 2002). The many uncertainties make the value of these investments difficult to justify in advance (Coughlan, Lycett, & Macredie, 2005).

The emergence of new technologies enables new unknown types of products with challenging forms of interaction. In this context, interactivity (Jens F. Jensen, 1998, 2010) is a central concept where people can interact with a product through multiple media platforms and also be co-creators of content. This affects the organisation inwardly in several ways. Among other things, it entails some new work processes

where staff must give authority to users and take on a more facilitating than instructive role for users to contribute and speak.

People are pampered with latest technologies from their everyday life, where it is not enough to think, that if you pack traditional communication into 'something digital' - just changing the form – will retain people's interest. It must be made clear that a targeted effort to capture the interest of people and get them on-board, means that the content of communication must be changed fundamentally (Jenkins, 2003). Today, most companies use great resources to be present on multiple media platforms, where each media platform is used to communicate the same content. Thus, the potential of each media platform is not fully utilised to provide a coherent experience across multiple media platforms. Therefore, one must ask what ideas and thoughts inform implementation of emerging digital technologies that particularly point to issues of resources, quality and evaluation as current and necessary issues to relate to. In practice, this shift of focus manifests itself through organisational changes, where functions arise or expand in order to carry out new tasks.

More critical reflections are missing on the quality and depth of the actual user experience that new digital technologies are expected to provide. Knowledge must be created about how organisations explore and measure effect of new digital technologies and thus specify what efforts are needed when the potential of new digital technologies is to be realised.

Research into use of emerging digital technologies by companies is still at the pioneer stage, with no established standards, routines and adequate research. Therefore, it is an area where research and practice have ample opportunity to mutually fertilise each other. Thus, the political motive was to generate knowledge that contributes to reinforcing Danish organisations' process of adapting new digital technologies to provide high quality experience, especially in Danish exhibition context that directly contributes to the Danish experience economy.

* * *

The three motives formed the initial elements for the working hypotheses, which is detailed in the following section.

1.5. WORKING HYPOTHESES

In correlation with the three motives, the value sought is to explore the potential of transmedia in an exhibition context, which established the foundation for the working hypotheses explored throughout the last three years:

A transmedia approach can be used to interweave a coherent exhibition experience across multiple media platforms, where the physical exhibition is the core platform for the content.

The assumption, inherent in the hypothesis, is that a transmedia approach can establish a cohesive exhibition universe across multiple media platforms, where the physical exhibition contains the primary content (Davidson, 2010). Thus, the exhibition is considered to be the central media platform. Concordantly, another working hypothesis was that:

Through exploring the cohesive exhibition universe, visitors will be more motivated to get involved and educated pre-, during- and post-visit.

This changes the conventional value chain (figure 3). The change is an innovative challenge regarding the commercial eco system in which Nordsøen Oceanarium is placed (Adner, 2013), where co-innovation by external partners and internal processes are required.
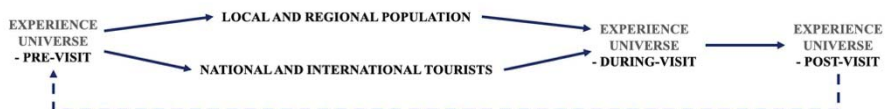
Figure 3: The conventional value chain and the new value chain.

As illustrated in figure 3, these goals are dependent on the size of both local and regional population and number of national, and international tourists. Moreover, population and tourists' demography matters. The Oceanarium does have activities in the tourist industry, however, this was not within the scope of this project.

First of all, the new value chain changes the understanding of marketing at the Oceanarium; from being an exclusive pre activity, it is changed to be an inclusive pre- during- and post-experience activity. Marketing is executed together with the exhibition and related activities like the store and café – and vice versa.

The boundaries between different stages in the value chain will be removed and merged together to form the foundation for delivering a transmedia experience. Previously, marketing in an experience economical context, aimed at selling the experience, whereas in this situation the marketing is a part of the experience. In general, there is a movement from value chain to an ecosystem; where the ecosystem is constituted by the fact that post-visit visitor activities, such as sharing and reviewing becomes pre-visit experiences for new and returning visitors. These are strategic challenges that require new organisational cooperation formats and organisational changes with development of new processes across different departments.

* * *

In this dissertation, the term 'exhibition' encapsulates a wide range of similar contexts such as museums; science centres, aquariums, zoos, etc. The following chapter is a literature review of the area of interest starting with transmedia storytelling.

CHAPTER 2. TRANSMEDIA & EXHIBITIONS

This chapter consists of a literature review that also functions as a theoretical framing that encapsulate transmedia, experience design, contemporary exhibitions, and ends by elaborating transmedia in exhibitions. The method and selection process of literature for the review is detailed in chapter 5.1.

2.1. TRANSMEDIA STORYTELLING

Transmedia encapsulate the phenomena, where multiple media platforms are utilised to systematically disperse a message or a story for the purpose of creating a coherent experience. It has most often been used to elucidate emerging practice in the realm of fictive arts, such as big-budget films, television series, and computer games (Kidd, 2014).

Transmedia is not a new phenomenon as it has been practiced since the non-digital era in form of conveying cultural myths such as the bible (Evans, 2011). However, it was first suggested by Marsha Kinder to describe the evolution of 1980s franchises (e.g. Teenage Mutant Ninja Turtles) caused by the multiplatform and multimodal expansion of media content, where TV and movie characters were brought into video games predominantly with an economic logic. Kinder's use of the concept 'transmedia intertextuality' paved the way for transmedia franchises to be referred as '*entertainment supersystems*', which contains a network of inter-textualities based on fictive or non-fictive popular-cultural phenomenon (Kinder, 1991). With reference to the Japanese franchise Pokemon, Mizuko Ito talks about a similar phenomenon under the term 'media mix' which includes both analogue and digital products. Ito writes:

"By linking content in multiple media forms such as video games, card games, television, film, manga books, toys, and household objects, Pokemon created a new kind of citational network that has come to be called a media mix" (Ito, 2006, p.4).

Early entries of similar blend of multiplatform products have also been denoted 'cross-sited narratives' by Dena (2007) and 'screen bleed' by Hanson (2004). However, these descriptions only give a perception of different dosages of content on different media platforms. Conversely, the phenomenon was further developed under the term 'transmedia storytelling', which is inextricably linked to Henry Jenkins (2003, 2006), who reintroduced the term within context of digital change, that disrupted the way entertainment was produced, distributed, marketed and conceived (Dena, 2004; Jenkins, 2006). This was a result of convergence processes, where intersection of new and old media liquidated the boundaries between media,

industries, producers, and consumers (Jenkins, 2006; Scolari, 2013). Dena specifically states:

"Such transmedia forms emerged when the awareness and penetration of a large range of technologies and art forms reached a pivotal point. That moment was, quite poetically, the penultimate year of the 20th century: 1999." (Dena, 2007)

In this regard, Henry Jenkins was the first one to describe an understanding of how fictional characters and storyworlds evolved into transmedia storytelling as a separate distribution form. He describes transmedia storytelling as:

"A transmedia story unfolds across multiple media platforms, with each new text making a distinctive and valuable contribution to the whole. In the ideal form of transmedia storytelling, each medium does what it does best - so that a story might be introduced in a film, expanded through television, novels, and comics; its world might be explored through game play or experienced as an amusement park attraction. Each franchise entry needs to be self-contained, so you don't need to have seen the film to enjoy the game, and vice versa. Any given product is a point of entry into the franchise as a whole" (Jenkins, 2006).

It is about creating of a narrative experience across media platforms, where each medium contributes uniquely to the whole. Thus, storytelling is a driving component behind transmedia storytelling which distinguishes it from similar phenomena such as 'intermediality' (Grishakova & Ryan, 2010), 'transmedial interactions' (Bardzell, Wu, Bardzell, & Quagliara, 2007), 'networked narrative environments' (Zapp, 2004), 'distributed narratives' (Walker, 2005), 'transmedial worlds' (Klastrup & Tosca, 2004), 'distributed experiences' (J. E. McGonigal, 2006), 'pervasive games' (Montola, Stenros, & Waern, 2009), 'free play' (Morrison, Viller, & Mitchell, 2011), and 'crossmedia' (Dena, 2004; Gitelman, 2006; Petersen, 2006) by being centred on one overall narrative that unfolds over several media platforms, where each text contributes with a significant and valuable part of the whole (Jenkins, 2006).

Based on The Matrix franchise, which is considered to be the first major transmedia approach, Jenkins explains, how this was not only driven by economic, but also by creative ambitions. The Matrix' narrative universe builds on additive understanding: It is distributed over three feature films, computer games, comics and animation series, which together spans a coherent narrative experience without internal contradictions or redundancy - at the same time as the franchise's single parts (e.g. the movie trilogy) function as isolated independent stories. Thus, The Matrix franchise contains multiple narratives told within same, larger story world. In this regard, Edwards (2012) states that transmedia storytelling has the potential to be a powerful and unique approach for narrative world production, which substantiate Henry Jenkins' statement on transmedia being "the art of worldbuilding" (Jenkins, 2006, p.21).

This illuminates another important component in transmedia concepts being worldbuilding, where numerous coherent stories can unfold and flow across multiple media platforms. As such, transmedia storytelling is a form of crossmedia communication, but where focus is largely on narrative. Ibrus & Scolari (2012, p.7) expresses the difference between crossmedia and transmedia by the following formula: 'crossmedia + narrative = transmedia storytelling'. This formula supports Dena's (2004) claim that transmedia storytelling is distinguishable from crossmedia by its emphasis on narrative. According to the transmedia practitioner Jeff Gomez, transmedia must be placed as a part of the broader crossmedia concept. Gomez formulates it as follows:

"It [transmedia] falls under the rubric of cross-media, but while cross-media can imply any method, strategy or content that iterates itself over various distribution methods, transmedia implies a design sensibility customized to the message at hand, which also leverages the strengths of each platform and promotes dialogue with the audience." (Gomez, 2011)

Thus, there is a hierarchy in the concepts, where crossmedia is the overall strategy, while transmedia is more specific aimed at involving audience. Hence, reflecting a way of how media can be organised to optimise audience engagement and participation (Jenkins, 2010a). According to many transmedia scholars such as Jenkins (2006), Dena (2009), Scolari (2009), Beddows (2012), and the practitioner Jeff Gomez (2008) participation is the criteria for a successful transmedia experience, and involves cultivation, validation and celebration of participating audience, which reinforces the connection between audience and the storyworld. This elucidates another crucial component of transmedia storytelling being participation.

By reviewing the literature of transmedia, it is possible to roughly divide transmedia into three major components: storytelling, worldbuilding, and participation. Storytelling component focuses on the story, message, or content dispersed across multiple media platforms. Worldbuilding component focus on the coherent 'storyworld' (also called universe or just world) where multiple related stories unfold with related objects and/or subjects. Participation component focus on the audience's active participation and engagement. There are many other features and details that are necessary to define transmedia such as Henry Jenkins' (2009c, 2009b) seven complementary principles of transmedia storytelling: 'Spreadability and Drillability', 'Continuity and Multiplicity', 'Immersion and Extraction', 'Worldbuilding', 'Seriality', 'Subjectivity', and 'Performance'. However, I argue that these principles, and other features and details can be denoted within the three major components. Following sections elaborate the three major components.

2.1.1. STORYTELLING

There are well established methods to craft stories through linear storytelling approaches such as 'The Hero's Journey' (Campbell, 1949) and 'The Writer's Journey' (Vogler, 2007) or through non-linear storytelling approaches (Cameron, 2008; Pearce, 1994). However, in the arena of transmedia, these approaches can be combined as a story or a message, can be launched in one medium, expanded through a number of other mediums, where each medium contributes to the experience through medium's specific potential. Thus, the whole is worth more than sum of the parts.

To craft a cohesive story, three principles of Jenkins transmedia storytelling can substantiate the process: *continuity and multiplicity, seriality*, and *subjectivity*. *Continuity and multiplicity* are all about the coherence of stories. A strong *continuity* reinforces cohesiveness and plausibility of stories (Jenkins, 2009b), which means that stories are based on the same storyworld (see chapter 2.1.2) and follow the same canon. The practitioner Tyler Weaver says:

"A great continuity and mythology give audiences something to dig into and a reason to hunt for back issues and return month after month. The only way stories - be it a transmedia story experience, video game, comics, television, novel - inspire that sort of emotional and time investment is through incredible storytelling and characters that the audiences want to revisit again and again." (Weaver, 2013)

However, the disadvantage with a strong *continuity* is that it might prevent fanfiction and spin-offs by the audience. On the other hand, *multiplicity* enables diversity around stories and will most often be expressed in the form various artists' editions of same story or fanfiction (see chapter 2.1.3). Moving between *continuity* and *multiplicity* can be a balancing act. Too much diversity will enhance risk of being incoherent and compromise continuity needed for the audience to make sense of different story pieces. If *continuity* is maintained too much, it may affect audience's desire to get involved and become co-creators of the story (Jenkins, 2009b).

Seriality refers to how the story is divided into smaller pieces, which is a necessity to be spread across multiple media platforms. Jenkins explains the concept as follows:

"The story refers to our mental construction of what happened which can be formed only after we have absorbed all of the available chunks of information. The plot refers to the sequence through which those bits of information have been made available to us. A serial, then, creates meaningful and compelling story chunks and then disperses the full story across multiple instalments." (Jenkins, 2009a)

Seriality, however, differs from linear seriality process that occurs in the case of comics, TV series, etc., as the serial parts appear much more fragmented when spread across different media platforms. In traditional seriality the audience's engagement is

maintained through e.g. cliff hangers, while transmedia engagement invites other structures. Here, each one has his or her own individual journey across media platforms. Part of traditional story structure disappears, but other possibilities arise for activating and engaging the audience. The fact that the parts can be read independently increases accessibility, as audience can get something out of each media platforms, no matter how and when they encountered it. At the same time, it helps to activate audience's collective intelligence, as each individual journey across media platforms creates a breeding ground to discuss the individual story pieces and collectively map the overall story (Jenkins, 2009a).

Subjectivity is when a secondary story illuminates the main story from a new perspective (Jenkins, 2009a). Among other things, it can be a story from the point of view of a supporting character as in the computer game 'Enter The Matrix', where audience experiences the world through character Niobe; it can be the short film 'The Second Renaissance', where audience experiences the world through historical archives of machines; or the comic book 'The Miller's Tale' that shows the lives of inhabitants and cultural rituals in the city of Zion in The Matrix. In the case of fanfiction, audience contribute with their stories with their subjective perspectives.

Apart from Jenkins' description of transmedia storytelling and his principles, many practitioners and scholars have been exploring different multiplatform narrative productions (Dena, 2014). For example, Jason Mittell distinguishes between two different types of transmedia storytelling: one characterised as a centrifugal, storyworld-driven form of transmedia storytelling, which spreads parts of a coherent narrative across different media, the other one characterised as centripetal, character-driven transmedia storytelling, where transmedia extensions do not extend a fictional world, but add depth to already established characters in the primary medium (Mittell, 2014). Giovagnoli (2011) expresses transmedia storytelling through two 'shapes' of communicative systems; a flat shape, where story moves on a measurable single infinite plane; secondly, a curved shape, where stories circulate and take different forms often in a complex and unpredictable way. Gambarato (2012b, 2012a) details transmedia storytelling through a mathematical equation and also provides a toolset for metrics and actions that can be quantified to access the effectiveness of a transmedia story. In a production context, Pratten (2015) operates with a taxonomy of transmedia storytelling: Transmedia franchise - a series of narratively integrated media platforms that are interrelated, but also function independently of each other (e.g. prequels and sequels); 'Portmanteau' transmedia refers to examples where a narrative unfolds simultaneously over collaborative media platforms primarily on the basis of audience's involvement and collaboration, such as an alternate reality game (ARG). This type requires a high level of audience involvement, where audience can coordinate through a variety of media platforms, such as social media. Thus, Portmanteau is heavily dependent of the participation aspect of a transmedia experience; The last type Pratten denotes is 'complex transmedia experiences' which

is a combination of previous two: The first type of transmitter-controlled communication is combined with the other type of interactive experience.

Knowledge of transmedia storytelling provides different methods to construct stories that can be dispersed across multiple media platforms. However, knowledge regarding mechanics that interweave the dispersed stories together is limited.

2.1.2. WORLDBUILDING

Beside story or message, which are both crucial for transmedia and especially transmedia storytelling, worldbuilding is as much fundamental and is inherent to transmedia logic - creating a cohesive universe across various media platforms. In recent years, there has been an increased focus on worldbuilding (Hills, 2012; Jenkins, 2013; D. Johnson, 2009; Parkin et al., 2017; Saler, 2012; Scolari, 2009; Wolf, 2012). Worldbuilding emerged from the field of fiction but has also been applied in non-fiction space e.g. documentary (Karlsen, 2018) and journalism (Gambarato & Alzamora, 2018). Worldbuilding describes the art of creating a universe around media content, corporate brand or e.g. a toy franchise. Anyone with an intellectual property (IP) right can in principle use worldbuilding as a strategy to offer engaging experiences with their products. There are several storytellers that advocate building storyworlds rather than one linear story, such as (Mittell, 2015). Concordantly, worldbuilding is also a principle in Jenkins principles of transmedia storytelling, where he denotes worldbuilding as:

"The process of designing a fictional universe that will sustain franchise development, one that is sufficiently detailed to enable many different stories to emerge but coherent enough so that each story feels like it fits with the other." (Jenkins, 2006, p.335)

Worlds are described as systems containing different moving parts (e.g. characters, institutions, locations) that span the foundation for multiple stories and characters that are connected through their underlying structures. Possibility to dive deep into this world and explore e.g. backstories and characters, is a driving element for transmedia consumption. Thus, level of detail and internal consistency of a storyworld is what distinguishes it from linear storytelling. Level of detail is unfolded e.g. through genre - the style of storyworld, theme – idea or subject of the world, setting - time and place, existence – characters and subjects, concept – key events and conflicts, which together create a rich backdrop (Ghellal & Morrison, 2017). Consistency denotes the mentioned elements stay recognisable in different stories and across multiple platforms reinforcing a coherent storyworld. For example, the visual style of The Matrix universe is a radical element that is maintained across all story-products to make the audience recognise the storyworld, its stories, and characters. It is a relationship where storyworld forms the basis for stories, and where stories contribute in creating the storyworld.

Jenkins *drillability* concept in his principles of transmedia storytelling also substantiates worldbuilding as a strong *drillability* dimension allows audiences to immerse themselves in a storyworld and create even more insight into the world than the main story allows them. Here, more information and extra stories give another and/or an extended experience of individual stories. This also creates the foundation for fan cultures, as it allows the core audience to get involved deeply in the storyworld. A good example of this is the Matrix example that enables *drillability* in a high degree through a rich and detailed worldbuilding. If focus is on drillability dimension, a long-lasting effect and an in-depth relationship with its audience is potentially created, but it may be at the expense of only appealing to a smaller segment of the audience.

In continuation of this, principles *immersion* and *extractability* does also contributes to worldbuilding. *Immersion* focuses on how well audience is brought into the storyworld, while *extractability* focuses on how artefacts from the storyworld are brought physically into the real world in form of e.g. merchandises by audience (Jenkins, 2009a). Thus, the driving force of *immersion* is about the ability of the storyworld to make audience enter the storyworld to explore other related content. *Extractability*, on the other hand, is considered as individual parts of the storyworld, which audience can bring into the real world and possibly use it to create own stories. Examples of such may include action figures, costumes, film tools, etc. However, *immersion* can also include physical manifestations such as theme parks, while *extractability* also can include virtual manifestations such as a screensaver for the computer. Thus, this emphasises the importance of building a world that both content-wise and visually immerses the audience and provides aspects they can make their own from the storyworld.

Fictional approaches to transmedia is about designing new worlds, where non-fiction investigate and map existing worlds (Jenkins, 2016). The core of worldbuilding is how the world is designed and represented with varied dimension, plausibility, and richness of details, to be intriguing, compelling and equally as important as its character and plots. Apart from sharing characters and world dynamics, worldbuilding also offers immersive media experience and emotional reactions (Freeman & Gambarato, 2018b).

2.1.3. PARTICIPATION

Transmedia requires active participation by the audience to explore many story layers in the storyworld. Participation emphasises the importance of inviting audience to act and allowing them to contribute with their own personal touch to the story and storyworld. It covers a wide spectrum of activities, ranging from simple social media engagement to generating content (Tenderich, 2014), which is also widely known as participatory culture (Delwiche & Henderson, 2012; Jenkins, 2012; Jenkins, Purushotma, Weigel, Clinton, & Robison, 2009).

Henry Jenkins principle *performance* reinforces the significance of activating audience to participate (Jenkins, 2009a). Jenkins also denotes the importance of designing platforms in and around a story, encouraging audience to actively participate - creating either implicit or explicit strategies for involving audience. He particularly describes, that something has to catch audience's attention, which he calls 'attractors', and concordantly something has to encourage them to participate, which he calls 'activators' (Jenkins, 2009a). Thus, psychological mechanisms such as intrinsic and extrinsic motivations can be combined to invoke participation (R. M. Ryan & Deci, 2000; Vallerand, 1997). However, Jenkins also mentions that even without such strategies, it becomes more and more common for audience themselves to actively seek ways in which they can participate, and thus, has become easier to involve the audience (Jenkins, 2009a). However, Jenkins most often talk about fan like audience who have a high interest, but knowledge regarding how to motivate the general audience is still limited.

Apart from the possibility to create content, participation also involves how audience shares content with others by spreading it (Green & Jenkins, 2011). Thus, participation also denotes *spreadability* concept in Jenkins' principles of transmedia storytelling. *Spreadability* denotes the process of making content appealing for audience to spread it across media landscape (Jenkins, 2009b). Jenkins describes it as "the capacity of the public to engage actively in the circulation of media content through social networks and in the process expand its economic value and cultural worth" (2009b). The *spreadability* can be associated with both the medium (Mittell, 2009) and the story (Green & Jenkins, 2011). Some media are better at spreading content such as social media. Likewise, the *spreadability* can be embedded in stories, which qualifies them to spread more easily. According to Mittell (2009) the *spreadability* dimension have the potential to reach many people quickly, but it may be at the expense of being a short-term effect, where audience disappear or forget the story or message after a short time. Thus, transmedia has been criticised for inviting audience involvement while being a distribution model maintained and controlled by the sender through controlled flow of content across platforms. Such a distribution model consolidates official texts (canon) and forecloses franchise from unofficial use (fannon) (Hills, 2012; Scott, 2013). Matt Hills (2012) suggests a more openness and flexibility that allow audience involvement, where transmedia world is co-produced by producers and fans over time - such as trans-discourses that move across industry, fan contexts, and across media platforms.

In continuation of participation in fictional space, Gambarato distinguishes between interaction and participation in non-fictional space of transmedia, as such:

 "An interactive project allows the audience to relate to it somehow, for instance, by pressing a button or control, deciding the path to experiencing it, but not being able to co-create and change the story; a participatory project invites the audience to engage in a way that expresses their creativity in a unique, and surprising manner, allowing

them to influence the final result. Participation occurs when the audience can, with respect at least to a certain aspect of the project, influence on the set of components, such as the story. Stories that are mainly interactive can be considered as closed systems, in which the audience can act but cannot interfere with the story. Closed systems presuppose interaction but not participation. Besides the interactivity, open systems allow participation, i.e. the audience can influence the result and change the outcome." (Gambarato, 2013)

Experiences that are only interactive, where audience can act but not interfere, are considered 'closed systems'. In contrast 'open systems' presuppose participation, where audience can influence the experience. An effective *open system* transmedia experience invites audience participation in an easy way allowing them to influence the final result with their creativity (Gambarato, 2012a; Tenderich, 2014). Here, the degree of complexity is a major factor; if the experience becomes too complex it becomes a demotivating factor for the general audience (Dena, 2009; Jenkins, 2006; Leiter, 2011). Gambarato argues that *closed systems* are more interactive in contrast to *open systems* that embrace participation. These two simplified approaches can however also be argued to be applicable in fictional projects, as they do not limit or compromise transmedia features in general (Gambarato, 2013).

Although there are several approaches to make audiences participate, it is not a simple task as majority of audience may be vastly engaged in a story but might often "simply want to watch" (Jenkins, 2006, p.139). This is concurred by media culture scholars such as Bird (2011), Carpentier (2011), and Couldry (2011). Concordantly, Dena (2008), Evans (2008, 2011), Beddows (2012), and Phillips (2012) also addresses this issue and furthermore, maps audience involvement roughly through three levels: low, medium, and high.

> **Low** addresses 80-90% of the audience who do not invest significant amount of time or energy into the storyworld and only briefly engages with the content (Dena, 2008).
>
> **Medium** addresses 10-20% of the audience who interact with others about the storyworld and seeks other story pieces (A. Phillips, 2012).
>
> **High** addresses 1-5% of the audience who invest significant amounts of time and energy to seek, share, curate, discuss and collaborate to know more about the storyworld (E. Evans, 2011).

Thus, it is necessary to know which kind of audience a transmedia product is targeting to create an appropriate way to reach a satisfying transmedia experience. Transmedia techniques and tools enable a more meaningful, emotionally connected, and fulfilling media experience. According to Freeman and Gambarato (2018b), meaningful

experiences, social connections, share stories, and being part of something larger than themselves, are still elements that motivate people. However, knowledge regarding participation in non-fictional transmedia is still limited (Gambarato, 2013; Karlsen, 2018).

<p style="text-align:center">* * *</p>

The features of the three components interact with each other and collectively spans the foundation for transmedia storytelling. However, there are both strengths and weaknesses in all three components of which one must be aware when designing a transmedia product. Since Kinder suggested the term transmedia, the phenomenon has kept evolving and today embraces different disciplinary fields. Therefore, it is necessary to map, what transmedia is in the contemporary time. This is detailed in the following section.

2.2. TRANSMEDIA FROM A BROADER PERSPECTIVE

One of the dominant ways the flow of entertainment across media is understood today, especially in a digital and commercial setting relays on Jenkins' (2007) definition of transmedia storytelling being "a process where integral elements of a fiction get dispersed systematically across multiple channels for the purpose of creating a unified and coordinated entertainment experience". However, Jenkins acknowledges that transmedia storytelling simply refers to one logic that seems to affect the entertainment industry. He describes on his blog:

"Narrative represents simply one kind of transmedia logic which is shaping the contemporary entertainment realm. We might identify a range of others - including branding, spectacle, performance, games, perhaps others - which can operate either independently or may be combined within any given entertainment experience" (Jenkins, 2009b).

Thus, transmedia is understood as a broader concept, of which storytelling is merely one of the elements. Dena (2009, 2018) and Ruppel (2012) also contest the definition of transmedia storytelling, as it excludes adaptations claiming that audience finds it to be redundant and simple retellings. However, Dena (2018) argues that there is no proof offered that audiences find adaptations redundant. Adaptations or simple retellings might open new possibilities in the realm of transmedia especially in the field of tourism and museums that need to disseminate facts to different target- and age groups.

Thus, a softening of arguments is also noticeable (Harvey, 2015; Jenkins, 2017; O'Flynn, 2013) and Jenkins has also regularly reviewed and developed his theory of transmedia storytelling (Jenkins, 2006, 2007, 2011). More recently, he defined transmedia simply to be "a set of relationships across media" (Jenkins, 2016). Along

Jenkins' works, others have built on distinct subfields of scholarly investigation and industry-specific contexts.

As such, over the years, transmedia has evolved into an umbrella term for the controversial phenomenon that exists at the intersection between several academic disciplines and creative practices and industries. This fuzzy nature of the phenomenon not only illuminate a multifaceted design problem that demands transmedia producers to combine different 'mental models of creation' (Dena, 2016) but also has been causing major confusion and debate. In general, it is still a form of communication that utilises multiple media platforms in distribution of content. It is also typically understood as a commercial practice that enables numerous revenue streams and multiple sites of engagement (Dena, 2004, 2008; Long, 2007). Evans (2011) describes transmedia as "the increasingly popular industrial practice of using multiple media technologies to present information… through a range of textual forms". In the general logic of transmedia, each pieces of content enriches, enhances or augments its companion pieces and also contains the possibility to enlighten a new, previously absent dimension that can transform that piece of content to give it a whole new meaning. Thus, transmedia holds the quality of shaping and re-shaping how we perceive the media and the world around it (Dalby, 2017). As such, transmedia has evolved into many fields e.g. brand development practice (Johnson, 2013), and distribution practices of film and television (Evans, 2015). But is most closely associated with global media giants "such as Disney and Time-Warner, [which] take advantage of globalisation to expand abroad and diversify" (Birkinbine, Gómez, & Wasko, 2017).

However, according to Jenkins (2006), Cunningham (2012), and Pratten (2015), transmedia storytelling is not fully dedicated to conglomerates and fictional franchises but has also spanned the foundation for small scale- and non-fiction producers, such as the documentary film 'Amplify Her' (Mackenzie, 2017) and the podcast 'Serial' (Koenig, 2014), which travels across multiple media platforms expanding the narrative and motivating participation in an innovative way through conversations and interaction. Dena (2009) also substantiate the importance of innovation for small scale productions, as it differentiates them from larger competitors.

Thus, transmedia has also evolved from operating only in large scale fictional spaces to embrace small scale fiction and non-fiction productions as well. Here, Gambarato (2018) elaborates three characteristics of transmedia in non-fiction space being multiple media platforms, content expansion, and audience engagement. However, these characteristics do not deviate from the characteristics of transmedia in fictional space, as emphasised by Kinder (1991) and Jenkins (2003, 2006). However, Dena (2009) note that small scale productions use of multiple media platforms is not a new phenomenon, as particular media and media industries have always been extending content across platforms, where audience have been encouraged to migrate across stream of content, which has pushed the media culture to become more transmedial.

Evans (2018) reasons this to be a result of the fundamental shift that digital media technologies have wrought on content creators and their audiences. As such, digital technologies have a vital role in disseminating transmedia content, making content easily available, reaching a varied range of audiences, enabling audience engagement, and contribution to a participatory culture, for instance (Freeman & Gambarato, 2018b). But according to Jenkins (2018), the experience can be dramatically increased by incorporating a variety of alternative combinations of both online and offline activities, such as live events and analogue initiatives, which contributes to the feeling of immersion, sense of belonging, and the emotional response of audiences. Concordantly, digital technologies especially in form of mobile devices are burgeoning the ideas about transmedia locations, meaning "the context from which transmedia products emerge" (Jenkins, 2016). This assigns much more importance to physical space by enabling real time interaction between digital space and the physical location. Thus, according to the continuous propagation of the phenomenon transmedia, Jenkins argues that:

"transmedia – broadly defined – continues to grow in many different directions as people respond to the challenge and opportunities of communicating systematically across multiple platforms." (Jenkins, 2016).

This is also evident and substantiated by the fact that transmedia in recent years has broadened its definition through different disciplinary optics e.g. storytelling (Evans, 2011; Jenkins, 2006; Ryan, 2013), worldbuilding (Wolf, 2012), marketing (Grainge & Johnson, 2015; Gray, 2010), historical culture (Freeman, 2016), activism (Scolari, Freeman, & Bertetti, 2014), literacy (Scolari, 2016), journalism (Gambarato & Alzamora, 2018), Sport (Tussey, 2018), and so on. Thus, transmedia also inevitably holds different meanings for different people at different times (Gambarato & Alzamora, 2018). As such, Scolari (2017) argues that in contemporary media landscape all content can be considered more or less transmedia. Conversely, Henry Jenkins argues that:

"this does not mean that transmedia means everything to all people and thus means nothing to anyone. Rather, it means that we need to be precise about what forms of transmedia we are discussing and what claims we are making about them." (Jenkins, 2016).

Concordantly, Freeman and Gambarato (2018) recently described that practices of transmedia is a convergence of diverse practices into a single innovative package. They specifically describes transmedia as:

"the building of experience across and between the borders where multiple media platforms coalesce, altogether refining our understanding of this phenomenon as specifically a mode of themed storytelling that, by blending content and promotion, fiction and non-fiction, commerce and democratization, experience and participation,

affords immersive, emotional experiences that join up with the social world in dynamic ways. And in doing so, it becomes more than the sum of its parts-weaving through industry, art, practice, and culture." (Freeman & Gambarato, 2018b).

As a substantiation of this, Kate Fitzpatrick says that "today, the concept of transmedia itself means creating a journey or experience that uses the most relevant mix of channels and platforms for your intended audience." (Fitzpatrick in Freeman & Gambarato, 2018a). Natalie Rios Gioco substantiate this further by suggesting that transmedia is about "delivering information by experience" and elaborates it as "a system of cause and effect - a distribution of information (cause) that triggers an integrated, expansive response (effect)." (Gioco in Freeman & Gambarato, 2018a). Broadly, this can be described as the interaction between content and audience.

Summing up, the art of transmedia can thus be argued to concern a coherent experience across multiple media platforms shaped by experience-fragments that engage audiences emotionally and experientially. This illustrates the phenomenon's move towards experiential and immersive perspectives illuminating the rise of experience aspect, which enhances the importance of experience design (Jensen, 1998) and experience economy (Pine & Gilmore, 2011). This move substantiates Oppelaar et al.'s statement:

"Where in the past century a great emphasis was on products (20th century is called the 'product age'), in the current age products are just vehicles to construct an experience… this move cannot stay without consequences: the design process has certainly changed and moved from the original perspective of functionality, cognition and usability to much broader perspective, with new 'experience factors'." (Oppelaar, Hennipman, & van der Veer, 2008)

This move manifests itself in many different ways and levels, thus, become a rapidly growing paradigm that has been attracted attention over the last 10-20 years in the field of experience design. As such, the following section details how to design an experience.

2.3. EXPERIENCE DESIGN

The field of experience design is as much fragmented and complicated as transmedia by having different perspectives that are disintegrated and spread over many different contexts and many different disciplines with different theoretical models such as affect (Forlizzi & Ford, 2000), technology as experience (McCarthy & Wright, 2004), hedonic/aesthetic variables (Hassenzahl & Tractinsky, 2006), pleasure (Jordan, 2002), ambiguity (W. W. Gaver, Beaver, & Benford, 2003), emotion (Desmet & Hekkert, 2007), empathy and experience (Wright & McCarthy, 2008), pragmatism (Cockton, 2008), beauty (Diefenbach & Hassenzahl, 2009), to name a few. Several studies have given their view on what constitutes an experience design (Cockton, 2008; Jensen,

2013; Law, Roto, Hassenzahl, Vermeeren, & Kort, 2009; Law, Roto, Vermeeren, Kort, & Hassenzahl, 2008; Roto, Rantavuo, & Väänänen-vainio-mattila, 2009). However, to understand what experience design is, one must understand what constitutes an experience. Recently, Professor Jens F. Jensen defined an experience as:

"Experiences (understood as particular instances of or the processes or facts of personally observing, encountering or undergoing something) are sensory-based effects that humans get in interaction with products/objects, services, events, processes, other people, surroundings and so on, which are reflected in the form of emotional impressions and/or meaningful experiences (understood as the knowledge or practical wisdom gained from what one has observed, encountered or undergone). Experiences are a consequence of the experiencing individual's internal state (for example, needs, wishes, motivations, personality traits, emotions, convictions, values, culture, knowledge, skills, expectations, mood/spirits/sentiment and so on), characteristics of the product/object, service and so on (for example, functionality/utility, usability, accessibility, design, brand and so on) and the context in which the interaction takes place (for example, environment/physical context, social context, cultural context, technological context, temporal context, organizational context, task-related context and so on)." (Jens F. Jensen, 2013a)

Here, interaction has an important role and in an identification of concepts 'interaction' and 'interactivity', Jensen identified the origin of the concepts in three different subject traditions, which automatically imply different understandings of their content and use: In short, *interaction* within sociology relates to face-to-face interaction between two people (Jens F. Jensen, 1998). In the field of informatics and media sciences, both *interaction* and *interactivity* are used to describe different forms of communicative exchange between users and media or between user and machine also called human-computer interaction (HCI) (Jens F. Jensen, 1998).

In order to set focus on the interaction between user and system or product as the key to understand experiences, Jensen suggests the following graphic representation, see figure 4:
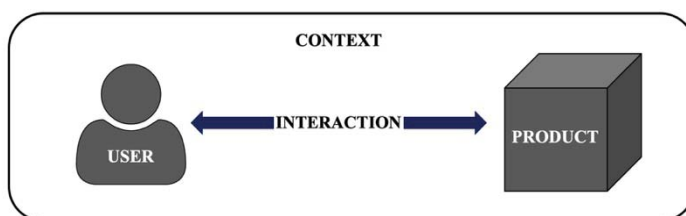
Figure 4: Model for experiences based on interaction between user and product in a context. Redrawn from (Jens F. Jensen, 2013a).

Here, an experience is located at the user, but an experience arises in the interaction between user and system/product. User is the human subject - the experiencing - who experiences in the interaction with the product. Product is the object that user interacts with – the experienced - and which through interaction evokes the experience for the user. Product shall be perceived broadly as object, system, service, activity, event, place, environment, media, other people etc. Context is the environment or situation where the interaction between user and product takes place. Reason why the context is important is that an experience cannot be isolated from the context in which it occurs. In other words, the use experience can change if the context changes even if user and product are the same (Jens F. Jensen, 2013a). According to transmedia, the product here is the transmedia property, which user interacts with in different contexts, where the condition for experience is located in the interaction between user and the transmedia property.

It is important to state that product is not the same as the experience, but only constitutes the condition for the experience. The experience designer Bob Jacobson describes e.g.:

"… there is no way to design experiences. Experiences occur by definition only in the minds of those who have them, not at a designer's behest. There is no way to reach into the head of individuals and implant or create particular experiences." (Jacobson, 2007)

It is thus not possible directly to design experiences. This is partly because experiences are a product of the experiencer's own mental and emotional work, which the designer cannot grasp directly into, and partly that the experience designer cannot take complete control of all relevant elements in the experience product and in the experience context, so that it gives a controllable and predictable result in form of a specific predetermined experience (Gube, 2010; Jens F. Jensen, 2013b).

However, it is possible to design *for* experiences (Forlizzi & Ford, 2000; Oppelaar et al., 2008), which means "creating the conditions by which target audiences can be made, persuaded, or encouraged to have desired experiences." (Jacobson, 2007).

Designing *for* an experience means designing the product - the experienced - (as well as the context) in such a way that through affordances, functionality, story of use, idiom, structure, attributes, degree and form of interactivity, responsiveness, aesthetics qualities, accessibility, brand, image, etc. are very likely to trigger a particular interaction with the user or a particular user segment, thereby producing a certain experience. However, there are no guarantee for the intended experience to occur, as the designer cannot control all variables e.g. the context the product is encountered (Forlizzi & Ford, 2000).

In experience design, the experience is thus not the actual end product that is designed. Conversely, it is the product, the system, the object and to some extent the context that is the subject of design - and thus the designable. Great experiences are according to Shedroff based on proven principles and if factors that produce great experiences are to some extent documented and known, it is possible to reproduce the effect (Shedroff,). In other words, it is designable. In this specific sense, it is thus possible (indirectly) to design experiences - or to design *for* experiences - and with a certain probability to control and predict the experience produced as an effect. Which is the whole rationale behind experience design as activity and profession.

Thus, it can be argued that the conditions for a transmedia experience to occur involves the three major components of transmedia: storytelling, worldbuilding, and participation that expand across multiple digital and/or physical platforms, and how well the multiplatform media is designed with rich possibilities to interact and participate in different contexts. According to this study's area of interest, the primary context is exhibitions, and therefore, the state of exhibitions is elaborated in the following section.

2.4. EXHIBITIONS

Exhibitions around the world and specially in Denmark are in a process of deep transformation as a result of the technologically mediated forms of communication (Drotner, Dziekan, Parry, & Schrøder, 2018b).

As already mentioned, the contemporary world of exhibitions has already entered the experience economy and is increasingly challenged by an array of other commercial organisations for visitors and tourism (Macdonald, 2002; Rudloff, 2016; Skot-Hansen, 2008, 2009). Today, exhibitions are not only seen as knowledge institutions, but also to a greater extent as experience centres and attractions. Before, the exhibition encounter started at the entrance of the exhibition and ended at the exit, now it might well start on a blog post, continue on social media or Wikipedia sites during the visit, and end on a site like TripAdvisor. Although these are not directly a part of the physical visit, they are however, a part of the exhibition experience (Kidd, 2014). Thus, the exhibitions have expanded across physical walls and their official websites. In this situation, the exhibitions have had to sharpen their focus on the experience aspect in direction demanded by visitors (Skot-Hansen, 2008, 2009). As such, the past two decades uptake of multiple media technologies starting from film and audio guides to a wide spectrum of media technologies such as smartphones, has marked the exhibition experience (Drotner, Dziekan, Parry, & Schrøder, 2018a). The phase after digitalisation (e.g. administrative processes and remediation of content) is characterised by a more thorough and mature integration of digital content in exhibition practices (Parry, 2013), which among other things facilitates new kinds of exchanges between the exhibition and its visitors. Thus, the exhibitions have evolved into distinctively multiplatform entities that have capability to converge the whole

media ensemble into a combined experience in a particular place and space (Drotner et al., 2018a). Angelina Russo describes contemporary exhibition as a "media space" (Russo, 2012). Although, "[exhibitions] are not media, but without media there would be little left of [exhibitions] as we have come to know them." (Drotner et al., 2018a).

The integration of digital technologies into exhibitions began in 1990s and can thus still be considered a new trend (Drotner & Laursen, 2011). Today, in an exhibition experience, it is impossible to avoid interacting with a wide range of digital technologies. However, the demand for new digital experiences by the exhibition visitors is continuing in conjunction with continuous arrival of new digital technologies. Thus, the exhibitions still has an uptight focus on developing digital experiences that can create new forms of engagement, knowledge dissemination, and interaction (Drotner et al., 2018b). This focus can also be found both in national and international investments on digital experiences in exhibitions (Heath & Lehn, 2008, 2010; Olsson & Svensson, 2013; "Our Museum," 2019; Velux, 2018). However, despite the increased awareness and substantial support, there is still only limited research on how visitors understand, apply and respond to these new digital offers (Heath & Lehn, 2008; Olsson & Svensson, 2013). Thus, there is also increasing criticism of the great focus on digital technologies rather than on the content that is to be communicated (Drotner et al., 2018b; Drotner & Laursen, 2011), which leads to a trade between experience and enlightenment. Enlightenment is the heart of the exhibitions' function; however, a recent experience discourse points to the cultural institutions, including the exhibitions, as brands operating in a competitive market. Here, the potential lifestyle of potential visitors will be essential to maintain interest in these cultural offerings (Drotner & Laursen, 2011).

The exhibition researchers John Falk and Lynn Dierking have for many years researched the exhibition experience, and their studies have shown that the way in which visitors perceive and use the exhibition depends very much on their previous experiences, motivations and expectations (Falk & Dierking, 2016). In other words, there are as many exhibition experiences as there are visitors, and each exhibition visit can in principle lead to a new experience. However, this does not mean that there are no predominant ideas about what a good exhibition experience is. In much literature about postmodern exhibitions, visitor experience is justified as a central element in the exhibition's objective. As such, in a survey conducted by the Danish Agency for Culture in 2014 and published in 2015, it is assessed that visitors are very satisfied with experiences at both exhibitions and cultural institutions in a national perspective (J. T. Jensen, 2015). However, it is noted that one of two core services that visitors consider least satisfactory is active participation (J. T. Jensen, 2015).

The exhibition practitioner Nina Simon argues that exhibitions these years are met by audiences that request participation. She points out that:

"There's a major shift going on in [exhibitions] around opening up authority and ownership, propelled by the rise of the social web and visitors' expectations of greater participation and involvement." (Simon, 2010b)

Nina Simon describes in her book 'The Participatory Museum' various ways in which museums can support and benefit from participatory culture (Simon, 2010a). Simon operates with four categories of museum projects that invite participation: contributory, collaborative, co-creative and hosted.

Projects that are contributory let visitors contribute very specifically to actions or objects within a framework set by the exhibition. Projects that are collaborative let visitors contribute to actual development of projects. Projects that are co-creative not only allow visitors to contribute to development of projects, but also to the objective of the projects. Finally, projects hosted by visitors use part of the exhibition's resources for visitors' own projects.

Simon's description of the attendant visitor can be seen as part of both a digital and analogue participation (Carpentier, 2011b; Jenkins, 2006) and at the same time some calls it a 'dialogic turn' (Gómez, Puigvert, & Flecha, 2011; L. Phillips, 2011). This development reflects a general shift in focus in the exhibitions' practice, where the exhibitions have moved from being concentrated around their exhibit collections to become visitor-oriented (Christensen, 2009; Hooper-Greenhill, 2012; Larsen & Ingemann, 2005; Rudloff, 2013).

The participatory museum is a place where visitors can create, share, and achieve social ties based on the exhibition's content (Simon, 2010a). However, Jenkins says "not every member must contribute, but all must believe they are free to contribute and that they will be appropriately valued" (Jenkins et al., 2009).

Summing up, both the technological development and the increased demand for involving experiences through engagement and participation have disrupted and are disrupting the exhibition practice. Thus, several studies have been conducted addressing both exhibition practices from an organisational and cultural perspective and how specific technologies affect visitors during an exhibition from a design and evaluation perspective. Studies concerning organisational and cultural perspectives offers e.g. insights about on-going changes disrupting exhibition practices (Janes, 2009; lang, Reeve, & Woollard, 2006), additionally, some studies explore the relation between organisational practices and design (Hosker, Knowles, & Rodger, 2014; Mason, 2015; Roberts, 2015). Specifically, Ciolfi (2012) and Hosker et al. (2014), discusses the benefit in involving the exhibition practitioners in the design process with their perspective and competences to create more sustainable solutions. In general, these studies focus on management practices and the relation between organisation and exhibition practitioners' competences. Another set of studies focuses on the role of exhibitions in society as knowledge institutions and how visitors

approach the exhibition (Crowley & Jacobs, 2003; Falk, 2013). Finally, last set of studies explores how the exhibitions can use visitors to innovate curatorial practice (Lischke et al., 2014; Simon, 2010a).

Studies concerning design and evaluation perspectives offer insights e.g. into interaction design specifically on how visitors engage with digital technologies in exhibitions (Drotner, 2011; E. Hornecker, 2008; Eva Hornecker & Stifter, 2006), and how these technologies can substantiate learning or support visitor activities in exhibitions (Apostolellis & Bowman, 2015; Danielak, Mechtley, Berland, Lyons, & Eydt, 2014; Muise & Wakkary, 2010). In general, these studies focus on how digital technologies facilitate visitors' engagement and knowledge acquisition. Another set of studies has a more methodological focus on the design process of digital exhibits and the value of participatory design (Ciolfi, 2012; Dindler & Iversen, 2009; Hall & Bannon, 2005; Iversen & Smith, 2012; McCaw, Oliver, & Glen, 2014). In general, empowering visitors is a common goal of these studies. Few studies focus on guided tours, especially on the interaction between visitors, guides and visitors, and the exhibition space (Best, 2012; Pierroux, 2011), and some discusses the possibilities with digital technologies to enrich guided tours with more opportunities for interaction (Best, 2012; Dysthe, Esbjørn, & Bernhardt, 2012; Marchetti, 2016). More comprehensive studies into exhibition experience are conducted by Falk and Dierking (2016). The potential of transmedia storytelling in exhibitions are presented by Jenny Kidd (2014, 2018), and a more recent companion focus on mediated communication through digital platforms in exhibitions (Drotner et al., 2018b).

The recent studies within exhibitions provides a partial and complementary picture of the complex changes affecting contemporary exhibition practice. However, being a learning environment or an educative space still remains a major purpose of contemporary exhibitions. Another aspect getting increased importance is visitor-oriented experiences that can be argued to encapsulate involvement, engagement and participation.

The review also reveals the limited knowledge regarding transmedia in exhibitions that can interweave a coherent experience across multiple physical/digital platforms. In the book 'Museums in the New Mediascape: Transmedia, Participation, Ethics' and in 'The Routledge Companion to Transmedia Studies', Jenny Kidd (2014, 2018) discusses the increased possibilities transmedia can have in an exhibition context and offers an overview of its potential use-value, which also substantiates this study's working hypotheses. But there are very few studies that actually implement transmedia in an exhibition context to validate its use-value. Buysch and Kaa (2016, 2018), explore a method to measure the effect of transmedia storytelling based on tracking online touchpoint for a coherent narrative, but which does not include offline activities or physical locations.

2.5. TRANSMEDIA IN EXHIBITIONS

The exhibitions have evolved to use multiple media platforms and technologies to communicate their content online and offline. Therefore, they can be broadly understood as already transmediated. However, it can be argued that the content is incongruous and overlapping which resembles a more crossmedia characteristic rather than a transmedia characteristic.

Understanding the exhibition experience as a transmedia experience invokes a number of ways to interweave a coherent experience with multiple entry points across multiple media platforms and digital technologies that blur the boundaries between online and offline, audience and producer, and also invite participation (Kidd, 2014). Scolari (2016, 2018) demonstrates that transmedia also has the quality to be a learning space for different groups, which is substantiated by Jenkins (2010b). There is an emerging scholarship about transmedia in educational environments, which also fortifies the exhibitions that have a similar agenda (Rodríguez-Illera & Castells, 2014). Concordantly, Tárcia (2018) argues that offline extensions are extremely important in transmedia educational projects. Thus, transmedia has the quality to cover the requirements such as being educative through dispersed learning and collaboration, involving through digital technologies and participation, and coherent through interconnecting different exhibits and their content both in and outside the exhibition. However, this does not come without challenges. Henry Jenkins has warned that "the more a media producer moves in this direction, the greater the challenges of coordination and consistency become" (2011). This is an important fact to be aware of, as contemporary exhibition organisations are already affected by restricted resources and, therefore, the ambition of transmedia concept must not be greater than the resources to maintain it. Without maintenance it might become incoherent and an example of 'chaotic storytelling' (J. McGonigal, 2011), which complicates participation as it becomes hard to make sense of (Løvlie, 2011). Even though the experience is designed to be simple and straight forward with compelling reasons to participate, it is still a challenge to motivate people to engage (Bourdaa, 2013; Jones, 2012).

As such, there are many assumptions based on existing literature about the effect a transmedia experience can contribute within an exhibition context. However, these are not scientifically proved in an exhibition context. As such, knowledge regarding transmedia design, implementation, and evaluation processes is very limited at the present state-of-the-art in an exhibition context. Thus, knowledge is needed to design and implement a transmedia experience in an exhibition context that caters for the requirements of the exhibition organisation being an involving and educative exhibition experience. Concordantly, knowledge regarding organisational implementation and analytical knowledge regarding measuring transmedia initiatives is also needed to identify the value of a transmedia experience in an exhibition context. Following chapter details the research framing.

CHAPTER 3. RESEARCH FRAMING

This chapter frames the research by presenting the research question and the derived work questions. Following this, an overview details conducted studies, a timeline illustrates start and end times of studies, and finally derived research papers are presented.

3.1. RESEARCH QUESTION

In correlation with the literature review, the primary objective is to generate new theory, methods, and techniques for designing, implementing, and evaluating an involving and educative transmedia experience in an exhibition context, which bridges the pre- and post-experience with the actual visit. This objective is formulated as the following research question.

---

*What are the theoretical, methodical, and analytical conditions
for designing, implementing, and evaluating an involving and
educative transmedia experience in an exhibition context
pre-, during- and post-visit?*

The research question introduces four research perspectives that result in the following related work questions:

Designing – resulting in the following work question:
What characterises the design of an involving and educative transmedia experience in an exhibition context?

Implementation – resulting the following work question:
How can an involving and educative transmedia experience be implemented in an existing exhibition context?

Evaluation – resulting in the following work question:
Which standards and techniques can be used to evaluate the quality of an involving and educative transmedia experience in an exhibition context?

Organisation – resulting in the following work questions:
What are the conditions and dependencies between design, implementation, and evaluation of an involving and educative transmedia experience in an exhibition organisation?

Which new processes and organisational initiatives are required to realise a transmedia experience in an exhibition context?

The work questions shall be seen as different research areas (parts) that during the project where unfolded in a hermeneutic research process with the project's general problem as a whole.

3.2. RESEARCH OVERVIEW

The research project consists of five major studies and six derived research papers. Studies and related papers are shortly presented through the following table (Figure 5). The table contains a summary of the individual studies, their contributions according to the four research perspectives, and the derived papers. Studies were selected based on the strategy, motive, and tasks of the Oceanarium, and to examine the various work questions to cover the area of interest in relation to the research question. Thus, each of the derived papers uncovers a significant part of the research and, thereby, in combination with the individual studies, contributes to a hermeneutic whole in answering the research question. In practice, the research project was a long organisational implementation that took place through the individual studies B-E. The order in which the studies are presented follows the chronological process of which they were initiatated.

STUDIES	PERSPECTIVES	PAPERS
Study A: Storytelling Focus on reviewing the discourse of transmedia storytelling and identifying the design criteria for a transmedia experience that can be used in an exhibition context.	Design	**[Bridge Complexity]** Bridge Complexity as a Factor in Audience Interaction in Transmedia Storytelling
Study B: Worldbuilding Focus on interweaving a cohesive universe for an existing exhibition (Oceanarium)	Design, Implementation, Organisation	**[Fruitful Gaps]** Fruitful Gaps in Digital Literacy: Interpreting gaps in digital literacy among stakeholders in collaborative design research projects as an evolving innovative capacity
Study C: Participation Focus on how to motivate visitors to participate and engage in content creation during the visit, which also add pre- and post-visit value for both visitors and the exhibition.	Design, Implementation, Evaluation, Organisation	**[Transmedia Exhibition]** A Heuristic for Improving Transmedia Exhibition Experience **[Applied Gamification]** Applied Gamification in Self-Guided Exhibitions: Lessons Learned from Theory & Praxis **[Fruitful Gaps]**
Study D: Experience Focus on creating a transmedia experience at the exhibition, where the relation between enlightenment and experience are explored.	Design, Implementation, Evaluation, Organisation	**[Exhibition Design]** Balancing Enlightenment and Experience in Interactive Exhibition Design **[Fruitful Gaps]**
Study E: Mobile Technology Focus on self-facilitated exhibition experience through the use of a mobile technology	Design, Implementation, Evaluation, Organisation	**[Exhibition Systems]** Towards Designing Self-Facilitated Systems for Exhibition Sites **[Fruitful Gaps]**

Figure 5: Overview of individual studies, related research perspectives, and derived papers.

3.3. RESEARCH TIMELINE

The section presents the time distribution of the individual studies including the stay abroad through a timeline chart in figure 6.
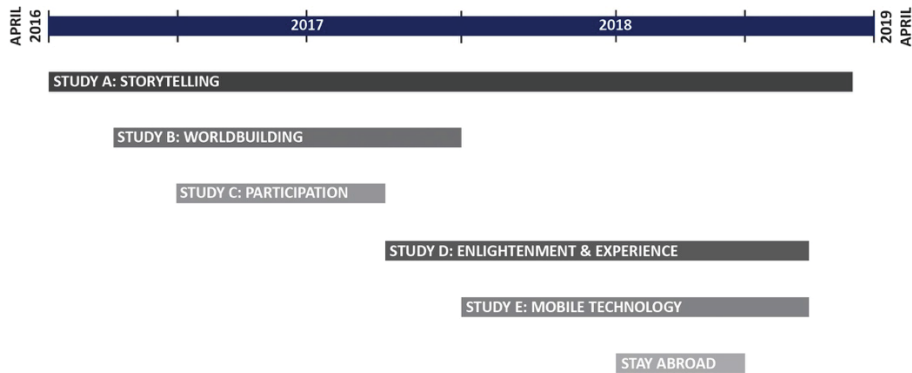
Figure 6: Time distribution of the individual studies and the stay abroad.

The timeline chart presents an overview of the research project and when each study started and ended. Study A is a literature review combined with a theoretical framing of transmedia and exhibitions, which has been continuously updated throughout the entire project period. Study B was the first activity after project start and a few months later, study C was initiated and ran alongside study B. The activities in Study D, were initiated before start of my Ph.D. project, but I got involved from 2017. Initial start-up meetings for study E were conducted in mid 2017 and the actual activities began in ultimo 2017. From February 2018 until April 2018 I was at RMIT University in Melbourne and from April 2018 until July 2018 I was at Griffith University in Brisbane; both were part of my research stay abroad.

3.4. RESEARCH PAPERS

This section presents the contributions of research papers, which consist of practical information, publication channels' ranking level maintained by the Ministry of Higher Education and Science in Denmark (2019), and Mathiassen (2017) framework for research publications is used to structure paper descriptions. The order of papers reflects the main movement of my studies. See appendix 7.1 for signed co-author statements.

3.4.1. PAPER 1: BRIDGE COMPLEXITY

Title	Bridge Complexity in Transmedia Storytelling
Authors and distribution	Selvadurai, V. (50%), Vistisen, P. (30%), Binns, D. (20%)
Review Status	Submitted
Publication Channel	Journal of Asia-Pacific Pop Culture (JAPPC)
Ranking Level	N/A
Number of Words	8059 (16 pages)
Area of Concern	Audience motivation to travel across multiple media platforms
Problem Setting	The mechanics in play to motivate the audience to follow a story or non-story content across multiple media platforms are largely ignored
Research Question	How do different bridges facilitate audience action in transmedia concepts?
Theoretical Framing	Framed with transmedia literature and an analysis of state-of-the-art transmedia properties
Methods	Desk Research
Contribution	This paper introduces the term 'bridge complexity' that facilitate three different audience interaction: storyworld, storyline, and character bridges to connect multiple media platforms in transmedia projects of any size. This adds to the body of knowledge in transmedia design, by suggesting different ways of bridging between media platforms.

Figure 7: Bridge Complexity in Transmedia Storytelling.

3.4.2. PAPER 2: TRANSMEDIA EXHIBITION EXPERIENCE

Title	A Heuristic for Improving Transmedia Exhibition Experience
Authors and distribution	Selvadurai, V. (70%), Rosenstand, C.A.F. (30%)
Review Status	Published in 2017
Publication Channel	The Design Journal – (Taylor & Francis Online)
Ranking Level	2 (High)
Number of Words	3663 (8 pages)
Area of Concern	Visitors involvement in a transmedia experience in an exhibition context, that spans the pre-, during- and post-experience
Problem Setting	There is a lack of knowledge in designing transmedia experience in an exhibition context that links the pre- and post-activities to the actual visit.
Research Question	How to involve visitors in a transmedia experience for an existing exhibition, which bridges the pre-, during- and post-experience?
Theoretical Framing	Framed with literature about exhibitions and transmedia
Methods	Research-through-design, Action Research, Case-study of visitors, Statistical Data, Observational Studies
Contribution	The paper shows that conventional communication methods are less effective according to the effect of presenting visitors' experience as an entry-point. The study also identifies a link between content and platforms, thus formulating a heuristic for transmedia exhibition experiences: The more platform complexity, the less content complexity. The study was measured through quantified digital data that contributes to existing research on transmedia in an exhibition context, which focuses on the design category. To this point, the paper argues for a more data-driven design for a transmedia experience in an exhibition context.

Figure 8: A Heuristic for Improving Transmedia Exhibition Experience.

3.4.3. PAPER 3: APPLIED GAMIFICATION IN EXHIBITIONS

Title	**Applied Gamification in Self-Guided Exhibitions: Lessons Learned from Theory & Praxis**
Authors and distribution	Vistisen, P. (45%), Selvadurai, V. (35%), Krishnasamy, R. (20%)
Review Status	In Press
Publication Channel	Gamescope – Aalborg University Press
Ranking Level	1 (normal)
Number of Words	9852 (20 pages)
Area of Concern	Onboarding visitors into engaging with digital experiences during their visit.
Problem Setting	There is a lack of knowledge about motivating and onboarding visitors into participating and using designed digital products and services in an exhibition context during their visit.
Research Question	How can applied gamification in an exhibition context facilitate and engage the visitor's experience?
Theoretical Framing	Framed with literature about exhibitions and gamification
Methods	Research-through-design, Action Research, Case studies, Observational studies, Statistical Data
Contribution	The paper identifies that there is something about extrinsic motivational properties at play in persuading visitors to use digital experience layers including digital services. As such, this paper contributes new knowledge to the existing body of research; namely gamification as a method to target adoption and usage of services.

Figure 9: Applied Gamification in Self-Guided Exhibitions: Lessons Learned from Theory & Praxis.

3.4.4. PAPER 4: BALANCING ENLIGHTENMENT AND EXPERIENCE

Title	**Balancing Enlightenment and Experience in Interactive Exhibition design**
Authors and distribution	Vistisen, P. (40%), Selvadurai, V. (40%), Jensen, J.F. (20%)
Review Status	Submitted
Publication Channel	Chi Play 2019 (by ACM SIGCHI)
Ranking Level	2 (High)
Number of Words	6973 (10 pages)
Area of Concern	Enlightenment and experience in an exhibition context
Problem Setting	There is a tension of traditions in balancing enlightenment and experience in an exhibition design
Research Question	How can experience and enlightenment be balanced in gamified digital exhibition design? Can gamified interactions facilitate not only joyful experiences, but also didactic enlightenment for visitors?
Theoretical Framing	Framed with literature about enlightenment and experience in museum research and interactive exhibition design.
Methods	Statistical Data, Observational Studies, Interviews
Contribution	The paper demonstrate demonstrates how attempts to deliver purely fact-based information through didactic design elements fail to succeed in engaging visitors, while a more informal delivery through embodied interactions with content sparks enlightenment about the subject matter. Thus, interactive exhibition design needs to balance the traditions, by allowing for other types of enlightenment than authoritative fact delivery, while gamified installations should also not transcend into straying too far away from communicating a message about the subject matter. From this, the paper contributes with guiding principles for balance, between experience and enlightenment in gamified exhibition designs.

Figure 10: Balancing Enlightenment and Experience in Interactive Exhibition design.

3.4.5. PAPER 5: EXHIBITION SYSTEMS

Title	Towards Designing Self-facilitated Exhibition Systems
Authors and distribution	Krishnasamy, R. (40%), Selvadurai, V. (40%), Vistisen, P. (20%)
Review Status	Manuscript in preparation
Publication Channel	JOCCH – (ACM Journal on Computing and Cultural Heritage)
Ranking Level	2 (High)
Number of Words	10158 (20 pages)
Area of Concern	Digital systems that can support users in self-facilitated exhibitions.
Problem Setting	Mobile self-facilitated exhibition design is still challenging to implement successfully – not creating the digital component itself, but rather to make it useful, usable and desirable enough to ensure a widespread use by visitors.
Research Question	With current trend in digital technologies, is it possible to design self-facilitated exhibition applications to become useful, usable and desirable for the user? What then are the criteria for the content of mobile exhibition applications to best engage the visitors? How can (perceived) requirements and key challenges, seen from the institution, better be aligned with the actual (realised) user experience of visitors? What are the perceived key challenges?
Theoretical Framing	Framed with literature about mobile guides and exhibitions
Methods	Observational Studies, Focus Group Interviews
Contribution	The paper point toward design insights that should be taken into careful consideration, regarding the physical setting, the content and how the user's interaction with the exhibition can result in an enriched experience.

Figure 11: Towards Designing Self-facilitated Exhibition Systems.

3.4.6. PAPER 6: FRUITFUL GAPS IN DIGITAL LITERACY

Title	**Fruitful Gaps in Digital Literacy: Interpreting Gaps in Digital Literacy among Stakeholders in Collaborative Design Research Projects as an Evolving Innovative Capacity**
Authors and distribution	Selvadurai, V. (40%), Vistisen, P. (30%), Rosenstand, C. A. F. (30%)
Review Status	In Press
Publication Channel	The Design Journal
Ranking Level	2 (High)
Number of Words	5058 (10 pages)
Area of Concern	Digital literacy among stakeholders in a collaborative design research project.
Problem Setting	There is a lack of knowledge of the role of literacy in the fast and ever-changing digital design research programs, and how participants evolve digital mindsets.
Research Question	How do collaborative design research projects establish a shared digital literacy over time?
Theoretical Framing	Framed with literature about digital literacy and co-design
Methods	Case Studies, Focus Group Interview
Contribution	The paper contribution is a synthesised outline of a methodology for optimising digital co-design practice arguing the dynamic gaps to be a precondition for a mutual long-term cultivation and growth of digital literacy, where gradual catch-up between researchers and practitioners leads to gradual increase in organisational innovation capacity. Thus, the gaps are to be seen as the strongest value propositions of co-design concerning digital technology.

Figure 12: Fruitful Gaps in Digital Literacy: Interpreting Gaps in Digital Literacy among Stakeholders in Collaborative Design Research Projects as an Evolving Innovative Capacity.

This chapter framed the research with the research question, work questions, overview, timeline, and presented the paper contributions. Next chapter details the research approach.

CHAPTER 4. RESEARCH APPROACH

The purpose of this chapter is to span the foundation to answer the research question as clearly as possible with collected data. As such the research approach details the broad construction of research to the narrow procedures of methods.

In organising my research approach, I have been using the three components of research aspects, as presented by Creswell (2014); 'philosophical worldview', 'research design', and 'research methods'. First component is philosophical worldview, which is the philosophical paradigm used as optic upon researched. Second component is research design; i.e. types of research strategies within the three choices; quantitative, qualitative, and mixed methods, which provide a specific direction for procedures in research design. Third component is research methods employed in conducting the strategies and involves forms of data collection, analysis, and interpretation that are proposed for the studies (Creswell, 2014).

I use Creswell's (2014) framework to describe the relationship between different components of my research approach, as presented in this chapter. As a whole the research approach can be expressed in Creswell's framework like this (Figure 13):
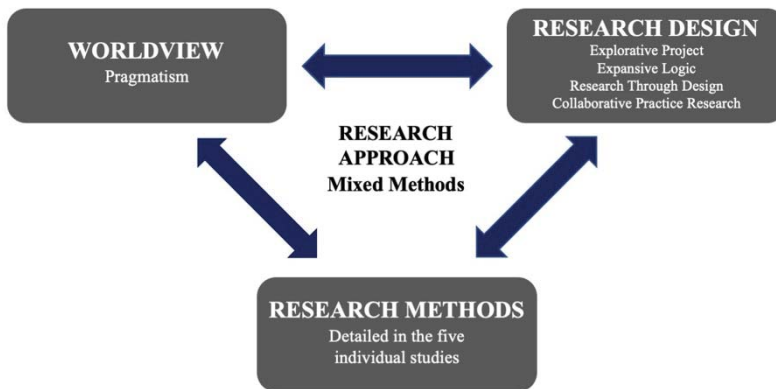
Figure 13: A framework for research – The interconnection of worldview, design and research methods, redrawn from (Creswell, 2014).

The arrows in the framework show the interconnection between different components – how my philosophical worldview influences the choice of research design, that spans the foundation for choosing specific methods for the individual studies and finally, how the three components establish substance for the research approach.

This chapter is structured around these three components, and the interaction between them. I will start by explaining my philosophical worldview being pragmatism, in line with the research project's practice-oriented focus. Following this, I introduce the fundamental aspects of research design being an exploratory research project that seeks to identify key variables within the area of interest with an expansive research logic, where the area of interest is explored through a series of individual studies, that collectively expand the existing body of knowledge. Specifically, knowledge is generated through a design research following the principles of research through design, where the area of interest is studied through designing, implementing and evaluating solutions in collaboration with practitioners in practice. Since this in an industrial Ph.D. project that presupposes both general and in-depth knowledge about practice, and the area of interest demands a high level of interaction between practice and research to answer the research question, collaborative practice research is chosen as the strategy to collect empirical data through an array of different methods. Thus, substance of the philosophical worldview and research design opens the door to multiple methods, as well as different forms of data collection and analysis. This leads to explaining the research having a mixed methods approach, that collects both quantitative and qualitative data to investigate the research question, and call for real-life contextual understandings, multi-level perspectives, and cultural influences. Further to this, I explain the criteria for evaluation leading up to the third component, where I describe the research methods of the five individual studies, labelled 'study A-E'. Here, I seek to describe how studies were conducted, what data they produced, how data was treated and finally, how it contributes to the body of knowledge in the area of interest.

As I mentioned, I will start by explaining my worldview being pragmatism. The question arises as to what types of research purposes can justify a pragmatic standpoint.

4.1. WORLDVIEW

Worldview consist of philosophical assumptions we make about the world and our acquisition of knowledge about it. The meaning of worldview is "a basic set of beliefs that guide action" (Guba, 1990, p.17). Creswell (2014) describes worldview as "a general philosophical orientation about the world and the nature of research that a researcher brings to a study". Others defines them as paradigms (Lynham, Lincoln, & Guba, 2011; Mertens, 2010); epistemologies and ontologies (Crotty, 1998), or broadly conceived research methodologies (Neuman, 2009).

The concept of worldview can be understood as a series of philosophical assumptions about the world and its nature as well as our way of acquiring and creating knowledge and validating the result through justification. There are different worldviews that can be brought to inquiry, but the following four are the most widely discussed in the

literature: post-positivism, constructivism, transformative, and pragmatism (Creswell, 2014).

Post-positivism challenges traditional positivism's notion of absolute truth of knowledge and fortifies quantitative research more than qualitative research, where standards of validity and reliability are important. Unbiased objectivity is an essential aspect of the philosophy (D. C. Phillips & Burbules, 2000). In constructivism, scientific theories are shaped by their social context, where objective facts play a small role and social factors play a major role. The approach is typically qualitative research (Crotty, 1998). The transformative view supports marginalised people by placing the central importance on the study of their lives and experiences. The philosophy links political and social action to inequities based on gender, race, ethnicity, disability, sexual orientations, and socioeconomic class that result in asymmetric power relationships. Finally, pragmatic philosophy is highly practice-oriented and focuses on actions, situations, and consequences and not on an abstract concept of truth (Patton, 1990). The philosophy is; what works in practice is the correct perception of reality. Pragmatism strives for more, better or new knowledge and can provide a significant systematic contribution to understanding practice (Holm, 2018).

My worldview is grounded in pragmatism as the connected relationship between theory and practice, which is a constant factor in my research project. Furthermore, the ambition is not only to become wiser but also to be embodied in practical results. As such, pragmatism has been used in two ways in this research project. On the one hand, I am grounded in a pragmatic view of acknowledgement, knowledge acquisition, and learning. On the other hand, the study is pragmatically analysed, which investigates what works in practical creation of a transmedia experience in an exhibition context. The pragmatic philosophy is, however, not an overall mindset and has, to some extent, inconsistent assumptions between its contributors. Therefore, I will explain some of the key pragmatic concepts in which I base my paradigmatic grounding for this research project. The nature of my research mostly follows the pragmatic philosophy of John Dewey (1938, 1998, 2004, 2005), which is described further in the following.

4.1.1. PRAGMATISM

Pragmatism emerged in the United States after the American Civil War (1861-1865), and its most important classical representatives, for the same reason, are all Americans, namely Charles Sanders Peirce (1994), William James, (1992) and John Dewey (1938). This does not mean they agree on all questions. However, they share the view that the world is not just unchangeable and eternal but is characterised by constant change because of its dynamic size where coincidences and chaos influence its evolution. Therefore, pragmatic understanding of science is based on the sceptical view that we cannot find an eternal and unchangeable 'truth' about the world (Brinkmann, 2006; Dewey, 1998, p.8). The nature of *truth* is temporary, which is the

key aspect that regards the world as being 'emergent' and never fully realised (Shalin, 1989). This also has consequences as Dewey (1998) specifies; when the world is constantly changing and, therefore, no truth applies absolutely, there is no statements that is absolutely right or wrong. However, in their opinion it does not imply that any statements about the world may be of equal value. It is the practical consequences, and implications of a proposition (e.g. a theory) that shows its *truth* when tested empirically (Rylander, 2012), which Charles Sanders Peirce calls 'Pragmatic Maxim' (Peirce, 1994). In pragmatism we only acknowledge the world and its attributes through practices where the fundamental practical action in the world derives theoretical reflection (Brinkmann, 2006, p30; Dewey, 1922, p.69, 2005, p34). Traditional science considers *truth* towards cause-and-effect pattern about 'what-is' in the world (Goldkuhl, 2011). In the pragmatic account, the *truth*, designates itself as 'justified' if it is effective, works, or benefits satisfactorily in a given practice (Birkler, 2005, p.33-37; Rylander, 2012). In practice, it is where claim of *truth* can be substantiated. Thus, value of *truth* is determined by whether the original problem has been resolved, or if the problem situation has been changed.

In Dewey's (1938) pragmatic optic, 'situation' is an important concept, as all issues are connected to a specific situation and cannot be understood separately. Theories are in this perspective "... problem solving tools in relation to concrete and situational problems" (Brinkmann, 2006, p.36). Shalin (1989, p.109) describes *situation* as "brimming with indeterminacy, pregnant with possibilities, waiting to be completed and operationalised". Indeterminacy is understood as a perceived tension or a problematic state of a situation, which qualifies the instigation of an inquiry with the aim of transforming it to a determinate situation (Dewey, 1938, p 108). Thus, the inquiry starts with encountering the indeterminacy of the situation, which leads to establishing hypotheses (e.g. possible explanations) of how the *situation* could be transformed towards a determinate situation (Dalsgaard, 2014). This is where pragmatic version of scientific process gives rise to abductive sensemaking. Abductive sensemaking is based on qualified guesses - based on, for example, existing theory, the researcher's intuition and experiences - or jumps from theory to practice, to examine these hypotheses in practice through different methods, techniques, and procedures to see their effectiveness in moving the indeterminate towards being more determinate (Holm, 2018, p.65; Rossman & Wilson, 1985). For example, this research project was initiated with working hypotheses, based on existing knowledge and experiences, which are examined in practice (Oceanarium). If the situation is moved towards determinacy, the hypotheses are proved effective and become a temporary 'fact of existence' (Dalsgaard, 2014). The result or conclusion of an abductive approach, as opposed to a deductive approach, may also end up false, even though the premises are true (Kolko, 2010; Peirce, 1998, p.227). Regardless of whether something (e.g. outcome or the result) is considered relatively good or bad, Dewey was convinced that there is always room for improvement (Brinkmann, 2006).

My inquiry of transmedia experience in an exhibition context can be connected to this train of thought of pragmatic process and knowledge generation. The activities in this research project all concern a problematic situation in practice - represent and explore transmedia experience in an exhibition context. This is handled by experimenting with dynamic qualities of transmedia to create a coherent experience across multiple media platforms pre-, during- and post-visit. Dewey (1910) points out that we never encounter a problem with an empty mind. As such, I entered this research project with a certain acquisition of accustomed understanding with a certain layer of previously developed meanings through my four years working period at the Oceanarium. During this period, I worked closely with the management, all departments and its staffs on various projects for the exhibition. I also supervised several student projects from Aalborg University that had the Oceanarium as their case. Following this, I participated in examining the smartphone application 'North Sea Moviemaker' in the exhibition, which was conducted in connection with Visitisen's (2016) Ph.D. project that was partly funded by the Oceanarium. During my master's study my focus was, as mentioned, on transmedia experiences in the semester projects, which also became my master's thesis subject (Selvadurai & Nielsen, 2012). The experience acquired through my master's study and the involvement with the activities at the Oceanarium have equipped me with a set of understandings and meanings of the area of interest, the organisation, the exhibition, and its visitors. I argue that the acquired experience has guided me and the research project in establishing a strong relationship with practice, which reduced the challenges in anchoring the project in the organisation.

It has been a philosophy that the organisation had to take ownership of the project and be rooted in management to achieve an effective result. Therefore, the research is conducted through active participation with practitioners in practice. To align research and practice goals, anchor the project in the organisation, and manage the processes, a steering committee was formed with the managing director, chief of marketing and the chief of exhibition from the Oceanarium, including the university supervisor and myself as the researcher. Except through my research stay in Australia, the committee meetings were held every third month, where ongoing activities were discussed, completed activities were evaluated, and new activities were initiated. One of the important pragmatic functions of the steering committee was to secure organisational commitment and ownership, and to have a platform for organisational implementation due to the research, regarding both experimentation and findings. As an industrial Ph.D., I did not have the organisational mandate to implement. Therefore, committee members from the Oceanarium functioned as ambassadors of the research project in their respective departments and took part in different activities with their competences. The university supervisor acted as gate keeper to retain the research focus along the activities. Almost all decisions on research and practice were made in conjunction with the committee members. Some of monthly staff meetings were also used as a platform to propagate the results and emerging activities into rest of the organisation (Appendix 6.1).

This is itself related to a pragmatic study, but it is also the process of using transmedia theories in an exhibition context in first place (Brinkmann, 2006, p.205-206; Dewey, 1929, p.84). By evaluating how transmedia theories support a coherent experience across multiple media platforms in an exhibition context, the study relies on pragmatic maxim with practice to invoke a valuable change to solve the problem in practice (Brinkmann, 2006, p.205-206; Dewey, 1929, p.84). As such, results, principles, and lessons learned are based on the evaluation of consequences instigated by the approach's interaction with practice. The validity is thus placed in practice where it enables the establishment of a proposed solution. This means that through examination of transmedia experience in an exhibition context, I have attempted to establish a temporary *truth* that is meaningful in present practice and situation. I acknowledge that this *truth* is not a final or universal claim and, therefore, any generalisation of the research results can only take place under limited conditions depending on the contextual situation, that can change as discussion about the landscape of transmedia- and exhibitions changes over time (Dalsgaard, 2014). This leads to the overall research design being categorised as an 'exploratory research project' (Shields & Rangarajan, 2013) as it does not intend to offer any final or conclusive answers to the research question, but rather explores the subject field with varying depth.

4.2. RESEARCH DESIGN

This section elaborates the strategies that provide specific directions for procedures in the research design. As such, the research design details the overall type of research to the narrow strategy of inquiry.

4.2.1. AN EXPLORATORY RESEARCH PROJECT

Exploratory research is usually conducted to study problem areas with limited or no knowledge to help develop ideas, concepts, and theories. Thus, the objective of exploratory research is to generate knowledge through identifying key issues and variables in the area of interest. This objective, distance exploratory research from descriptive research, where the key variables are defined, and explanatory research, where both key variables and relationships are defined. The difference between these three researches can be characterised by how well the key variables and their relationships are defined (Brown, 2006, p.43).

In an exploratory research, the researcher has a theoretical and experimental idea of what will be encountered but does not know how investigation will proceed or what observations that will be registered. Thus, standardised methods cannot be applied because they paradoxically require prior knowledge about the topic. The choices of methods must necessarily include methods that are more flexible with regard to nuances and individual situations, and be open to new and surprising information (Brown, 2006, p.43).

The proposed research question and work questions for this study of transmedia experience in an exhibition context aim to identify key variables needed to do more formal studies into this area of interest. As such, previous contributions, on creating transmedia experiences, as well as related contributions in the field of exhibitions, form the area of interest that my research project seeks to expand. This leads to the overall logic of this research project being 'expansive'.

4.2.2. AN EXPANSIVE RESEARCH LOGIC

Krogh et al (2015) have developed a typology of different logics in research designs, where expansive logic is one among them (Figure 14).
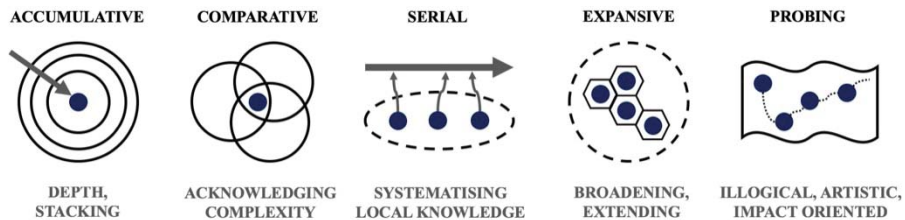
Figure 14: Krogh et al's (2015) categorisation of logic structures typically seen in design research (Redrawn version).

The expansive logic of inquiry articulates identification of as yet uncovered aspects of the research area with the ambition to reveal undefined key variables. Unlike serial logic of inquiry, expansive logic does not follow any strict successive or linear order between different studies in a research project. In other words, there is no strict adhesion concerning start of the research, its activities and the link between them. Instead of gaining deep understanding of the domain, the scope of area of interest is broadened. Experiments of this type contribute new knowledge as the area is explored. This widens the perspective and extends the concerns that should be included when further examining the field.

The studies in transmedia experience are evolving fast, as I detail in chapter 2, and the studies surrounding experience design are also comprehensive and, to a large degree, have also explored and investigated new technologies inside the domain of exhibitions.

However, as I mentioned in chapter 2 as a result of the literature review, the studies into a transmedia experience in an exhibition context, have only been scarcely addressed in previous contributions. This is either as studies into the use of different media platforms in the exhibition, or a broader critical view on transmedia as supplementing marketing tool. As such, I argue that territory of transmedia experience in an exhibition context has to be understood in its width, and thus would gain advantage from an exploratory study with an expansive logic. As such, this research

project takes off from contributions drawn by prior studies as a starting point of reference and extends the knowledge by broadening the scope of transmedia experience in an exhibition context.

Thus, studies conducted in the research project can be described as continuous exploration of key variables of a transmedia experience in an exhibition context, without any linear order or seriality between the conducted studies. The connection between the studies is established by viewing the different studies as a hermeneutic whole, which maps the expanded scope of previously unmapped area. Thus, the aim is not to map all relevant knowledge about transmedia experience in an exhibition context, but contribute with insights and lesson learned that serve to draw a more detailed map of previously uncharted areas to support further exploration. As such, the contributions as a whole to the domain of transmedia experience in an exhibition context, needs to be seen in regard to how the individual studies fit together as an expansion to the field.

As the purpose of the research project has a high focus on the process of designing a transmedia experience, the individual studies utilise the design process as a method of inquiry, where the design process itself becomes a way to acquire new knowledge (Forlizzi, Zimmerman, & Stolterman, 2009). This method of inquiry is called 'research *through* design', which is elaborated in the following section.

4.2.3. RESEARCH THROUGH DESIGN

Research *through* design originates from 'design research' and utilises the design process as a method of academic inquiry. Christoffer Frayling (1993) coined the term 'research *through* design' as a proposal to distinguish between three types of design research, one being 'research *through* design', other ones being 'research *into* design', and last one 'research *for* design'. The ambition of research *into* design is to develop detailed understanding of human activity of design or related activities. The focus is on producing theory that describes the process of design. Research *for* design focus on the outcome of different design activities to form theories that intend to advance practice of design by contributing to use of designs as unique examples – what Stolterman (2008) calls the 'ultimate particulars'. Here, the designer moves iteratively along the way to develop an ultimate particular in form of e.g. framework, method of design, or design solution, while also extracting knowledge to guide appliance of them. The focus is not how the solution necessarily solves the problem in practice, but rather how specific way of creating the *ultimate particular* evolved the design practice. Both research *into* and *for* design, refer to the outcome and the type of knowledge generated. Contrary, research *through* design is an approach to doing research, with a higher emphasis on the role of the design as a solution to a specific problem that can result in knowledge *for* and *into* design.

Research *through* design is a practice-based experimental approach that aims ultimately to reach, develop and produce new methodological and theoretical knowledge at a scientific level through the creation of design artefacts and design processes. Research *through* design allow researcher to improve the world through disrupting, complicating or transforming current state of the world by becoming actively involved and engaging with wicked problems of design (Rittel & Webber, 1973), in the attempt to make 'the right thing' (Zimmerman, Forlizzi, & Evenson, 2007). Research *through* design seeks to capture and document the reflections that make it explicitly reflective in its process of interpreting, reinterpreting, and reframing the situational problem through a process of making and critiquing the artefact that functions as a proposed solution (Rittel & Webber, 1973; Schön, 1983). As a researcher in this research project, I was involved and engaged with practice in designing an involving and educative transmedia experience in an exhibition context to produce new knowledge at a scientific level through reflecting on the design process and measuring the effect of the designed solutions.

That being said, the researcher's involvement in creation of the *ultimate particular* is a challenge to build theory – unified propositions – in research *through* design (Zimmerman & Forlizzi, 2008). Additionally, the researcher's ability to capture and document events is limited by the level of involvement, which makes it harder to obtain structured data and to validate. However, Stolteman (2008, p.59) argues, that the artefact of design research has "... the same dignity and importance as truth in science". To same extent, Buchanan's view on hypotheses in research *through* design informs "... what will be investigated and sets the relation of causes that will become the themes of subsequent inquiry." (Buchanan, 2001, p.11). The result therefore becomes the natural embodiment of the theory developed through the inquiry of the design process.

As such, the working hypotheses have been examined through different solutions that have been designed, implemented and evaluated with practitioners in practice. Thus, research is conducted through designing in collaboration with practitioners and tested by experimenting and exposing the design solution for visitors in practice. Examination of transmedia experience in an exhibition context has been subject to continuous learning from the individual studies that influenced the cause of action along the way. Thus, there is no strict cohesion between the individual studies, but rather an expansion of the area of interest about transmedia experience in an exhibition context. However, tracing the lines between the studies later reveals an overall image of the contribution that also results in contributions to research *for* design by generating 'facts of existence' on how an involving and educative transmedia experience performed under an array of interventions in an exhibition context. This can be seen as an accumulated expansion of the body of knowledge about transmedia experience in an exhibition context.

The individual design solutions in the individual studies, form the portfolio of experiential knowledge of how they supported the move from different indeterminate situations towards determinacy in practice. Thus, studies of transmedia experience in an exhibition context can be seen as a process of pragmatic experimentation consisting of multiple indeterminate design situations that creates a situation of indeterminacy about transmedia experience in an exhibition context itself. The facts on the determinate situation about transmedia experience in an exhibition context are gradually qualified through experimenting with the indeterminate situations of the individual design problems. Thus, the perspectives of research *through* and *for* design invoke the transformation of the situation from indeterminacy towards determinacy.

There are many philosophical positions in which design research can be grounded; e.g. phenomenology, neo-positivism and constructivism (e.g. Buchanan, 1992; Cross, 1999; Fallman, 2003). However, a number of contributions in recent years have suggested that design research can be grounded in philosophical tradition of pragmatism, as many of the fundamental theories of design research roots in pragmatism (Buchanan, 1992; Dalsgaard, 2014; Godin & Zahedi, 2014; Goldkuhl, 2011; Hevner & Chatterjee, 2010; Rylander, 2012; Schön, 1983). Thus, design research with a pragmatic optic opens the door for a hermeneutic process, where the effect of transmedia experience in an exhibition context is interpreted iteratively on the situation in close collaboration between practice and research (Coyne & Snodgrass, 1991). Thus, pragmatism is the reason why collaborative practice research becomes the natural choice for the research strategy, as detailed in the following section.

4.2.4. RESEARCH STRATEGY

In the research project, there is a practice related mission and a set of research goals. The ambition is to improve practice and same time add to the body of knowledge within the area of interest. Thus, the process is constantly confronted with dilemmas between practice- and research-driven goals. Hence, there is a risk that researcher becomes too involved with practical struggle and thereby weakens the rigour of the research effort (Baskerville & Wood-Harper, 1996). Therefore, it is crucial to structure and manage the process by applying appropriate methodologies to collect and archive data systematically to produce rigorous results (Nielsen, 1999; Pettigrew, 1990).

There are many research methodologies with different strengths and weaknesses to collect relevant data (Galliers & Land, 1987). However, in research projects like this, the objective is to establish a mutual beneficial relation between practice and research – a synergy, where the researcher and practitioners collaborate closely to produce relevant knowledge. This is problematic, as different rationales drive practice and research respectively. Therefore, the relationship between practice and research must be somewhat formalised, where time is spent on research in practice and practice in

research contexts. For example, in this project, the steering committee was one attempt to ensure this distribution, where 40% of time was allocated for research in practice, 40% for practice in research context, and 20% for courses and the research stay abroad.

In this process, propositions and interpretations of practise are ultimately tested through attempts to improve practise (Mathiassen, 2002, p.327-328). In other words, a deeper understanding of practise is achieved in attempt to change it. Thus, the challenge is to find practical ways to support the varied and fairly contradictory criteria of research and practice. Mathiassen (2002) with expertise in information studies, tackles the dilemmas related to fulfilling the criteria of practise and research, by detailing a research strategy called Collaborative Practice Research (CPR), where he combines three types of research methodologies; action research, practice studies, and experiments to build knowledge, see figure 15.
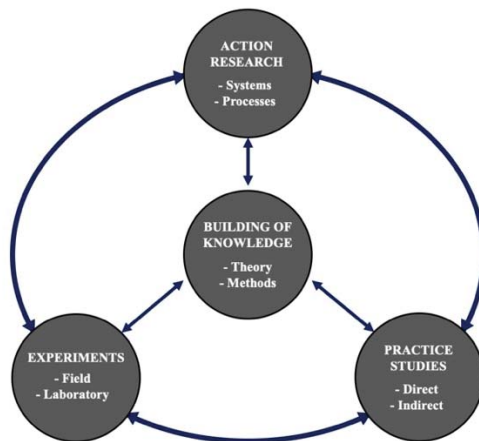
Figure 15: CPR model redrawn from (Mathiassen, 1998; Munk-Madsen, 1986; Nunamaker, Chen, & Purdin, 1990; Wynekoop & Russo, n.d.).

Following is a description of the three methodologies in CPR and how these are conducted in this research project.

> Practice Studies are intended to understand practice without researcher's direct involvement in practice. The advantage is that researcher stands outside practice, which enables researcher to focus upon practice through structured methods. The practice can be studied directly or indirectly. The direct approach, study practise through e.g. case studies and field studies, whereas indirect approach studies people's opinions and beliefs through interviews or surveys. The research process can be structured through a vast repertoire of methods that are available for researcher to study representative instances of

practice. This is the strength of this methodology. The weakness is that researcher is separated from practice, which only provides indirect knowledge (Mathiassen, 2002).

Action Research has its focus on improving practice. It gives researcher, a direct and optimal access to practice by getting involved in practical problem situations with practitioners, where research is carried out from the rationales driving practice. Action research is action- and problem-oriented, where general theories and terms are reduced to guidelines for context-specific studies. Through this methodology, no relationships between practice and research are excluded in advance. Limited support to structure the research process and findings, is the significant weakness. Thus, results are strongly dependent on how practice evolves, which makes it hard to predict and control the focus of the research outcome. Therefore, it is difficult to determine which types of data to collect because of the emerging nature of findings (Gibbons, Nowotny, Schwartzman, Seot, & Trow, n.d.; Mathiassen, 2002). In this way, action research is a radically pragmatic interpretation of knowledge creation and acknowledgement (Greenwood & Levin, 2006).

Experiments imply a direct access to practice in a controlled or partly controlled environment. It primarily supports practice through design and evaluation of artefacts that function as *ultimate particulars*. The advantage with this approach is, that experiments can be precisely designed to investigate relationships that researcher finds relevant to gather knowledge about. The experiment can be located in a laboratory environment or in a realistic setting as a field experiment. The field experiment can look somewhat like action research, as the research activity can take place in actual practice and, therefore, be viewed from both perspectives. Compared with action research, field experiments have a weaker relationship to practice, as the purpose of field experiments controls practice. This restriction creates an artificial relationship between practice and research, which provides the possibility to exclude relevant relationships in advance (Mathiassen, 2002).

CPR focuses on three different relationships between practice and research, which enable same practice to be investigated in three different research optics, where involved activities presuppose and support each other (see triangualtion in chapter 4.3). Combination of these three methodologies is the strength of CPR, as all three methodologies contribute to building knowledge of the area of interest. In this way, weakness of one methodology is compensated by strength of the other two and enables the strategy to achieve a useful balance between relevance and rigour.

As an essential basis for this research project general knowledge about transmedia experiences and exhibitions is acquired through practice studies. In-depth knowledge about transmedia experience in an exhibition context is primarily acquired through

experiments. And in-depth knowledge about the process of designing and implementing a transmedia experience in an exhibition context is primarily acquired through action research.

Practice studies about transmedia experiences consist of a literature review about the design of transmedia experiences (Chapter 2) and a desk research about transmedia experiences in practice detailed in research paper [Bridge Complexity], where an array of different cases is studied to identify core mechanics that are being used at the present time. Practice studies about exhibition and exhibition experiences are conducted at the Oceanarium through a vast repertoire of methods, such as interviews, observational studies, focus group interview, statistics, and workshops, which are supplemented with knowledge gained through participating in Our Museum's national network.

Action research studies primarily focus on organisational processes in designing, implementing, and evaluating the *ultimate particulars* at the Oceanarium. As an action researcher, I was able to follow, take part in and influence practice, where the involvement of practitioners contributed to the research process. The mutual involvement was the strength in establishing a strong integration of research and practice that supported improved practice through organisational interventions and new initiatives in the exhibition that collectively generated new knowledge. To systematically capture data, apply appropriate methods of interpretation and gradually build extensive documentation related to the research activities, action research was complemented with autoethnography as the primary research method to ensure sufficient rigour. With this method, data was collected by self-observations and reflexive investigation through questioning, listening, watching, acting, analysing, and reflecting upon gained experience, where data was logged through field notes, photos, videos, project plans, meeting summaries etc. throughout the process (Baarts, 2015), see figure 16.
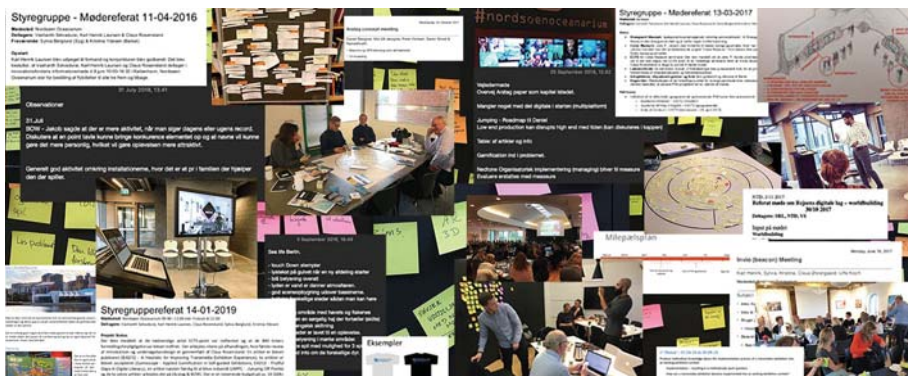
Figure 16: A collage with some of the notes, meeting summaries, photos, plans, etc.

Autoethnography is formed by 'auto', 'etno' and 'grafi'. The 'auto' gives rise to self-exploration, 'etno' focuses on the description and analysis of key events, including the inclusion of own experiences, finally, 'grafi' emphasise systematic, scientific and qualitative study that transforms personal experiences into scientific knowledge (Baarts, 2015, p.169; Ellis, Adams, & Bochner, 2011, p.273). Common to all three is that the self is the fulcrum, which is also a subject of some criticism (Ellis & Bochner, 2000; Walford, 2004). Having said that, autoethnography provides a number of opportunities in relation to exploration and dissemination, which other qualitative research cannot equally offer. In autoethnography the researcher can be fully embedded in practice and thereby become an 'anchored participant'. Autoethnography, also makes room for researcher to be embedded in practice prior the study. Instead of denying acquired knowledge on the research field, the point is to make known situations or already acquired expertise to substantiate research. Part of such a sociological inspection involves an introspection of the researcher's unique historical and biographical experience, where the significance of this for research is explored (Adler & Adler, 1987; Baarts, 2004, 2009). The peculiarity of this kind of autoethnography is that, I as the researcher, did not have to resort to the setting where the role as practitioner needed be developed. I was already familiar with the setting and an anchored participant with a preunderstanding of social and organisational forces that shape actions in the exhibition.

However, the challenge of being an anchored participant was not to become a pure facilitator, designer, or consultant that overtook the role as a researcher, rigorously collecting data. This challenge was even harder, when practitioners associated me with my previous role in the organisation more than a researcher. Therefore, I admit, that sometimes it was hard to retain the research focus and observe when facilitating or designing with practitioners. For example, in study B in the process of worldbuilding, which took place at the beginning of this research project, I was more focused on designing as I had the responsibility for the whole design process, which limited my focus on observing and reflecting through the process. However, with help of the steering committee, this expected challenge was discussed, and the responsibility to complete different design tasks where evenly distributed to the practitioners, thus making room for research focus.

The challenge of having a dual role as a participant and a researcher at the same time has been recognised by multiple researchers (Dorst, 2006; Frayling, 1993; Koskinen, Zimmerman, Binder, Redstrom, & Wensveen, 2011; Pedgley, 2007). To tackle this issue, I was inspired by Basballe & Halskov's (2012) way of distinguishing between three dynamics in research through design: 'Coupling', 'Interweaving', and 'Decoupling'. *Coupling* focuses on uniting design and research interests to establish a common point of departure, *Interweaving* focus on interplay between research and design that interweaves research and design, *Decoupling* focuses on examining research material through the analytical research optic.

Through *coupling*, my responsibility as a designer and a facilitator, were sought to align with time allocated for documenting the process. During *interweaving*, research and design goals influenced each other through the development processes with practitioners. Although, as already mentioned, during *interweaving* it was hard to stick to the aligned setup in *coupling*. Designing and facilitating usually took a lot of time and caused lack of documentation. Thus, the documentation was done in form of written summaries and photos that gave the documentation a character of post-reflection. During *decoupling* I refocused on the collected data, ordered and categorised it according to the research perspectives in the studies, which became the initial treatment in my analytical reflections. As dedicated research initiatives emerged and took form, I based my analysis on selected parts of this material. For example, in study E, the facilitation became dominant in the test experiment because of the problems that occurred during the test and needed to be solved, and which complicated the planned observational study. However, this experiment was conducted in collaboration with other researchers who audio recorded their observations, which my *decoupling* among other became grounded in for the study and the research paper [Exhibition Systems].

While examining the process through action research, the outcomes were examined through experiments. This means, while conducting the experiments, I also had the action researcher's optic focusing on the process. The collected data were substantiated through interviews of involved parties as practice studies. In the view of action research, the importance was on knowledge generation through problem solving and influencing practice. In contrast, the experiments grounded their importance in designing, implementing, and evaluating the *ultimate particular*. Action research was also intended to educate the organisation to create and manage a transmedia experience at the Oceanarium, whereas experiments sought to develop normative support to transmedia experience in an exhibition context.

Throughout this process of continuous learning, knowledge could be acquired through reflecting on the actions in two different time frames. One in action and one on action, which Schön (1983) describes as 'reflection-in-action' and 'reflection-on-action'. *Reflection-in-action* happens simultaneously with the action being performed, and *reflection-on-action* is the reflection done after the action. As already mentioned, as a result of being involved as a participator it was a challenge to capture the reflections in action during the process. In addition, software and hardware dependencies also constrained capturing reflections in action, especially in Study E, with the new CMS system for mobile application. Thus, the conducted experiments were poorly qualified to capture *reflection-in-action* in detail, which gives the documentation in the studies the character of *reflections-on-action*. Through the lens of Basballe and Halskov's (2012) dynamics, *reflections-on-actions* serves to decouple *reflections-in-actions* carried out during the process. As such, the validity of knowledge extracted from *decoupling* is determined according to the *pragmatic maxim*.

The substance of research design and the pragmatic worldview spans the methodological field in which mix of quantitative and qualitative methods are justified to examine the research problem in best possible way to answer the research question. This makes the research approach being mixed methods which is also widely associated with pragmatism as a philosophical underpinning (Morgan, 2007; Patton, 1990; Tashakkori & Teddlie, 2010). A mix methods approach is further detailed in the forthcoming section.

4.3. A MIXED METHODS APPROACH

This section looks at what mixed methods research really is, what purposes it has and why it is scientifically legitimate.

The interest in mixed methods research is increasing internationally across disciplinary boundaries. Many perceive combinations of methods as promising in terms of understanding well-known issues in new ways and exceeding the limitations of certain methods. Mixed methods research is a relatively new term that started to be described in late 80's (Brannen, 2017; Brewer & Hunter, 1989; Tashakkori & Teddlie, 1998). Mixed methods research is, however, not new and is almost as old as the empirical social sciences (Brinkmann & Tanggaard, 2015, p.198). Although, it is only recently that it has been perceived as a methodological problem to be solved, which is the reason for the late arrival of the literature. The vast majority of existing literature originates more or less directly from the American variant of the controversy concerning methods – 'the paradigm wars' (Rist, 1977). The focal point of the conflict was the incompatibility between quantitative and qualitative research, where the result was an understanding of both methods as paradigmatically different and fundamentally incompatible - a position that was firmly defended by both quantitative (J. K. Smith & Heshusius, 1986) and qualitative (Guba, 1990) oriented researchers.

The reaction of researchers who would like to combine methods, called mixed methods research into the third paradigm in addition to quantitative and qualitative paradigms (Morgan, 2007). The epistemological point of departure is American pragmatism, which rejects the validity of research in discussions about what is in the world and our ability to gain knowledge about it. On the other hand, the research and knowledge it creates will be judged on how it helps to answer questions and understand the phenomena that occupy us (Tashakkori & Teddlie, 2010). Among European researchers the understanding is that qualitative and quantitative represent different ends of a continuum and are not categorically separated (Newman, Benz, & Ridenour, 1998). Mixed methods research resides in the middle of this continuum because it includes elements of both approaches. Therefore, a study with this understanding can be more qualitative than quantitative or vice versa (Creswell, 2014). The rejection of the categorical separation as the decisive distinction has allowed mixtures that would more traditionally be perceived as mixtures of purely quantitative or purely qualitative methods (Brewer & Hunter, 2006; Hammersley,

1992). The consequence of the view is that combinations of methods are justified if they better help to answer scientific questions and that there are no significant philosophical problems associated with the mixed methods research. This position is the dominant in most of the literature on mixed methods research (Brinkmann & Tanggaard, 2015, p.199).

This research project is placed more towards the qualitative end of the continuum, because only a small amount of research exists on transmedia experiences in an exhibition context, and the existing transmedia theories do not directly apply in an exhibition context. Thus, the key variables are also unknown. The purpose of an explorative approach does not have a major focus on verifying or falsifying hypotheses. Finally, the area of interest is a qualitative field by having the experience aspect. These together point more towards a qualitative approach (Morse, 1991), where qualitative data is primarily collected through practice studies and action research. However, the qualitative data is further substantiated with quantitative data collected through the experiments. As a result, the inferences are made across both qualitative and quantitative data collected from few samples at different stages of inquiry.

Mingers (2001) has two arguments in favour of combining research methods and substantiate the reason to mix. First, the ontologically differentiated real world consist of multiple structures and events. Thus, multiple methods are needed to effectively unfold the richness of it. Secondly, research activities are part of an evolving process that proceeds through multiple stages posing different tasks and problems. It is not the purpose of research as such to decide whether to combine methods, but how to fulfil the research purpose. In this regard, there are five types of purpose for combining methods (Greene, 2007):

> **Triangulation** strives for more accurate knowledge through convergence, corroboration, or correspondence of results from different methods. It can also describe a range of estimates or a confidence interval on the correct answer. Here, different methods are used to evaluate discriminant as well as convergent validity of the same phenomenon. The purpose is to increase the validity of the results by counteracting bias.

> **Complementarity** seeks to generate more knowledge to elaborate, enhance, illustrate, clarify the results from one method with the results from the other method. Here, different methods are used to measure the overlapping and the different facets of a phenomenon. The purpose is to increase meaningfulness, interpretability, and validity of the results by reinforcing the strengths of the methods and counteract the bias.

> **Development** seeks to utilise the results acquired from one method to aid develop or inform the other method. Development is broadly construed to

include sampling and implementation, as well as measurement decisions. The purpose is to capitalise the method's strengths and thereby increase the validity of the constructs and results.

Initiation strives to discover paradox and contradiction, new perspectives of frameworks, altering the outcome from one method invoked by the results or questions from the other method. The purpose is to increase the breadth and depth of the interpretations and results by analysing them through different perspectives of different paradigms and methods.

Expansion aims to extend the breadth and range of inquiry by including multiple methods for multiple components. For example, in an evaluation context, the process is assessed through qualitative methods and the outcome is measured with quantitative methods. The purpose is to increase the scope of inquiry by choosing the methods most suitable for different inquiry components.

A procedure of a purpose can be used separately or be substantiated with another procedure to fulfil a research purpose in best possible way. As such, this research project includes and combines different procedures to investigate relationships exploratively and underpin the results through confirmatory analyses to fulfil the research purpose. To extend the scope of inquiry the procedure of *expansion* is used to uncover the three components in CPR, where the data in practice studies and action research are acquired primarily through qualitative methods and the outcome of the experiments are measured through both qualitative and quantitative methods. For example, in study D and E, the organisational implementation is measured through qualitative methods to evaluate the organisational implementation, and the design outcome is measured with quantitative methods to measure its effect.

The research activities in the individual studies are characterised by different tasks and problems and, therefore, studied with most suitable methods through the components of CPR. Here, more accurate knowledge is sought through *triangulation*, where different methods are used to investigate same phenomenon for convergent validation and, therefore, only considers those confirmed by both methods as the actual valid findings. All methods have different weaknesses, blind spots and embedded sources of error. Therefore, by using two methods that have different weaknesses, any findings confirmed by both methods will be more accurate. This is especially used to underpin the results of the experiments through practice studies and action research.

More comprehensive knowledge is sought through the procedure of *complementarity* by uncovering different facets of the phenomenon with different methods. Here, the results of different methods are perceived as an analytical supplement, which provides a more in-depth understanding of the research. The results from the experiments and

knowledge acquired through practice studies are especially useful as an analytical supplement for action research to increase interpretability and clarification. For example, in study C, the aspect of participation is investigated with different methods resulting in two different research papers [Transmedia Exhibition] and [Applied Gamification], each one having a specific perspective on motivating visitors to participate, which together creates more knowledge of the subject. As such, mixed methods purpose *complementarity* is used to produce more clarifying knowledge through measuring different facets of the phenomenon with two different research papers.

More complex knowledge is sought through the procedure of *initiation*, where the aim is not to give an overall description that unites knowledge gained by different methods, but to give a representation that realises reality as myriad and sometimes contradictory. This knowledge is mainly acquired through practice studies to create more complex descriptions focusing on communicating and describing aspects, but to a lesser extent focusing on issues of validity. For example, in study D, the quantitative data showed a high usage of a lexicon feature on a digital installation in the exhibition. However, the qualitative data identified the reason for high use being a less understandable interface design and not because of visitors' desire to learn more. The result of this study is detailed in the research paper [Exhibition Design].

Aspects of the procedure of *development* are, for example, used to aid the field experiment in Study E, with the result acquired through pilot studies conducted in lab settings. The focus was especially the functionality of beacon technology and the interaction between smartphone and beacons.

Overall, I have argued for the purpose of combining methods to generate knowledge that contributes to identifying key variables of a transmedia experience in an exhibition context. The next section will substantiate the criteria to evaluate the scientific contributions of this research project.

4.3.1. CRITERIA FOR EVALUATION

Pragmatism as the philosophical paradigm sets the foundation in research design for how we know what we know, which is the epistemology and what is real, which is the ontology (Creswell, 2014). The description of underlying conditions for research and how reasonable the propositions are, exist in an interplay between epistemology and ontology. The maxim of practical effect is the reality of an idea which spans the foundation for ontology. From this, reliability and validity of the research contribution is epistemologically evaluated (Rylander, 2012). This means, a result must be reproduced based on exact and accurate measurements by different researchers at different times for a reasonable evaluation. This is a challenge in regard to constructing the *ultimate particular* in research through design, which depends on present time and context (Buchanan, 2001; W. Gaver, 2012; Godin & Zahedi, 2014;

Goldkuhl, 2011; Krogh, Markussen, & Bang, 2015; Rylander, 2012; Stolterman, 2008; Zimmerman et al., 2007). In CPR, action research has a research interest in social context of practice, and experiments have a research interest in intervention into practice, which also depends on the present time and context. Thus, the construction of this research design becomes incompetent to deliver criteria with absolute scientific reliability (Godin & Zahedi, 2014). Therefore, action researcher's understanding of recoverability is followed as the common denominator, which means that "the process is recoverable by anyone interested in subjecting the research to critical scrutiny" (McNiff, 1988, p.18). Thus, recoverability is not tied to the result of the research, but instead to the research process itself. If the research process is recoverable by others, the research is considered rigorous. In contrast to traditional science, this is argued to be a proof of validity according to Biggs and Bütchler: "We say the process was rigorous, and therefore validates the claims of the outcome" (Biggs & Büchler, 2007, p.67). However, the validation is on a locale scale but not on a global scale. The contribution is thus intended to be appropriated by others, but without any universal claim to the contribution. Thus, validity of this research outcome is determined on researcher's effort to capture the process.

Following section presents an overview of the primary methods applied in the indivudual studies.

4.4. RESEARCH METHODS

The research project consists of five major studies conducted at the Oceanarium. The applied methods for data collection are added to the table presented in chapter 3.2, see updated table in figure 17. The methods column presents the specific methods used in CPR as all the studies have all three components of CPR apart from study A, which only uses practice studies.

STUDIES	PERSPECTIVES	METHODS	PAPERS
Study A: Storytelling Focus on reviewing the discourse of transmedia storytelling and identifying the design criteria for a transmedia experience that can be used in an exhibition context.	Design	Desk Research	[Bridge Complexity]
Study B: Worldbuilding Focus on interweaving a cohesive universe for an existing exhibition (Oceanarium)	Design, Implementation, Organisation	Autoethnography, Observational Studies, Workshop	[Fruitful Gaps]
Study C: Participation Focus on how to motivate visitors to participate and engage in content creation during the visit, which also adds pre- and post-visit value for both visitors and the exhibition.	Design, Implementation, Evaluation, Organisation	Autoethnography, Observational Studies, Statistical Analysis	[Transmedia Exhibition] [Applied Gamification] [Fruitful Gaps]
Study D: Experience Focus on creating a transmedia experience at the exhibition, where the relation between enlightenment and experience are explored.	Design, Implementation, Evaluation, Organisation	Autoethnography, Observational Studies, Interviews, Statistical Analysis, Workshop	[Exhibition Design] [Fruitful Gaps]
Study E: Mobile in Exhibitions Focus on self-facilitated exhibition experience through the use of a mobile technology	Design, Implementation, Evaluation, Organisation	Autoethnography, Observational Studies, Focus Group Interviews, Questionnaires	[Exhibition Systems] [Fruitful Gaps]

Figure 17: Overview of individual studies, research perspectives, applied methods and the derived papers.

All individual studies and papers contribute to answering the work questions and thereby also contribute as a whole to answering the research question.

4.4.1. START-UP WORKSHOP

As a starting point for the research project, the organisation's expectations and wishes for their ideal future exhibition were mapped through a workshop to collaboratively identify the focus areas for the studies (Appendix 1.2). The workshop was conducted with the managing director, chief of exhibition, chief of marketing, the graphic designer, and myself as the facilitator. The workshop was divided into three phases;

first phase focussed on primary elements of the exhibition, second phase focussed on secondary elements, and final phase focussed on mapping existing activities and brainstorming about future activities regarding pre-, during- and post-visit. The three phases were illustrated with a circle diagram, where inner circle was the primary area, second was the secondary area, and the outer circle showed the activities divided into pre-, during- and post-visit, see figure 18.

Figure 18: Photos taken during the initiating workshop at the Oceanarium.

During the workshop practitioners wrote their expectations and wishes as topics and placed them according to the three phases. The primary topics were discussed according to the organisation's strategy, secondary topics were discussed according to the broadening scope of the exhibition experience, and activities were discussed according to the experience value. Finally, all topics where discussed according to their relevance and importance in forming a cohesive universe for the Oceanarium, ending with collectively marking the topics of interest to focus on. In continuation of the workshop, I grouped related topics to form a descriptive foundation to guide the initial direction of the studies. The entire workshop was audio recorded and photos were taken for postprocessing, as the facilitating role limited me in observing and noting during the workshop (Appendix 1.2). Following is a short description of the two main areas of interest compiled from the workshop.

- **The Exhibition**: The Oceanarium shall still be known as the largest aqua zoo in northern Europe containing unique aquariums with unique fish. It has to beam an image of credibility, professionalism and 'world class exhibition'. The exhibition has to be actual and relevant for different age groups, keep up with the times according to enlightenment and experience, and provide a coherent experience

- **The Visitors**: The Oceanarium shall still primarily be targeted at families, where the focus is on a shared experience among family members with content and activities aimed for each of them. Visitor participation shall be an area with more focus to make the experience more engaging and involving. Making visitors become ambassadors for the Oceanarium has to be explored as a channel for informing new potential visitors about the exhibition.

These two areas are not to be seen as areas that make an experience coherent, but areas of interest to explore a coherent experience. As such, the different studies have these preferences from the organisation as point of departure. These do not deviate from the identified three components of transmedia storytelling. Hence, the storytelling component is covered through the aspect of enlightenment through content, and the worldbuilding is covered through the exhibition theme being the North Sea, and participation is covered through engaging and involving visitor experiences.

<div align="center">* * *</div>

In this chapter, the research approach is introduced and discussed, organised around Creswell's (2014) framing of intersection between the three component in a research approach. The project is detailed as exploratory research, with an expansive logic broadening the knowledge about transmedia experiences in an exhibition context. The research process is grounded in research-*through*-design, in which I use collaborative practice research to produce knowledge with the character of research-*for*-design. I have discussed, how the research is viewed through a pragmatic lens based on practical effect of transmedia experience in an exhibition context. Thus, the individual studies are primarily organised as pragmatic inquires situated in the field collecting data though multiple methods. The next chapter details the individual studies.

CHAPTER 5. STUDIES

5.1. STUDY A: STORYTELLING

Study A investigates the discourse of transmedia and exhibitions through reviewing existing literature. This is a practice study conducted through desk research.

The literature review is the first step towards expanding body of knowledge about a phenomenon. A Literature review can be defined as a synthesis and analysis of scientific materials on topics related to the phenomenon (Garrard, 2016). The purpose is to document understanding of prior research, the usual theories and methods as well as the primary criticisms and weaknesses within the area of interest (Hart, 1998). Auxiliary perspectives often exit with conflicting conclusions and different terms for the same phenomenon, thus, the process has to clarify the area of interest and enlighten the potential gaps (Lungaard in Brinkmann & Tanggaard, 2015).

There are different approaches to conduct a literature review to compare, evaluate and organise in a way that is relevant to a specific topic or a problem area (Noble & Smith, 2018). I used the 'snowball method' presented by Torfing (2004), which builds on uncovering primary sources to the research topic by following links and references until only sources with secondary relevance are left. The process starts with identifying ominously referenced sources by other mapped texts and ends when references become redundant (Torfing, 2004). But in praxis, it is up to the researcher to judge when the review cycle ends (Torfing, 2004).

To uncover the ominously referenced sources five relevant databases were selected as sources for the initial search: ACM Digital Library, EbscoHost, Emerald Insight, ProQuest, and Scopus. These databases where found on AUB (Aalborg University Library) by selecting relevant subject areas: learning, film, media science, information science, communication, and cultural studies. The initial search on different databases were limited to peer-reviewed studies published in English between 2000-2018. The research question deals with three topics being transmedia, exhibitions, and experience. Therefore, these three topics were used as the initial search terms. Sources already known and retrieved in my bachelor's and master's studies, were also included to identify the primary sources.

The primary topic is transmedia and therefore a more detailed review is conducted on this domain to map the landscape. Following this, the state of exhibitions is investigated to identify the potential of transmedia in this context. The research question points towards designing a transmedia experience in an exhibition context. Therefore, designing an experience was explored in relation to transmedia and exhibitions, where the topics involving and educative, are discussed in relation to transmedia and exhibitions. The derived research paper [Bridge Complexity] covers

one of the gaps identified in the literature review on motivating audience to shift from one media platform to another. Although, the literature review and the research paper are conducted through the same method, the result of the literature review aided the research paper on what to investigate and, therefore, can be argued to have a mixed methods characteristic of *development*.

Although, the literature review and the research paper were finalised by end of the project, major part of it was conducted at the beginning to span the theoretical foundation and design a transmedia experience, where the research papers [Transmedia Exhibition], [Applied Gamification], [Exhibition Design], and [Exhibition Systems] explore different aspects of a transmedia experience in an exhibition context.

Following is a condensed overview of the primary topics of the literature review and frequently referenced sources used for the review (figure 19). The literature review can be found in chapter 2.

TOPIC	MAJOR SOURCES USED IN REVIEW
Transmedia	Kinder (1991), Jenkins (2006, 2007, 2010a, 2010b, 2016), Dena (2009), Gomez (2008, 2011), Gambarato (2013), Scolari (2013), Mittell (2009, 2014), Pratten (2015), Freeman (2016), Freeman & Gambarato (2018b), Evans (2011, 2018)
Exhibitions	Skot-Hansen (2008, 2009), Simon (2010a), Drotner & Laursen (2011), Parry (2013), Kidd (2016), Falk & Dierking (2016), Buysch and Kaa (2016, 2018), Drotner et al. (2018b)
Experience Design	Jens F. Jensen (2013), Gube (2010), Jacobson (2007), Oppelaar et al. (2008), Forlizzi & Ford (2000)

Figure 19: Overview of primary topics and major works used for the literature review.

5.1.1. STUDY & PAPER CONTRIBUTION

In reviewing existing literature on the domain of transmedia it was possible to identify a specific gap in how audience motivations are engineered to ensure that they shift from one media platform to another in order to follow a narrative. As such, missing from the scholarship are deep considerations of the individual mechanics at work during telling of a story across platforms.

The research paper [Bridge Complexity], examines the state-of-the-art transmedia properties in different disciplinary fields and identifies the mechanics in play to motivate audience to follow a story or non-story content across multiple media platforms. The mechanics are identified to be the 'bridges' that connect the dispersed

content. This is an effect of increased complexity amongst transmedia franchises that challenges traditional monocentric 'tentpole approach' with a broader polycentric approach. Thus, the complexity is not managed through tie-ins, but rather as a mix of what the paper labels as storyline, storyworld, and character bridges with different levels of complexity in their relation to traditional tentpole medium. As such, this paper introduces the term 'bridge complexity' that facilitates three different audience interactions; storyworld, storyline, and character bridges to connect multiple media platforms in transmedia projects of any size, see figure 20.

Figure 20: Illustration of Bridge Complexity.

Bridge complexity defines how different types of narrative and non-narrative bridges form a typology of ways audiences can access a transmedia concept - whether focused around a traditional monocentric tentpole, based on a polycentric franchise, or more vaguely-defined transmedia products.

This opens a wider discussion on what and when something is transmedia that provides a coherent experience. The complexity of a transmedia can be defined by the number of ways audience transit from one media platform to another. As such, transmedia with one bridging method can be characterised as simple, and transmedia that combines bridging methods can be characterised as complex. Thus, a coherent storyline is not a requirement for a transmedia experience. It can simply consist of storyworld or character bridges to provide a transmedia experience. This widens the lens for transmedia in other disciplinary fields, such as exhibitions.

This covers a significant scholarly gap in how such bridges are described, and how the significance of these bridges might aid in assessing both the narrative and cultural dimensions of a transmedia concept's complexity. This adds to the body of knowledge in transmedia design and expands the existing knowledge of transmedia storytelling, by suggesting different ways of bridging between media platforms.

There are certain limitations with the study approach, as a more structured or a systematic literature review could have provided a more comprehensive and more

objective picture of the area of interest. However, it is questionable whether it would have radically changed the result of the conducted literature review.

5.2. STUDY B: WORLDBUILDING

According to Henry Jenkins, the core idea of a transmedia experience is the art of worldbuilding focusing on creating a seamless cohesive universe in order to maximise synergistic effect and recognition (Jenkins, 2006). A cohesive universe concerns among other things, visual style, elements, and objects that need to be consistent and coherent across media platforms (Wolf, 2012).

The Oceanarium has a strong world with coherent stories concerning the North Sea and its surroundings. Therefore, in this case the real world is transmedia world and it is already inhabited by cultures, characters and stories. However, the visual style and visual elements in the exhibition and across different media platforms were affected by inconsistency as a result of different design trends and designers over the last three decades. This was a disrupting factor for the brand identity and the organisation's professionalism and credibility. Therefore, as a step towards a cohesive universe, it was necessary to make a coherent visual style in the exhibition and across the different media platforms. This process was an extension of the revitalisation process initiated by the new strategy to reinforce the exhibition experience (see chapter 1.3).

The common denominator that guides the visual style of a product is the brand identity, which includes the brand name and logo. As a logo change has a positive effect when it comes to brand modernity, attitude, and loyalty (Müller, Kocher, & Crettaz, 2013), the organisation started by re-designing their logo as the starting point for their revitalised identity. The visual identity was further detailed in the process of designing their new website, which resulted in defining a set of design guidelines to make the exhibition visually rigorous.

The knowledge gained from the prior experience universe of the Oceanarium clearly showed complication in sustaining an experience universe (see chapter 1.3). This was argued to be a result of not including practitioners in the design process, which led to the ambition of the experience universe being greater than the resources to sustain it. This is also argued to have prevented staff from taking ownership which made it unsustainable (see chapter 1.3). Therefore, this time the worldbuilding process had a high involvement of practitioners.

In these processes, I collaborated with practitioners by consulting, facilitating, and designing as well as being a researcher collecting data through autoethnography, meeting minutes, and mail correspondences. The intention was not to take a subservient role, but instead to engage as an influential actor, and equal partner (Etzkowitz, 2003). The activities were more practice-oriented, and less about research because of the vast amount of knowledge already existing in the domain of logo design

(e.g. Grinsven & Das, 2015; Henderson & Cote, 1998; Walsh, Winterich, & Mittal, 2010) and website design (e.g. Firdaus, 2013; Frain, 2012; Gardner, 2011; Gibbs & Gretzel, 2015; Glassman & Shen, 2014; Hussain & Mkpojiogu, 2015; Kim, 2013; Mohorovičić, 2013). Therefore, research focus was worldbuilding as a prerequisite for creating an involving and educative transmedia experience across multiple platforms by reinforcing a coherent visual style of the exhibition pre-, during- and post-visit. The research focus was also to invoke organisational changes as a whole.

5.2.1. LOGO RE-DESIGN

The logo is the essential component of any brand (Schechter, 1993) and can be described as the most important visual element in establishing corporate visual identity (Wallace, 2001) that connects the target group to the brand (Park, Eisingerich, Pol, & Park, 2013). It represents the brand image (Henderson & Cote, 1998; MacInnis, Shapiro, & Mani, 1999; Swartz, 1983), and functions as a badge of identification (Dowling, 1996; Henderson & Cote, 1998; Janiszewski & Meyvis, 2001), act as a label of quality (Baker & Balmer, 1997), works as a method to increase reputation (Baker & Balmer, 1997; Olins, 1989), and operates as a differentiator from competitors (Janiszewski & Meyvis, 2001; MacInnis et al., 1999). Thus, the characteristics of an organisation and its product (including services) can be expressed through the logo (van Riel & van den Ban, 2001), and is, therefore, the most important variable to attract attention and facilitate recognition (Crystal & Herskovitz, 2010; Henderson & Cote, 1998). An effective logo carries the signature of the organisation it represents; typically through its typeface, shape, colour scheme and design (Hynes, 2009). Therefore, these are considered to be the primary components of the visual identity (Henderson & Cote, 1998; Melewar & Jenkins, 2002; van den Bosch, de Jong, & Elving, 2005).

A logo typically consists of a brand name with a unique typeface, a symbol that represents the brand and the colour, which imparts information from which the target group can derive meaning (Henderson & Cote, 1998; Hynes, 2009; Keller, 2012; Napoles, 1987; Park et al., 2013). Although the main element of a logo is usually the brand name, the symbol also plays a more relevant role than the brand name in transmitting information and connecting with the target group (Keller, 2012, p.155; MacInnis et al., 1999; Swartz, 1983). By crafting an interesting form geometrically or compositionally, symbols can implant themselves into the target group's memory (Skaggs, 2017, p.135-137), and by being representative of familiar and recognisable objects or meanings they require lower learning effort, which results in correct recognition of the brands they represent (Henderson & Cote, 1998; Pimentel & Heckler, 2003; Schechter, 1993; Skaggs, 2017, p.135-137). On the other hand, abstract and meaningless symbols are more difficult for the target group to interpret (Koen, 1969; Nelson, 1971; Seifert, 1992). Simplicity and minimalism also have important roles in recall and recognition, as they only require low-level attention and less processing capacity (Grinsven & Das, 2016; Pimentel & Heckler, 2003). One of

the most important principles considering simple design is removing unnecessary elements (Eytam, Tractinsky, & Lowengart, 2017). Finally, the logo has to be versatile and applicable in a variety of sizes and materials (Skaggs, 2017, p.135-137).

There are two different paths a re-design process can take, an evolutionary path with a small degree of changes to refine, or a revolutionary path with a substantial degree of change to reflect a major strategic shift (Airey, 2009). The Oceanarium did not made any major changes to their revitalised strategy, even though they did emphasise digital means. Therefore, their logo only needed to be rejuvenated resulting in an evolutionary path, where the aim was to revitalise and to signal change in strategy without losing or changing brand identity and values. This minimised the changes needed with regard to the existing exhibits, which also decreased the work load in the worldbuilding process of a cohesive universe.

In the logo re-design process, I functioned as consultant and facilitator contributing knowledge of design guidelines in order to reach a strong brand identity that can form the foundation for the prospective coherent visual style of the exhibition by becoming the core signature of the Oceanarium's universe 'North Sea Universe'. I collaborated closely with the graphic designer and the management to determine and describe the requirements for the new logo by studying the existing literature on logo design and the revitalised strategy of the organisation. Following are the core requirements condensed from the literature infused with the requirements of the organisation.

> The new logo shall consist of the exhibition name with a refreshed typeface, a symbol representing an aqua zoo facility, and a colour that symbolises the sea. Geometrically or compositionally it has to symbolise an aquarium containing North Sea marine life. The logo has to be simple and must be easy to decode and recognise. It is preferred to be timeless and not dominated by current trends. It must be able to be used in many contexts – on different media, different formats and sizes. The logo has to work as a signature of the exhibition by advocating the value and identity of the organisation.

Based on the description, several design ideas were made and presented for the board of management, where five were selected and presented to rest of employees at a staff meeting (Appendix 2.3), see figure 21.

Figure 21: Designed logos for the Oceanarium. The selected five in the middle box.

Here, I made a presentation to practitioners not schooled in branding or design, about the logo design and the preliminary process of re-designing to explain the importance of a strong logo and how it contributes to establishing a coherent visual style. With this knowledge as a base, final decision was made through a vote among all employees, see figure 22. The effort was made to get all employees to collectively take ownership and thereby also become stakeholders of the revitalised logo and the prospective visual style and cohesive universe of the exhibition. This was a step towards invoking an organisational change by actively engaging employees in deciding the visual signature of the organisation.

Figure 22: Selected logo on the left and the previous logo on the right.

The most remarkable changes to the logo are the form and colour. The angular form represents an aquarium, the blue colour is made lighter to symbolise the sea, and the name colour is made grey to symnolise reliability, neutrality, balance, and timelessness. The thickness of the fish is slightly reduced, shadow effects from the old logo are removed, and the typography is made a bit thinner to reduce weight and make the overall logo simpler, clearer and timeless. The style of typography and the fish are retained as they represent and holds the identity of the organisation. With the new design, the brand name can work alone without the symbol and vice versa, and be combined in different ways without losing its identity, which makes the logo versatile and usable on different formats and sizes, see figure 23.

Figure 23: The Oceanarium's new logo on differen media platforms and products.

With the new logo, foundation for the prospective visual guidelines and a cohesive universe were established. The visual guidelines were further detailed through the process of designing the new website, which is elaborated in the following section.

5.2.2. WEBSITE DESIGN

The website is the main channel for the Oceanarium's external communication pre-visit. It allows visitors to access information about the Oceanarium's various exhibits, plan their visits and purchase tickets. During the visit, visitors have the possibility to access the website for practical information, such as feeding times. However, this information is available in different formats in the exhibition (e.g. signages, brochure, and announcements). To this point, the website does not have a major function after the visit.

The initial phase of the customer journey usually originates from a knowledge of the facility, which the visitor either possesses in advance, or obtains from one of the Oceanarium's communication channels. The Oceanarium's survey in 2016 on visitors first touchpoint substantiates the importance of their website (Figure 24).

TOUCHPOINTS	Official Website	Oceanarium Brochure	Top Attraction Brochure	Top Attraction Website	Social Media	Smartphone Applications	None	Do not know
%	38.1%	21.1%	11.3%	3%	9.7%	3%	11.8%	1.9%

Figure 24: Touchpoint survey results of the Oceanarium conducted in 2016 (Appendix 2.1).

Since the Oceanarium did not have in-house competencies to design a new website from scratch, several offers were obtained from various design agencies to complete the task. The design agency Gotcha ("Gotcha,") was chosen as they could deliver a complete website that met the requirements of the organisation (Appendix 2.4). In the process of designing a new website, I participated in a multidisciplinary design team consisting of designers and programmers from Gotcha and the managing director, chief of exhibition, chief of marketing, and the graphic designer from the Oceanarium. My role in this process was to co-facilitate decision making and create consensus among stakeholders from widely different domains in order to keep the website visually in line with the design guideline made during logo re-design, and the overall identity of the organisation to substantiate a coherent visual style pre-, during- and post-visit. The research focus was on the collaboration between the organisation, the supplier, and me as the researcher designing the *ultimate particular*; i.e. the new website. Research about, how to design a website, was not a subject area of interest for this research project.

The process of the new website was initiated with the functional elements midway through the process of logo re-design and continued with the visual elements after the new logo was chosen. The design process was composed of a series of meetings, workshops, and design sprints both at Gotcha and the Oceanarium. This composition resembles a normal process flow between any website supplier and client-organisation. However, so as to collectively achieve a website that was in line with the guidelines and ensured the necessary coherence, specific times were allocated to underline the importance of coherence for supplier and all participants. In addition, tours in the exhibition were provided to give an impression of the facility, and I presented the organisation's strategy and the vision with a cohesive universe in order to equip supplier and their designers with optimal understanding of the purpose of a new website. This detailed pre-phase of design provided the basis for supplier to initiate the design process. Throughout the design process, the design team from the organisation was presented with possible design solutions, where the design team and the supplier together chose the most suitable designs that provided a coherent style according to the guidelines and the exhibition. Then, the design solutions and functional requirements were reviewed by all department heads in the organisation, where additional requirements and wishes were also met before finalising the website. See figure 25 for the new and previous website.
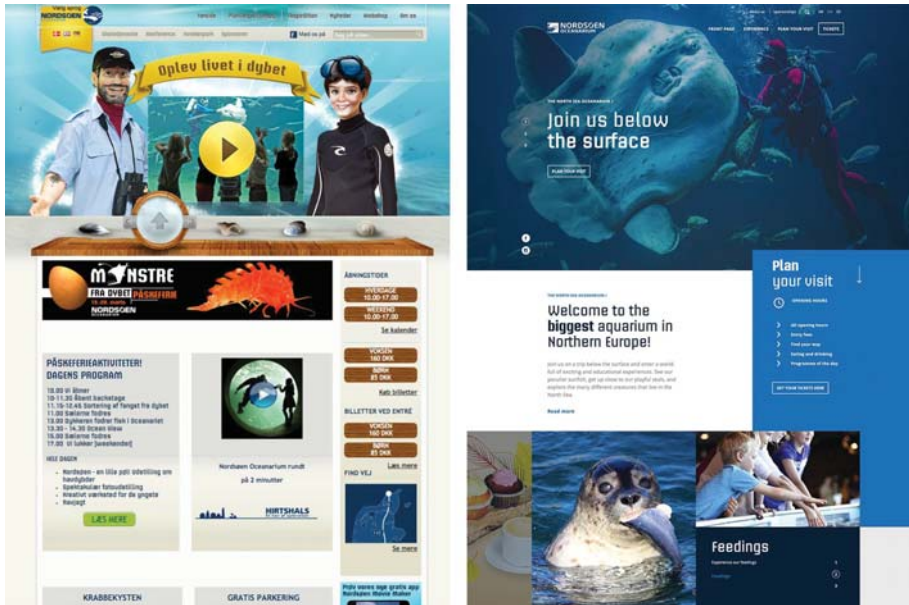
Figure 25: Previous website of the Oceanarium left and the new website on right.

As the essential addition to the revitalised visual style, the dark blue colour from previous logo was included in the colour scheme of the website to retain the identity of the organisation. Thus, the design of new logo and new website became the design guideline for all the marketing materials, social media channels, and seasonal exhibition materials.

The process of developing the website with both suppliers and practitioners can be considered constructive, and successful in eliminating confusion and misunderstanding. It was, however, necessary to have somebody with a complete overview of the cohesive universe to align and design the process in accordance with the requirements of the cohesive universe. In this process, I had this role in alligning the design according to the requirement.

In next step towards creating a cohesive universe, the permanent visual elements in the exhibition would also have to comply with the new design guideline, and this is elaborated in the following section.

5.2.3 EXHIBITION DESIGN

A re-design of the visual elements of the permanent exhibition would be a major intervention that would be time consuming and require a larger budget. Therefore, the management decided to follow the new design guideline for the prospective exhibits and use the changes to reinforce their coherence with the existing exhibits. Ideally, a

full revamp would be preferable for creating best coherence but, as it is unviable to change the existing exhibits every time a design change has to be implemented, this is probably the most practical and affordable way of creating coherence for existing exhibitions.

To reinforce the coherence, I screened the entire exhibition by taking photos of all visual elements and made a collage for each different area and floor showcasing inconsistency with visual style in the exhibition (Appendix 2.2). The inconsistency was primarily on signages with different typefaces, pictograms, colours, and styles of design. There were a lot of empty white walls without any visual indication of being under the sea. Also, a lot of the signages were held in place with clay, and were slipping down from their places, demonstrating carelessness and unprofessionalism. Finally, old versions of the logo could be found both inside and outside the exhibition, see figure 26.

Figure 26: Some of the visual elements that created inconsistency at the exhibition.

In a workshop with the managing director, chief of exhibition, chief of marketing and the graphic designer, I presented the collages, without mentioning the inconsistency. I facilitated the workshop, where we discussed the visual elements one by one resulting in practitioners slowly discovering the inconsistencies by themselves. This was a major eye opener for all of them, as they had not previously seen all signages side by side in this way. I wanted practitioners to discover the problem by themselves in order to understand the value of a cohesive universe, and to make them stakeholders of initiatives needed to make the exhibition visually coherent. This requires an organisational change because, even though majority of signages are designed by the graphic designer, there are everyday situations where some of the signages (e.g special announcements regarding new fish or changes in feeding times etc.) are designed and placed in the exhibition by staff from different departments according to their needs. Therefore, a strict procedure across different departments needed to be implemented to facilitate a sustainable change. As a first step towards tackling this issue, the graphic designer was told to start the process of reinforcing the exhibition visually by professionally replacing the signages with the established guidelines and all departments were asked to prioritise getting the signages made and mounted professionally by the graphic designer and the exhibition carpenter. However, it was

acknowledged that emergency situations might arise, where the graphic designer or the carpenter would not be available. For these situations, it was decided to provide ready-made templates that staff could use temporarily.

Today, most of signages are replaced and the graphic designer is still working parallelly with other tasks to create a cohesive universe. The empty walls still remain but rectifying this is on their list of things to do. The staff from other departments had also begun notifying the graphic designer about limping signages that need to be changed. As such, this indicates the approach used to invoke organisational awareness is highly effective. However, organisational change is a long-term process that is regularily affected by other inevitable organisational activities, such as new or seasonal exhibits.

The study draws on knowledge gathered through the literature review on worldbuilding in designing a coherent universe. Action research was conducted while designing with practitioners and suppliers, focusing on the process of designing the *ultimate particular* for the brand logo, website, and the design guidelines for the exhibition.

The data was gathered through autoethnography, meeting minutes and mail correspondences adding knowledge partly about implementing a transmedia experience in form of worldbuilding and how to invoke organisational changes. As such the *decoupling* was grounded in autoethnographically captured materials during the design process, my experience of the process, and reflecting on the *ultimate particulars*. Thus, the *decoupling* cannot fully escape the subjectivity of me as an influential actor and equal partner, assessing and evaluating the process of worldbuilding. As such, collected data regarding organisational changes feeds into the empirical source for the research paper [Fruitful Gaps] by *reflecting-on-action*. This contributes knowledge to the existing body of knowledge regarding organisational implementation of a transmedia experience in an exhibition context.

5.2.3. STUDY CONTRIBUTION

Worldbuilding is an essential part of creating a transmedia experience, where 'world' has to be seen as an overall platform consisting of the physical platform; i.e. the physical exhibition, and the digital platforms. How to create a coherent experience across these platforms was not within the scope of this study; but this worldbuilding study was a prerequisite for being able to create a coherent experience across platforms pre-, during- and post-visit.

As such, study B contributes knowledge regarding worldbuilding in an existing exhibition. In practice, an existing exhibition usually has a theme (e.g. the Oceanarium having the North Sea as their theme). As such, it is not necessary to build a world from scratch, but it is necessary to analyse and evaluate the requirements, both in

terms of content and visually to establish a coherent universe that is recognisable across physical and digital platforms for visitors. In this process, elements that create incoherence have to be identified and re-designed, re-structured, adjusted, or aligned to create coherence. In particular, the exhibition's logo has to be representative not only for the exhibition, but also for the universe as it validates any content communicated with the logo as a part of the universe. However, the logo itself is not enough to create coherence. The content communicated, and the visual style have equal parts in creating and sustaining coherence. Ideally, a full revamp will create best coherence, but in practice, it is unviable as it demands a major intervention and a larger budget to implement.

Involvement of exhibition practitioners in the design and implementation process is inevitable because of the importance of their practical skills, knowledge and work experience for development of a sustainable, cohesive universe. The collaborative design process helps to make the practitioners into stakeholders and creates willingness to take ownership [Fruitful Gaps]. In addition, the design process provides practitioners with deep insight into the coherent universe and corresponding changes being made to the exhibition and organisationally, which qualifies and prepares them to sustain the coherent universe. However, in practice, it is a long-term process that has to be maintained systematically to achieve a satisfactory result.

This covers a significant scholarly gap in how worldbuilding processes are initiated and implemented in an exhibition context and add to the body of knowledge in implementing a transmedia experience in an exhibition context and expands the existing body of knowledge on worldbuilding.

There are certain limitations to the results, as they do not verify the coherence worldbuilding contributes in an exhibition context from the perspective of visitors. Additionally, the worldbuilding at the Oceanarium and across the media platforms on which they are represented today, is not fulfilled. Thus, the results are drawn on the implemented part only. However, it does not restrict the knowledge acquired on the organisational implementation of worldbuilding.

5.3. STUDY C: PARTICIPATION

Study C explores the participation aspect of a transmedia experience in an exhibition context and how to motivate and engage visitors.

Content generated by visitors is valuable free information that can be turned into an attractor. The generated content works as word-of-mouth audience signals (Hennig-Thurau, Wiertz, & Feldhaus, 2015; Vany, 2003) that induce interest in a product and overpowers traditional advertising, as it is perceived to be more credible (Katona, Zubcsek, & Sarvary, 2011). However, it is not an easy task to motivate audience to participate, as contemporary audiences are substantially more fragmented and are

CHAPTER 5. STUDIES

structured as complex layers, networks and segments (Napoli, 2011; Webster, 2005; Webster & Ksiazek, 2012). The discussions on contemporary transmedia audience shows that the implied audience of a transmedia experience is a small minority (E. Evans, 2011) that mostly resembles fan-like audience that is loyal, deeply invested and highly involved (Busse & Gray, 2011; Green & Jenkins, 2011; Jenkins, 2006; Jenkins, Ford, & Green, 2018).

For contemporary exhibitions the place to go to facilitate participation is the social media, either by acknowledging visitors' content on the exhibition's official social media account, or providing official online locations where visitors can share content produced during their visit using mobile technologies (Weilenmann, Hillman, & Jungselius, 2013). Here, smartphones offer a wide range of features that can encourage greater involvement by enabling visitors to create and share their exhibition experience with text, photos and videos on social media (Hughes & Moscardo, 2017; Pierroux, Krange, & Sem, 2011; Rung & Laursen, 2012). This enables the organisations to reach and connect with a broader segment than their primary target group (Black, 2010; L. F. Johnson & Witchey, 2011; Pierroux et al., 2011; Russo, Watkins, & Groundwater-Smith, 2009) and at same time enrich the exhibition's authenticity by enabling mutual real-time dialog (Russo, Watkins, Kelly, & Chan, 2006).

In recent years, social media has emerged to take a prominent role in learning in informal environments such as exhibitions (Russo et al., 2009, 2006; Whitworth & Garnett, 2011). And combined with social media platforms e.g. Facebook, YouTube, and Instagram, the smartphone encourages social interaction through multimedia (Lobinger, 2016). This is a result of rapid development of smartphones with cameras, which has made social photography ubiquitous and easily accessible for visitors (Weilenmann et al., 2013). Visuals are increasingly prevalent and engaging in the digital realm (Budge, 2017; Pink, 2013), where Instagram has a leading role as a growing number of people use it to tell stories with photos (B. Jensen, 2013; Miller & Edwards, 2007). These photos are furthermore distributed in image streams and photographic conversations by tagging in order to communicate and add context to photos, attract attention, and for opinion expression etc. (Ames & Naaman, 2007; Highfield & Leaver, 2015; Marlow, Naaman, Boyd, & Davis, 2006). The increasing popularity of Instagram can be argued to be an effect partly caused by the rise of visual and screen culture, and digital connectivity and engagement, where people record, document and account for their cultural life (B. Evans & Giroux, 2015; Humphreys, 2018).

Despite the benefits, there are several challenges in designing a transmedia experience that encourages and induces audience participation pre-, during- and post-visit (Davis, 2013), especially in an exhibition context, where the primary target group is neither emotionally involved nor deeply invested. Therefore, this study explored how to engage exhibition visitors to participate in a transmedia experience departing from the

photo sharing platform Instagram. Part of the rationale to explore Instagram was limited knowledge existing on the use in exhibitions by visitors. The existing knowledge mostly focuses on the marketing aspect of connecting with visitors and discussion about visitation in general (Budge, 2017; Espinós, 2016; B. Jensen, 2013; J. H. Smith, 2015; Weilenmann et al., 2013). Thus, Instagram was selected additionally because of the visual quality and its widespread use ("Instagram," 2018).

In addition to the above, the study is based on knowledge gathered from the literature review on transmedia participation, and further substantiated with insights from the design case of a mobile augmented reality application called North Sea Movie Maker. The design case of North Sea Movie Maker is a study in Vistisen's (2016) Ph.D. project, which is partly conducted at the Oceanarium. I was employed as a graphic designer at the Oceanarium during Vistisen's research and was a part of implementing the study and the mobile augmented reality application in the exhibition. The Instagram study was conducted as part of my Ph.D. project, where I participated as a design researcher designing an Instagram service, that bridged pre- and post-experience with the actual visit. The service was developed and implemented in collaboration with the service provider Brand Heroes ("BrandHeroes,") and the marketing department of the Oceanarium. The aim was to encourage visitors to actively share experiences socially on Instagram during their visits, where generated content feeds into pre-experience for possible future visitors and post-experience for previous visitors.

Both cases are based on a constructive design research study – grounded in the methodological consideration from Koskinen et al (2011). As such, both cases are considered design interventions used to investigate how to encourage visitor participation. The *decoupling* is based on research data consisting of field notes and design documents from each of the two designed products (Appendix 3). The effect of different onboarding and engaging methods is measured with quantitative data and complemented with qualitative data being observations conducted in the exhibition. As such, mixed methods purpose *complementarity* is used to produce clearer knowledge by measuring different facets of the phenomenon with the two different research papers.

The entire study and corresponding results are detailed in the research papers [Transmedia Exhibition] and [Applied Gamification]. Following is a summary of the contribution.

5.3.1. STUDY & PAPER CONTRIBUTION

The case studies in the research papers [Transmedia Exhibition] and [Applied Gamification] identifies a number of mechanics to motivate visitors to participate, and their effects have subsequently been explained. The collected data on Movie Maker application and the Instagram service, reveals clear patterns in related assistance from

exhibition guides vs. self-facilitated initiation of the experiences. With this assistance the number of users increased, and without assistance the number of users dropped drastically. The reason for this was mainly because they could not understand how these services would support their desired experience during the visit. Optimally, visitors will participate if they can decode the value the designed service can give. However, the key risk is that visitors will simply skip it, if they don't understand the concept with which they are being presented.

To this point, the case studies show, that socially shared content is more efficient in encouraging participation than conventional promotion methods [Transmedia Exhibition], where a connection could be made to extrinsic motivational properties that persuaded visitors to engage [Applied Gamification]. This is in line with many previous contributions according to creating motivation. However, this study contributes new knowledge on gamification as a method of targeting adoption and use of services. Especially in a context where there is no one to help visitors understand and use the service. Moreover, the research paper [Transmedia Exhibition] shows there is a link between content complexity and platform complexity. Thus, a heuristic is formulated for transmedia exhibition experiences: The more platform complexity, the less content complexity. I acknowledge, that this result is only a first, however, important stepping-stone towards constructing a more comprehensive framework for a transmedia experience in an exhibition context.

According to the organisational implementation of Instagram service, there was a general mistrust among practitioners in allowing social media content to be a part of the exhibition. At this point, the exhibition did not have any visitor generated content exhibited. Therefore, it was hard for them to identify its value for the exhibition. However, a presentation of quantitatively measured data convinced practitioners and the organisation of the positive and constructive effect of exhibiting visitor generated content in the exhibition. This reinforces the importance of quantitative data to onboard practitioners with the discourse of participatory culture in the exhibition and understand the value it creates both for visitors and the organisation.

Based on the practical lessons learned from the two cases and knowledge drawn from the organisational implementation, this study contributes to the body of knowledge about designing a transmedia experience in an exhibition context, and expands upon the existing body of knowledge on participation by exploring how to onboard visitors to participate in a transmedia experience pre-, during- and post-visit.

There are certain limitations to the contribution, such as the initial interest and rewards to motivate visitors to dig deeper or spend additional time with a new service. But their potential to introduce and elaborate new concepts, such as a transmedia experience that include emerging digital technologies in an exhibition context have not yet been investigated. Further research is needed with studies targeting adoption, acquisition and use of emerging digital experiences in an exhibition context.

According to the study approach, a qualitative investigation through interviewing visitors will further elaborate the challenges identified through quantitative data.

5.4. STUDY D: EXPERIENCE

In 2017 the Oceanarium started a renewal project of an outdated exhibit dating back to 1998. With knowledge and experience gathered over the years, and through this research project, the organisation's desire was to create a coherent exhibit through coherent storytelling and coherent scenography departing from the defined design guideline. This initiative was next step in creating a cohesive universe for the exhibition, where this exhibit should be seen as the founding base for the prospective coherent exhibition. Therefore, my role in practice was to substantiate the process in making the exhibit coherent across physical and digital platforms and thereby continue exploring an involving and educative transmedia experience in an exhibition context.

Concretely, the practical aim of the exhibit was to create an involving family experience, as well as communicate the food chain in North Sea between coast and deep sea describing the relationships between typical predators and prey (Appendix 4.1). See figure 27.
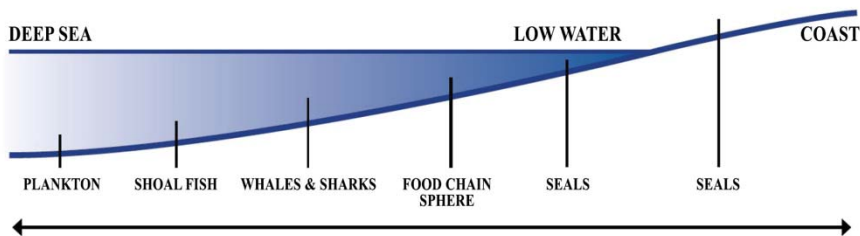
Figure 27: The hunters of the North Sea: Here, visitor meets every link in the food chain at a specific destination: the coast, the low water, and the deep sea. The food chain is summed up in the food chain sphere, which gathers all animals in a predator-prey scenario.

Dissemination has always been a core element for the exhibition, as also stated in the Oceanarium's strategy. However, the challenge is to balance the aspects of enlightenment and experience that together span the foundation for a worthwhile exhibition experience. Here, transmedia storytelling gives rise to achieve both enlightenment and experience aspect, which also substantiates coherence and creates an immersive learning landscape (Fleming, 2013). Scolari (2016, 2018) argues that transmedia also has the quality to be a learning space for different groups. Thus, the practice aim was to disperse dissemination across physical and digital platforms in the exhibit area.

In this regard, I participated in a multidisciplinary design team consisting of the managing director, chief of exhibition, chief of dissemination, chief of school services, and chief of marketing from the Oceanarium, including an external exhibit designer and technology supplier. I engaged as an influential actor and equal partner (Etzkowitz, 2003) concerning the design and development of a coherent exhibit across physical and digital platforms in the exhibition. The design activities took place in formal and informal spaces across different departments and locations, which made it unfeasible to make a constrained observation setup, and therefore relies on photo documentation, mail correspondences, meeting minutes, and field notes with observations akin to autoethnography (Baarts, 2015). The engagement has the character of a reflective practice, where these reflections are substantiated by statistical data that has generated one Danish report [BOW] (Appendix 4.2) and one paper [Exhibition Design].

Initially, the process started with me sharing acquired knowledge regarding transmedia storytelling, coherent experiences, and participation as a tool for involving experiences, to all practitioners in the design team; especially the external exhibition designer and technology supplier to bring them in line with practitioners from the Oceanarium, who have worked with these aspects since start of this research project. The intention was to help all participants in the design team to embark on this project with a common denominator; i.e. an involving coherent experience disseminating the food chain in North Sea. In continuation of this, a manual [Hunters] for the exhibit was developed detailing the two primary aspects, one enlightening visitors about the food chain in North Sea through transmedia storytelling approaches, and one creating an involving coherent experience, see appendix 4.3 for the manual.

In addition to the manual, I prepared a report [Target Group] on the Oceanarium's visitors to create an overview of gender and age distributions in order to map the contemporary target group for creating involving experiences. This report relies on existing visitor data collected in the exhibition, google analytics data from the website and the North Sea Moviemaker application, Facebook and Instagram statistics, external target group analysis, and one visitor type investigation conducted in 2015, where I was a part of the research team. See appendix 4.4 for [Target Group] report. The exhibit manual and target group report were used as guidelines for practitioners designing the exhibit.

With these prerequisites, the exhibit was designed and developed by the design team and named 'Hunters of the North Sea' following a vote among all employees.

5.4.1. HUNTERS OF THE NORTH SEA

The exhibit is designed to disseminate North Sea's food chain from predators to prey, and from prey to predators, as both have biological relevance. Each part of the chain occurs in a particular area somewhere between coast and deep sea. Thus, the

geographical coherence is maintained, as visitors can move from coast towards deep sea or vice versa depending on where they enter the exhibit. See figure 28.
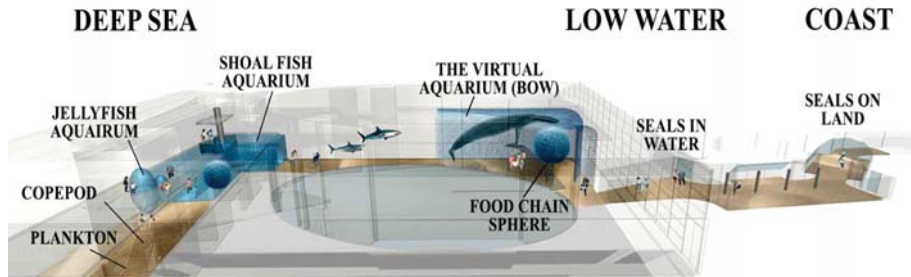
Figure 28: An illustration of the new exhibit Hunters of the North Sea.

Figure 28 is an illustration of the new exhibit with deep sea on left (plankton), continuing to the virtual aquarium (BOW), and stretching all the way to the coast on the right side (seals on land). In this constellation, visitors can enter the exhibit via different areas and choose direction of their path. Therefore, the exhibit was dispersed systematically across different self-contained locations at the geographical spots where each location makes a distinctive and valuable contribution to the whole.

To make the exhibit less resource intensive the experience is designed to offer two types of dissemination – active and passive. The passive dissemination takes place through signages, posters, and digital screens etc., while active dissemination takes place with a tour-guide. The aim is that each tour should be able to stand alone, and that the visitor should also be able to take full advantage of the exhibition without a guide. Conversely, a guide must also be able to use the route to prepare guided tours, provide special talks, etc. Age groups are also taken into account, so that there are activities for both children and adults.

Each location is designed to utilise different media platforms to disseminate content and provide an involving experience for children, youths and adults respectively. The intention was to utilise emerging technologies to create involving digital experiences in some of the locations, where visitors could actively participate and contribute with visitor-generated content. Therefore, a specific research aim was to explore how emerging digital technologies could facilitate a coherent experience that is educative for visitors. The focus was especially on the interplay between digital experience and enlightenment. This is detailed in research paper [Exhibition Design].

The study focused on designing a coherent experience in collaboration with the organisation, external exhibition designer, and technology supplier. Implementing the designed exhibit was not in the scope of this study, as I was on my research stay in Australia at the time of implementation. However, I continued the study after returning from Australia, when I focused on measuring the effect of the implemented

digital installations in providing educative transmedia experiences in an exhibition context, which feeds into the research paper [Exhibition Design]. The contribution is based on quantitative data from visitors' interactions with digital installations and is substantiated by observational studies and interviews with users of the digital installations (Appendix 4.5). As such, the mixed method purpose is a blend of *triangulation* and *initiation*. The focus of *triangulation* was to retrieve more accurate knowledge and increase validity of the result by counteracting bias. *Initiation* was used to increase the breadth and depth of the interpretations and results by analysing with different methods. For example, a specific quantitative outcome illustrated a high use of lexicon feature on the digital installation, which could indicate more enlightenment. But the qualitative data identified the reason as being a less understandable interface design. The results are further elaborated in the research paper [Exhibition Design].

The knowledge gathered though the process of co-designing feeds into the research paper [Fruitful Gaps] through *reflection-on-action*, which relied on photo documentation of workshop activities, field notes taken with observation akin to autoethnography, meeting minutes and mail correspondences. The measurement of total impact of the exhibit was not in scope of this study because the designed exhibit was not fully implemented in the timeframe of this Ph.D. project. Therefore, the *decoupling* is grounded in the autoethnographically materials collected during the design process, my experience of the process (Appendix 4.6, 4.7), and reflecting on the *ultimate particular* (the implemented parts of the exhibit). Thus, the *decoupling* cannot fully escape the subjectivity of me as an influential actor and equal partner, assessing and evaluating the process of designing a transmedia exhibit. The mixed methods purpose *expansion* is utilised to evaluate this study and increase the scope of inquiry by choosing methods most suitable for the process and outcome. Thus, the process is assessed through qualitative methods and the outcome is measured with both qualitative and quantitative methods.

With regard to digital installation, I wrote an evaluation report [BOW] in collaboration with a researcher from Aalborg University (Appendix 4.2). The report and the results of the evaluation are detailed in paper [Exhibition Design]. Following is a summary of this study's contribution.

5.4.2. STUDY & PAPER CONTRIBUTION

The research paper [Exhibition Design] elaborates how the tension between enlightenment tradition and experience tradition in exhibition design, and its resulting compromises in the design process, are not optimal for either traditions, and serve to create inadequate interactive exhibition designs in which either the experiential or enlightenment-oriented parts are forced upon each other.

The paper demonstrates how attempts to deliver purely fact-based information through didactic design elements fail to succeed in engaging visitors, since it competes against play-oriented part of the experience. In contrast, it indicates a more informal delivery, through embodied interactions during playthroughs, sparking enlightenment about the subject matter, not through delivery of facts, but through users seeing themselves in relation to the subject matter, and reflecting upon it through playing the games. Even though it is not the authoritative ideal of traditional exhibition discourse, it gives empirical foundation for gamified exhibition design as an enabler of experience-based learning, where enlightenment is assessed through gained reflections, rather than the transfer of facts alone.

Based on the results, the paper elaborates that certain type of enlightenment can arise from building gamified experiences around the facts, but without forcing the facts upon users. As such, the interactive exhibition design needs to balance the traditions, by allowing for other types of enlightenment than authoritative fact delivery, while the gamified installations should also not transcend into straying too far away from communicating a message about the subject matter. As such, from the gathered insights, the paper point to three guiding principles for balance, between experience and enlightenment in gamified exhibition designs.

1. Avoiding adding 'forced' fact-based features and content as an add-on to gamified exhibition designs, since these run the risk on only seeing limited or mis-interpreted use. If factual content is to be presented in an authoritative way it should be done either through design placed prior to or after the game-based interactions as preparation or debriefing of the player.

2. Letting the informal learning be front and centre for gamified interactive exhibition design, which has been shown to arise from users being engaged in embodied interactions in a playful manner, being enlightened about their own relation to the facts through performative play which promotes reflection. This requires a discussion in relation to the four positions of what the role of museums should be in society, and whether we can accept less formal facts to be delivered if the visitors leave the museum with their own subjective reflections on the subject matter experienced.

3. If informal learning is not desired, and authoritative enlightenment is needed, the two are better separated, letting the experience design deliver entertainment, and the facts deliver enlightenment on their own respective premises. This requires a more strict discussion about when and where, in a museum context, interactive experience design could be used to give visitor a 'break', potentially avoiding so-called 'museum fatigue' (Bitgood, 2009).

According to the design process, it was possible to note the impact of having a written manual and report to create consensus among stakeholders from different domains to focus on a common task throughout the design process. It was also possible to note the impact in having transmedia elements written into the manual to design a coherent

experience in the exhibition. In terms of content, most of dissemination is implemented through wall posters, signages, and digital installations. When looking at the worldbuilding aspect - especially the visual appearance - it is possible to note that the design guideline has been followed with regard to colours, style, and simplicity. However, there is still room for improvement as there are a lot of empty spaces without any indication of being below the sea or within *North Sea Universe*, see figure 29.

Figure 29: Photos of Hunters of the North Sea exhibit at the Oceanarium.

The evaluation report by the external exhibition designer also points to the limited worldbuilding in the exhibit, which breaks the desired coherent experience and universe defined in the exhibit manual [Hunters]. According to the organisation, the reasons were time constraints and a lack of overview in implementation process, which was caused, among other things by changing project managers. Thus, I will argue that, as an agent for coherence, me being absence might also had contributed to the limited coherence in the exhibit. This indicates, that even if the organisation and its practitioners are collectively able to design a transmedia exhibit, they are necessarily not able to have same amount of focus on it during implementation. Here, a transmedia director or someone with special responsibility for maintaining overview in the exhibition organisation might have been preferable to achieve the desired design solution.

Based on collaborative design process of a coherent exhibit and practical lessons learned on how experience and enlightenment can be balanced in gamified digital exhibition design, this study and the derived research paper [Exhibition Design] elaborates how emerging digital technologies can facilitate a coherent experience that is educative for visitors. This add to the body of knowledge of designing, implementing, and evaluating an involving and educative transmedia experience in an exhibition context, and expands upon the existing body of knowledge on storytelling,

worldbuilding, participation, and emerging digital technologies in an exhibition context.

There are certain limitations to the contribution, according to the organisational implementation, acquiring participating practitioners experience would clarify the challenges in implementing a transmedia experience, especially with regard to worldbuilding. A visitor study would also illuminate the effect of designed solution. However, the exhibit is not fully implemented, which limits the investigation at the current state of the exhibit.

According to the results of research paper [Exhibition Design] it is not to be seen as the only design strategy going forward, but rather a data supported argument for allowing player-based experiences in exhibitions to function on their own terms, and not be forced to adhere to authoritative fact delivery.

5.5. STUDY E: MOBILE TECHNOLOGY

The focus of this study is to explore the potential of context-aware technologies to enrich the experience through multiple media formats (e.g. text, audio, video) on different locations in the exhibition, where content on each location makes a valuable distinctive contribution to the transmedia experience. The aim is to understand the impact of context aware transmedia experience in an exhibition context, particularly the advantages, disadvantages, and best practices.

Exhibitions are early adopters of new emerging technologies and are constantly looking for ways to improve visitors' experience (Tallon, 2008; Verdaasdonk, van Rees, Stokmans, van Eijck, & Verboord, 1996). In recent years there has been an increase towards providing various forms of mobile technologies to either provide basic information to guide visitors during their visit (Falk & Dierking, 2008; Goldman, 2007; Hughes & Moscardo, 2017; Marshall, 2018; Wakkary et al., 2009). Therefore, the use of mobile technologies has become commonplace in modern exhibitions. These mobile technologies were introduced in 1952 (Tallon, 2008) and were primarily supplied by the exhibitions as audio guides allowing visitors to experience the exhibition while listening to commentary about the exhibits. So far, a wide range of extensions has been developed from display technologies, interactive exhibits, multimedia tours on different devices, virtual reality simulations as well as applications for smartphones (Grinter et al., n.d.; Hughes & Moscardo, 2017; Procto, 2011; Rhee & Choi, 2015; Roes, Stash, Wang, & Aroyo, 2009; Schroyen et al., 2016; Sung, Chang, Hou, & Chen, 2010; Tomiuc, 2014; Wakkary et al., 2009).

The rapid development of mobile technologies and the increased accessibility and popularity have permeated all aspects of our lives and become fully integrated into everyday life (Aldhaban, 2012; Poushter, 2016). According to Statista, over 2.5 billion people worldwide owned a smartphone in 2018, and this megatrend is growing rapidly

("Number of smartphone users worldwide 2014-2020," 2016). In Denmark 88% of the population possessed a smartphone in 2018 ("Elektronik i hjemmet," 2018). Thus, it is far more efficient to let visitors use their own devices rather than lending them dedicated devices. It also minimises the learning curve for using smartphone guides in exhibitions, and enables pre- and post-visit interactions (Othman, Petrie, & Power, 2013).

Today, smartphones have evolved into fully functional computers with powerful processors, efficient operating systems, multiple sensors, and user-friendly interfaces (Strutu, Caspari, Pickert, Grossmann, & Popescu, 2013), that allow for interactions that mix modalities, such as reading and writing, seeing and hearing, touching and feeling (Norman, 2009). The portability and capability to install applications suited to the needs and lifestyles of the individuals, makes the platform a versatile and multipurpose object. Smartphones offer a substantial variety of features which can be harnessed to underpin the exhibition experience, such as, contextually relevant information, instant communication, and wayfinding (Strutu et al., 2013). In total, this enables the opportunity for multi-sensory or multi-functional experiences that relate well to the concept of transmedia experience.

In the new exhibition era, the issue is no longer whether smartphone applications should be used by exhibitions, but how they can be used to add value for the visitor and the organisation. Despite the benefits of mobile technologies and smartphone applications, there are still several challenges in providing a valuable context aware smartphone experience in an exhibition context. Although, location-based interaction supported by GPS positioning is well developed for context aware applications, many scenarios still cannot easily be implemented because of the missing applicability of GPS positioning inside buildings (Strutu et al., 2013). Several methods have been explored to incorporate context aware applications inside buildings e.g. QR-codes, NFC tags, and WiFi triangulations (Ceipidor et al., 2013; Kovavisaruch et al., 2015; Liu, Darabi, Banerjee, & Liu, 2007; Medic & Pavlovic, 2014; Villarrubia, Paz, Prieta, & Bajo, 2014), but the challenge still remains for providing a seamless application with similar functionality to an outdoor context aware application.

Another challenge with such applications is that content is pre-loaded and cannot be updated or regulated in real-time by the exhibition organisations but have to go through supplier to update the whole application. This causes high maintenance cost, which makes it unviable and unsustainable for the organisations. Concordantly, studies also show that visitors generally hesitate to use smartphone applications in exhibition contexts (Calvi & Cassella, n.d.; Laine, Sedano, Vinni, & Joy, 2009; Tallon, 2008). This was also evident with the North Sea Movie Maker application at the Oceanarium (Vistisen, 2016). Therefore, to date, knowledge about ways in which visitors use context-aware smartphone application in exhibitions is limited, and the effect of the application content is even more limited.

Thus, this study sheds light on how to design a smartphone application, that seamlessly integrate a context aware experience in an exhibition context that can be updated real-time by the organisation. In that regard, I participated in the development project of a context aware smartphone application named Aratag [Aratag App] ("Aratag,") initiated by Pangea Rocks ("Pangea Rocks,") targeting exhibitions, museums, zoos, aquariums, and theme parks. This collaborative design project is detailed in the following section.

5.5.1. ARATAG

Pangea Rocks is a construction company specialised in artificial rockwork and replication of natural aquatic and land features for zoos, aquariums, theme parks, museums, and entertainment centres. They have been involved in design and building of more than 600 exhibits worldwide ("Pangea Rocks,"). In 2017, they started Aratag project with purpose of providing a mobile service, where the organisations can add a digital layer to their exhibition easily through a CMS (Content Management System) platform independent of developers and programmers (Appendix 5.2). To identify the needs of the field of interest and develop a sustainable application, potential organisations and academics from Aalborg University were invited to co-design with development agency Kruso ("Kruso,"). See the designed application in figure 30.

I participated in this co-design project as a representative of the Oceanarium and one of four academics from Aalborg University. Apart from the Oceanarium and Aalborg University, the design team were represented with practitioners from different exhibition organisations ("Ecolarium,"; "Hals Museum,"; "Invio,"; "Naturhistorisk Museum,"; "Ree Park Safari,").

The first workshop was held in autumn 2017 at Kruso's office, where all participating organisations were represented to map the requirements for the application. At the beginning of the workshop, my co-academics and I shared the existing knowledge regarding context aware smartphone applications in exhibition contexts, and the practical experience gathered from the North Sea Movie Maker project to make everyone aware of the challenges associated with mobile technologies in exhibitions.

ATTRACTIONS	INTRODUCTIONS	EVENTS	NEAR YOU	OPENING HOURS	RESTAURANTS

EXPERIENCE	MAP	SHORT TEXT	LONG TEXT	AUDIO	VIDEO
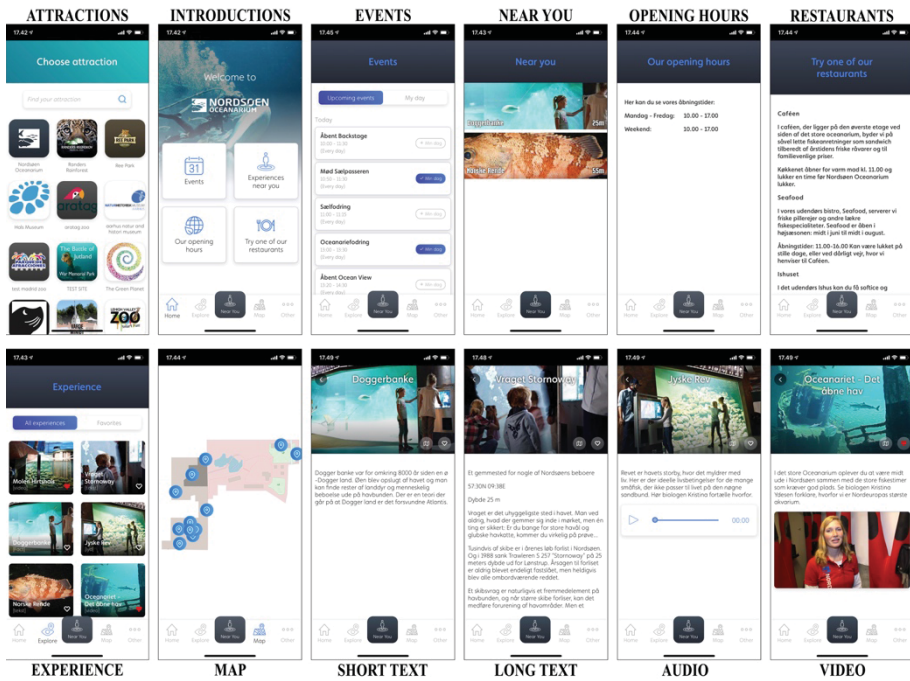
Figure 30: Screenshots of the different windows in the Aratag application. The windows are detailed in the research paper [Exhibition Systems]. See appendix 5.4 for application content.

The shared knowledge spanned the foundation for the workshop discussions on what a sustainable application should contain. The result of the workshop was a mapping of the requirements from all participating organisations for the application and its CMS system (Appendix 5.1). See figure 31.

Figure 31: The mapped requirements on the initiating workshop by the participating organisations. The requirements were mapped according to the three phases of a visit: pre-, during- and post-visit.

The process of designing and developing the application continued for a year with several workshops with different purposes ranging from selecting basic features, conducting pilot studies in lab settings, to testing a working prototype of the application at the Oceanarium (Appendix 5.3). The test was carried out at the Oceanarium October 2018 with seven families, each consisting of two parents and 1-2 children. The families tested and explored the Aratag application during their visit. The data was collected through observational studies conducted on families' interaction with the application during their visit. After the visit families' feedback was gathered through focus group interviews (Appendix 5.6). Both the observational studies and focus group interviews were audio recorded, and on which the *decoupling* was based. The gathered data was used to evaluate the value of context aware smartphone application, the best suitable content format, and practical requirements in an exhibition context. The mixed methods purpose *complementarity* is used to elaborate and clarify the results from the observational study with results from the focus group interview. The result of this case study is detailed in research paper [Exhibition Systems]. Knowledge gathered though the process of co-designing feeds into research paper [Fruitful Gaps] through *reflection-on-action*, which relied on photo documentation of workshop activities, field notes taken with observation akin to autoethnography, meeting minutes and mail correspondences (Appendix 5.5). Following is a summary of the study contribution.

5.5.2. STUDY & PAPER CONTRIBUTION

The reserch paper [Exhibition Systems] addresses a very specific challenge, self-facilitation through digital technologies in exhibitions, mediated via smartphones in a guide application. The paper provide insight about how to design for interplay between the physical setting and the digital platform, that informs the utility, desirability and usability of mobile guides. Specifically, the paper identifies that mobile technologies must first and foremost provide the visitor with a more functional dimension to support their visit (e.g. wayfinding, guidance, practical information, etc.) in order for the visitor to see an initial value of the system. Secondly, when a smartphone application takes the role as the guide, there are several media modalities that can be taken into use to mediate content. As such, in an exhibition context, the different media formats have different strengths and weaknesses. Short texts enrich both parents and children and adds value especially in loud areas. Audio format works best in less noisy areas, where video is the most preferable format and by including subtitle it can become more effective in both quiet and loud areas.

The content preferences varied, but in general, there was unity regarding entry-level 'bite-size' content to sample whether or not the information interests the individual user, and if it does, a possibility to deep-dive into specific content they want to. This as an indication for the desire to be able to explore more content on their own volition instead of having it thrust upon them by the institution. In out setup, video was the preferred type of content, because it could engage with both the kids as well as the

adults, thus enabling situations where the operator of the mobile guide would share it with other members of the family. However, it does not imply that the institutions should 'dumb down' on information, merely make it accessible, but at the user's request and not by straining their cognitive load by having everything in the exhibitions physical space. In general, the users' attitude towards the use of smartphones in exhibitions was positive.

As the application was a working prototype, there was not much focus on the organisational implementation. However, some initial findings can be drawn from the test experiment. The content of the application was developed by the chief of exhibition. The textual content was prepared within one working day and the audio-visual content was recorded within a few hours with a smartphone camera. It took one working day to integrate all these content into the CMS system with the right format and photos. Totally, it took three days to get the application ready for the test experiment, and as it is a CMS system, the content could be updated at any time by anyone with basic knowledge about CMS systems on which most of present websites are based. This timeframe and easy management can be argued to be attractive for any exhibition that wants to manage the application content seasonally, or for any other occasions, and same time sustain coherence. This opens a whole new possibility for the exhibition organisation to communicate with new content as often they wish, which can also be argued to impact the reason for visitors to revisit. As such, the way of thinking in direction of a CMS system for smartphone applications in an exhibition context adds value for both the exhibition organisation and visitors.

Based on practical lessons learned on how to prepare, implement, and publish content on a smartphone application and acquired knowledge through user test, this study and derived research paper [Exhibition Systems] add to the body of knowledge in designing, implementing, and evaluating an involving and educative transmedia experience in an exhibition context, and expand upon the existing body of knowledge on storytelling and mobile technologies in an exhibition context.

There are certain limitations to the contribution, the organisational implementation, is not investigated and currently relays on the initial experience with one practitioner developing content. The organisational implementation is an important factor, to sustain an application that have the possibility to be updated real-time. The conditions and dependencies have to be investigated to make a confirmatory conclusion. According to the visitor experience, the application has to be tested with their own devices in different situations (e.g. in high season and low season) to confirm its effect.

CHAPTER 6. CONTRIBUTIONS

The individual studies and the derived papers of this research project portray various attempts to expand the body of knowledge about using transmedia in an exhibition context. As such, in the following, I have summarised the contributions and the expanded areas according to the work questions.

6.1. DESIGNING

The research perspective on design resulted in the following work question:

What characterises the design of an involving and educative transmedia experience in an exhibition context?

The characterisation of the design of an involving and educative transmedia experience in an exhibition context is detailed through studies A-E and the derived research papers. The individual studies and the research papers cover different aspects to different degrees in designing a transmedia experience in an exhibition context. The following summary details how the different studies and research papers feed into the design aspect and expand the body of knowledge.

Studies A, D, and E contribute knowledge about designing an educative transmedia experience in an existing exhibition, which expands upon the existing body of knowledge on storytelling. Study A with research paper [Bridge Complexity] expands with the new term 'Bridge Complexity' that describes three mechanics to bridge multiplatform content, that motivate visitors in three different ways to shift from one media platform to another. This widens the lens for transmedia in other disciplinary fields, such as exhibitions. Adding to this point, study D contributes with knowledge on designing educative transmedia experiences in an exhibition context with practitioners and suppliers from different disciplinary fields. The research paper [Exhibition Design] of study D, contributes with knowledge regarding design implications for balancing enlightenment and experience for interactive digital installations in an exhibition context. The research results show that informal learning through embodied interaction with content is far more effective and desirable for enlightenment than didactic communication. Thus, provides three guiding principles for balance, between experience and enlightenment in gamified exhibition designs. The research paper [Exhibition Systems] of study E, demonstrate how to design the mediation of educative materials on a smartphone application in order to provide the most effective educative transmedia experience in an exhibition context.

Studies B and D contribute knowledge about designing a cohesive universe in an existing exhibition, which expands upon the existing body of knowledge about worldbuilding. The study B identifies the exhibition practitioners' involvement with their disciplinary knowledge and work experience as inevitable to avoid designing a universe greater than the resources to sustain it. Study D contributes knowledge about the effect a defined cohesive universe has when developing a new exhibit.

Study C contributes knowledge about designing an involving transmedia experience in an existing exhibition, which expands upon the existing body of knowledge of participation. The research paper [Transmedia Exhibition] in Study C, identifies how to design for effective visitor involvement and presents a heuristic for designing a transmedia exhibition experience: The more platform complexity, the less content complexity. To this point, the paper argues for a more data-driven design for a transmedia experience in an exhibition context. In the same study, research paper [Applied Gamification] adds to this call by focusing on gamification as a method to onboard visitors into engaging with digital experiences during their visit. Specially, when visitors do not have access to assistance or instructors to help understanding. As such, this paper expands with new knowledge; namely gamification as a method to target adoption and usage of services.

6.2. IMPLEMENTATION

The research perspective on implementation resulted in the following work question:

How can an involving and educative transmedia experience be implemented in an existing exhibition context?

How an involving and educative transmedia experience can become implemented into an existing exhibition context is detailed through study B-E and the derived research papers. The individual studies and the research papers cover different aspects to different degrees in implementing a transmedia experience in an exhibition context. The following summary details how the different studies and research papers feed into the implementation aspect and expand the body of knowledge.

Studies D and E contribute knowledge on implementing an educative transmedia experience in an existing exhibition, which expands upon the existing body of knowledge about storytelling. The derived research paper [Exhibition Design] of Study D, identifies that learning has to be implemented in embodied experiences to have the most educative effect in an exhibition context. The research paper [Exhibition Systems] of study E, illustrates how to implement educative materials into

a smartphone application through different formats and length in order to provide the most effective educative transmedia experience in an exhibition context.

Studies B and D contribute knowledge about implementing a cohesive universe in an existing exhibition, which expands upon the existing body of knowledge of worldbuilding. Study B identifies the collaborative design process with practitioners to be a prerequisite to implement a cohesive universe in an exhibition context. The collaborative design process accommodates and assign stakes to practitioners, which creates willingness to implement and sustain. However, Study D, illuminates the complication in implementing a cohesive universe, without a responsible person with the full overview of the cohesive universe (e.g. transmedia designer or director). The study also indicates that implementation is a long-term process.

Study C contributes knowledge about implementing an involving transmedia experience in an existing exhibition, which expands upon the existing body of knowledge of participation. The study identifies the data-driven design as a prerequisite for implementing participatory experiences that substantiate an involving transmedia experience in an exhibition context. It is necessary for exhibition practitioners to understand the value participatory culture creates for both visitors and the exhibition organisation to implement and sustain an involving transmedia experience in an exhibition context.

6.3. EVALUATION

The research perspective on evaluation resulted in the following work question:

Which standards and techniques can be used to evaluate the quality of a transmedia experience in an exhibition context?

The standards and techniques for evaluating the quality of a transmedia experience in an exhibition context are explored through studies C-E and their derived research papers. The individual studies and the research papers cover different aspects to different degrees in evaluating a transmedia experience in an exhibition context.

The research papers [Transmedia Exhibition] in study C and [Exhibition Design] in study D, demonstrate how to measure visitors' involvement with a transmedia experience in an exhibition context by tracking quantitative data on digital touchpoints. [Exhibition Design] identified learning as taking place through embodied experience in interacting with content. Based on this, the quality of an educative transmedia experience in an exhibition context can be measured quantitatively by tracking visitors' interaction, use time, and use pattern on digital platforms.

Concordantly, this data can also be used to measure the quality of an involving transmedia experience in an exhibition context, which is substantiated by Instagram case-study in research paper [Transmedia Exhibition]. The research paper [Exhibition Systems] in study E, measures the quality of a coherent exhibition experience with a smartphone application that utilises digital and non-digital exhibition content to provide an involving and educative transmedia experience in an exhibition context. The data for research paper [Exhibiton Systems] was gathered with qualitative methods; i.e. focus group interviews substantiated by observational studies. However, Experiences are personal and, therefore, qualitative methods are needed to measure the quality. However, the conditions for a good experience can be measured by quantitative methods such as tracking digital touchpoints. The smartphone application was not ready to track visitors during their visit, but the technology has rich possibility to track visitors' interactions and use, which can be used to measure the quality of an involving and educative transmedia experience in an exhibition context as demonstrated in the research papers [Transmedia Exhibition] and [Exhibition Design]. However, qualitative methods are beneficial to identify problems such as interface or interaction design when incorporating new digital technologies as illustrated in the research paper [Exhibition Design]. As such, quantitative measurement on digitial touchpoints are helpful in projecting a general picture of the effect, where quantitative measurements are needed to elaborate the quantitative data.

6.4. ORGANISATION

The research perspective on organisation resulted in the following work questions:

What are the conditions and dependencies between design, implementation, and evaluation of a transmedia experience in an exhibition organisation?

Which new processes and organisational initiatives are required to realise a transmedia experience in an exhibition context?

Both work questions are investigated through studies B-E and the research papers [Fruitful Gaps] and [Transmedia Exhibition]. The individual studies and the research papers cover different organisational aspects of an involving and educative transmedia experience in an exhibition context that together contribute knowledge about the conditions and dependencies between design, implementation, and evaluation of a transmedia experience in an exhibiton context. It also explores the processes and organisational initiatives needed to realise an involving and educative transmedia experience in an exhibition context.

With knowledge gained from studies B-E and research papers [Fruitful Gaps] and [Transmedia Exhibition], it is possible to state that exhibition practitioners' involvement is an inevitable condition for the design, implementation and evaluation of an involving and educative transmedia experience in an exhibition context. However, the design, implementation, and evaluation of such systems not only depends on exhibition practitioners, but also an often-diverse set of stakeholders. This creates a challenging mix of different levels of digital literacy among the stakeholders towards realisation of an involving and educative transmedia experience in an exhibition context. To this point, the research paper [Fruitful Gaps] demonstrate that in collaborative design projects like this, it is not about creating an equilibrium of literacy amongst stakeholders, but a process of recognising dynamic gabs between how stakeholders develop digital literacy gradually throughout the development process, which might actually evolve to become one of the strongest value propositions in collaborative projects concerning digital technology. Another condition is that the suppliers understand the contextual needs of the organisation and its digital pre-conditions. It defines how well an involving and educative transmedia experience that depends on digital technologies can be integrated and received by practitioners with responsibility for creating and sustaining interest in an exhibition context. It is not just a question of technology, but also of synchronising the expectations of what value an involving and educative transmedia experience can and should realise in the organisation. As such, development of project specific literacy is an important condition for the design, implementation, and evaluation of an involving and educative transmedia experience in an exhibition context. Hence, the dependencies between design, implementation, and evaluation relies on the process of how well the stakeholders reach a shared literacy that accommodates the conditions and processes of an involving and educative transmedia experience in an exhibition context identified through the previous three work questions.

* * *

The scientific contribution adds to the overall field of experience economy (Pine & Gilmore, 1999) and experience design (Jensen J. F., 1998) with the focus on transmedia experience in an exhibition context. Even though the interest is transmedia, the scientific contribution is just as valuable for experience and exhibition designers on how to build or transform existing exhibitions to utilise transmedia potentials to expand a larger universe with the use of multiple media platforms pre-, during- and post-visit. The contributions from the research project feeds into the larger domain of the experience economy, in which prior contributions has focused on integrated experiences in exhibitions, but not yet fully explored the potential of binding the experiences together to form a coherent exhibition experience across multiple media platforms through a transmedia approach.

Overall, the generated knowledge contributes to a significant empty space in the scientific arena of bringing a transmedia experience into an existing exhibition.

However, the domain still has ample space to explore, which is discussed in 'Further Perspectives' (Chapter 8). Based on the contributions the following chapter concludes this research project.

CHAPTER 7. CONCLUSIONS

This chapter concludes on the research contributions from the individual studies and the derived research papers. Routing in three motives in chapter 1, this research project was initiated with the working hypotheses:

> *A transmedia approach can be used to interweave a coherent exhibition experience across multiple media platforms, where the physical exhibition is the core platform for the content.*
>
> *Through exploring the cohesive exhibition universe, visitors will be more motivated to get involved and educated pre-, during- and post-visit.*

With the working hypotheses as the point of venture for the research, I began to dive into this area of interest and was intrigued by the opportunity to explore a research area, which only had a few contributions in its arsenal.

With an elaborated review of this area of interest, I looked forward to exploring and expanding the knowledge of transmedia in an exhibition context. As such, grounded in pragmatism, my research project was aimed at examining the following research question:

> *What are the theoretical, methodical, and analytical conditions for designing, implementing, and evaluating an involving and educative transmedia experience in an exhibition context pre-, during- and post-visit?*

The research question introduced four research perspectives, which resulted in the following related work questions:

Designing – resulting in the following work question:
What characterises the design of an involving and educative transmedia experience in an exhibition context?

Implementation – resulting in the following work question:
How can an involving and educative transmedia experience be implemented in an existing exhibition context?

Evaluation – resulting in the following work question:
Which standards and techniques can be used to evaluate the quality of an involving and educative transmedia experience in an exhibition context?

Organisation – resulting in the following work questions:
What are the conditions and dependencies between design, implementation, and evaluation of an involving and educative transmedia experience in an exhibition organisation?

Which new processes and organisational initiatives does it require to realise an involving and educative transmedia experience in an exhibition context?

Chapter 5 summarised the research contributions and the expanded areas corresponding to the work questions, which portrays various endeavours into expanding the body of knowledge about using transmedia in an exhibition context.

Coming to the end, it is obvious to ask, to what extent this research project has succeeded in answering the primary research question. The contributions of the individual studies and the derived research papers at least serve to give exemplary evidence towards claiming that the working hypotheses are in part confirmed, become a temporary *fact of existence*, and answer the research question through their results.

Thus, the research project has sought to identify the theoretical, methodical, and analytical conditions for designing, implementing, and evaluating an involving and educative transmedia experience in an exhibition context. As such, I argue, that the contributions of this research project leave the area of interest pragmatically more stable and in a determinate situation, than it was prior to this research project.

As such, this research project has expanded the body of knowledge in the area of interest. However, it is only in one exhibition context that transmedia is explored through this research project. To this point, it is possible to lose sight of the fact, that it only represents a certain part of a much bigger and versatile repertoire of exhibition contexts. Thus, the findings and contributions of the studies, cannot be fully generalised, as the vast territory of the area of interest is still unmapped.

Hence, I conclude, this research project has succeeded in contributing and expanding the area of interest.

However, the area of interest is sprouting with possibilities for further research in areas included and excluded in this research project. Following chapter will look into some of the obvious extensions of this research.

CHAPTER 8. FURTHER PERSPECTIVES

While the area of interest has been studied with different perspectives, it is relevant to consider whether the findings and experiences can be generalised to a broader range of exhibition contexts, i.e. can transmedia experiences be brought into all kind of exhibition contexts? If not, what are the limitations? The covered aspects of transmedia experience in an exhibition context should be seen as examples of a much broader landscape. Thus, it would be relevant to explore more examples, not only in the same exhibition context, but in a diverse set of exhibition contexts to clarify and validate the value.

Although, different exhibition contexts would be interesting to look into, it would be far more relevant to investigate the potential of transmedia to connect different exhibitions located within a short distance of each other. This can be explored through the term 'Bridge Complexity' introduced in the research paper [Bridge complexity]. With the three bridges it is theoretically possible to span a cohesive universe in which different exhibitions can share a common, character, storyline, and/or storyworld to provide a large-scale transmedia experience. Here, a location-based smartphone application like Aratag would enable bridging between exhibitions. It, it will also be interesting to investigate how to motivate and onboard people to travel between these exhibitions. In large scale concepts like this, the organisational implementation cannot be left out as it requires practitioners from different exhibitions to collaborate in designing, implementing, and sustaining a large-scale transmedia experience across multiple exhibitions. This would truly test the scalability of this research project's contributions.

Diving back into the micro level from the macro level, it would also be interesting to explore methods to track visitor activities across platforms to form an understanding of visitors' behaviour within transmedia space to assess the value of a transmedia experience. Currently, these data are collected separately on different systems in an exhibition. It might help practitioners to adjust and enhance the transmedia experience, if these data could be gathered, not only in one place, but also visualised in a simple way to understand and act upon. Here, automated processes and machine learning might be an area of interest.

New technologies are reaching into all aspect of our everyday life. As such, it is unavoidable to explore the potential of new emerging technologies, such as AR and VR to enhance the transmedia experience. Apart from the people's interaction with technologies, the interaction between technologies also creates opportunities to personalise a transmedia experience, which is another interesting area to explore.

Getting back to the macro level, other industries, such as tourism, theme parks, cultural- and sports events etc. are also potential areas of interest to explore the

benefits with transmedia experiences. Merging different entities together through a cohesive universe might open unexplored doors for these fields.

The chapter shows, that the last word has not been written about transmedia in an exhibition space. Thus, I look forward to further exploring the domain in the future. As the final remark, I thank you for sticking with me to the end of this thesis.

Vashanth Selvadurai, 2019

BIBLIOGRAPHY

Adler, P. A., & Adler, P. (1987). *Membership Roles in Field Research*. SAGE.

Adner, R. (2013). *The Wide Lens: What Successful Innovators See That Others Miss* (Revised edition). New York, New York: Portfolio.

Airey, D. (2009). *Logo Design Love: A Guide to Creating Iconic Brand Identities* (1 edition). Berkeley, CA: New Riders.

Aldhaban, F. (2012). Exploring the adoption of Smartphone technology: Literature review. *2012 Proceedings of PICMET '12: Technology Management for Emerging Technologies*, 2758–2770.

Ames, M., & Naaman, M. (2007). Why we tag: motivations for annotation in mobile and online media. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems - CHI '07*, 971. https://doi.org/10.1145/1240624.1240772

Apostolellis, P., & Bowman, D. A. (2015). Small Group Learning with Games in Museums: Effects of Interactivity As Mediated by Cultural Differences. *Proceedings of the 14th International Conference on Interaction Design and Children*, 160–169. https://doi.org/10.1145/2771839.2771856

Aratag. (n.d.). Retrieved February 8, 2019, from https://aratag.com/#home

Baarts, C. (2004). *Viden og kunnen: en antropologisk analyse af sikkerhed på en byggeplads*. Københavns Universitet, Det Samfundsvidenskabelige Fakultet.

Baarts, C. (2009). Stuck in the middle: research ethics caught between science and politics. *Qualitative Research*, *9*(4), 423–439. https://doi.org/10.1177/1468794109337873

Baarts, C. (2015). In *Kvalitative metoder: en grundbog*. Hans Reitzel.

Baker, M. J., & Balmer, J. M. T. (1997). Visual identity: trappings or substance? *European Journal of Marketing*, *31*(5/6), 366–382. https://doi.org/10.1108/eb060637

Bardzell, S., Wu, V., Bardzell, J., & Quagliara, N. (2007). *Transmedial Interactions and Digital Games*. 307–308. Salzburg, Austria.

Basballe, D. A., & Halskov, K. (2012). *Dynamics of research through design*. 58. https://doi.org/10.1145/2317956.2317967

Baskerville, R. L., & Wood-Harper, A. T. (1996). A critical perspective on action research as a method for information systems research. *Journal of Information Technology*, *11*(3), 235–246. https://doi.org/10.1080/026839696345289

Beddows, E. (2012). *Consuming Transmedia: how audiences engage with narrative across multiple story modes* (Doctoral Dissertation). Retrieved from http://www.emmabeddows.com/wp-content/uploads/2013/03/EmmaBeddows_PhDTHESISFINAL_ConsumingTransmedia_2012.pdf

Best, K. (2012). Making museum tours better: understanding what a guided tour really is and what a tour guide really does. *Museum Management and Curatorship*, *27*(1), 35–52. https://doi.org/10.1080/09647775.2012.644695

Biggs, M. A. R., & Büchler, D. (2007). Rigor and Practice-based Research. *Design Issues*, *23*(3), 62–69. https://doi.org/10.1162/desi.2007.23.3.62

Bird, S. E. (2011). Are We All Produsers Now? *Cultural Studies*, *25*(4–5), 502–516. https://doi.org/10.1080/09502386.2011.600532

Birkinbine, B. J., Gómez, R., & Wasko, J. (2017). *Global Media Giants*. Routledge.

Birkler, J. (2005). *Videnskabsteori: en grundbog*. Munksgaard Danmark.

Bitgood, S. (2009). Museum Fatigue: A Critical Review. *Visitor Studies*, *12*(2), 93–111. https://doi.org/10.1080/10645570903203406

Black, G. (2010). Embedding civil engagement in museums. *Museum Management and Curatorship*, *25*(2), 129–146. https://doi.org/10.1080/09647771003737257

Borum, F., & Christiansen, J. K. (2006). Actors and structure in IS projects: What makes implementation happen? *Scandinavian Journal of Management*, *22*(3), 213–237. Retrieved from https://ideas.repec.org/a/eee/scaman/v22y2006i3p213-237.html

Bourdaa, M. (2013). "Following the Pattern": The Creation of an Encyclopaedic Universe with Transmedia Storytelling. *Adaptation*, *6*(2), 202–214. https://doi.org/10.1093/adaptation/apt009

BrandHeroes. (n.d.). Retrieved February 3, 2019, from Brandheroes website: https://brandheroes.com/

Brannen, J. (2017). *Mixing Methods: Qualitative and Quantitative Research*. Routledge.

Brewer, J., & Hunter, A. (1989). *Multimethod research: a synthesis of styles*. Sage Publications.

Brewer, J., & Hunter, A. (2006). *Foundations of Multimethod Research: Synthesizing Styles*. SAGE.

Brinkmann, S. (2006). *John Dewey: en introduktion*. Hans Reitzels Forlag.

Brinkmann, S., & Tanggaard, L. (2015). *Kvalitative metoder: en grundbog*. Hans Reitzel.

Brown, R. B. (2006). *Doing Your Dissertation in Business and Management: The Reality of Researching and Writing*. SAGE.

Buchanan, R. (1992). Wicked Problems in Design Thinking. *Design Issues*, *8*(2), 5–21. https://doi.org/10.2307/1511637

Buchanan, R. (2001). Design Research and the New Learning. *Design Issues*, *17*(4), 3–23. https://doi.org/10.1162/07479360152681056

Budge, K. (2017). Objects in Focus: Museum Visitors and Instagram. *Curator: The Museum Journal*, *60*(1), 67–85. Retrieved from http://onlinelibrary.wiley.com/doi/10.1111/cura.12183/full

Busse, K., & Gray, J. (2011). Fan Cultures and Fan Communities. In *The Handbook of Media Audiences* (pp. 425–443). https://doi.org/10.1002/9781444340525.ch21

Buysch, E. O. den, & Kaa, H. van der. (2016). Towards a new transmedia metrics model. *Fontys Transmedia Stortelling Lab*.

Buysch, E. O. den, & Kaa, H. van der. (2018). A Metrics Model for Measuring Transmedia Engagement. In M. Freeman & R. R. Gambarato (Eds.), *The Routledge Companion to Transmedia Studies* (pp. 464–472). Taylor & Francis Group.

Calvi, L., & Cassella, M. (n.d.). Always On: Museums in the Mobile Communication Era. *Always On*, 10.

Cameron, A. (2008). Modular Narratives in Contemporary Cinema. In A. Cameron (Ed.), *Modular Narratives in Contemporary Cinema* (pp. 1–19). https://doi.org/10.1057/9780230594197_1

Campbell, J. (1949). *The Hero with a Thousand Faces*. New World Library.

Carpentier, N. (2011a). Contextualising Author-Audience Convergences. *Cultural Studies*, *25*(4–5), 517–533. https://doi.org/10.1080/09502386.2011.600537

Carpentier, N. (2011b). *Media and Participation: A Site of Ideological-democratic Struggle*. Intellect Books.

Ceipidor, U. B., Medaglia, C. M., Volpi, V., Moroni, A., Sposato, S., Carboni, M., & Caridi, A. (2013). NFC technology applied to touristic-cultural field: A case study on an Italian museum. *2013 5th International Workshop on Near Field Communication (NFC)*, 1–6. https://doi.org/10.1109/NFC.2013.6482445

Christensen, H. D. (2009). Digitale forskydninger. Hvorfor bevare den fysiske kulturarv, når den kan digitaliseres? In N. D. Lund (Ed.), *Digital formidling af kulturarv: fra samling til sampling* (pp. 99–126). Multivers.

Ciolfi, L. (2012). Social Traces. Participation and the creation of shared heritage. In E. Giaccardi (Ed.), *Heritage and Social Media: Understanding Heritage in a Participatory Culture* (pp. 69–86). Routledge.

Cockton, G. (2008). Putting Value into E-valu-ation. In E. L.-C. Law, E. T. Hvannberg, & G. Cockton (Eds.), *Maturing Usability: Quality in Software, Interaction and Value* (pp. 287–317). https://doi.org/10.1007/978-1-84628-941-5_13

Coe, J. C. (1986). *Towards a Co-Evolution of Zoos, Aquariums and Natural History Museums*. 11.

Coughlan, J., Lycett, M., & Macredie, R. D. (2005). Understanding the business–IT relationship. *International Journal of Information Management*, *25*(4), 303–319. https://doi.org/10.1016/j.ijinfomgt.2005.04.003

Couldry, N. (2011). More Sociology, More Culture, More Politics. *Cultural Studies*, *25*(4–5), 487–501. https://doi.org/10.1080/09502386.2011.600528

Coyne, R., & Snodgrass, A. (1991). Is designing mysterious? challenging the dual knowledge thesis. *Design Studies*, *12*(3), 124–131. https://doi.org/10.1016/0142-694X(91)90020-W

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE.

Cross, N. (1999). Design Research: A Disciplined Conversation. *Design Issues*, *15*(2), 5–10. https://doi.org/10.2307/1511837

Crotty, M. (1998). *The Foundations of Social Research: Meaning and Perspective in the Research Process*. SAGE.

Crowley, K., & Jacobs, M. (2003). Building Islands of Expertise in Everyday Family Activity. In G. Leinhardt & K. Knutson (Eds.), *Learning Conversations in Museums* (pp. 333–355). Taylor & Francis.

Crystal, M., & Herskovitz, S. (2010). The essential brand persona: storytelling and branding. *Journal of Business Strategy*, *31*(3), 21–28. https://doi.org/10.1108/02756661011036673

Cunningham, S. (2012). Emergent Innovation through the Coevolution of Informal and Formal Media Economies. *Television & New Media*, *13*(5), 415–430. https://doi.org/10.1177/1527476412443091

Dalby, J. (2017, October). *Transmedia Audiences: The Modular Body Confirmed*. Presented at the Transmedia Earth Conference: Global Convergence Culture, EAFIT University.

Dalsgaard, P. (2014). Pragmatism and Design Thinking. *International Journal of Dsign*, (1). Retrieved from http://www.ijdesign.org/ojs/index.php/IJDesign/article/view/1087

Danielak, B. A., Mechtley, A., Berland, M., Lyons, L., & Eydt, R. (2014). MakeScape Lite: A Prototype Learning Environment for Making and Design. *Proceedings of the 2014 Conference on Interaction Design and Children*, 229–232. https://doi.org/10.1145/2593968.2610459

Danish Agency for Research and Education. (2017). *forsk2025 - Fremtidens løftrige forskningsområder*. Retrieved from https://ufm.dk/publikationer/2017/filer/forsk2025.pdf

Danish Disruption Council. (2017). Danish Disruption Council. Retrieved January 27, 2019, from Regeringen.dk website: https://www.regeringen.dk/partnerskab/

Davidson, D. (2010). Cross-media stories. *ACM SIGGRAPH Computer Graphics*, *44*(3), 1. https://doi.org/10.1145/1852645.1852657

Davis, C. H. (2013). Audience Value and Transmedia Products. In T. Storsul & A. H. Krimsvik (Eds.), *Media Innovations* (pp. 175–190). Göteborg: Nordicom.

Delwiche, A., & Henderson, J. J. (2012). *The Participatory Cultures Handbook*. Routledge.

Dena, C. (2004). Current state of cross media storytelling: preliminary observations for future design. *European Information Systems Technologies Event*, 1–11.

Dena, C. (2007). *Patterns in Cross-Media Interaction Design: It's much more than a URL... (Part 1)*. 8. Retrieved from http://www.christydena.com/wp-content/uploads/2007/11/dena_morethan_part1.pdf

Dena, C. (2008). Emerging Participatory Culture Practices: Player-Created Tiers in Alternate Reality Games. *Convergence: The International Journal of Research into New Media Technologies*, *14*(1), 41–57. https://doi.org/10.1177/1354856507084418

Dena, C. (2009). *Transmedia practice: Theorising the practice of expressing a fictional world across distinct media and environments* (Doctoral Dissertation). University of Sydney, Sydney, Australia.

Dena, C. (2014). Transmedia as 'Unmixed Media' aesthetics. In D. Polson, A.-M. Cook, J. T. Velikovsky, & A. L. Brackin (Eds.), *Transmedia Practice: A Collective Approach* (pp. 3–16). Retrieved from https://www.interdisciplinarypress.net/online-store/ebooks/digital-humanities/transmedia-practice-a-collective-approach

Dena, C. (2016, November 15). Transmedia Behaving Badly? *Immerse*. Retrieved from https://immerse.news/transmedias-transitions-9c28ef2c5835

Dena, C. (2018). Transmedia Adaptation: Revisiting the No-Adaptation Rule. In M. Freeman & R. R. Gambarato (Eds.), *The Routledge Companion to Transmedia Studies* (pp. 195–206). Taylor & Francis Group.

Desmet, P., & Hekkert, P. (2007). *Framework of Product Experience*. 10.

Dewey, J. (1922). *Human Nature And Conduct*. Retrieved from
http://archive.org/details/humannatureandco011182mbp

Dewey, J. (1929). *The Quest for Certainty: A Study of the Relation of Knowledge and Action*. New York:
Putnam.

Dewey, J. (1938). *Logic, the Theory of Inquiry*. H. Holt.

Dewey, J. (1998). *The Essential Dewey: Pragmatism, education, democracy*. Indiana University Press.

Dewey, J. (2004). *Democracy and Education*. Courier Corporation.

Dewey, J. (2005). *Art as Experience*. Penguin.

Diefenbach, S., & Hassenzahl, M. (2009). The "Beauty Dilemma": beauty is valued but discounted in
product choice. *Proceedings of the 27th International Conference on Human Factors in
Computing Systems - CHI 09*, 1419. https://doi.org/10.1145/1518701.1518916

Digital Hub Denmark. (2018, August 22). Digital Hub Denmark. Retrieved January 27, 2019, from
Digitalhub Denmark website: https://digitalhubdenmark.dk/

Dijk, J. A. G. M. van. (2005). *The Deepening Divide: Inequality in the Information Society*. SAGE
Publications.

Dindler, C., & Iversen, O. S. (2009). *MOTIVATION IN THE MUSEUM - MEDIATING BETWEEN
EVERYDAY ENGAGEMENT AND CULTURAL HERITAGE*. 11.

Dorst, K. (2006). Design Problems and Design Paradoxes. *Design Issues*, *22*(3), 4–17.
https://doi.org/10.1162/desi.2006.22.3.4

Dowling, G. R. (1996). *Corporate Reputations: Strategies for Developing the Corporate Brand*. London:
Kogan Page Ltd.

Drotner, K. (Ed.). (2011). *Det interaktive museum* (1. udgave). In (1. udgave). Frederiksberg:
Samfundslitteratur.

Drotner, K., Dziekan, V., Parry, R., & Schrøder, K. C. (2018a). Media, mediatisation and museums. In
The Routledge Handbook of Museums, Media and Communication. Routledge.

Drotner, K., Dziekan, V., Parry, R., & Schrøder, K. C. (2018b). *The Routledge Handbook of Museums,
Media and Communication*. Routledge.

Drotner, K., & Laursen, D. (2011). Introduction. *Journal of Media and Communication Research*, *27*(50), 1–6.

Dysthe, O., Esbjørn, L., & Bernhardt, N. (2012). *Dialogbaseret undervisning: kunstmuseet som læringsrum*. Skoletjenesten.

Ecolarium. (n.d.). Retrieved February 8, 2019, from Økolariet website: http://en.okolariet.dk/

Edwards, L. H. (2012). Transmedia Storytelling, Corporate Synergy, and Audience Expression. *Global Media Journal*, *12*(20).

Elektronik i hjemmet. (2018). Retrieved February 10, 2019, from Danmarks Statestik website: https://www.dst.dk/da/Statistik/emner/priser-og-forbrug/forbrug/elektronik-i-hjemmet

Ellis, C., Adams, T. E., & Bochner, A. P. (2011). Autoethnography: An Overview. *Historical Social Research / Historische Sozialforschung*, *36*(4 (138)), 273–290. Retrieved from https://www.jstor.org/stable/23032294

Ellis, C., & Bochner, A. (2000). Autoethnography, Personal Narrative, Reflexivity: Researcher as Subject. *Handbook of Qualitative Research*, 733–768. Retrieved from https://scholarcommons.usf.edu/spe_facpub/91

Espinós, A. (2016). *Museums on social media: Analyzing growth through case studies*. Presented at the Museums and the Web 2016, Los Angeles, California, USA. Retrieved from https://mw2016.museumsandtheweb.com/paper/museums-on-social-media-analyzing-growth-through-case-studies/

Etzkowitz, H. (2003). Innovation in Innovation: The Triple Helix of University-Industry-Government Relations. *Social Science Information*, *42*(3), 293–337. https://doi.org/10.1177/05390184030423002

Evans, B., & Giroux, H. A. (2015). *Disposable Futures: The Seduction of Violence in the Age of Spectacle* (1 edition). San Francisco: City Lights Publishers.

Evans, E. (2008). Character, audience agency and transmedia drama. *Media, Culture & Society*, *30*(2), 197–213. Retrieved from http://journals.sagepub.com/doi/pdf/10.1177/0163443707086861

Evans, E. (2011). *Transmedia television: audiences, new media, and daily life*. In *A Comedia Book*. New York: Taylor & Francis.

Evans, E. (2015, June 22). *Building Digital Estates: Transmedia Television in Industry and Daily Life*. Presented at the ECREA TV in the age of Transnationalisation and Transmediation, Roehampton University. Retrieved from http://mediaacrossborders.com/wp-content/uploads/2016/02/Evans-Building-Digital-Estates-paper.pdf

Evans, E. (2018). Transmedia Television: Flow, Glance, and the BBC. In M. Freeman & R. R. Gambarato (Eds.), *The Routledge Companion to Transmedia Studies* (pp. 35–43). Taylor & Francis Group.

Eytam, E., Tractinsky, N., & Lowengart, O. (2017). The paradox of simplicity: Effects of role on the preference and choice of product visual simplicity level. *Int. J. Hum.-Comput. Stud.*, *105*, 43–55. https://doi.org/10.1016/j.ijhcs.2017.04.001

Falk, J. H. (2013). Understanding museum visitors' motivations and learning. In J. T. Jensen & I. B. Lundgaard (Eds.), *Museums social learning spaces and knowledge producing processes*. Retrieved from https://slks.dk/fileadmin/user_upload/dokumenter/KS/institutioner/museer/Indsatsomraader/Bruger undersoegelse/Artikler/John_Falk_Understanding_museum_visitors__motivations_and_learning.p df

Falk, J. H., & Dierking, L. D. (2008). Enhancing Visitor Interaction and Learning with Mobile Technologies. In L. Tallon (Ed.), *Digital Technologies and the Museum Experience: Handheld Guides and Other Media* (pp. 19–33). Rowman Altamira.

Falk, J. H., & Dierking, L. D. (2016). *The Museum Experience Revisited*. https://doi.org/10.4324/9781315417851

Fallman, D. (2003). *Design-oriented human-computer interaction*. 225. https://doi.org/10.1145/642611.642652

Fårup Sommerland. (n.d.). Retrieved February 13, 2019, from https://www.faarupsommerland.dk/dk/

Firdaus, T. (2013). *Responsive Web Design by Example Beginner's Guide*. Packt Publishing Ltd.

Fleming, L. (2013). Expanding Learning Opportunities with Transmedia Practices: "Inanimate Alice" as an Exemplar. *Journal of Media Literacy Education*, *5*(2), 370–377. Retrieved from https://eric.ed.gov/?id=EJ1043444

Forlizzi, J., & Ford, S. (2000). The building blocks of experience: an early framework for interaction designers. *Proceedings of the DIS00 Conference*, 419–423. ACM Press.

Forlizzi, J., Zimmerman, J., & Stolterman, E. (2009). *From Design Research to Theory: Evidence of a Maturing Field*. Presented at the International Association of Societies of Design Research.

Frain, B. (2012). *Responsive Web Design with HTML5 and CSS3*. Packt Publishing Ltd.

Frayling, C. (1993). Research in Art and Design. *Royal College of Art Research Papers*, *1*(1). Retrieved from http://researchonline.rca.ac.uk/384/

Freeman, M. (2016). *Historicising Transmedia Storytelling: Early Twentieth-Century Transmedia Story Worlds*. Routledge.

Freeman, M., & Gambarato, R. R. (Eds.). (2018a). Afterword: The Present and Future of Transmedia Practices - A Conversation. In *The Routledge Companion to Transmedia Studies* (pp. 473–480). Taylor & Francis Group.

Freeman, M., & Gambarato, R. R. (2018b). Introduction: Transmedia Studies - Where Now? In *The Routledge Companion to Transmedia Studies* (pp. 1–12). Taylor & Francis Group.

Galliers, R. D., & Land, F. F. (1987). Viewpoint: Choosing Appropriate Information Systems Research Methodologies. *Commun. ACM*, *30*(11), 901–902. https://doi.org/10.1145/32206.315753

Gambarato, R. R. (2012a). How to Analyze Transmedia Narratives? In A. Joesaar (Ed.), *Baltic Film and Media School Screen Studies* (p. 23). Tallinn University Press.

Gambarato, R. R. (2012b). Signs, Systems and Complexity of Transmedia Storytelling. *Communication Studies*, *12*, 15.

Gambarato, R. R. (2013). Transmedia Project Design: Theoretical and Analytical Considerations. *Baltic Screen Media Review*, *1*(1), 80–100. https://doi.org/10.1515/bsmr-2015-0006

Gambarato, R. R. (2018). Transmedia Journalism: The Potentialities of Transmedia Dynamics in the News Coverage of Planned Events. In M. Freeman & R. R. Gambarato (Eds.), *The Routledge Companion to Transmedia Studies* (pp. 90–98). Taylor & Francis Group.

Gambarato, R. R., & Alzamora, G. (2018). *Exploring Transmedia Journalism in the Digital Age*. IGI Global.

Gardner, B. S. (2011). Responsive Web Design: Enriching the User Experience. *Sigma*, *11*, 13–19. Retrieved from http://www.webdesignblog.gr/wp-content/uploads/2012/03/5.pdf#page=15

Gaver, W. (2012). What Should We Expect from Research Through Design? *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 937–946. https://doi.org/10.1145/2207676.2208538

Gaver, W. W., Beaver, J., & Benford, S. (2003). Ambiguity As a Resource for Design. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 233–240. https://doi.org/10.1145/642611.642653

Ghellal, S., & Morrison, A. (2017). *The interpretative role of an experiencer* (ACM Press). Retrieved from http://dl.acm.org/citation.cfm?doid=3152771.3152782

Gibbons, M., Nowotny, H., Schwartzman, S., Seot, P., & Trow, M. (n.d.). *THE NEW PRODUCTION OF KNOWLEDGE*. 11.

Gibbs, C., & Gretzel, U. (2015). Drivers of Responsive Website Design Innovation by Destination Marketing Organizations. In I. Tussyadiah & A. Inversini (Eds.), *Information and Communication Technologies in Tourism 2015* (pp. 581–592). Springer International Publishing.

Giovagnoli, M. (2011). *Transmedia storytelling: imagery, shapes and techniques*. Pittsburgh: ETC Press.

Gitelman, L. (2006). *Always already new: media, history and the data of culture*. Cambridge, Mass: MIT Press.

Glassman, N. R., & Shen, P. (2014). One Site Fits All: Responsive Web Design. *Journal of Electronic Resources in Medical Libraries*, *11*(2), 78–90. https://doi.org/10.1080/15424065.2014.908347

Godin, D., & Zahedi, M. (2014). Aspects of Research through Design. *Proceedings of DRS 2014*. Presented at the Design Research Society.

Goldkuhl, G. (2011). Design Research in Search for a Paradigm: Pragmatism Is the Answer. In M. Helfert & B. Donnellan (Eds.), *Practical Aspects of Design Science* (pp. 84–95). https://doi.org/10.1007/978-3-642-33681-2_8

Goldman, K. H. (2007). *Cell phones and exhibitions 2.O: moving beyond the pilot stage*. Retrieved from http://www.museumsandtheweb.com/mw2007/papers/haleyGoldman/haleyGoldman.html

Gómez, A., Puigvert, L., & Flecha, R. (2011). Critical Communicative Methodology: Informing Real Social Transformation Through Research. *Qualitative Inquiry*, *17*(3), 235–245. https://doi.org/10.1177/1077800410397802

Gomez, J. (2008). *Talking Transmedia: An Interview with Starlight Runner's Jeff Gomez (Part Two)* (H. Jenkins, Interviewer). Retrieved from http://henryjenkins.org/blog/2008/05/an_interview_with_starlight_ru_1.html

Gomez, J. (2011). *Jeff Gomez of Starlight Runner Entertainment on Transmedia Storytelling* (I. Kopp, Interviewer). Retrieved from https://www.tfiny.org/blog/detail/jeff_gomez_of_starlight_runner_entertainment_on_transmedia_storytelling

Gotcha. (n.d.). Retrieved January 31, 2019, from Gotcha website: https://gotcha.dk/forside?gclid=Cj0KCQiA1sriBRD-ARIsABYdwwFdG_RasrXYSgpscbMqP0Pv0h91cqaxVSxBhPL1bCTXpvVToHGvMOcaAgClEALw_wcB

Grainge, P., & Johnson, C. (2015). *Promotional Screen Industries*. Routledge.

Gray, J. (2010). *Show Sold Separately: Promos, Spoilers, and Other Media Paratexts*. New York: NYU Press.

Green, J., & Jenkins, H. (2011). Spreadable Media: How Audiences Create Value and Meaning in a Networked Economy. In *The Handbook of Media Audiences* (pp. 109–127). https://doi.org/10.1002/9781444340525.ch5

Greene, J. C. (2007). *Mixed Methods in Social Inquiry*. John Wiley & Sons.

Greenhill, E. H. (1992). *Museums and the Shaping of Knowledge* (1 edition). London ; New York: Routledge.

Greenwood, D. J., & Levin, M. (2006). *Introduction to Action Research: Social Research for Social Change*. SAGE Publications.

Grinsven, B. van, & Das, E. (2015). Processing different degrees of logo change. *European Journal of Marketing; Bradford*, *49*(11/12), 1710–1727. http://dx.doi.org/10.1108/EJM-02-2014-0127

Grinsven, B. van, & Das, E. (2016). Logo design in marketing communications: Brand logo complexity moderates exposure effects on brand recognition and brand attitude. *Journal of Marketing Communications*, *22*(3), 256–270. https://doi.org/10.1080/13527266.2013.866593

Grinter, R. E., Aoki, P. M., Hurst, A., Szymanski, M. H., Thornton, J. D., & Woodruff, A. (n.d.). *Revisiting the Visit: Understanding How Technology Can Shape the Museum Visit*. 10.

Grishakova, M., & Ryan, M.-L. (2010). *Intermediality and Storytelling*. Walter de Gruyter.

Guba, E. G. (1990). *The Paradigm Dialog*. SAGE Publications.

Gube, J. (2010, October). What Is User Experience Design? Overview, Tools And Resources. *Smashing Magazine*. Retrieved from https://www.smashingmagazine.com/2010/10/what-is-user-experience-design-overview-tools-and-resources/

Hall, T., & Bannon, L. (2005). Co-operative design of children'sinteraction in museums: a case studyin the Hunt Museum. *CoDesign*, *1*(3), 187–218. https://doi.org/10.1080/15710880512331392362

Hals Museum. (n.d.). Retrieved February 8, 2019, from Hals Museum website: https://nordmus.dk/en/u/hals-museum-2/

Hammersley, M. (1992). *What's Wrong with Ethnography?: Methodological Explorations*. Psychology Press.

Hanson, M. (2004). *The End of Celluloid: Film Futures in the Digital Age*. RotoVision.

Hart, C. (1998). *Doing a Literature Review: Releasing the Social Science Research Imagination*. SAGE
    Publications.

Harvey, C. B. (2015). *Fantastic transmedia: narrative, play and memory across science fiction and
    fantasy storyworlds*. Retrieved from
    http://public.eblib.com/choice/publicfullrecord.aspx?p=4321678

Hassenzahl, M., & Tractinsky, N. (2006). User experience - a research agenda. *Behaviour & Information
    Technology*, *25*(2), 91–97. https://doi.org/10.1080/01449290500330331

Heath, C., & Lehn, D. vom. (2008). Configuring "Interactivity": Enhancing Engagement in Science
    Centres and Museums. *Social Studies of Science*, *38*(1), 63–91. Retrieved from
    https://www.jstor.org/stable/25474565

Heath, C., & Lehn, D. vom. (2010). Interactivity and collaboration. New forms of participation in
    museums, galleries and science centers. In R. Parry (Ed.), *Museums in a Digital Age* (pp. 266–
    280). Routledge.

Henderson, P. W., & Cote, J. A. (1998). Guidelines for selecting or modifying logos. *Journal of
    Marketing; Chicago*, *62*(2), 14–30. Retrieved from
    https://search.proquest.com/docview/227831782/abstract/4940E7F2FAB84801PQ/4

Hennig-Thurau, T., Wiertz, C., & Feldhaus, F. (2015). Does Twitter matter? The impact of microblogging
    word of mouth on consumers' adoption of new movies. *Journal of the Academy of Marketing
    Science*, *43*(3), 375–394. https://doi.org/10.1007/s11747-014-0388-3

Hevner, A., & Chatterjee, S. (2010). *Design Research in Information Systems: Theory and Practice*.
    Springer Science & Business Media.

Highfield, T., & Leaver, T. (2015). A methodology for mapping Instagram hashtags. *First Monday*, *20*,
    1–11. Retrieved from https://eprints.qut.edu.au/79684/

Hills, M. (2012). *Torchwood's trans-transmedia: Media tie-ins and brand 'fanagement.' 9*(2), 409–428.

Holm, A. B. (2018). *Videnskab i virkeligheden* (2nd ed.). Samfundslitteratur.

Hooper-Greenhill, E. (2012). Changing Values in the Art Museum: Rethinking Communication and
    Learning. In B. M. Carbonell (Ed.), *Museum Studies: An Anthology of Contexts* (pp. 517–532).
    John Wiley & Sons.

Hornecker, E. (2008). "I don't understand it either, but it is cool" - visitor interactions with a multi-touch
    table in a museum. *2008 3rd IEEE International Workshop on Horizontal Interactive Human
    Computer Systems*, 113–120. https://doi.org/10.1109/TABLETOP.2008.4660193

Hornecker, Eva, & Stifter, M. (2006). Learning from Interactive Museum Installations About Interaction Design for Public Settings. *Proceedings of the 18th Australia Conference on Computer-Human Interaction: Design: Activities, Artefacts and Environments*, 135–142. https://doi.org/10.1145/1228175.1228201

Hosker, R., Knowles, C., & Rodger, N. (2014). Cross Cutting Concepts for Change: Collections – Alignment – Engagement. *Engaging Spaces. Interpretation, Design and Digital Strategies*, 62–68. Retrieved from http://nodem.org/wp-content/uploads/2014/09/NODEM-2014-Proceedings.pdf

Hughes, K., & Moscardo, G. (2017). Connecting with New Audiences: Exploring the Impact of Mobile Communication Devices on the Experiences of Young Adults in Museums. *Visitor Studies*, *20*(1), 33–55. https://doi.org/10.1080/10645578.2017.1297128

Humphreys, L. (2018). *The Qualified Self: Social Media and the Accounting of Everyday Life* (1 edition). Cambridge, Massachusetts: The MIT Press.

Hussain, A., & Mkpojiogu, E. O. C. (2015). THE EFFECT OF RESPONSIVE WEB DESIGN ON THE USER EXPERIENCE WITH LAPTOP AND SMARTPHONE DEVICES. *Jurnal Teknologi*, *77*(4). https://doi.org/10.11113/jt.v77.6041

Hynes, N. (2009). Colour and meaning in corporate logos: An empirical study. *Journal of Brand Management; London*, *16*(8), 545–555. http://dx.doi.org/10.1057/bm.2008.5

Ibrus, I., & Scolari, C. A. (2012). *Crossmedia Innovations: Texts, Markets, Institutions*. Peter Lang.

Innovation Fund. (n.d.). Retrieved February 20, 2019, from Innovationsfonden website: https://innovationsfonden.dk/en

Innovation Fund Denmark. (2019). New Technological Opportunities | Innovationsfonden. Retrieved January 28, 2019, from https://innovationsfonden.dk/en/programmes/grand-solutions/new-technological-opportunities

Instagram: active users 2018. (2018). Retrieved February 11, 2019, from Statista website: https://www.statista.com/statistics/253577/number-of-monthly-active-instagram-users/

Interactive Digital Media. (n.d.). Retrieved February 20, 2019, from Indimedia website: https://www.kommunikation.aau.dk/forskning/vidensgrupper/indimedia

Invio. (n.d.). Retrieved February 8, 2019, from Innovation Network for Experience Economy website: http://invio-net.dk

Ito, M. (2006). Intertextual Enterprises: Writing Alternative Places and Meanings in the Media Mixed Networks of Yugioh. In D. Battaglia (Ed.), *E.T. Culture* (pp. 180–199; By C. F. Roth, D. Samuels, & S. Lepselter). https://doi.org/10.1215/9780822387015-006

Iversen, O. S., & Smith, R. C. (2012). Connecting to Everyday Practices. *Heritage and Social Media*, 126–144.

Jacobson, B. (2007). Diseño de Experiencias: Obstáculos para el diseño de experiencias. Retrieved March 4, 2019, from Diseño de Experiencias website: http://experiential-design.blogspot.com/2009/11/obstaculos-para-el-diseno-de.html

James, W. (1992). *Writings, 1878-1899*. Library of America.

Janes, R. R. (2009). *Museums in a Troubled World: Renewal, Irrelevance or Collapse?* Routledge.

Janiszewski, C., & Meyvis, T. (2001). Effects of Brand Logo Complexity, Repetition, and Spacing on Processing Fluency and Judgment. *Journal of Consumer Research*, *28*(1), 18–32. https://doi.org/10.1086/321945

Jenkins, H. (2003, January 15). Transmedia Storytelling: Moving characters from books to films to video games can make them stronger and more compelling. *MIT Technology Review*. Retrieved from https://www.technologyreview.com/s/401760/transmedia-storytelling/

Jenkins, H. (2006). *Convergence Culture: Where Old and New Media Collide*. NYU Press.

Jenkins, H. (2007, March). Transmedia Storytelling 101. Retrieved June 8, 2017, from Henry Jenkins website: http://henryjenkins.org/2007/03/transmedia_storytelling_101.html

Jenkins, H. (2009a). Revenge of the Origami Unicorn: The Remaining Four Principles of Transmedia Storytelling. Retrieved March 2, 2019, from Henry Jenkins website: http://henryjenkins.org/blog/2009/12/revenge_of_the_origami_unicorn.html

Jenkins, H. (2009b). The Revenge of the Origami Unicorn: Seven Principles of Transmedia Storytelling (Well, Two Actually. Five More on Friday). Retrieved February 28, 2019, from Henry Jenkins website: http://henryjenkins.org/blog/2009/12/the_revenge_of_the_origami_uni.html

Jenkins, H. (2010a). Transmedia Storytelling and Entertainment: An annotated syllabus. *Continuum*, *24*(6), 943–958. https://doi.org/10.1080/10304312.2010.510599

Jenkins, H. (2010b, June). Transmedia Education: the 7 Principles Revisited. Retrieved December 6, 2018, from Henry Jenkins website: http://henryjenkins.org/blog/2010/06/transmedia_education_the_7_pri.html

Jenkins, H. (2011). Transmedia 202: Further Reflections. Retrieved February 25, 2019, from Henry Jenkins website: http://henryjenkins.org/blog/2011/08/defining_transmedia_further_re.html

Jenkins, H. (2012). *Textual Poachers : Television Fans and Participatory Culture*. https://doi.org/10.4324/9780203114339

Jenkins, H. (2013). *Henry Jenkins keynote speech 2013 ISIS Conference*. Keynote Speech presented at the
    Rethinking Intermediality in the Digital Age, Sapientia Hungarian University of Transylvania.
    Retrieved from https://www.youtube.com/watch?v=35Vx0Elyqpc#t=1806

Jenkins, H. (2016, November 15). Transmedia What? Retrieved February 12, 2019, from Immerse
    website: https://immerse.news/transmedia-what-15edf6b61daa

Jenkins, H. (2017). Adaptation, Extension, Transmedia. *Literature/Film Quarterly*, *45*(2). Retrieved from
    https://lfq.salisbury.edu/_issues/first/adaptation_extension_transmedia.html

Jenkins, H. (2018). Foreword. In M. Freeman & R. R. Gambarato (Eds.), *The Routledge Companion to
    Transmedia Studies* (pp. xxvi–xxx). Taylor & Francis Group.

Jenkins, H., Ford, S., & Green, J. (2018). *Spreadable Media: Creating Value and Meaning in a
    Networked Culture*. NYU Press.

Jenkins, H., Purushotma, R., Weigel, M., Clinton, K., & Robison, A. J. (2009). *Confronting the
    challenges of participatory culture: media education for the 21st century*. In *The John D. and
    Catherine T. MacArthur Foundation Reports on Digital Media and Learning*. Cambridge, MA:
    The MIT Press.

Jensen, B. (2013). Instagram as cultural heritage: User participation, historical documentation, and
    curating in Museums and archives through social media. *2013 Digital Heritage International
    Congress (DigitalHeritage)*, *2*, 311–314. https://doi.org/10.1109/DigitalHeritage.2013.6744769

Jensen, J. T. (2015). Museernes Brugere og Brugernes Museer. In I. B. Lundgaard (Ed.),
    -BÆREDYGTIGE -LØSNINGER (pp. 18–57). Copenhagen, Denmark: Kulturstyrelsen Danish
    Agency for Culture.

Jensen, Jens F. (1998). "Interactivity": Tracking a New Concept in Media and Communication Studies.
    Nordicom Review, *19*(1), 185–204. Retrieved from
    http://www.nordicom.gu.se/sites/default/files/kapitel-pdf/38_jensen.pdf

Jensen, Jens F. (2010). *Multimedier, hypermedier, interaktive medier*. Aalborg Universitetsforlag.

Jensen, Jens F. (2013a). IT and Experiences: user experience, experience design and user-experience
    design. In J. Sundbo & F. Sørensen (Eds.), *Handbook on the Experience Economy* (pp. 179–208).
    Edward Elgar Publishing.

Jensen, Jens F. (2013b). *UX, XD & UXD. User Experience, Experience Design og User Experience
    Design.* Aalborg Universitetsforlag.

Jensen, Jens Frederik. (1998). *Multimedier, hypermedier, interaktive medier*. Retrieved from http://vbn.aau.dk/da/publications/multimedier-hypermedier-interaktive-medier(d635ebf0-002c-11da-b4d5-000ea68e967b)/export.html

Jensen, K. L., Krishnasamy, R., & Selvadurai, V. (2010). Studying PH.A.N.T.O.M. in the Wild: A Pervasive Persuasive Game for Daily Physical Activity. *Proceedings of the 22nd Conference of the Computer-Human Interaction Special Interest Group of Australia on Computer-Human Interaction*, 17–20. Retrieved from http://dl.acm.org/citation.cfm?id=1952228

Johnson, D. (2009). The fictional institutions of Lost: world building, reality, and the economic possibilities of narrative divergence. In R. E. Pearson, *Reading Lost : perspectives on a hit television show* (pp. 27–49). Retrieved from https://trove.nla.gov.au/version/45088408

Johnson, D. (2013). *Media Franchising: Creative License and Collaboration in the Culture Industries*. NYU Press.

Johnson, L. F., & Witchey, H. (2011). The 2010 Horizon Report: Museum Edition. *Curator: The Museum Journal*, *54*(1), 37–40. https://doi.org/10.1111/j.2151-6952.2010.00064.x

Jones, M. (2012, October 2). *On storyworlds, immersive media, narrative and museums – an interview with Mike Jones* (S. Chan, Interviewer). Retrieved from https://www.freshandnew.org/2012/10/storyworlds-immersive-media-narrative-interview-mike-jones/

Jordan, P. W. (2002). Human factors for pleasure seekers. In J. Frascara (Ed.), *Design and the Social Sciences: Making Connections* (pp. 9–23). CRC Press.

Karlsen, J. (2018). Transmedia Documentary: Experience and Participatory Approaches to Non-Fiction Transmedia. In M. Freeman & R. R. Gambarato (Eds.), *The Routledge Companion to Transmedia Studies* (pp. 25–34). Taylor & Francis Group.

Katona, Z., Zubcsek, P. P., & Sarvary, M. (2011). Network Effects and Personal Influences: The Diffusion of an Online Social Network. *Journal of Marketing Research*, *48*(3), 425–443. https://doi.org/10.1509/jmkr.48.3.425

Keller, K. L. (2012). *Strategic Brand Management: Building, Measuring, and Managing Brand Equity, 4th Edition* (4th edition). Boston: Pearson.

Kidd, J. (2014). *Museums in the new mediascape: transmedia, participation, ethics*. Farnham, Surrey, England: Ashgate.

Kidd, J. (2016). *Museums in the New Mediascape: Transmedia, Participation, Ethics*. Routledge.

Kidd, J. (2018). Transmedia Heritage: Museums and Historic Sites as Present-Day Storytellers. In M. Freeman & R. R. Gambarato (Eds.), *The Routledge Companion to Transmedia Studies* (pp. 272–278). Taylor & Francis Group.

Kim, B. (2013). Chapter 4: Responsive Web Design, Discoverability, and Mobile Challenge. *Library Technology Reports*, *49*(6), 29–39. Retrieved from https://www.journals.ala.org/index.php/ltr/article/view/4507

Kinder, M. (1991). *Playing with power in movies, television, and video games: from Muppet Babies to Teenage Mutant Ninja Turtles*. Retrieved from http://books.google.com/books?hl=en&lr=&id=raDNu1lThHQC&oi=fnd&pg=PR9&dq=%22elab orate+on+Teenage+Mutant+Ninja+Turtles.+It+was+Tania+Modleski+who+first+suggested%22+ %22and+Men+for+giving+me+a+faculty+summer+research+grant+to+do+empirical+studies%22 +&ots=GZQp6G0reH&sig=lY7wpzymX-sKWU5rRSF1NBdFdb4

Klastrup, L., & Tosca, S. (2004). Transmedial worlds-rethinking cyberworld design. *Cyberworlds, 2004 International Conference On*, 409–416. Retrieved from http://ieeexplore.ieee.org/abstract/document/1366205/

Koen, F. (1969). *Verbal and Nonverbal Mediators in Recognition Memory for Complex Visual Stimuli*. Retrieved from https://eric.ed.gov/?id=ED029349

Koenig, S. (2014). Serial: Season One. Retrieved December 9, 2018, from Serial website: https://serialpodcast.org/

Kolko, J. (2010). Abductive Thinking and Sensemaking: The Drivers of Design Synthesis. *Design Issues*, *26*(1), 15–28. https://doi.org/10.1162/desi.2010.26.1.15

Koskinen, I., Zimmerman, J., Binder, T., Redstrom, J., & Wensveen, S. (2011). *Design Research Through Practice: From the Lab, Field, and Showroom*. Elsevier.

Kovavisaruch, L., Sanpechuda, T., Chinda, K., Wongsatho, T., Chaiwongyen, A., & Wisadsud, S. (2015). Museums pool: A mobile application for museum network. *2015 Portland International Conference on Management of Engineering and Technology (PICMET)*, 1230–1235. https://doi.org/10.1109/PICMET.2015.7273028

Krishnan, M. S., & Prahalad, C. K. (2008). *The New Age of Innovation: Driving Co-created Value Through Global Networks*. McGraw-Hill Education.

Krogh, P. G., Markussen, T., & Bang, A. L. (2015). Ways of Drifting—Five Methods of Experimentation in Research Through Design. In A. Chakrabarti (Ed.), *ICoRD'15 – Research into Design Across Boundaries Volume 1* (pp. 39–50). https://doi.org/10.1007/978-81-322-2232-3_4

Kruso [Digital development agency]. (n.d.). Retrieved February 8, 2019, from https://www.kruso.dk/en/

Laine, T. H., Sedano, C. I., Vinni, M., & Joy, M. (2009, January). *Characteristics of Pervasive Learning Environments in Museum Contexts*. 10.

lang, C., Reeve, J., & Woollard, V. (2006). *The Responsive Museum: Working with Audiences in the Twenty-First Century*. Ashgate Publishing, Ltd.

Larsen, A. H., & Ingemann, B. (2005). *Ny dansk museologi*. Aarhus Universitetsforlag.

Law, E. L.-C., Roto, V., Hassenzahl, M., Vermeeren, A. P. O. S., & Kort, J. (2009). Understanding, Scoping and Defining User Experience: A Survey Approach. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 719–728. https://doi.org/10.1145/1518701.1518813

Law, E., Roto, V., Vermeeren, A. P. O. S., Kort, J., & Hassenzahl, M. (2008). Towards a Shared Definition of User Experience. *CHI '08 Extended Abstracts on Human Factors in Computing Systems*, 2395–2398. https://doi.org/10.1145/1358628.1358693

Leiter, D. (2011). *Detecting audience design: The rhetoric of mystery and transmedia storytelling in the case of "Harper's Island"* (Ph.D., Purdue University). Retrieved from https://search.proquest.com/docview/904667978/abstract/1B439266C6474532PQ/1

Lischke, L., Dingler, T., Schneegaß, S., Scgmidt, A., Vaart, M. van der, & Wozniak, P. (2014). Parallel Exhibits: Combining Physical and Virtual Exhibits. *Engaging Spaces. Interpretation, Design and Digital Strategies*, 149–156. Retrieved from https://s3.amazonaws.com/academia.edu.documents/36436443/NODEM_2014_Proceedings.pdf? AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1552162617&Signature=UiYipvP gvo4ekUNO1qTwFDqxA8k%3D&response-content- disposition=inline%3B%20filename%3DConference_Proceedings_Chapter_Lanz_Fra.pdf#page=1 49

Liu, H., Darabi, H., Banerjee, P., & Liu, J. (2007). Survey of Wireless Indoor Positioning Techniques and Systems. *IEEE Transactions on Systems, Man, and Cybernetics, Part C (Applications and Reviews)*, *37*(6), 1067–1080. https://doi.org/10.1109/TSMCC.2007.905750

Lobinger, K. (2016). Photographs as things – photographs of things. A texto-material perspective on photo-sharing practices. *Information, Communication & Society*, *19*(4), 475–488. https://doi.org/10.1080/1369118X.2015.1077262

Long, G. A. (2007). *Transmedia storytelling: Business, aesthetics and production at the Jim Henson Company* (Master's Thesis, Massachusetts Institute of Technology). Retrieved from https://dspace.mit.edu/handle/1721.1/39152

Løvlie, A. S. (2011). Annotative Locative Media and G-P-S: Granularity, Participation, and Serendipity. *Computers and Composition*, *28*(3), 246–254. https://doi.org/10.1016/j.compcom.2011.07.006

Lynham, S. A., Lincoln, Y. S., & Guba, E. G. (2011). Paradigmatic controversies, contradictions, and emerging confluences revisited. In *The SAGE Handbook of Qualitative Research* (pp. 97–128). SAGE.

Macdonald, S. (2002). *Behind the Scenes at the Science Museum* (First Edition edition). Oxford ; New York: Berg Publishers.

MacInnis, D. J., Shapiro, S., & Mani, G. (1999). Enhancing Brand Awareness Through Brand Symbols. *ACR North American Advances*, *NA-26*. Retrieved from http://acrwebsite.org/volumes/8328/volumes/v26/NA-26

Mackenzie, I. (2017). *Amplify Her* [Documentary]. Retrieved from http://www.imdb.com/title/tt6962906/

Marchetti, E. (2016). *Experiencing Historical Processes* (Aalborg University Press). https://doi.org/10.5278/vbn.phd.hum.00048

Marlow, C., Naaman, M., Boyd, D., & Davis, M. (2006). HT06, Tagging Paper, Taxonomy, Flickr, Academic Article, to Read. *Proceedings of the Seventeenth Conference on Hypertext and Hypermedia*, 31–40. https://doi.org/10.1145/1149941.1149949

Marshall, M. T. (2018). Interacting with Heritage: On the Use and Potential of IoT Within the Cultural Heritage Sector. *2018 Fifth International Conference on Internet of Things: Systems, Management and Security*, 15–22. https://doi.org/10.1109/IoTSMS.2018.8554899

Mason, M. (2015). Prototyping practices supporting interdisciplinary collaboration in digital media design for museums. *Museum Management and Curatorship*, *30*(5), 394–426. https://doi.org/10.1080/09647775.2015.1086667

Mathiassen, L. (1998). *Reflective Systems Development. 10*, 52.

Mathiassen, L. (2002). Collaborative practice research. *Information Technology & People*, *15*(4), 321–345. https://doi.org/10.1108/09593840210453115

Mathiassen, L. (2017). Designing Engaged Scholarship: From Real-World Problems to Research Publications. *Engaged Management ReView*, *1*(1). https://doi.org/10.28953/2375-8643.1000

Matt, C., Hess, T., & Benlian, A. (2015). Digital Transformation Strategies. *Business & Information Systems Engineering*, *57*(5), 339–343. https://doi.org/10.1007/s12599-015-0401-5

McCarthy, J., & Wright, P. (2004). Technology As Experience. *Interactions*, *11*(5), 42–43. https://doi.org/10.1145/1015530.1015549

McCaw, C., Oliver, M., & Glen, L. (2014). Restaging a Garden Party: Sharing Social Histories through the Design of Digital and Material Interactive Experiences. *Engaging Spaces. Interpretation, Design and Digital Strategies*, 19–26. Warsaw, Poland: Nodem.

McGonigal, J. (2011). *Reality Is Broken: Why Games Make Us Better and How They Can Change the World* (Reprint edition). London: Penguin Books.

McGonigal, J. E. (2006). *This Might Be a Game: Ubiquitous Play and Performance at the Turn of the Twenty-First Century*.

McNiff, J. (1988). *Action Research: Principles and Practice*. Routledge.

Medic, S., & Pavlovic, N. (2014). Mobile technologies in museum exhibitions. *Turizam*, *18*(4), 166–174. https://doi.org/10.5937/Turizam1404166M

Melewar, T. C., & Jenkins, E. (2002). Defining the Corporate Identity Construct. *Corporate Reputation Review*, *5*(1), 76–90. https://doi.org/10.1057/palgrave.crr.1540166

Mertens, D. M. (2010). *Research and Evaluation in Education and Psychology: Integrating Diversity With Quantitative, Qualitative, and Mixed Methods*. SAGE.

Miller, A. D., & Edwards, W. K. (2007). Give and take: a study of consumer photo-sharing culture and practice. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems - CHI '07*, 347. https://doi.org/10.1145/1240624.1240682

Mingers, J. (2001). Combining IS Research Methods: Towards a Pluralist Methodology. *Information Systems Research*, *12*(3), 240–259. https://doi.org/10.1287/isre.12.3.240.9709

Ministry of Business. (2017). *Danmark som digital frontløber*. Retrieved from https://em.dk/media/9698/digitalt_vaekstpanel_web.pdf

Ministry of Business and Growth. (2014). *Danmark i arbejde - Vækstplan for dansk turisme*.

Ministry of Business, D. (2018). *Strategi for danmarks digitale vaekst*. Retrieved from https://www.regeringen.dk/media/4766/strategi-for-danmarks-digitale-vaekst_online.pdf

Ministry of Education and Research. (2017). *Danmark - Klar til Fremtiden*. Retrieved from https://ufm.dk/publikationer/2017/filer/ufm-dk-klar-til-fremtiden-2017-final-web-0512.pdf

Ministry of Employment. (2017). *Forlæns ind i fremtiden*. Retrieved from https://www.regeringen.dk/media/3398/forlaensindifremtiden.pdf

Ministry of Higher Education and Science. (2019). The BFI lists — Uddannelses- og Forskningsministeriet [Page]. Retrieved March 18, 2019, from https://ufm.dk/en/research-and-innovation/statistics-and-analyses/bibliometric-research-indicator/bfi-lists

Mittell, J. (2009). To Spread or To Drill? | Just TV. Retrieved March 2, 2019, from Just TV website: https://justtv.wordpress.com/2009/02/25/to-spread-or-to-drill/

Mittell, J. (2014). Strategies of Storytelling on Transmedia Television. In M.-L. Ryan & J.-N. Thon (Eds.), *Storyworlds Across Media: Toward a Media-Conscious Narratology* (pp. 253–277). U of Nebraska Press.

Mittell, J. (2015). *Complex TV: The Poetics of Contemporary Television Storytelling*. NYU Press.

Mohorovičić, S. (2013). Implementing responsive web design for enhanced web presence. *2013 36th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO)*, 1206–1210.

Montola, M., Stenros, J., & Waern, A. (2009). *Pervasive Games: Theory and Design*. Taylor & Francis.

Morgan, D. L. (2007). Paradigms Lost and Pragmatism Regained: Methodological Implications of Combining Qualitative and Quantitative Methods. *Journal of Mixed Methods Research*, *1*(1), 48–76. https://doi.org/10.1177/2345678906292462

Morrison, A., Viller, S., & Mitchell, P. (2011). Building Sensitising Terms to Understand Free-play in Open-ended Interactive Art Environments. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 2335–2344. https://doi.org/10.1145/1978942.1979285

Morse, J. M. (1991). Approaches to Qualitative-Quantitative Methodological Triangulation. *Nursing Research*, *40*(2), 120–123. Retrieved from https://journals.lww.com/nursingresearchonline/Citation/1991/03000/Approaches_to_Qualitative_Quantitative.14.aspx

Muise, K., & Wakkary, R. (2010). Bridging Designers' Intentions to Outcomes with Constructivism. *Proceedings of the 8th ACM Conference on Designing Interactive Systems*, 320–329. https://doi.org/10.1145/1858171.1858229

Müller, B., Kocher, B., & Crettaz, A. (2013). The effects of visual rejuvenation through brand logos. *Journal of Business Research*, *66*(1), 82–88. https://doi.org/10.1016/j.jbusres.2011.07.026

Munk-Madsen, A. (1986). Viden om systemudvikling. *DAIMI Report Series*, (213). https://doi.org/10.7146/dpb.v15i213.7564

Napoles, V. (1987). *Corporate Identity Design* (1 edition). New York: Wiley.

Napoli, P. M. (2011). *Audience Evolution: New Technologies and the Transformation of Media Audiences*. Columbia University Press.

Naturhistorisk Museum. (n.d.). Retrieved February 8, 2019, from Naturhistorisk Museum website: http://www.naturhistoriskmuseum.dk/Default.aspx?ID=1870

Nelson, K. E. (1971). Memory development in children: Evidence from nonverbal tasks. *Psychonomic Science*, *25*(6), 346–348. https://doi.org/10.3758/BF03335901

Neuman, W. L. (2009). *Social Research Methods: Qualitative and Quantitative Approaches* (7 edition). Boston Mass.; London: Pearson.

Newman, I., Benz, C. R., & Ridenour, P. C. S. (1998). *Qualitative-quantitative Research Methodology: Exploring the Interactive Continuum*. SIU Press.

Niehm, L. S., Tyner, K., Shelley, M. C., & Fitzgerald, M. A. (2010). Technology Adoption in Small Family-Owned Businesses: Accessibility, Perceived Advantage, and Information Technology Literacy. *Journal of Family and Economic Issues*, *31*(4), 498–515. https://doi.org/10.1007/s10834-010-9197-0

Nielsen, P. A. (1999). *"Action research and the study of IT in organisations: making sense of change*. Department of Computer Science, Aalborg University, Aalborg.

Noble, H., & Smith, J. (2018). Reviewing the literature: choosing a review design. *Evidence Based Nursing*, *21*(2), 39–41. https://doi.org/10.1136/eb-2018-102895

Norman, D. (2009, October 2). THE TRANSMEDIA DESIGN CHALLENGE: Co-Creation. Retrieved February 25, 2019, from jnd.org website: https://jnd.org/the_transmedia_design_challenge_co-creation/

Number of smartphone users worldwide 2014-2020. (2016). Retrieved February 9, 2019, from Statista website: https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/

Nunamaker, J. F., Chen, M., & Purdin, T. D. M. (1990). Systems Development in Information Systems Research. *Journal of Management Information Systems*, *7*(3), 89–106. https://doi.org/10.1080/07421222.1990.11517898

O'Flynn, S. (2013). Epilogue. In L. Hutcheon (Ed.), *A Theory of Adaptation*. Routledge.

Olins, W. (1989). *Corporate Identity*. Thames and Hudson.

Olsson, T., & Svensson, A. (2013). Reaching and including digital visitors: Swedish museums and social demand. In P. Pruulmann-Vengerfeldt & P. Viires (Eds.), *The Digital Turn: User's Practices and Cultural Transformations* (pp. 45–57). New York: Peter Lang GmbH.

Oppelaar, E.-J. R. G., Hennipman, E.-J., & van der Veer, G. C. (2008). Experience Design for Dummies. *Proceedings of the 15th European Conference on Cognitive Ergonomics: The Ergonomics of Cool Interaction*, 27:1–27:8. https://doi.org/10.1145/1473018.1473052

Othman, M. K., Petrie, H., & Power, C. (2013). Measuring the Usability of a Smartphone Delivered Museum Guide. *Procedia - Social and Behavioral Sciences*, *97*, 629–637. https://doi.org/10.1016/j.sbspro.2013.10.282

Our Museum. (2019). Retrieved February 20, 2019, from Our Museum website: http://ourmuseum.dk/

Pangea Rocks [Company website]. (n.d.). Retrieved February 8, 2019, from Pangea Rocks website: https://pangea.dk/

Park, C. W., Eisingerich, A. B., Pol, G., & Park, J. W. (2013). The role of brand logos in firm performance. *Journal of Business Research*, *66*(2), 180–187. https://doi.org/10.1016/j.jbusres.2012.07.011

Parkin, L., Williams, W. J., Cornell, P., Orman, K., Sim, D., Alvarez, R., … Mittell, J. (2017). *Third Person: Authoring and Exploring Vast Narratives* (Reprint edition; P. Harrigan & N. Wardrip-Fruin, Eds.). Cambridge, Massachusetts: The MIT Press.

Parry, R. (2013). The End of the Beginning: Normativity in the Postdigital Museum. *Museum Worlds*, *1*(1), 24–39. https://doi.org/10.3167/armw.2013.010103

Patton, M. Q. (1990). *Qualitative Evaluation and Research Methods*. SAGE Publications.

Pearce, C. (1994). The Ins & Outs of Non-linear Storytelling. *SIGGRAPH Comput. Graph.*, *28*(2), 100–101. https://doi.org/10.1145/178951.178956

Pedgley, O. (2007). Capturing and analysing own design activity. *Design Studies*, *28*(5), 463–483. https://doi.org/10.1016/j.destud.2007.02.004

Peirce, C. (1994). *Semiotik og pragmatisme*. Retrieved from http://www.gyldendal.dk/semiotik-og-pragmatisme-id3322?utm_source=Facebook&utm_medium=Open%2BGraph&utm_campaign=Like

Peirce, C. (1998). *The Essential Peirce, Volume 2: Selected Philosophical Writings (1893-1913)*. Indiana University Press.

Perez, C. (2002). *Technological revolutions and financial capital: The dynamics of bubbles and golden ages*. Edward Elgar Publishing.

Petersen, A. B. (2006). Internet and Cross Media Productions. *International Journal of Emerging Technologies and Society*, *4*(2), 84–107.

Pettigrew, A. M. (1990). Longitudinal Field Research on Change: Theory and Practice. *Organization Science*, *1*(3), 267–292. Retrieved from https://www.jstor.org/stable/2635006

Phillips, A. (2012). *A Creator's Guide to Transmedia Storytelling: How to Captivate and Engage Audiences across Multiple Platforms*. McGraw Hill Professional.

Phillips, D. C., & Burbules, N. C. (2000). *Postpositivism and Educational Research*. Rowman & Littlefield.

Phillips, L. (2011). *The Promise of Dialogue: The Dialogic Turn in the Production and Communication of Knowledge*. John Benjamins Publishing.

Pierroux, P. (2011). Guiding Meaning on Guided Tours. In Andrew Morrison (Ed.), *Inside Multimodal Composition* (pp. 417–450). Cresskill, NJ: Hampton Press.

Pierroux, P., Krange, I., & Sem, I. (2011). Bridging contexts and interpretations: Mobile blogging on art museum field trips. *MedieKultur: Journal of Media and Communication Research*, *27*(50), 18. https://doi.org/10.7146/mediekultur.v27i50.2997

Pimentel, R. W., & Heckler, S. E. (2003). Changes in Logo Designs: Chasing the Elusive Butterfly Curve. In L. M. Scott & R. Batra, *Persuasive imagery: a consumer response perspective* (pp. 105–127). Retrieved from http://public.eblib.com/choice/publicfullrecord.aspx?p=335532

Pine, B. J., & Gilmore, J. H. (1999). *The experience economy: work is theatre & every business a stage*. Boston: Harvard Business School Press.

Pine, B. J., & Gilmore, J. H. (2011). *The Experience Economy*. Harvard Business Press.

Pink, S. (2013). *Doing Visual Ethnography*. SAGE.

Poushter, J. (2016). *Smartphone Ownership and Internet Usage Continues to Climb in Emerging Economies* (p. 45). Retrieved from Pew Research Center website: http://s1.pulso.cl/wp-content/uploads/2016/02/2258581.pdf

Pratten, R. (2015). *Getting started with transmedia storytelling: a practical guide for beginners 2nd edition*.

Procto, N. (Ed.). (2011). *Mobile Apps for Museums: The AAM Guide to Planning and Strategy*. Washington, DC: American Alliance Of Museums.

Ree Park Safari. (n.d.). Retrieved February 8, 2019, from Ree Park Safari website: https://en.reepark.dk/

Rejseplanen. (n.d.). Retrieved February 13, 2019, from https://www.rejseplanen.dk/webapp/index.html

Rhee, B., & Choi, Y. (2015). Using Mobile Technology for Enhancing Museum Experience: Case Studies of Museum Mobile Applications in S. Korea. *International Journal of Multimedia and Ubiquitous Engineering*, *10*(6), 39–44. https://doi.org/10.14257/ijmue.2015.10.6.05

Rist, R. C. (1977). On the Relations Among Educational Research Paradigms: From Disdain to Detente2. *Anthropology & Education Quarterly*, *8*(2), 42–49. https://doi.org/10.1525/aeq.1977.8.2.05x1394p

Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, *4*(2), 155–169. https://doi.org/10.1007/BF01405730

Roberts, T. (2015). Factors affecting the role of designers in interpretation projects. *Museum Management and Curatorship*, *30*(5), 379–393. https://doi.org/10.1080/09647775.2015.1055582

Rodríguez-Illera, J. L., & Castells, N. M. (2014). Educational uses of transmedia storytelling. *Journal of Educational Multimedia and Hypermedia*, *23*(4), 335–357. Retrieved from https://www.learntechlib.org/primary/p/41258/

Roes, I., Stash, N., Wang, Y., & Aroyo, L. (2009). A Personalized Walk Through the Museum: The CHIP Interactive Tour Guide. *CHI '09 Extended Abstracts on Human Factors in Computing Systems*, 3317–3322. https://doi.org/10.1145/1520340.1520479

Rosenstand, C. A. F., & Ivang, R. (2018). *Digital Forestillingskraft*. Retrieved from Aalborg University website: http://e-pages.dk/aalborguniversitet/714/html5/

Rossman, G. B., & Wilson, B. L. (1985). Numbers and Words: Combining Quantitative and Qualitative Methods in a Single LargeScale Evaluation Study. *Evaluation Review*.

Roto, V., Rantavuo, H., & Väänänen-vainio-mattila, K. (2009). *Evaluating User Experience of Early Product Concepts*. Presented at the International conference on designing pleasurable products and interfaces, Compiegne University of Technology, France.

Rudloff, M. (2013). *Formidling i forandring* (Doctoral Dissertation). Syddansk Universitet.

Rudloff, M. (2016). Formidlingsbegrebets digitalisering i Danmark. Diskursive implikationer og praktiske konsekvenser. *Nordisk Museologi*, *0*(2), 21. https://doi.org/10.5617/nm.3012

Rung, M. H., & Laursen, D. (2012). Adding to the Experience: Use of Smartphone Applications by Museum Visitor. In E. Kristiansen (Ed.), *The Transformative Museum: proceedings of the DREAM conference, 23-25 May 2012, Roskilde University, Denmark* (pp. 314–324). Odense: Danish Research Center on Education and Advanced Media Materials, DREAM.

Ruppel, M. (2012). *Visualizaing Transmedia Networks: Links, Paths and Peripheries*. Retrieved from http://drum.lib.umd.edu/handle/1903/13589

Russo, A. (2012). The rise of the "media museum." In E. Giaccardi (Ed.), *Heritage and Social Media: Understanding heritage in a participatory culture* (pp. 145–158). Routledge.

Russo, A., Watkins, J., & Groundwater-Smith, S. (2009). The impact of social media on informal learning in museums. *Educational Media International*, *46*(2), 153–166. https://doi.org/10.1080/09523980902933532

Russo, A., Watkins, J. J., Kelly, L., & Chan, S. (2006). How will social media affect museum communication? *Creative Industries Faculty*. Presented at the Nordic Digital Excellence in Museums (NODEM), Oslo, Norway. Retrieved from https://eprints.qut.edu.au/6067/

Ryan, M.-L. (2013). Transmedial Storytelling and Transfictionality. *Poetics Today*, *34*(3), 361–388. https://doi.org/10.1215/03335372-2325250

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology*, *25*(1), 54–67. https://doi.org/10.1006/ceps.1999.1020

Rylander, A. (2012). *Pragmatism and Design research - an overview*. Retrieved from Designfakultetens kunskapssammanställningar, KTH website: http://www.gu.se/english/research/publication/?publicationId=168123

Saler, M. (2012). *As If: Modern Enchantment and the Literary PreHistory of Virtual Reality* (1 edition). Oxford ; New York: Oxford University Press.

Schechter, A. H. (1993). Measuring the Value of Corporate and Brand Logos. *Design Management Journal (Former Series)*, *4*(1), 33–39. https://doi.org/10.1111/j.1948-7169.1993.tb00124.x

Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books.

Schroyen, J., Gabriëls, K., Teunkens, D., Robert, K., Luyten, K., Coninx, K., & Manshoven, E. (2016). Beyond mere information provisioning: a handheld museum guide based on social activities and playful learning. *Nordisk Museologi*, *0*(1), 30. https://doi.org/10.5617/nm.3256

Scolari, C. A. (2009). *Transmedia storytelling: Implicit consumers, narrative worlds, and branding in contemporary media production*. Retrieved from http://dspace.uvic.cat/handle/10854/2867

Scolari, C. A. (2013). Lostology: Transmedia storytelling and expansion/compression strategies. *Semiotica*, *2013*(195), 45–68. https://doi.org/10.1515/sem-2013-0038

Scolari, C. A. (2016). Transmedia literacy: informal learning strategies and media skills in the new ecology of communication. *Telos*. Retrieved from http://repositori.upf.edu/handle/10230/27788

Scolari, C. A. (2017, October 28). *Transmedia is dead. Long live transmedia!* Presented at the
     Transmedia Earth Conference: Global Convergence Cultures, EAFIT University. Retrieved from
     https://hipermediaciones.com/2017/10/28/transmedia-is-dead/

Scolari, C. A. (2018). Transmedia Literacy: Rethinking Media Literacy in the New Media Ecology. In M.
     Freeman & R. R. Gambarato (Eds.), *The Routledge Companion to Transmedia Studies* (pp. 323–
     331). Taylor & Francis Group.

Scolari, C. A., Freeman, M., & Bertetti, P. (2014). *Transmedia archaeology storytelling in the
     borderlines of science fiction, comics and pulp magazines*. Basingstoke: Palgrave Pivot.

Scott, S. (2013). Who's Steering the Mothership? The Role of the Fanboy auteur in Transmedia
     Storytelling. *The Participatory Cultures Handbook*, 43–52.

Seifert, L. S. (1992). Pictures as a means of conveying information. *Journal of General Psychology*,
     119(3), 279. https://doi.org/10.1080/00221309.1992.9917808

Selvadurai, V., Andersen, E. S., Nielsen, R. N., Krishnasamy, R., & Vistid, R. (2010). *iBEX* (7th
     Semester Thesis). Aalborg University.

Selvadurai, V., & Krishnasamy, R. (2010). *Physical Activity through New Technology on Mobiles
     (PH.A.N.T.O.M.)* (Bachelor Thesis). Aalborg University.

Selvadurai, V., & Nielsen, R. N. (2011). *SmartGuide – Guide to Create an ARG using Transmedia
     Storytelling and So-cial Media, which Integrates Smartphones as the Central Interacting Device*
     (9th Semester Thesis). Aalborg University.

Selvadurai, V., & Nielsen, R. N. (2012). *Creating a Transmedia Experience* (Masters' Thesis). Aalborg
     University.

Shalin, D. (1989). Pragmatism & Social Interactionism. *American Sociological Review*, *51*(1), 9–29.

Shedroff, N. (n.d.). Nathan.com – My World and what I'm up to. Retrieved March 4, 2019, from
     http://nathan.com/

Shields, P. M., & Rangarajan, N. (2013). *A Playbook for Research Methods: Integrating Conceptual
     Frameworks and Project Management*. New Forums Press.

Simon, N. (2010a). *The Participatory Museum*. Museum 2.0.

Simon, N. (2010b, October). Community Museums & Museum Communities. Retrieved March 7, 2019,
     from Shareable website: https://www.shareable.net/blog/community-museums-museum-
     communities

Skaggs, S. (2017). *FireSigns: A Semiotic Theory for Graphic Design*. MIT Press.

Skot-Hansen, D. (2008). *Museerne i den danske oplevelsesøkonomi*. Retrieved from
https://www.plusbog.dk/museerne-i-den-danske-oplevelsesoekonomi-dorte-skot-hansen-
9788770710053/

Skot-Hansen, D. (2009). Danske museer som børs eller katedral:-udfordringer fra oplevelsessamfund og
oplevelsesøkonomi. *Nordisk Kulturpolitisk Tidskrift*, *12*(1), 140–167.

Smith, J. H. (2015). *The Me/Us/Them model: Prioritizing museum social-media efforts for maximum
reach*. Presented at the Museums and the Web 2015, Los Angeles, California, USA. Retrieved
from https://mw2015.museumsandtheweb.com/paper/the-meusthem-model-prioritizing-museum-
social-media-efforts-for-maximum-reach/

Smith, J. K., & Heshusius, L. (1986). Closing Down the Conversation: The End of the Quantitative-
Qualitative Debate Among Educational Inquirers. *Educational Researcher*, *15*(1), 4–12.
https://doi.org/10.3102/0013189X015001004

Stolterman, E. (2008). The Nature of Design Practice and Implications for Interaction Design Research.
Retrieved December 7, 2015, from International Journal of Dsign website:
http://www.ijdesign.org/ojs/index.php/IJDesign/article/view/240/148

Strutu, M., Caspari, D., Pickert, J., Grossmann, U., & Popescu, D. (2013). Pedestrian smartphone based
localization for large indoor areas. *2013 IEEE 7th International Conference on Intelligent Data
Acquisition and Advanced Computing Systems (IDAACS)*, *01*, 450–454.
https://doi.org/10.1109/IDAACS.2013.6662726

Sung, Y.-T., Chang, K.-E., Hou, H.-T., & Chen, P.-F. (2010). Designing an electronic guidebook for
learning engagement in a museum of history. *Computers in Human Behavior*, *26*(1), 74–83.
https://doi.org/10.1016/j.chb.2009.08.004

Swartz, T. A. (1983). Brand symbols and message differentiation. *Journal of Advertising Research*, *23*(5),
59–64.

Tallon, L. (2008). Introduction: Mobile, Digital, and Personal. In L. Tallon (Ed.), *Digital Technologies
and the Museum Experience: Handheld Guides and Other Media* (pp. Xiii–XXV). Rowman
Altamira.

Tárcia, L. P. T. (2018). Transmedia Education: Changing the Learning Landscape. In M. Freeman & R.
R. Gambarato (Eds.), *The Routledge Companion to Transmedia Studies*. Taylor & Francis Group.

Tashakkori, A., & Teddlie, C. (1998). *Mixed Methodology: Combining Qualitative and Quantitative
Approaches*. SAGE.

Tashakkori, A., & Teddlie, C. (2010). *SAGE Handbook of Mixed Methods in Social & Behavioral Research*. SAGE.

Tenderich, B. (2014). *Transmedia Branding* (H. Schmidt & J. Schmidt, Eds.). EIMO.

The North Sea Oceanarium. (n.d.). Retrieved February 20, 2019, from Nordsøen Oceanarium website: https://en.nordsoenoceanarium.dk/

Tomiuc, A. (2014). Navigating Culture. Enhancing Visitor Museum Experience through Mobile Technologies. From Smartphone to Google Glass. *Journal of Media Research - Revista de Studii Media*, *VII*(3 (20)), 33–46. Retrieved from https://www.ceeol.com/search/article-detail?id=246457

Torfing, J. (2004). *Det stille sporskifte i velfærdsstaten: en diskursteoretisk beslutningsprocesanalyse*. Aarhus Universitetsforlag.

Tussey, E. (2018). Transmedia Sport: The National Basketball Association, Emojis, and Personalized Participation. In M. Freeman & R. R. Gambarato (Eds.), *The Routledge Companion to Transmedia Studies* (pp. 99–106). Taylor & Francis Group.

Vallerand, R. J. (1997). Toward A Hierarchical Model of Intrinsic and Extrinsic Motivation. In M. P. Zanna (Ed.), *Advances in Experimental Social Psychology* (Vol. 29, pp. 271–360). https://doi.org/10.1016/S0065-2601(08)60019-2

van den Bosch, A. L. M., de Jong, M. D. T., & Elving, W. J. L. (2005). How corporate visual identity supports reputation. *Corporate Communications: An International Journal*, *10*(2), 108–116. https://doi.org/10.1108/13563280510596925

van Riel, C. B. M., & van den Ban, A. (2001). The added value of corporate logos - An empirical study. *European Journal of Marketing*, *35*(3/4), 428–440. https://doi.org/10.1108/03090560110382093

Vany, A. D. (2003). *Hollywood Economics: How Extreme Uncertainty Shapes the Film Industry* (1 edition). London ; New York: Routledge.

Vashanth Sellathurai. (2019). Retrieved February 13, 2019, from IMDb website: http://www.imdb.com/name/nm5902304/

Velux, F. (2018). *Museumsprogram Bevillinger 2015-2018*. Retrieved from https://veluxfoundations.dk/sites/default/files/museumsprogram_bevillinger_2015-2018.pdf

Verdaasdonk, H., van Rees, C. J., Stokmans, M., van Eijck, K., & Verboord, M. (1996). The impact of experiential variables on patterns of museum attendance: The case of the Noord-Brabant museum. *Poetics*, *24*(2), 181–202. https://doi.org/10.1016/S0304-422X(96)00011-3

Villarrubia, G., Paz, J. F. D., Prieta, F. D. L., & Bajo, J. (2014). Hybrid indoor location system for museum tourist routes in augmented reality. *17th International Conference on Information Fusion (FUSION)*, 1–8.

Vistisen, P. (2016). *Animation-based Sketching: an explorative study of how animation-based sketching can support the concept design of non-idiomatic digital technologies* (PhD-thesis, Aalborg University). Retrieved from http://vbn.aau.dk/ws/files/238026522/PHD_Peter_Vistisen_LOW_E_pdf.pdf

Vogler, C. (2007). *The Writers Journey: Mythic Structure for Writers, 3rd Edition* (3rd edition). Studio City, CA: Michael Wiese Productions.

Wakkary, R., Hatala, M., Muise, K., Tanenbaum, K., Corness, G., Mohabbati, B., & Budd, J. (2009). Kurio: a museum guide for families. *Proceedings of the 3rd International Conference on Tangible and Embedded Interaction - TEI '09*, 215. https://doi.org/10.1145/1517664.1517712

Walford, G. (2004). Finding the limits: autoethnography and being an Oxford University Proctor. *Qualitative Research*, *4*(3), 403–417. https://doi.org/10.1177/1468794104047238

Walker, J. (2005). Distributed Narrative: Telling Stories Across Networks. *The 2005 Association of Internet Researchers Annual*. Presented at the AoIR 5.0, Brighton. Retrieved from http://jilltxt.net/txt/Walker-AoIR-3500words.pdf

Wallace, R. (2001). Proving our value: Measuring package design's Return On Investment. *Design Management Journal (Former Series)*, *12*(3), 20–27. https://doi.org/10.1111/j.1948-7169.2001.tb00549.x

Walsh, M. F., Winterich, K. P., & Mittal, V. (2010). Do logo redesigns help or hurt your brand? The role of brand commitment. *The Journal of Product and Brand Management; Santa Barbara*, *19*(2), 76–84. http://dx.doi.org/10.1108/10610421011033421

Weaver, T. (2013). *What Transmedia Producers Should Know About Comics: An Interview with Tyler Weaver (Part One)* (H. Jenkins, Interviewer). Retrieved from http://henryjenkins.org/blog/2013/02/what-transmedia-producers-should-know-about-comics-an-interview-with-tyler-weaver-part-one.html

Webster, J. G. (2005). Beneath the Veneer of Fragmentation: Television Audience Polarization in a Multichannel World. *Journal of Communication*, *55*(2), 366–382. https://doi.org/10.1111/j.1460-2466.2005.tb02677.x

Webster, J. G., & Ksiazek, T. B. (2012). The Dynamics of Audience Fragmentation: Public Attention in an Age of Digital Media. *Journal of Communication*, *62*(1), 39–56. https://doi.org/10.1111/j.1460-2466.2011.01616.x

Weilenmann, A., Hillman, T., & Jungselius, B. (2013). Instagram at the museum: communicating the museum experience through social photo sharing. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems - CHI '13*, 1843. https://doi.org/10.1145/2470654.2466243

Whitworth, A., & Garnett, F. (2011). MOSI-ALONG: Social Media, the Museum and the Community. *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments*, 161–164. https://doi.org/10.1145/2181037.2181063

Wolf, M. J. P. (2012). *Building Imaginary Worlds: The Theory and History of Subcreation*. Routledge.

Wright, P., & McCarthy, J. (2008). Empathy and Experience in HCI. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 637–646. https://doi.org/10.1145/1357054.1357156

Wynekoop, J. L., & Russo, N. L. (n.d.). *SYSTEM DEVELOPMENT METHODOLOGIES: UNANSWERED QUESTIONS AND THE RESEARCH-PRACTICE GAP*. 11.

Zapp, A. (2004). *Networked narrative environments as imaginary spaces of being*. Retrieved from https://e-space.mmu.ac.uk/110785/

Zimmerman, J., & Forlizzi, J. (2008). The Role of Design Artifacts in Design Theory Construction. *Human-Computer Interaction Institute*. Retrieved from http://repository.cmu.edu/hcii/37

Zimmerman, J., Forlizzi, J., & Evenson, S. (2007). Research Through Design As a Method for Interaction Design Research in HCI. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 493–502. https://doi.org/10.1145/1240624.1240704

APPENDIX OVERVIEW

All appendix material in this thesis has been appended digitally. Below is an overview of the appended materials with appendix numbers used in the references in the thesis.

APPENDIX 1 – GENRAL
1.1 – Oceanarium Strategy Plan
1.2 – Initial workshop
1.3 – Concept Expedition North Sea
1.4 – Digital layer of North Sea

APPENDIX 2 – STUDY B – WORLDBUILDING
2.1 – Touchpoint Survey
2.2 – Screening
2.3 – Logo Presentation
2.4 – Website Requirements

APPENDIX 3 – STUDY C – PARTICIPATION
3.1 – Notes
3.2 – Photos
3.3 – Stats from Brandheroes

APPENDIX 4 – STUDY D – EXPERIENCE
4.1 – Project Description
4.2 – BOW Evaluation Report
4.3 – Hunters Manual
4.4 – Target Group
4.5 – Experiment
4.6 – Design
4.7 – Meeting Minutes

APPENDIX 5 – STUDY E – MOBILE TECHNOLOGY
5.1 – Workshop
5.2 – Aratag Concept
5.3 – Aratag Design
5.4 – Aratag Application
5.5 – Meeting Minutes
5.6 – Aratag Test

APPENDIX 6 – STEERING COMMITTEE MINUTES
6.1 – Steering Committee Meeting Minutes

APPENDIX 7 – DECLARATION OF CO-AUTHORSHIP
7.1 – Declarations of Co-authorship

APPENDIX 8 – PROJECTS
8.1 – Medialogy Projects
8.2 – InDiMedia Projects

APPENDED CONTRIBUTIONS

Bridge Complexity as a Factor in Audience Interaction in Transmedia Storytelling

Vashanth Selvadurai | Aalborg University, Aalborg
Peter Vistisen | Aalborg University, Aalborg
Daniel Binns | RMIT University, Melbourne

Abstract:
The scholarship to date on transmedia storytelling has focused on analysing existing properties, or otherwise establishing holistic approaches to craft itself. Missing from the scholarship are deep considerations of the individual mechanics at work during telling of a story across platforms. In particular, we must ask: how are audiences motivated to follow a narrative across multiple media platforms?

This paper examines state of the art transmedia properties to identify how audience motivations are engineered to ensure that the audience shifts from one media platform to another. We see this as an effect of an increased complexity amongst transmedia franchises, challenging the traditional monocentric 'tentpole approach' with a broader polycentric approach. Here, the complexity is managed not through tie-ins to one tent pole, but rather as a mix of what we will label as storyline, storyworld, and character bridges with varying level of complexities in their relation to the traditional tentpole medium.

Keywords: Transmedia, Storytelling, Tentpole, Experience, Design, Mechanics

Introduction

Storytelling has hugely powerful persuasive capacities.[1] It is a means by which people can interpret and understand the world around them.[2] The methods of storytelling have evolved coherently with technological development from wall drawings in caves to (much) more recent innovations, such as blending different forms across multiple media platforms to enrich the audience's experience. Each media platform opens a port into an experience where all the story elements are intertwined to form a greater universe. This phenomenon is called transmedia storytelling.[3]

> A transmedia story unfolds across multiple media platforms with each new text making a distinctive and valuable contribution to the whole. In the ideal form of transmedia storytelling, each medium does what it does best—so that a story might be introduced in film, expanded through television, novels, and comics; its world might be explored through game play or experienced as an amusement park attraction. Each franchise entry needs to be self-contained, so you don't need to have seen the film to enjoy the game.[4]

The core storyline in a transmedia franchise tends to rely on a medium that will reach a large amount of audience.[5] The stories that unfolds on this driving platform are described as the 'mother ship'[6], or more commonly as the so-called 'tentpole' as "one big media experience that supports a lot of other related media experiences".[7] A tentpole can either function as one big media experience, such as a large blockbuster film, with smaller secondary storytelling platforms acting as tie-ins, or it can consist of a number of smaller, but seemingly equal, storytelling platforms where no one can claim a clear

1

role of being 'the' tentpole. Such transmedia concepts contain references that direct the audiences to other narrative units called 'flow tags' and vice versa,[8] see Figure 1.
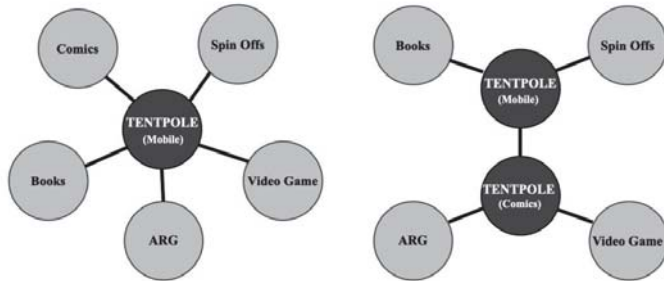
Figure 1: Illustration of the classic single tentpole concept of transmedia (left), and multi centred transmedia franchises which contains multiple tentpole with their own independent secondary media platforms (right).

An example of a single tentpole concept is the transmedia franchise 'The Matrix'[9], the films themselves serves as the primary tentpole in which the core narrative can be watched by following a traditional path starting with the first film 'The Matrix', continues with the second film 'Matrix Reloaded'[10], and ends with the third film 'Matrix Revolution'[11]. The films' extended narrative consisting of short films, video games, and comics, can be explored through a transmedia path, see Figure 2. In the beginning of the second film 'The Matrix Reloaded'[12], the freedom fighter Niobe referrers to the last transmission of Osiris, which is elaborated both in the animated short film 'The Final Flight of the Osiris'[13] and in the first level of the video game 'Enter the Matrix'[14]. The animated short film and the video game are examples of flow tags that audiences can explore and interact with.
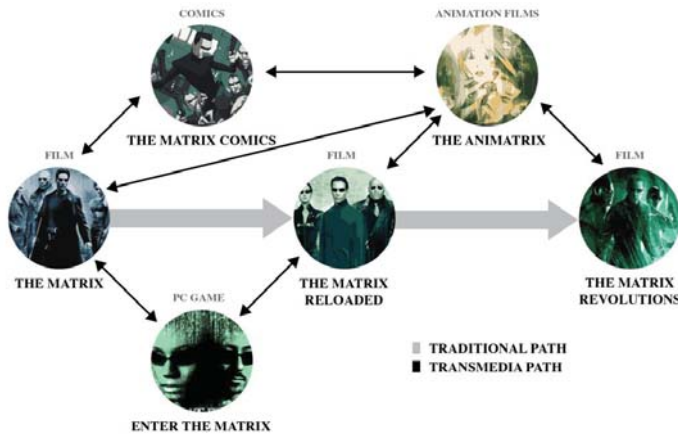
Figure 2: Illustration of the Matrix franchise and the connection between each story products.

2

An example of the more distributed approach can be found in the Pokémon franchise,[15] where the original video game(s) each presented different entry points into (somewhat) parallel universes where Pokémon exist, with the following television show representing its own separate entry as a tentpole in and of itself. Later, the mobile augmented reality game 'Pokémon GO' became its own independent tentpole, in which the 'real' world was made a part of Pokémon universe. However, the augmented experience was separated from the narratives of the games, TV series and films, in order to reach a wider audience.

However, a central claim in much of the scholarly work on transmedia is the need for all elements to construct a cohesive storytelling in a storyworld.[16] If this is not the case, Ibrus & Scolari argues transmedia is 'just' cross-media content - pieces of content spread across platforms which might have a tentpole, but in which the tie-ins do not support the storytelling, instead taking the form of paratextual items like merchandise, promotional web-sites, and so on.[17] However, Jenkins acknowledge that the storytelling aspect simply refers to one logic that seems to affect the entertainment industry.[18] More recently, he defined transmedia simply to be "a set of relationships across media"[19].

The Problem
In practice, transmedia - or cross-media, cross- or multi-platform – communication has been a marketing tool for many years, and whether the *storytelling* component is prevalent, or extensive, varies a great deal. Cross-platform communication is used to great effect in advertising and is now finding applications beyond traditional storytelling environments, such as in exhibitions and museums.[20] As such, even though scholars have sought to pin down principles for what characterises transmedia storytelling specifically,[21] there is still some confusion as to when something is part of a transmedia story, or experience, or campaign, or when it is not. Can something, as an example, only qualify as transmedia if is produced canonically by the producers of the tentpole - or can co-produced or fan-made narratives also qualify as part of the storytelling universe, as proposed by e.g. Jensen and Vistisen[22] and Matt Hills[23]?

The scholarship to date on transmedia storytelling has focused on analysing existing properties, or otherwise establishing holistic approaches to craft itself. For example, Henry Jenkins describes seven core principles to consider, when analysing or developing a transmedia experience.[24] Giovagnoli provides two 'shapes' of communicative systems for planning transmedia projects; the first is flat, where the different media platforms and the contents of the project move on a measurable single infinite plane; the other is curved, where the different media platforms and the contents move around and take on different forms, which often are complex and not always predictable.[25] Gambarato reduces storytelling to a somewhat daunting mathematical equation, where the transmedia story is seen as a super-system: nested systems that themselves contain subsystems. The systems consist of story, experience, platforms, audience, and so forth, and each system is comprised of its own separate subsystems. For example, the story system might be built with subsystems such as genre, plot, characters, locations, etc.[26] The nests and the systems can be divided into two sub-categories: narrative, and cultural. The narrative category provides guidelines to develop fictional universes and characters,[27] and the cultural category provides guidelines on how to invite the audience to participate in a transmedia concept.[28] Some scholars combine these views and offer some suggested as to how to more practically design transmedia concepts.[29]

What have been largely ignored are the mechanics of how the interplay between these categories manifest in the users experiencing content across media platforms. The current claim is that the users

3

are motivated to e.g. interact through a centripetal strategy of 'drilling' into details of e.g. a character's backstory or follow small breadcrumbs of stories in a 'serial' centrifugal strategy.[30] However, we argue this does not fully address the use complexity of many transmedia concepts, since there seems to be an assumption that users will follow these producer-led strategies, and only in a limited extent mix this with other points of entry. Take Lucasfilm's *Star Wars* franchise, recognised as an early archetypical example of transmedia storytelling.[31] The franchise began with the original 1977 film, and has evolved to contain several so-called saga and anthology films (like 2018's *Solo: A Star Wars Story*), hundreds of books, comic books, video games and multiple series.[32] Each of these media platforms, and objects, are potential entry points into the Star Wars universe with their respective content contributing to the overall story. Beyond the primary content, there are other potential, organic points of entry. A fan of George Lucas' *Indiana Jones* films might explore other popular films of George Lucas, for instance. An avid video gamer who likes the video game *Battlefield 1* might explore other works from the developer EA DICE, thus coming across *Star Wars Battlefront*. Thirdly, a sci-fi literature fan may come across some *Star Wars* books. All three individuals arrive in the *Star Wars* universe from different entry points motivated by different elements. This occurs not just as flow tag tie-ins to the Star Wars film as tentpoles, but just as much as different types of intertextual[33] references happening both horizontally (related actors, genres, thematics, etc.) and vertically (reviews, blogs, fan fiction, etc.) which together constitute a multitude of ways that audiences might enter into and interact with the narrative (and potentially each other) across media platforms.

We argue this is one issue of addressing the complexity of the interactions users undertake when engaging with media across platforms - regardless of it being story or non-story content. Arguably, the design of any transmedia or cross-media content depends on motivating the audience to interact across platforms. This does not necessarily concern the individual pieces themselves, but rather the 'bridges' that connect them.[34] There is currently a scholarly gap in how such bridges are described, and how the significance of these bridges might aid in assessing both the narrative and cultural dimensions of a transmedia concept's complexity. Thus, in this paper we introduce the term 'bridge complexity' to describe how different types of both narrative and non-narrative bridges form a typology of ways users can access a transmedia concept - whether focused around a traditional monocentric tentpole, based on a polycentric mega-franchise, or more vaguely-defined transmedia products, such as exhibitions. In particular, we ask: how do different bridges facilitate audience action in transmedia concepts?

To answer this question, we examine two of the recent decade major transmedia franchises, the DC and Marvel universes, and two smaller independent projects, the podcast *Serial* and a student project from the media studio 'The Story Lab' at Melbourne's RMIT University. The aim is to identify how bridge complexity enables the audiences to travel from one media platform to another. We finally present three types of transmedia bridges for assessing the complexity of relations between media platforms in transmedia projects of any size.

Transmedia storytelling – between platforms and user interactions
The overarching concept of transmedia storytelling has existed for decades - with some even arguing transmedia storytelling being as old as various religious narratives of e.g. Greek Mythology and Christianity.[35] However, in popular culture Lucasfilm's 'Star Wars', and Walt Disney's universe of cartoon characters are considered amongst the first transmedia storytelling franchises that utilised different media platforms like television, video games, films and furthermore made it possible to interact with the characters and thereby expanded the universe for the audience.[36] Though, the early

4

concepts that utilised multiple media platforms were not created in the outset of being a transmedia experience and therefore not tightly interwoven to have a strong continuity from one medium to another.

> A great continuity and mythology give audiences something to dig into and a reason to hunt for back issues and return month after month. The only way stories - be it a transmedia story experience, video game, comics, television, novel - inspire that sort of emotional and time investment is through incredible storytelling and characters that the audiences want to revisit again and again.[37]

Even though transmedia concepts use different media platforms, the focus is not the media platform, but how the content immerses the audience in communities. The creator only has 50 percent of the composition of a transmedia narrative as the rest is in the hand of the consumer.[38] Jenkins notes that "reading across the media sustains a depth of experience that motivates more consumption"[39]; by expanding the franchise and giving the audiences more to engage with, individuals or groups can maintain a high level of interest towards the universe. The audiences' will to discover is a major driving element as transmedia is about discovery which require active participation, where they have to hunt, gather, and chase for story parts across media channels and share, compare, collaborate and be part of knowledge communities to ensure that those who invest time and effort gets a richer experience.[40]

Producer Jeff Gomez describes audience interaction to be one of the criteria for successful transmedia franchises, where interactivity includes cultivation, validation and celebration of fan base.[41] The focus here is the collaboration between producer and fans, and how to promote and add value to fans' activity and contribution, which reinforces the connection between the transmedia universe and the fans. The fans are to be understood as actively engaging audience in contrast to passively spectating audience. The transmedia pioneer Henry Jenkins describes the fans' activity as one of the core concepts named 'Performance'. "Some performances are invited by the creator while others are not; fans actively search for sites of potential performance".[42] He furthermore, explains that something has to catch the audience's attention, which he calls attractors and something else have to encourage them to engage, which he calls activators.[43] In the above-mentioned 'The Matrix' example, the reference to the transmission of Osiris is the attractor, and the curiosity to know more about the transmission, functions as the activator that leads fans to 'The Final Flight of the Osiris' and 'Enter the Matrix'. Hayes collapses these two concepts into the term 'bridges', with the attracting seen as the mere fact that it is recognised that other media platforms can be interacted with, and the activator is the interaction through the bridge itself.[44] Both Jenkins, Gomez, and Hayes discuss and points out the importance of interactivity and gives their suggestions on how to establish the connection between the story and the fans.[45]

Since 1990s number of products have experimented with extending their narratives across multiple media platforms. Alternate reality game (ARG) is one of the earliest examples that dispersed its narrative across multiple media platforms, where the players had to collaborate to assemble the whole story. This form of transmedia is called Portmanteau transmedia and requires a high level of user involvement, where users have to coordinate through multiple media platforms, such as social media.[46] ARGs are often engineered as a marketing and promotional tool to evoke the desire towards a primary product by engaging the audience to explore back stories and rewarding their activity with game elements like batches, merchandises and story pieces. ARGs deliberately expels the boundary between the game and reality, where the events in the game often extends into the player's real

5

world.[47] The promotional campaign 'The Beast'[48] for Steven Spielberg's film 'A.I.'[49] in 2001 was arguably one of the first ARG where the audience travelled between different media platforms to collect information and collaborated in solving puzzles that unlocked story pieces along the active period leading up to the film premiere.[50] In the following years, ARG was not only explored by the film industry, but also adopted by other industries.[51] For example, the ARG 'I love bees' was a marketing campaign for the video game 'Halo 2' released in 2004, 'Cathy's Book' is an young adult novel published in 2006 with ARG elements and an iPhone app that enables the readers to investigate Cathy's disappearance, 'Lonelygirl15' is a web series that used its lead character Bree to interact with the audience to solve puzzles through vlogs on YouTube during 2006 to 2008, 'Year Zero' was a promotional ARG for Nine Inch Nails album released in 2007, 'Lewis Hamilton: Secret Life' is an ARG with Formula 1 racer Lewis Hamilton which took place in 2010 to brand Reebok sneakers, 'Dexter' is a TV series that used ARG in between two seasons as a preview for the upcoming season in 2010, and the ARG 'Urgent Evoke' in 2010 by World Bank Institute encouraged entrepreneurship and generated ideas in Africa. The marketing campaign for the series 'Game of Thrones' in 2011 extended the fictional world into the real world, by sending properties from the fictional world to social media influencers in their target group, who then created content on social media about the received packages.[52] The influencer created content functioned as bridges for the audience to explore more before the launch of the series. Often the ARG narrative in marketing campaigns did not rely on a tentpole medium but rather tied to fictional or real-world characters that functioned as the driving element for the narrative progression across multiple media platforms. ARGs that work along the primary product like Cathy's book have the book as the tentpole medium where the ARG functions as a flow tag. The kind of bridge this type of transmedia creates between the ARG and a book, is what we might label as 'storyline bridge' and is in many ways the idealised version of bridges - timeline and events extending across platforms through seamless user interactions.

From storyline bridges to storyworld bridges in DC Comics
The use of storyline bridges arguably reached its current zenith in 2008 with the innovative augmented reality advertising campaign 'Why So Serious'[53] for Christopher Nolan's film 'The Dark Knight'[54]. The award-winning campaign is one of the most comprehensive ARG that took place 18 months with over 11 million unique participants in over 75 countries from 2007 leading up to the film premiere in 2008.[55] Thus, it is suffice to say that the campaign radically shifted the ways people thought about storytelling and how it could be leveraged beyond a primary product. 'The Dark Knight' is based on DC Comics character Batman and is second part of Christopher Nolan's The Dark Night Trilogy. Alongside the ARG campaign, and the release of the film in 2008, the game studio Rocksteady released the game 'Batman: Arkham Asylum'[56] for PC, Xbox and PlayStation. This game also portrayed Batman, and villains present in the live action film, but did not exist in the same timeline and events of the films. As such, they would not traditionally be considered part of the transmedia storytelling, since they only shared characters, but not story, with the tentpole medium. However, if we consider this through the optic of how each platform bridges between each other we can shine another light on the issue. The 'Why So Serious' ARG and Dark Knight films share clear storyline bridges with each other but share only some basic characteristics of the Batman character, as well as the story world of Gotham city as a context. But due to the timing of release, between ARG campaign, live action film, and the video games, the two different versions of Batman are undoubtedly tied together, the same way as the previous mentioned Star Wars examples link between disparate pieces of content. This can be explained by adding a second type of bridge to the mix, alongside the 'traditional' storyline bridge. While not sharing the same storyline as the Dark Knight films, the Batman Arkham video games share norms, context, and to a large degree historicity between each other - e.g. both products takes place in Gotham city, in which a billionaire named

6

Bruce Wayne became a caped crime fighter to avenge the murder of his parents. So, while the storyline of the events in the two variants a so different, that they do not bridge between each other, the storyworld of 'Batman' creates a bridge motivating audience of the film to 'play as Batman' in the game - regardless of if it adds to the totality of the film universe or not. These 'storyworld bridges' are less complex to manage, but still enables audiences to travel between two different storylines because of the shared storyworld bridge between them. DC followed this strategy when realising the last part of the film trilogy 'The Dark Knight Rises'[57] in 2011, with Rocksteady Games launching a game sequel at the same time, named 'Batman: Arkham City', see Figure 3.
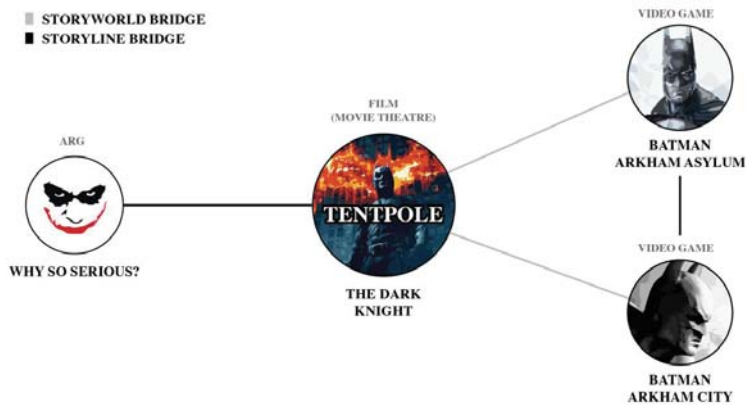

Figure 3: An illustration of the direct storyline bridge between the ARG campaign and live action film (in the theatre), and the storyworld bridges to the two contemporary video games launched alongside The Dark Knight films.

The mix between storyline and storyworld bridges does however also arguably add to the total complexity of DC transmedia storytelling of their Batman property throughout the period of 2008-2012, after which they turned to a model more directed towards establishing strong storyline bridges of shared continuity starting with the film 'Man of Steel'[58] in 2013[59] for their film universe unofficially referred as 'DC extended universe'[60] (DCEU). Even though the DCEU's films on individual characters performed well, the cross-over films 'Batman v Superman: Dawn of Justice'[61] in 2016 and 'Justice League'[62] in 2017, failed at the box-office and was criticised by audience.[63] Beside DCEU, DC Comics also have a TV universe with a shared continuity called 'Arrowverse'[64] consisting of several television- and web series, where the cross-over episodes functions as the centre for connection. For example, at the end of some episodes of the TV series 'Supergirl'[65], the character Flash from another series 'The Flash'[66], reach out for Supergirl's help, where the story continues in a third series 'Arrow'[67], and travels through the next episodes of 'The Flash' and 'Supergirl'. The series separates after concluding the cross-over and continues with their individual storylines in their respective series, see Figure 4. This cross-over phenomenon is a storyworld bridge towards the series 'The Flash' and 'Arrow', where audience is forced to travel across series if they wish to follow the story.
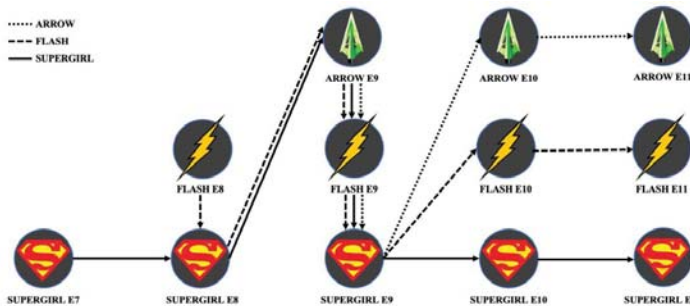
7

Figure 4: An example of how the series Supergirl, Flash, and Arrow are tightly connected with storyline bridges, starting form episode 7 (E7) in Supergirl series.

DC Comics works with different universes, which co-exist with more or less the same characters without being in narrative sync across different media platforms.[68] This approach reveals another type of bridge, in which it is not the storyline or storyworld itself, but rather the presence of recognizable characters that bridge between the different media platforms. This is what we label 'character bridges', and which are special since they potentially do not need neither shared stories or shared storyworld to be meaningful for the audience. These bridges are what ties in separate storyworlds when e.g. DC Comics Superman encounters Marvel Comics Spiderman, which is not canon in either storyworlds, and is its own separate storyline. Furthermore, character bridges are often seen when we see intertextual references in media products, which are not part of neither storyline or storyworld, but might be placed to enable an arguably weak bridge to another franchise.

The character bridges can thus both act as a clear bridge between separate franchises, as well as act as more discrete easter eggs through intertextuality. The ladder shows, that intertextual character bridges are often used as simple bridging mechanism to slowly evolve a transmedia concept, and thus lead to the formation of stronger and more complex storyworld and storyline bridges to- and from other media platforms. In the next section we will discuss this further through the lens of the Marvel Cinematic Universe.

The many centres of the Marvel Cinematic Universe
The Walt Disney Company[69] is one of the early pioneers to utilise transmedia elements to engage audience through different formats like television, film, live events including theme parks and more. They have since then, fine-tuned these methods to fully deliver transmedia experiences with their acquisition of Marvel Entertainment[70] in 2009 and Lucasfilm in 2012. Today, Marvel has become a frontrunner of transmedia storytelling by successfully expanding their cinematic universe called Marvel Cinematic Universe (MCU) in a big scale sustaining from 2008. MCU is intentionally designed from the outset to be a transmedia experience,[71] and its success of building and extending the MCU through different media platforms and formats, is becoming a major influence on shaping the contemporary- and the future of transmedia experiences.

Marvel has since 1960s encouraged fan interaction through playful captions, letters pages and readers' club that together was the foundation to establish a rapport with the readers. These interaction possibilities and the validation by incorporating user generated content in their comic releases, formed a high level of loyalty among the readers.[72] Early recognition of the importance of a dedicated fan

8

base and prioritising the goodwill of fans, supported to narrow down the boundaries between the consumer and the creator.[73]

Today, the loyal fan base is still one of the cornerstones of Marvel's success with their transmedia experience MCU. Yet, Marvel acknowledges that the mass audience has a limited interest in chasing other story units across multiple media platforms. Therefore, they carefully balance the production by making self-contained stories for the mass audience, which includes moments of interconnectivity in some scenes to fortify the MCU and thereby accommodate the fan base.[74] The interconnectivity strengthens the continuity between the films and are mostly concentrated in the mid and post-credit teasers. The first major bridge in MCU was delivered through the post-credit teaser that followed 'Iron Man' (2008), where Nick Fury tells Tony Stark, that he has become a part of a bigger world - immediately creating a storyworld bridge to a yet to be seen universe. The curiosity about Nick Fury and the bigger world works as the activators to explore more. Following this, a large amount of content was released across multiple media platforms, such as the following film 'The Incredible Hulk'[75], which also included characters-bridge references to both Nick Fury and the 'Iron Man' film, as well as the comic book series The Avengers Prelude: Fury's Big Week[76], the series Agent of S.H.I.E.L.D (2013 -)[77], One-shots short films[78] and Iron Man 2 video game[79], see Figure 5 for an overview of the story products and the bridges connecting them.
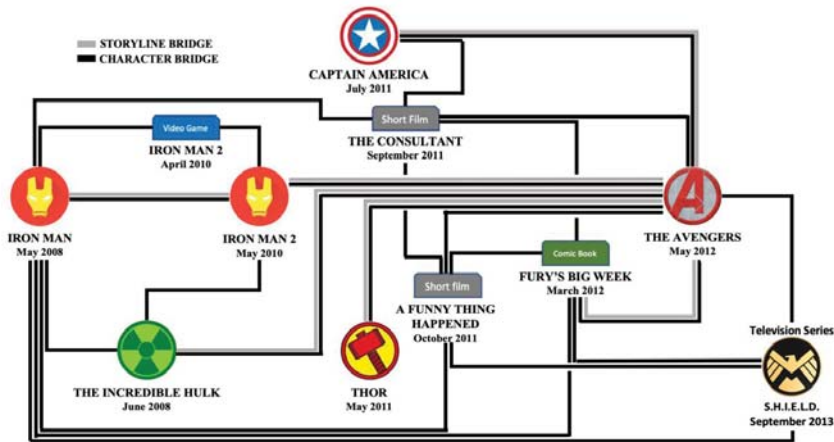
Figure 5: A timeline of the initial phase of Marvel Cinematic Universe and the bridges between the story products. Here, all the stories take place within the same storyworld, where each initial film is its own centre for additional films, comics, toys etc.

The mid- and post-credit scenes are a continuing tradition in marvel films, which often teases an upcoming marvel film within MCU. For example, the post-credit scene of Iron Man 2 (2010)[80], introduces Thor's hammer, which directly points towards the next film Thor (2011)[81]. At the end of The Avengers (2012)[82], one mid-credit scene and a post-credit scene where used. The mid-credit scene dives deep into MCU and introduces Thanos, who is behind the alien attacks, who later becomes a major character in the film Avengers Infinity War (2018)[83]. The following post-credit scene at the end illuminate the unity among the superheroes in a shawarma bar. Sometimes the post-

9

credit scenes just function as a reward for those who are sitting through the credits and doesn't necessarily points the audience in any direction.

Apart from the post-credit scenes, many references to other story units and elements within MCU can be spotted. For instance, the serum which caused the increased abilities for 'Captain America'[84], is the same serum that have a part in transforming the villain into a monster in 'The Incredible Hulk' (2008)[85]. These references are often spotted by the fans who have a broad knowledge about MCU and its stories. These kinds of references are necessarily not recognised by the general audience. In contrast, Captain America's shield can be spotted in Tony Stark's lab in 'Iron Man' (2008). The shield does also appear in 'Iron Man 2' (2010) in the scene where Agent Coulson visits Tony Stark. This visual reference can somehow be familiar for the general audience, as it refers directly to a story unit on a tentpole medium. These references work in some degree as attractors and interconnect the different story units through worldbuilding but does not necessarily activate the audience to travel between tentpoles. Instead these references are recalled and recognised by the audience when they come by related topics in other story units within MCU. As such, the initial MCU was constructed primarily through character-bridging easter eggs, before scaling up to deliver clear storyworld bridges to meet the promise of a being 'part of bigger world', and now with the later films weave a complex of storyline bridges between both films and their secondary media platforms.

Marvel's transmedia approach attracts the audience by telling multiple stories over multiple platforms that together tell one cohesive story. Interestingly though, the MCU is also a transmedia franchise without a clear tentpole from which other products bridge from or towards. Rather, each live action film has started its own independent tentpole, with sequels, games, comics, etc. To some degree the story products, such as films, series, short films, comics and video games within MCU are self-contained, and can be experienced separately. This construction does not force the consumer to invest a lot of time in MCU, but rather gives the consumer the freedom of choice to dig further into MCU according to their interest. To this extend, the gradual scaling in bridge complexity, from characters, to storyworld to a cohesive storyline are all integrated into a polycentric universe of individual transmedia products, rather than gathered around one tentpole event that the audience has to experience before being able to make sense of the rest. Arguably, this has changed to some degree with the launch of the latest Avengers films, which has introduced significant storyworld changes, that without much explanation also affects the separate MCU films, making the Avengers films the defacto tentpoles of the MCU after the fact. This mechanic, of tentpoles forming long after the introduction of the transmedia universe is an interesting trait of this range of polycentric transmedia products, which does not originate from a monocentric event, but rather converges towards a centre from multiple starting points.

Transmedia in the Independent space
Independent productions may not immediately leap out as a transmedia product as they often are entirely self-contained, but there are many that travel across multiple media platforms to expand the conversation or narrative such as the podcast 'Welcome to Night Vale'[86] that began in 2012 representing a radio show broadcasted from the fictional town of Night Vale, where all the conspiracy theories are real, and the documentary film 'Amplify Her'[87] from 2017 that presents the rise of female artists in the electronic music scene. Both examples are tentpoles using either storyworld bridges or character bridges to connect to their flow tags.

An interesting example in the independent space in the student project 'Protest of Pasion'[88] that was partly told through online blogs and social media - with scheduled releases - before climaxing in an

immersive experience where the audience was invited to 'break in' to the headquarters of a party. To draw audiences in, the students employed posters and a campaign of spam on social media. Only very rarely were audience told that it was fiction. The posters and spam drew the audience to the two competing blogs - one belonging to a political candidate, the other to a seemingly shady free speech Anonymous-like organisation. Things came to a head on the blogs, and the free speech group decides to invade the candidates' headquarters - and through clever use of information scraping, the audience was invited to raid a real space. What's particularly interesting here is, that there were no existing audience or 'fandom' for this project to plug into, but the students used their 'drawing-in' tactics as attractors and again, the ability to affect change activated the audience. The real world is the storyworld with real-world characters involved in a real-world course being the storyline, which makes the transmedia bridges less complex even though all three bridges are in play, as a result of the audience's familiarity with the real world and its laws. There is no tentpole in this concept, but a driving common course that directed the narrative progression, and thus again an example of how the newer waves of transmedia products tend to be polycentric, rather than monocentric around one clearly defined tentpole.

One of the most discussed independent transmedia production is probably the podcast 'Serial'[89] in the genre true crime hosted by Sarah Koenig. The first season of the podcast was a long-form series that reopened and investigated the 1999 murder case of Hae Min Lee and the conviction of her ex-boyfriend Adnan Syed.[90] At the end of each episode, Koenig mentions that there are supplementary materials on the website, such as pictures, maps, cell phone records, letters, and interviews.[91] The website for the podcast contains interactive features and provides additional information for the listeners interested in learning more or wanted to participate actively in the investigation. The podcast is not dependent on the extra material, in contrast, the extra material is very much dependent on listeners' familiarity with the podcast. Here, the podcast is the tentpole, where the evidence materials work as the flow tags. The audience is attracted to find out the truth and activated by the ability to affect genuine change. It can be argued, that the podcast uses character bridges by focusing on the persons involved in the real-world incident, where the evidence materials and the real-world references are storyworld bridges, which together tries to form the true storyline in collaboration with the listeners. During 12-episode run from October to December 2014, the podcast achieved 40 million downloads, doubled to 80 million by 2015,[92] and re-opened the murder case in 2016 and granted Adnan Syed a new trial.[93] The blend of storyworld bridges and character bridges elevates the bridge complexity of the transmedia product, however the storyline takes place primarily in the podcast which prevent the rise of complexity level more.

Transmedia productions in the independent space seems to travel on a less complex level and within a limited time frame. Storyworld and character bridges are the most used connections between the platforms, where the more demanding storyline bridge is limited in its use.

A new perspective - bridge complexity in transmedia
Content is key, as always, and the ways in which creators use each individual platform remains as important as ever. Also, as always, distributing the narrative or project across multiple platforms moves it beyond the linear and into the experiential, giving audiences agency to explore and make their own decisions. In the beginning of transmedia storytelling the motivation to travel between platforms where often purely narrative-based and engineered simply for early adopters and existing hardcore fans. The story was serially connected across multiple media platforms, which worked well in small-scale projects, but when the sheer network of narrative connections became too complex like

11

the marketing campaign 'Why So Serious', it gets hard for the mass audience to grasp as a whole, and therefore the transmedia experience was mainly consumed by the hardcore fans.

Today, transmedia storytelling as seen in Wachowskis' Matrix franchise has been co-opted not only by big production companies like Disney and DC Comics, but to the same extend by journalists, interactive documentary-makers, grassroots, independent and student-led productions and, as always, marketing. As audiences have become more digitally savvy, the 'mass' audience has become more fragmented, and they now seek out their own narratives or individual pieces of content to explore. The storyworld, storyline, and character bridges are thus a way of elaborating the existing bridge concept inside the diegetic of narratives, with the non-diegetic bridges as a broader bridge (e.g. following a producer, director, or a real-world course), which challenge the scope of transmedia. However, with clear examples of supporting how users are motivated to enact, interact and transit between different media platforms. The base interactions - from a user perspective is the same: Reading across and through media platforms by a mix of diegetic and non-diegetic bridges to form a broader more coherent experience, see Figure 6.
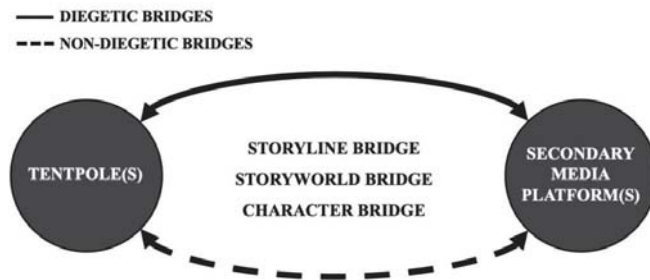

Figure 6: The proposed three types of bridges in transmedia between one or more tent-poles to one or more secondary media platforms. The bridge complexity arises from how the bridges are constituted by both diegetic (solid line) and non-diegetic (dashed line) content, and how the bridges develop over time, alongside the often polycentric network of media platforms in modern transmedia franchises.

Bridge complexity widens our lens for how to address these kinds of user interactions with transmedia products but embracing the variety of both monocentric and polycentric approaches to tell stories across media platforms. Bridge complexity opens op for a wider discussion on what and when something can be considered to be a transmedia concept that provides a coherent experience. The number of ways audience can transit from one media platform to another media platform defines the complexity of a transmedia concept. Thus, there can be simple transmedia with one bridging method from one media platform to another, or a highly complex transmedia that combines all three bridging methods to connect multiple media platforms. This means, that a coherent transmedia experience is not dependent on a cohesive storyline that interwove multiple media platforms through multiple bridging methods. It can consist of simple storyworld or character bridge and same time provide a coherent transmedia experience. As such, bridge complexity widens the lens for transmedia in other context, such as in physical exhibitions, that can work as part of a clearly defined storyline e.g. Disney's forthcoming Star Wars exhibition 'Galaxy's End'[94] to Disneyland, or simply connects non-related exhibitions in smaller areas, to collaborate on storytelling through a shared storyworld

12

concepts, or through character bridges between who and how the audience are met at the different exhibition locations.

Conclusions

Transmedia storytelling is changing and has always been changing. What is common across the examples is that they are all distributed content. What have been largely ignored are the mechanics in play to motivate the audience to follow a story or non-story content across multiple media platforms to interact with the distributed content which forms the transmedia experience. Thus, this paper investigated, how different bridges facilitate audience action in transmedia concepts through examining state of the art transmedia properties. The paper identifies, that this does not necessarily concern the individual content pieces themselves but rather the 'bridges' that connects them. The paper explains this as an effect of an increased complexity amongst transmedia franchises, challenging the traditional monocentric 'tentpole approach' with a broader polycentric approach. Here, the complexity is managed not through tie-ins to one tent pole, but rather as a mix of what we label as storyline, storyworld, and character bridges with varying level of complexities in their relation to the traditional tentpole medium. As such, this paper introduces the term 'bridge complexity' that facilitate a mix of three different user interaction through storyworld, storyline, and character bridges to connect content on multiple media platforms in transmedia projects of any size. Bridge complexity describes how different types of both narrative and non-narrative bridges form a typology of ways users can access a transmedia concept - whether focused around a traditional monocentric tentpole, based on a polycentric mega-franchise, or more vaguely-defined transmedia products, such as exhibitions. This covers a significant scholarly gap in how such bridges are described, and how the significance of these bridges might aid in assessing both the narrative and cultural dimensions of a transmedia concept's complexity.

13

Notes

[1] Helen Tattam, "Storytelling as Philosophy: The Case of Gabriel Marcel," *Romance Studies* 28, no. 4 (November 2010): 223–34, doi:10.1179/174581510X12817121842010.

[2] Walter R. Fisher, "The Narrative Paradigm: In the Beginning," *Journal of Communication* 35, no. 4 (December 1, 1985): 74–89, doi:10.1111/j.1460-2466.1985.tb02974.x; Jerome Bruner, "Life as Narrative," *Social Research* 71, no. 3, (2004): 691-, http://www.jstor.org/stable/40971721.

[3] Henry Jenkins, *Fans, Bloggers, and Gamers: Exploring Participatory Culture* (NYU Press, 2006). 97-98

[4] Ibid.

[5] Jeff Gomez, Talking Transmedia: An Interview With Starlight Runner's Jeff Gomez (part one), interview by Henry Jenkins, 2008, http://henryjenkins.org/blog/2008/05/an_interview_with_starlight_ru.html.

[6] Suzanne Scott, "Who's Steering the Mothership? The Role of the Fanboy Auteur in Transmedia Storytelling," ed. Aaron Delwiche and Jennifer Henderson, *The Participatory Cultures Handbook*, 2013, 43–52.

[7] Drew Davidson, *Cross-Media Communications: An Introduction to the Art of Creating Integrated Media Experiences* (Pittsburgh: ETC Press, 2015).

[8] Jeff Gomez, Entertainment Architecture: Constructing a framework for the creation of an emerging transmedia form. Interview with Jeff Gomez, interview by Woitek Konzal, July 4, 2012, https://culturalscience.org/article/10.5334/csci.50/. 91

[9] Lana Wachowski, *The Matrix*, accessed December 6, 2018, http://www.imdb.com/title/tt0133093/; Lana Wachowski, *The Matrix Reloaded*, accessed December 6, 2018, http://www.imdb.com/title/tt0234215/; Lana Wachowski, *The Matrix Revolutions*, 2003, http://www.imdb.com/title/tt0242653/.

[10] Wachowski, *The Matrix Reloaded*.

[11] Wachowski, *The Matrix Revolutions*.

[12] Wachowski, *The Matrix Reloaded*.

[13] Andrew R Jonas, *Final Flight of the Osiris*, accessed December 6, 2018, http://www.imdb.com/title/tt0350934/.

[14] Lana Wachowski, *Enter the Matrix*, accessed December 6, 2018, http://www.imdb.com/title/tt0277828/.

[15] Nintendo, "Pokémon," 2019, https://www.nintendo.dk/pokemon.

[16] Henry Jenkins, "Transmedia Storytelling: Moving Characters from Books to Films to Video Games Can Make Them Stronger and More Compelling.," *MIT Technology Review*, January 15, 2003, https://www.technologyreview.com/s/401760/transmedia-storytelling/.

[17] Indrek Ibrus and Carlos Alberto Scolari, *Crossmedia Innovations: Texts, Markets, Institutions* (Peter Lang, 2012).

[18] {Citation}

[19] {Citation}

[20] Vashanth Selvadurai and Claus Andreas Foss Rosenstand, "A Heuristic for Improving Transmedia Exhibition Experience," *The Design Journal* 20, no. sup1 (July 28, 2017): S3669–82, doi:10.1080/14606925.2017.1352873; Peter Vistisen, Vashanth Selvadurai, and Rameshnath Krishnasamy, "Applied Gamification in Self-Guided Exhibitions: Lessons Learned from Theory & Praxis" (GameScope Conference, Denmark: Aalborg University Press, In Press).

[21] Henry Jenkins, "The Revenge of the Origami Unicorn: Seven Principles of Transmedia Storytelling (Well, Two Actually. Five More on Friday)," *Henry Jenkins*, 2009, http://henryjenkins.org/blog/2009/12/the_revenge_of_the_origami_uni.html; Henry Jenkins, "Revenge of the Origami Unicorn: The Remaining Four Principles of Transmedia Storytelling," *Henry Jenkins*, 2009, http://henryjenkins.org/blog/2009/12/revenge_of_the_origami_unicorn.html.

[22] Thessa Jensen and Peter Vistisen, "Tent-Poles of the Bestseller: How Cross-Media Storytelling Can Spin off a Mainstream Bestseller," *Akademisk Kvarter / Academic Quarter* 7 (2013): 237–48.

[23] {Citation}

[24] Henry Jenkins, "Transmedia Education: The 7 Principles Revisited," *Henry Jenkins*, June 2010, http://henryjenkins.org/blog/2010/06/transmedia_education_the_7_pri.html.

[25] Max Giovagnoli, *Transmedia Storytelling: Imagery, Shapes and Techniques* (Pittsburgh: ETC Press, 2011). 39-42

[26] Renira Rampazzo Gambarato, "Signs, Systems and Complexity of Transmedia Storytelling," *Communication Studies* 12 (2012): 15.

[27] Brian Richardson, "Transtextual Characters," in *Characters in Fictional Worlds: Understanding Imaginary Beings in Literature, Film, and Other Media*, ed. Jens Eder, Fotis Jannidis, and Ralf Schneider, Revisionen. Grundbegriffe Der Literaturtheorie 3 (Berlin ; New York: De Gruyter, 2010), 527–41; Bryan Alexander, *The New Digital Storytelling:*

14

Creating Narratives with New Media (Santa Barbara, Calif: Praeger, 2011); Mark J. P. Wolf, *Building Imaginary Worlds: The Theory and History of Subcreation* (Routledge, 2012); Marie-Laure Ryan, "Transmedial Storytelling and Transfictionality," *Poetics Today* 34, no. 3 (September 1, 2013): 361–88, doi:10.1215/03335372-2325250.

[28] Henry Jenkins, *Convergence Culture: Where Old and New Media Collide* (NYU Press, 2006); Göran Bolin, "Media Technologies, Transmedia Storytelling and Commodification," *Ambivalence towards Convergence: Digitalization and Media Change*, 2007, 237–248, https://www.researchgate.net/profile/Goeran_Bolin/publication/256600189_Media_Technologies_Transmedia_Storytelling_and_Commodification/links/00b7d53751f2fbb964000000.pdf; Christy Dena, "Emerging Participatory Culture Practices: Player-Created Tiers in Alternate Reality Games," *Convergence: The International Journal of Research into New Media Technologies* 14, no. 1 (February 1, 2008): 41–57, doi:10.1177/1354856507084418; Elizabeth Evans, "Character, Audience Agency and Transmedia Drama," *Media, Culture & Society* 30, no. 2 (2008): 197–213, http://journals.sagepub.com/doi/pdf/10.1177/0163443707086861; N. Perryman, "Doctor Who and the Convergence of Media: A Case Study in `Transmedia Storytelling'," *Convergence: The International Journal of Research into New Media Technologies* 14, no. 1 (February 1, 2008): 21–39, doi:10.1177/1354856507084417; Jay Lemke, "Multimodal Genres and Transmedia Traversals: Social Semiotics and the Political Economy of the Sign," *Semiotica* 2009, no. 173 (January 2009), doi:10.1515/SEMI.2009.012; Elizabeth Evans, *Transmedia Television: Audiences, New Media, and Daily Life*, A Comedia Book (New York: Taylor & Francis, 2011); Emma Beddows, "Consuming Transmedia: How Audiences Engage with Narrative across Multiple Story Modes" (Doctoral Dissertation, 2012), http://www.emmabeddows.com/wp-content/uploads/2013/03/EmmaBeddows_PhDTHESISFINAL_ConsumingTransmedia_2012.pdf; Alice Marwick, Mary L. Gray, and Mike Ananny, "'Dolphins Are Just Gay Sharks' Glee and the Queer Case of Transmedia As Text and Object," *Television & New Media* 15, no. 7 (2014): 627–647, http://journals.sagepub.com/doi/abs/10.1177/1527476413478493.

[29] Jenkins, "Transmedia Education"; Christy Dena, "Transmedia Practice: Theorising the Practice of Expressing a Fictional World across Distinct Media and Environments" (Doctoral Dissertation, University of Sydney, 2009); Espen Aarseth, "The Culture and Business of Cross-Media Productions," *Popular Communication* 4, no. 3 (August 2006): 203–11, doi:10.1207/s15405710pc0403_4.No Reference

[30] Jason Mittell, "Strategies of Storytelling on Transmedia Television," in *Storyworlds Across Media: Toward a Media-Conscious Narratology*, ed. Marie-Laure Ryan and Jan-NoÔl Thon (U of Nebraska Press, 2014), 253–77.

[31] "StarWars.Com | The Official Star Wars Website," *StarWars.Com*, accessed December 8, 2018, https://www.starwars.com/.

[32] Ibid.

[33] Klaus Bruhn Jensen, *Medier og samfund: en introduktion* (Samfundslitteratur, 2013).

[34] Gary Hayes, "Social Cross Media – What Audiences Want," *PERSONALIZE MEDIA*, 2006, https://www.personalizemedia.com/cross-media-what-audiences-want/.

[35] Evans, *Transmedia Television*.

[36] "StarWars.Com | The Official Star Wars Website."

[37] Tyler Weaver, What Transmedia Producers Should Know About Comics: An Interview with Tyler Weaver (Part One), interview by Henry Jenkins, 2013, http://henryjenkins.org/blog/2013/02/what-transmedia-producers-should-know-about-comics-an-interview-with-tyler-weaver-part-one.html.

[38] Tyler Weaver, *Comics for Film, Games, and Animation: Using Comics to Construct Your Transmedia Storyworld* (Taylor & Francis, 2013). 44

[39] Jenkins, *Convergence Culture*.

[40] Weaver, *Comics for Film, Games, and Animation*; Jenkins, *Fans, Bloggers, and Gamers*.

[41] Jeff Gomez, Talking Transmedia: An Interview with Starlight Runner's Jeff Gomez (Part Two), interview by Henry Jenkins, 2008, http://henryjenkins.org/blog/2008/05/an_interview_with_starlight_ru_1.html.

[42] Jenkins, "Transmedia Education."

[43] Ibid.

[44] Hayes, "Social Cross Media – What Audiences Want."

[45] Jenkins, "Transmedia Education"; Gomez, Talking Transmedia, 2008.

[46] Robert Pratten, *Getting Started with Transmedia Storytelling: A Practical Guide for Beginners 2nd Edition*, 2015.

[47] Jane McGonigal, "'This Is Not a Game': Immersive Aesthetics and Collective Play," 2003, 10.

15

48 Eric Klopfer and Kurt Squire, "Environmental Detectives—the Development of an Augmented Reality Platform for Environmental Simulations," *Educational Technology Research and Development* 56, no. 2 (April 2008): 203–28, doi:10.1007/s11423-007-9037-6.

49 Steven Spielberg, *A.I. Artificial Intelligence*, 2001, http://www.imdb.com/title/tt0212720/.

50 Jeffrey Kim et al., "Storytelling in New Media: The Case of Alternate Reality Games, 2001–2009," *First Monday* 14, no. 6 (May 17, 2009): 2001–2009, doi:10.5210/fm.v14i6.2484.

51 Kim et al., "Storytelling in New Media."

52 "Campfire / Game of Thrones," accessed December 8, 2018, https://campfirenyc.com/work/hbo-game-of-thrones.

53 "Accolades," *42 Entertainment*, accessed December 7, 2018, http://www.42entertainment.com/awards.

54 Nolan Christopher, *The Dark Knight*, 2008, http://www.imdb.com/title/tt0468569/.

55 "Why So Serious?," *42 Entertainment*, 2007, http://www.42entertainment.com/work/whysoserious.

56 Sefton Hill, *Batman: Arkham Asylum*, 2009, http://www.imdb.com/title/tt1282022/.

57 Christopher Nolan, *The Dark Knight Rises*, 2012, http://www.imdb.com/title/tt1345836/.

58 Zack Snyder, *Man of Steel*, Action, (2013), http://www.imdb.com/title/tt0770828/.

59 Anthony Breznican, "'Man of Steel' Will Open Door for More DC Comics Superhero Movies," *EW.Com*, 2013, https://ew.com/article/2013/04/11/man-of-steel-dc-comics-superhero-movies/.

60 Andrew Auger, "DCEU Isn't Franchise's Official Name," *ScreenRant*, September 29, 2017, https://screenrant.com/dceu-movie-universe-official-name/.

61 Zack Snyder, *Batman v Superman: Dawn of Justice*, 2016, http://www.imdb.com/title/tt2975590/.

62 Zack Snyder, *Justice League*, 2017, http://www.imdb.com/title/tt0974015/.

63 Borys Kit, "'Batman v. Superman' Fallout: Warner Bros. Shakes Up Executive Roles (Exclusive)," *The Hollywood Reporter*, 2016, https://www.hollywoodreporter.com/heat-vision/batman-v-superman-fallout-warner-895174; Ross A. Lincoln, "Warner Bros Responding To Fans & Critics With DC Films Shakeup," *Deadline*, May 18, 2016, https://deadline.com/2016/05/dc-films-batman-v-superman-geoff-johns-jon-berg-1201758630/; Brent Lang, "DC Shake-Up in the Works After 'Justice League' Stumbles (EXCLUSIVE)," *Variety*, December 7, 2017, https://variety.com/2017/film/news/dc-films-justice-league-1202632214/; Brent Lang, "Warner Bros. Taps Walter Hamada to Oversee DC Films Production (EXCLUSIVE)," *Variety*, January 4, 2018, https://variety.com/2018/film/news/warner-bros-taps-walter-hamada-to-oversee-dc-films-production-exclusive-1202652878/.

64 Jeff Jensen, "This Week's Cover: CW Superheroes Crossover Revealed," *EW.Com*, 2016, https://ew.com/article/2016/11/09/flash-green-arrow-supergirl-cw-superheroes-crossover-cover/.

65 *Supergirl*, accessed December 13, 2018, http://www.imdb.com/title/tt4016454/.

66 *The Flash*, accessed December 13, 2018, http://www.imdb.com/title/tt3107288/.

67 *Arrow*, 2012, http://www.imdb.com/title/tt2193021/.

68 Geoff Johns, The Man At The Center Of DC's TV Multiverse, interview by Jarett Wieselman, 2014, https://www.buzzfeednews.com/article/jarettwieselman/the-man-at-the-center-of-dcs-tv-multiverse.

69 "The Walt Disney Company," *The Walt Disney Company Europe, Middle East & Africa*, accessed December 6, 2018, https://www.thewaltdisneycompany.eu/.

70 "Marvel Entertainment," *Marvel Entertainment*, accessed December 6, 2018, https://www.marvel.com/.

71 *Marvel Studios: Assembling a Universe*, Documentary, History, (2014), http://www.imdb.com/title/tt3591568/.

72 Pierre Comtois, *Marvel Comics in the 1960s: An Issue by Issue Field Guide to a Pop Culture Phenomenon* (TwoMorrows Publishing, 2009). 96

73 Matthew Pustz, *Comic Book Culture: Fanboys and True Believers* (University Press of Mississippi, 1999). 167

74 Derek Johnson, "Cinematic Destiny: Marvel Studios and the Trade Stories of Industrial Convergence," *Cinema Journal* 52, no. 1 (2012): 1–24, http://www.jstor.org/stable/23360278. 7

75 Louis Leterrier, *The Incredible Hulk*, 2008, http://www.imdb.com/title/tt0800080/.

76 Christopher Yost and Eric Pearson, *Marvel's The Avengers Prelude: Fury's Big Week* (New York, NY: Marvel, 2012).

77 *Agents of S.H.I.E.L.D.*, accessed December 13, 2018, http://www.imdb.com/title/tt2364582/.

78 *Marvel One-Shot: The Consultant*, accessed December 13, 2018, http://www.imdb.com/title/tt2011118/; *Marvel One-Shot: A Funny Thing Happened on the Way to Thor's Hammer*, accessed December 13, 2018, http://www.imdb.com/title/tt2011109/; *Marvel One-Shot: Item 47*, accessed December 13, 2018, http://www.imdb.com/title/tt2247732/; *Marvel One-Shot: Agent Carter*, accessed December 13, 2018,

16

http://www.imdb.com/title/tt3067038/; *Marvel One-Shot: All Hail the King*, accessed December 13, 2018, http://www.imdb.com/title/tt3438640/.

[79] Michael McCormick and Robert Taylor, *Iron Man 2*, Action, Adventure, Sci-Fi, (2010), http://www.imdb.com/title/tt1371159/.

[80] Jon Favreau, *Iron Man 2*, Action, Adventure, Sci-Fi, (2010), http://www.imdb.com/title/tt1228705/.

[81] Kenneth Branagh, *Thor*, 2011, http://www.imdb.com/title/tt0800369/.

[82] Joss Whedon, *The Avengers*, Action, Adventure, Sci-Fi, (2012), http://www.imdb.com/title/tt0848228/.

[83] Anthony Russo and Joe Russo, *Avengers: Infinity War*, Action, Adventure, Fantasy, (2018), http://www.imdb.com/title/tt4154756/.

[84] Joe Johnston, *Captain America: The First Avenger*, 2011, http://www.imdb.com/title/tt0458339/.

[85] Leterrier, *The Incredible Hulk*.

[86] "WELCOME TO NIGHT VALE," *WELCOME TO NIGHT VALE*, accessed December 13, 2018, http://www.welcometonightvale.com/.

[87] Ian Mackenzie, *Amplify Her*, Documentary, (2017), http://www.imdb.com/title/tt6962906/.

[88] Kylie Iva, "The Story Lab – Week 7 | Protest of Passion," 2015, http://www.mediafactory.org.au/kylie-iva/2015/04/23/the-story-lab-week-7-2/.

[89] Sarah Koenig, "Serial: Season One," *Serial*, 2014, https://serialpodcast.org/.

[90] Ibid.

[91] Sarah Koenig and Louise Kiernan, "Serial" podcast producers talk storytelling, structure and if they know whodunnit, 2014, https://niemanstoryboard.org/stories/serial-podcast-producers-talk-storytelling-structure-and-if-they-know-whodunnit/.

[92] BAmy Roberts, "The 'Serial' Podcast: By the Numbers," *CNN*, 2014, https://www.cnn.com/2014/12/18/showbiz/feat-serial-podcast-btn/index.html.

[93] Elahe Izadi, "Adnan Syed Granted New Trial in 'Serial' Case after Spending 16 Years in Prison," *Washington Post*, 2016, https://www.washingtonpost.com/news/post-nation/wp/2016/06/30/adnan-syed-granted-new-trial-in-serial-case-attorney-says/; "New Evidence Allowed in Serial Case," November 7, 2015, sec. US & Canada, https://www.bbc.com/news/world-us-canada-34753646.

[94] "Star Wars: Galaxy's Edge - Star Wars Land," 2019, https://disneyland.disney.go.com/destinations/disneyland/star-wars-galaxys-edge/.

17

A Heuristic for Improving Transmedia Exhibition Experience

Vashanth Selvadurai[a], Claus Andreas Foss Rosenstand[b]

[a]North Sea Oceanarium – Aquarium in Hirtshals, Denmark
Aalborg University – Department of Communication & Psychology
Corresponding author e-mail: vashanth@hum.aau.dk

[b]Aalborg University – Department of Communication & Psychology

Abstract: The area of interest is transmedia experiences in exhibitions. The research question is: How to involve visitors in a transmedia experience for an existing exhibition, which bridges the pre-, during- and post-experience?

Research through design, and action research are the methods used to design and reflect on a transmedia experience for an existing exhibition. This is framed with literature about exhibitions and transmedia, and analyzed with quantitative data from a case-study of visitors in the exhibition; this is organizationally contextualized.

The contribution covers a significant gap in the scientific field of designing transmedia experience in an exhibition context that links the pre- and post-activities to the actual visit (during-activities). The result of this study is a preliminary heuristic for establishing a relation between the platform and content complexity in transmedia exhibitions.

Keywords: Transmedia, Transmedia Storytelling Exhibition, Social Media, Instagram

1. Introduction

Museums, zoos, aquariums and art galleries etc. have existed and been shaped by their environments and the changing tides of culture over the past 400 years. These institutions have evolved enormously and often independently in the last century, where studies indicate a subconscious co-evolution (Coe, 1986).

Researchers in the field of contemporary museums, art galleries, science centers, libraries and cultural organizations, still focus on change and need thereof; how they are changing, and how they will change in the future. In recent years, exhibitions have entered the experience economy and are, therefore, competing with other visitor- and tourism-stakeholders (Mossberg, 2003). In this

Vashanth Selvadurai, Claus Andreas Foss Rosenstand

competition, recurring visitors expect new spectacular changes in exhibitions. One way organizations deal with this demand is by augmenting exhibitions with digital artefacts that allow new experiences with interactive elements (Opperman & Specht, 1999). Another is by experimenting with user-centered design through collaboration and co-creation with the visitors (Simon, 2010). The latter concentrates on cross-media initiatives that allow new interaction possibilities (Hall, 2013).

Nina Simon (2010) argues and discusses innovative design techniques and case-studies to make a powerful case for participatory practice. Other researchers focus on the pros and cons of transmedia initiatives in an exhibition context, and based on case-studies they present suggestions for improvement (Kidd, 2014; Hall, 2013; Kim & Hong, 2013; Pardo, 2011). However, these researchers do not focus on validating the suggestions with quantitative data.

Transmedia concepts have proved successful in enriching the experience with different products within the entertainment industry (The Dark Knight, 2008; Tron: Legacy, 2010; Halo 2, 2004). A transmedia experience is typically used to promote feature films, provide extra content to TV-series, add digital story layers to books, and to provide a fictional universe to specific products. Novel ways of applying certain aspects of transmedia are surfacing through experiments such as enhancing the experience of museums and exhibitions (Kidd, 2014; Hall, 2013).

Knowledge on transmedia in an exhibition context, based on quantitative data is still limited. Furthermore, within the field of exhibitions the current knowledge is even more limited and there is no research on visitors' pre-, during and post-experience. Through literature reviews, desk research and searching in databases with relevant search queries, the results were limited[1]. Most of the contributions in this search result focus on the need for implementation of new services, technologies, and installations on a conceptual level. A few of the articles discuss the importance of informative content in the pre- and post-visit, but they do not focus on a coherent experience across pre-, during-, and post-experience. The research does not validate the conceptual design ideas with practical implementations, and there is no focus on how to involve the target group. None of the articles from the Google Scholar search were identified as being of interest for the research question, which supports our argument about a significant knowledge gap.

The knowledge gap is addressed with the paper's research question: How to involve visitors in a transmedia experience for an existing exhibition, which spans the pre-, during- and post-experience?

2. Transmedia in Exhibitions

The research field of transmedia is continuously practiced and investigated by a number of researchers. Marsha Kinder coined and introduced the term transmedia in 1991 (Kinder, 1991). One of the leading transmedia practitioners today, Jeff Gomez, defines transmedia as:

"It [transmedia] falls under the rubric of crossmedia, but while crossmedia can imply any method, strategy or content that iterates itself over various distribution methods, transmedia implies a design sensibility customized to the message at hand, which also leverages the strengths of each platform and promotes dialogue with the audience." (Gomez, 2011).

This is only one definition among others like Jenkins' (Jenkins, 2006). When digging further into the field of transmedia, it is impossible to ignore the term transmedia storytelling, defined by Henry Jenkins as a story that "… unfolds across multiple media platforms, with each new text [video, print, audio etc. (Ed.)] making a distinctive and valuable contribution to the whole." (Jenkins, 2006, p. 95-96).

2

This definition has given rise to discussion on how to approach transmedia experience in practical contexts. Concepts that initially have transmedia experience as an objective can be defined as top-down productions; contrary to bottom-up productions, where the primary product is expanded with a transmedia experience (Ryan, 2013a). The success of a transmedia initiative is hard to measure objectively as it depends on many different variables like gathering, engaging and retaining the audience, and at the same time how well each medium succeeds in enriching the experience individually, thereby contributing to the proper functioning of the whole. Therefore, the measuring is usually done with subjective forms of success like observing and evaluating against tightly defined criteria (Long, 2011). Another approach by which existing transmedia initiatives have been measured, and continue to be measured is through the number of participants (Bole, 2013).

The state of the art research on transmedia experiences can be divided into three sub categories:
A cultural, a narrative, and a design category.

The cultural category focuses on how a transmedia production fits into participatory cultures and on the effects of these productions on groups of audiences. They also investigate and elaborate the social networks of transmedia storytelling, and the audience's behavior within the field of participatory culture and engagement (Jenkins, 2006; Bolin, 2007; Dena, 2008; Evans, 2008; Perryman, 2008; Lemke, 2009; Evans, 2011; Beddows, 2012; Jensen & Vistisen, 2012; Marwick, Gray, & Ananny, 2013).

The narrative category deals with the narrative part of transmedia. The approach is similar to the design category, although it focuses on developing fictional universes and characters. The researchers mainly concentrate on providing guidelines and structures wherein transmedia can be conceived and shaped (Richardson, 2010; Alexander B., 2011; Stackelberg, 2011; Wolf, 2012; Ryan, 2013b; Long, 2007). Researchers also present different ways of considering the migration of properties of fictional characters and narratives from a representation of fictional content to reality (Herman, 2004; Scolari, 2009; Alexander E., 2013).

The design category focuses on how to design a transmedia story and provides guidelines and principles of good practice. Generally, the researchers in this category suggest frameworks within which a plan for implementing and distributing a transmedia production can be created and executed (Klastrup & Tosca, 2004; Miller, 2008; Bernado, 2011; Pratten, 2011; Phillips, 2012; Dowd, Niederman, Fry, & Steiff, 2013; Spaulding, 2012; Spaulding & Faste, 2013; Long, 2007; Giovagnoli, 2011; Dowd, Niederman, Fry, & Steiff, 2013).

Some research covers all three categories where the experience is fragmented to identify, understand, and explain the different effects of the transmedia storytelling (Aarseth, 2006; Dena, 2009).

This study contributes to the design category, focusing on how to involve visitors in a transmedia experience in an existing exhibition by designing, implementing and evaluating a part of a transmedia experience.

Most of the research conducted in the field of transmedia is still focusing on defining the term, presenting guidelines or recounting earlier transmedia concepts. At the same time, the boundaries that indicate when a subject is within the definition of transmedia are continuously restated (Jenkins, 2012). In the existing body of knowledge about transmedia experience, there is a significant gap about how to involve visitors in a transmedia experience in an exhibition, and there are no consistent methods to evaluate the impact and gauge the results of a transmedia experience. This study contributes with a quantitative digital data evaluation, which drives the design further. We term this; data driven design for a transmedia experience in an exhibition.

3

Vashanth Selvadurai, Claus Andreas Foss Rosenstand

2.1 Organizational Context

North Sea Oceanarium is a tourist attraction located in northern Denmark and is Northern Europe's biggest aquarium measured by water capacity. The exhibition is covered by both the national and international laws and conventions of zoo facilities and offers knowledge regarding the North Sea and its surroundings. The North Sea Oceanarium is a government approved zoo facility, and it is a non-profit organization where profit is dedicated to develop the exhibition and/or related organizational development. The staff at North Sea Oceanarium comprise 35 full-time employees plus 35 seasonal employees.

North Sea Oceanarium is a conventional exhibition, where the organizational responsibilities are also conventionally divided between the exhibition, where the pre-, during-, and post visit are also divided between a marketing, exhibition, and store department respectively. In short, the marketing department reaches potential customers before the visit, the exhibition department provide the exhibition experience during the visit, and the store department offers merchandise in the shop placed after exiting the exhibition, but before exiting the zoo facility; i.e. after the exhibition visit.

The core visitor experience is located in the physical exhibition area, but the pre- and post-visit have not been understood by the organization as a part of the experience. This is illustrated in Figure 1.

Figure 1. An illustration of the three visit phases, where the dotted box is where the actual experience is located.

Today the organization is represented on many different media platforms with information, content and reviews about the exhibition (TripAdvisor, Inc., 2016; Wikipedia, 2016). The social media activity is primarily located on Facebook in contrast to the low activity on Instagram. However, the content on the different media platforms does not contribute to a transmedia experience, as those contain the same information about the exhibition adjusted to the different media platforms; and according to Jenkins definition (cf. "Transmedia in exhibitions") the content or text on each platform is not making a distinctive and valuable contribution to the whole. At the moment, North Sea Oceanarium is not represented on Twitter, Snapchat, or any other social media.

4

2.2 The Case-Study: Instagram

There is a potential for including the pre- and post-activities as part of the experience and thereby extending the exhibition with a transmedia approach, where the physical exhibition is the core media platform (Davidson, 2010). The focus for this study is to experiment on a part of the wider transmedia concept that can be designed, implemented, and evaluated.

At North Sea Oceanarium there is no tactical focus on promoting user driven content on social media; for example, there is no systematic recognition of visitors' content contributions on Trip Advisor, Facebook, and Instagram. This is an area with potential, where the organization can expand the visitors' experience by promoting user-generated content that can strengthen both visitors' learning and engagement (Russo et al. 2007:26). Furthermore, user-generated content also contributes to one of Jenkins seven core principals termed performance, to develop a transmedia experience. Performance denotes the user's participation, engagement and social activity. To add performance, the user needs to be encouraged to actively engage and to share the experience socially; e.g. by blogging, producing videos and sharing on social media (Jenkins 2010).

The exhibitions are typically limited to prioritize Facebook over other social services (Groneman, 2014), this tendency can also be identified at North Sea Oceanarium. Therefore, Instagram is chosen as the media platform to explore promoted user-generated content, as Instagram is a social media, where North Sea Oceanarium was identified as a platform with no organizational intended experience activity. Furthermore, the collection of user-generated photo material reflects the visitor's own perspective on the exhibition, and therefore constitutes both a complement and a corrective to the stories that already exist in the exhibition (Giersing, 2014). In this way, Instagram as a platform has the potential to make a distinctive and valuable contribution to the whole exhibition experience.

3. Case Study

A case study was conducted over two iterations with focus on promoting Instagram activities as part of the exhibition. The aim was to motivate the visitors to generate content on Instagram during visits. The purpose was to extend the visitors' experiences across pre-, during and post-visit, as shown in the Figure 2. There were not offered any extrinsic motivation like gifts, redemption incentives, or prizes to involve the visitors.

Figure 2. An illustration of the three visit phases and their different activities and content

5

Vashanth Selvadurai, Claus Andreas Foss Rosenstand

Content generated during the visit creates post-visit content for previous visitors, which feed pre-visit content for possible future visitors. The content on Instagram thus provides entry-points to the exhibition both before, during, and after the visit at North Sea Oceanarium; all with the purpose of improving the experience and at the same time leading to a possible increase of visitors.

During the Visit: During the visit, visitors are encouraged to take photos at different spots and share experience on Instagram. Six different Insta-spots are marked with a green floor labels with some unique hashtags in relation to the location. An example of one of the Insta-spots is illustrated in Picture 1.

Picture 1. A picture of one of the Insta-spot locations and the floor label with the hashtag and a small description in three languages; Danish, German and English.

Post-Visit: After the visit, uploaded photos create social media activities such as comments and likes from the previous visitor's network. Additionally, the previous visitors had the possibility to compile a photobook with their Instagram photos from the visit, which could be downloaded, printed or shared on the social media. By having different hashtags, it is possible to generate a photobook, where the different photos are connected to additional facts about the specific locations as seen in Picture 2. The photobook consists of 13 pages in three different languages; Danish, English, and German. A link to the photobook was automatically sent to the visitor's mail.

Picture 2. A picture of one of the pages in the photobook.

6

Pre-Visit: Previous to the visit, the visitors' social media networks have the possibility to explore photos uploaded on Instagram with the promoted hashtags. Hereby the social networks will get an entry-point to the exhibition from other visitors' perspective as shown in the Picture 3. The people in these social media networks are potential future visitors, which is also important to marketing.

Picture 3: A photo collage of the Instagram photos with the hashtag #nordsøenoceanarium.

4. Social Media Impact

The first iteration promoted the Instagram activity in the exhibition through conventional methods. The promotion was constructed to resemble any other promotion conducted for new activities in the exhibition. Big posters and printed flyers with information about the Instagram activity, were placed in the entrance. The flyers were also placed on all Instagram spots. The printed flyer is illustrated in Picture 4. Furthermore, the exhibition guides also offered visitors an introduction at the beginning of the exhibition. All department managers where informed in person and were asked to inform their staff.

Picture 4. A picture of the two inner pages from the information flyer.

7

Vashanth Selvadurai, Claus Andreas Foss Rosenstand

The first iteration of the experiment ran from July 7th, 2016 to October 3rd, 2016. In this period the exhibition had 96.331 visitors. The Instagram activity generated 137 posts and trigged 1.199 likes and comments, with a total social media reach of 15.034 persons. The numbers for the different Insta-spots are shown in Table 1.

Table 1. A table with the results from the first iteration.

	#hirtshals wind	#hirtshals fish	#hirtshals crab	#hirtshals cafe	#hirtshals seal	#ciao hirtshals	Totally
Posts	42	26	25	6	25	13	137
Reach	7.729	1.430	1.004	593	2.107	2.179	15.034
Likes & comments	531	164	103	61	201	139	1.199

Data collected from the first iteration showed a lower amount of content generated per visitor. This was discussed in the organization, and a hypothesis for the low activity was discussed: Too many hashtags complicated the experience and had affected the motivation to engage. And the conventional promotion methods did not have the desired effect. All in all, data confirmed that the Instagram activity was not functioning optimally.

In continuation of results gained from first iteration, the Instagram activity was re-designed to have only one hashtag and function by itself without the conventional promotion methods. All conventional promotional materials where removed from the exhibition and the guides were told not to actively offer information about the Instagram activity. Instead, a big screen with a controlled live feed from the Instagram hashtags were displayed in the exhibition – in the hallway between two major exhibition halls. The screen was decorated with visitors' Instagram photos and the name of the hashtag they had to use to be displayed. Picture 5 shows the big screen and an example of the content on it. All the green floor labels, on the six spots, were covered by the same new hashtag #nordsøenoceanarium.

Picture 5. A picture of the big screen and the content on it.

The second iteration of the experiment ran from October 15, 2016 to November 15, 2016. In this period the exhibition had 14.376 visitors. The Instagram activity generated 57 posts, triggered 1292 likes and comments and achieved a social media reach of 12.938 persons (Table 2).

8

Table 2. A table with the results from the second iteration.

	#nordsøenoceanarium
Posts	57
Reach	12.938
Likes & Comments	1.292

The only difference between the two iterations of the case study is the already mentioned number of hashtags, and the screen in the hallway instead of the conventional promoting methods (Figure 3). Of course, the duration and number of visitors differs, however this is allowed for by looking at the results per visitor. Table 3 lists how many times more effective the social media impact of iteration two was compared to the first iteration.

The second iteration shows a significant increase of posts, reach, likes and comments per visitor. Compared to the first iteration the number of posts is 2.79 times more effective, the reach is 5.62 times more effective, and likes and comments are 7.77 times more effective. This shows an improvement of both the experience and marketing. Moreover, the organizational effort was minimized by replacing the conventional promoting methods with the big screen (Figure 2).

Table 3. A table with the overall effect and social media impact according to both iterations.

	Iteration 1	Iteration 2	Relative social media impact
Posts per 1000 visitor	1.42	3.96	2.79
Reach per 1000 visitor	160	899.97	5.62
Likes & Comments per 1000 visitor	12.45	89.87	7.22

The case study shows that the increased impact can be explained by a combination of the reduced number of hashtags and the use of the big screen (Figure 3). These changes resulted in a reduced complexity of the Instagram activity and thereby made it easier for the visitors to participate.

The big screen with other visitors' photos seems to work as an entry-point for the Instagram experience, where the photos on the screen are results of other visitors' visits; thereby creating expectations for newly arrived visitors. The big screen might also function as a reminder to take photos during the visit. The opportunity to be featured on the big screen can also be a motivational factor for involvement. Generally, the Instagram activity is communicated significantly more effectively through the big screen than through conventional promotional channels.

The relative reduction in the number of hashtags is much more effective in iteration two, probably because it is easier to remember and use only one hashtag rather than six. Another reason could also be that the activity in iteration two was not communicated as limited to fixed Insta-spots, but opened the possibility to take photos anywhere in the exhibition. This was also possible in iteration one, however the idea of the photobook communicated a fixed link between Insta-spots and photos. From the photos, it is clear, that the green floor labels in iteration two works more as a reminder to take photos at different places in the exhibition, rather than being limited. No requirements from the activity itself encourage the visitors to become involved in the complete activity, as in iteration one with the idea of the complete photobook. However, the visitors could upload an incomplete

9

Vashanth Selvadurai, Claus Andreas Foss Rosenstand

photobook. This seems to be more convenient for visitors to adjust their involvement according to their interest. To this point, we conclude a heuristic for transmedia exhibition experience:

The more platform complexity, the less content complexity.

An increase in platform complexity to the user must be reduced by a decrease in the content complexity to the user and vice versa. In Figure 3 the number of platforms in use in the case-study is illustrated.
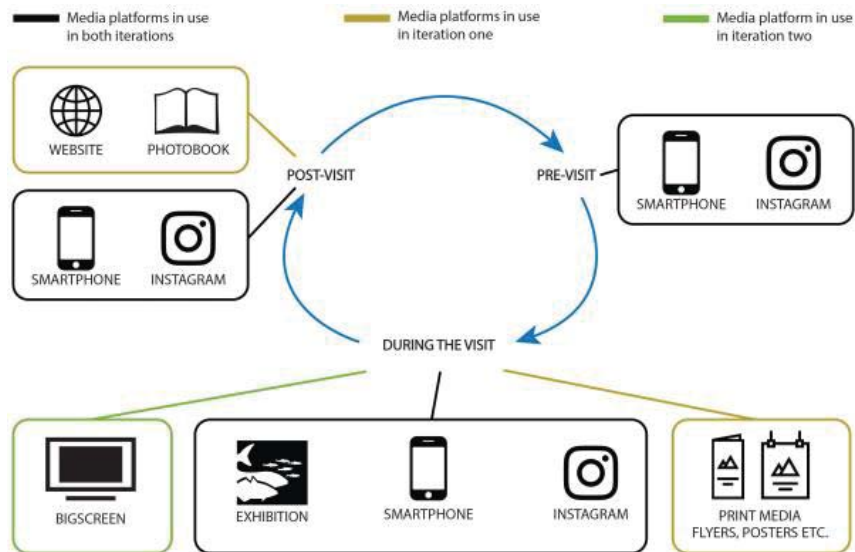

Figure 3. An illustration of the three visit phases and the different media platforms in use according to both iterations.

As illustrated in Figure 3, the actual number of platforms was also decreased from iteration one to two: The print media, website, and photobook were replaced with the big screen. This platform complexity reduction, has also according to the heuristic for transmedia exhibition experience contributed positively to the user experience.

There is clearly an interesting relation between platform and content complexity, social media impact, and user experience for transmedia exhibitions. In a practical organizational context, it would be useful to have a deeper understanding of this correlation, however further research is needed, where the following research question is posed: Is it possible in a meaningful and generic way to measure user experience as a function of platform and content complexity and social media impact?

5. Conclusions and Further Perspectives

In this paper, we investigated how to involve visitors in a transmedia experience for an existing exhibition, that spans the pre-, during- and post-experience. We have experimented with different communication methods to ensure the involvement of visitors. To this point, the case-study shows that presenting other visitors' experiences is a more efficient entry-point than conventional promotion methods. Moreover, the case-study shows, that a decrease in content complexity was

10

necessary because of the decrease in platform complexity. To this point a heuristic is formulated for transmedia exhibition experiences: The more platform complexity, the less content complexity.

The generated knowledge through quantified digital data contributes with new knowledge to existing research on transmedia in an exhibition context, with focus on the design category. And to this point, we argue for more data-driven design of transmedia exhibitions. Of course, this paper is only the first stepping-stone towards building a more comprehensive framework for transmedia exhibitions. Future research could show other interesting and organizationally useful correlations between pre-, during-, and post- transmedia exhibition experiences; both by experimenting with other platforms and with social media content.

Note 1: When searching for research on the visitors' pre-, during and post experience in a museum and/or in an exhibition, the result in Aalborg University Library database is only 14 peer reviewed articles. The actual search was done with the terms "museum(s)" and/or "exhibition(s)" containing "visitor(s)", "pre", "during" and "post". The abstract descriptions have been studied but none of them provide significant knowledge about the area of interest. When conducting the same search on Google Scholar, it results in too many search results (+80.000), because the terms "pre" and "post" are used in many different situations in the museum and exhibition context. By adding the term "transmedia" and "experience", the search results were narrowed down to 290.

References

Alexander, B. (2011). *The New Digital Storytelling: Creating Narratives with New Media.* Praeger.

Alexander, E. (2013). *Transmedial Migration: Properties of Fictional Characters Adapted into Actual Behaviour.* Department of English. Stockholm University.

Aarseth, E. (2006). The Culture and Business of Crossmedia Productions. *Popular Communication , 4*(3), 203-211.

Beddows, E. (2012). *Consuming Transmedia: How Audiences Engage with Narrative across Multiple Story Modes.* Swinburne University of Technology.

Bernado, N. (2011). *The Producer's Guide to Transmedia: How to Develop, Fund, Produce and Distribute Compelling Stories Across Multiple Platforms.* Beactive Books.

Bole, R. (2013, June 14). *Office of Digital & Design Innovation.* (Broadcasting Board of Governors) Retrieved December 27, 2016, from Innovation Series: http://www.innovation-series.com/2013/06/14/going-old-school-telling-digital-stories-in-analog-media

Bolin, G. (2007). Media Technologies, Transmedia Storytelling and Commodification. In T. Storsul, & D. Stuedahl (Eds.), *Ambivalence towards Convergence* (pp. 237-248).

Coe, J. C. (1986). Towards a Co-Evolution of Zoos, Aquariums and Natural History Museums. *American Association of Zoological Parks and Aquariums* (pp. 366-376). Wheeling.

Davidson, D. (2010). Tentpole. In D. Davidson, *An Introduction to the Art of Creating Integrated Media Experiences.* ECT Press.

11

Vashanth Selvadurai, Claus Andreas Foss Rosenstand

Dena, C. (2008). Emerging Participatory Culture Practices Player-Created Tiers in Alternate Reality Games. *Convergence: The International Journal of Research into New Media Technologies*.

Dena, C. (2009). *Transmedia Practice: Theorising the Practice of Expressing a Fictional World across Distinct Media and Environments.* Department of Media and Communications. University of Sydney.

Dowd, T., Niederman, M., Fry, M., & Steiff, J. (2013). *Storytelling across Worlds: Transmedia for Creatives and Producers.* Focal Press.

Evans, E. (2008). Character, Audience Agency and Trans-Media Drama. *Media, Culture and Society, 30*(1), 197-213.

Evans, E. (2011). *Transmedia Television: Audiences, New Media, and Daily Life.* Taylor & Francis .

Giersing, S. (2014). At dele autoriteten. Brugernes billeder som fremtidens kulturarv? (Sharing Authority. Users' photos as the cultural heritage in the future?) In *Sharing is caring : åbenhed og deling i kulturarvssektoren (openness and sharing in the heritage sector)* (pp. 199-207). Copenhagen, Denmark: Statens Museum for Kunst.

Giovagnoli, M. (2011). *Transmedia Storytelling: Imagery, Shapes and Techniques.* ETC Press.

Gomez, J. (2011). *Starlight Runner Entertainment.* Nordisk Film & TV Fond.

Groneman, S. T. (2014). Når museer prioriterer sociale medier. (When museums prioritize social media) *Nordisk Museologi, 1*, 37-53.

Hall, S. (2013). *Creating Strong Cross Media Concepts for Museum Exhibitions.* Cross Media Interaction Design, Department of informatics. UMEÅ University.

Halo 2. (2004). (Microsoft) Retrieved December 27, 2016, from 42 Entertainment: http://www.42entertainment.com/work/ilovebees

Herman, D. (2004). Toward a Transmedial Narratology. In M.-L. Ryan (Ed.), *Narrative across Media: The Languages of Storytelling.* University of Nebraska Press.

Jenkins, H. (2006). *Convergence Culture: Where Old and New Media Collide.* New York University Press.

Jenkins, H. (2010, June 21). *Transmedia Education: the 7 Principles Revisited*. (H. Jenkins, Editor) Retrieved December 27, 2016, from Henry Jenkins: http://henryjenkins.org/2010/06/transmedia_education_the_7_pri.html

Jenkins, H. (2012, March 24). *How to Ride a Lion: A Call for a Higher Transmedia Criticism*. Retrieved May 5, 2015, from Henry Jenkins: http://henryjenkins.org/2012/03/how_to_ride_a_lion_a_call_for.html

Jensen, J. F. (1998). *Multimedier Hypermedier Interaktive Medier.* Aalborg Universitetsforlag.

Jensen, T., & Vistisen, P. (2010). Tent-Poles of the Bestseller: How Cross-media Storytelling can spin off a Mainstream Bestseller. *Academic Quarter, 7*, 237-248.

12

Jensen, T., & Vistisen, P. (2012). En Opdagelsesrejse ud i De Sociale Medier: I Sporene på Sherlock. (A journey of discovery into the social media: In the tracks on Sherlock.) *Academic Quarter, 4*, 291-306.

Kidd, J. (2014). *Museums in the New Mediascape.* Ashgate Publishing.

Kim, J. H., & Hong, J. Y. (2013). *Analysis of Trans-media Storytelling Strategies* (Vol. 8). International Journal of Multimedia and Ubiquitous Engineering.

Kinder, M. (1991). *Playing with Power in Movies, Television and Video Games.* University of California Press.

Klastrup, L., & Tosca, S. (2004). Transmedial Worlds – Rethinking Cyberworld Design. *Cyberworlds*, 409-416. IEEE.

Lemke, J. (2009). Multimodal Genres and Transmedia Traversals: Social Semiotics and the Political Economy of the Sign. *Semiotica, 173*, 283-297.

Long, G. A. (2007). *Transmedia Storytelling: Business, Aesthetics and Production at the Jim Henson Company.* Massachusetts Institute of Technology. Kenyon College.

Marwick, A., Gray, L. M., & Ananny, M. (2013). "Dolphins Are Just Gay Sharks": Glee and the Queer Case of Transmedia As Text and Object. *Television and New Media*, 1-21.

Miller, C. H. (2008). *Digital Storytelling: A Creator's Guide to Interactive Entertainment.* Focal Press.

Mossberg, L. (2003). *Att skapa upplevelser - - från OK till WOW.* (Creating experiences - - from OK to WOW.) Studentlitteratur AB.

Opperman, R., & Specht, M. (1999). A nomadic Information System for Adaptive Exhibition Guidance . *Archives and Museum Informatics, 13*(2), 127-138.

Pardo, F. (2011). *New media and transmedia for documentary storytelling : a comprehensive approach.* Science and Natural History Filmmaking. Montana State University.

Perryman, N. (2008). Doctor Who and the Convergence of Media. *The International Journal of Research into New Media Technologies, 14*(1), 197-213.

Phillips, A. (2012). *A Creator's Guide to Transmedia Storytelling: How to Captivate and Engage Audiences Across Multiple Platforms.* McGraw-Hill.

Pratten, R. (2011). *Getting Started in Transmedia Storytelling: A Practical Guide for Beginners.* CreateSpace Independent Publishing Platform.

Richardson, B. (2010). Transtextual Characters. In J. Eder, F. Jannidis, & R. Schneider (Eds.), *Eder, J., Jannidis, F., & Schneider, R.* (pp. 527-541). De Gruyter.

Ryan, M.-L. (2013a). *Marie Laure Ryan Keynote Speech 2013 ISIS Conference*. Retrieved May 04, 2015, from http://www.youtube.com/watch?v=zqFsg8zqcLA

Ryan, M.-L. (2013b). Transmedial Storytelling and Transfictionality. *Poetics Today, 34*(3), 361-388.

13

Vashanth Selvadurai, Claus Andreas Foss Rosenstand

Russo, A., Jerry W., Lynda K., & Sebastian C. (2007). Social media and cultural interactivity experiences in museums. Nordisk Museologi, 1, 19-26.

Scolari, C. A. (2009). Transmedia Storytelling: Implicit Consumers, Narrative Worlds, and Branding in Contemporary Media Production. *International Journal of Communication, 3*, 586-606.

Simon, N. (2010). *The Participatory Museum.*

Spaulding, E. (2012). *Transmedia Storytelling: Principles, Practices & Prototypes for Designing Narrative Experiences with the Audience.* Carnegie Mellon University.

Spaulding, E., & Faste, H. (2013). Design-Driven Narrative: Using Stories to Prototype and Build Immersive Design Worlds. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 2843-2852). ACM.

Stackelberg, P. v. (2011). *Creating Transmedia Narratives: The Structure and Design of Stories Told across Multiple Media.* Institute of Technology. State University of New York.

The Dark Knight. (2008). (WARNER BROS) Retrieved December 27, 2016, from 42 Entertainment: http://www.42entertainment.com/work/whysoserious

TripAdvisor, Inc. (2016). Retrieved December 27, 2016, from TripAdvisor: https://www.tripadvisor.dk/Attraction_Review-g667538-d2264898-Reviews-Nordsoen_Oceanarium-Hirtshals_Hjoerring_North_Jutland_Jutland.html

Tron: Legacy. (2010). (Disney) Retrieved December 2016, 2016, from 42 Entertainment: http://www.42entertainment.com/work/flynnlives

Wolf, M. J. (2012). *Building Imaginary Worlds: The Theory and History of Subcreation.* Routledge.

About the Authors:

Vashanth Selvadurai, Industrial Ph.D. fellow at Aalborg University and North Sea Oceanarium. Selvadurai's research focus on generating theory, methods and techniques for creating and implementing an involving and educative transmedia exhibition, which bridges the pre- and post-experience with the actual visit.

Claus Andreas Foss Rosenstand, Ph.D. Creating Narrative Multimedia Systems, is associate professor at Aalborg University, with a research interest in innovation and management of people, organization and system development in digital media projects.

APPLIED GAMIFICATION IN SELF-GUIDED EXHIBITIONS

LESSONS LEARNED FROM THEORY & PRAXIS

Peter Vistisen, Vashanth Selvadurai, Rameshnath Kala Krishnasamy

ABSTRACT

This paper contributes to the current understanding of applied digital gamification by providing insights from two design cases from the Danish aqua zoo, the North Sea Oceanarium, concerned with self-facilitated exhibitions. Grounded in a short review of the current state of art, we provide two empirical case examples, concerning a mobile augmented reality design and an Instagram service. Analyzing the design process behind these cases, we identify some of the challenges arising from applying gamification in practice, and whether these insights verify, extents or contradicts current examples of applied gamification research.

Specifically, the cases provide insights to the challenge of on-boarding visitors into participating and using the designed products during their visit. In both cases, providing certain incentives for using the app or participating in the Instagram challenge, seemed to activate and engage more visitors and motivate them to participate in the activities as well as downloading the app and preparing for the activities on their own volition prior to their visit. By looking closer at what might have triggered the motivation with the visitors, a connection could be made to gamification and serious games, pertaining to the applied game design arena, in that there is something about extrinsic motivational properties at play, that persuaded the visitors to use the digital experience layers.

INTRODUCTION

Emerging technologies offer up new ways for visitors to experience exhibitions in or at attractions, such as museums and science centers, through digitally augmented layers. Whether it is to augment, drive, enhance an existing exhibition or be the exhibition itself (Damala et al 2007, Antoniou et al 2015, Coenen et al 2013). Exhibitions, in contexts such as museums, science centers, zoological attractions or similar contexts, have a long track record, in the field of academia, of being used as research test beds for various explorative research projects, that operate in the intersection between disciplines in design, technology and human factors, to test and develop bleeding edge technologies. The context provides a playground for testing novel ideas, where the goal can be to test technical implementations, several different related subjects, a technological platform or search for new ways to augment and enrich the visitor's experience through digital layers and media technologies (Damala et al 2013, Vlahakis et al 2002, Chen et al 2016). The latter, is the point of departure for this study's area of interest, with a focus on exhibitions in different contexts. Museums, in this study uses the inclusive definition provided by Falk and Dierking in the Museum Experience (1992). These are "historical homes and sites; science and technology and nature centers; aquaria, zoos, and botanical gardens; as well as traditional art, history and natural history museums." (Falk & Dierking 1992).

Alongside the point of departure, i.e. digital experience layers for museums, this study is focused on a very specific challenge within the area of interest; self-facilitated exhibitions. By self-facilitated, we mean exhibitions that are not staffed with dedicated guides, custodians or curators to follow the visitor's around, but only personnel to assist, instruct or otherwise help the visitors before entering the exhibitions. The inclusion of this dimension, is due to an increasing number of unmanned

1

exhibitions and attractions emerging over the past few years. This development has been on the rise in recent years due to economic constraints that are forcing certain established exhibition sites and landmarks to shut down permanently (Micklethwait 2011, Taul 2014). As an alternative to shutting down, technological interventions are explored to enable self-facilitated experiences at exhibition sites, so the staff can be cut down to a bare minimum, often skeletal crews, who runs maintenance and other practical tasks. The museum context has a long tradition of playing with emerging technologies as means for mediating knowledge to a broad audience. This is substantiated in the academic fields, by looking at the growing field of cybermuseology, that expands upon the established museology field, "...which reflects on the concepts concerning all museum activities from collection management to visitors' needs...", with reflections that advance the idea of the efficient use of digital media by museums." (Leshchenko 2015).

There have been several iterations of implementing technologies to support experience layers for exhibitions over the years, that are targeted at self-guided experiences. Early examples included audio-guides, displays with posters or signs/notes which were solutions that found wide-spread adoption, most likely because these solutions are/were relatively inexpensive and easy to implement and not too complicated for the visitor to decode. These solutions secured the historical objects and enabled unfacilitated curation. These are examples of how technological intervention could alleviate the staff (custodians and curators), with automated guides and added security, by securing the objects behind protective glass, etc. Later examples, become increasingly interactive, such as projections on display pieces, touch-based interactions (e.g. displays, buttons, etc.) and handheld devices such as PDA's (Walz et al 2007, Wakkary et al 2009, Coenen et al 2013). More recent examples are increasingly based on personal devices and context, where mobile and smart devices are becoming the baseline platforms for delivering digital experiences (Chung et al 2016, Sanchez & Pierreoux 2015). A rich body of research exists in the museum context where mobile devices, such as smartphones, tablets, PDA's etc. have been used to deliver augmented reality, location-based/context-aware content, virtual reality and other types of digital content. This is underpinned by reviewing the accumulated research on technologies that are particular, but not exclusive, to handheld and mobile devices, such as augmented, virtual and mixed reality (AR)(VR)(MR) has revealed that these types of digital layers can create immersive and engaging experiences, that can positively impact the user experience, learning and motivation. It can even impact a visitor's emotional attachment to a location (Chang et al 2015). This also corresponds to how visitors at museums expect learning and education mixed with elements of fun and games as a part of the museum experience in more recent times, due to the massive mainstream adoption and day-to-day use of mobile devices (Matossian et al 2012). These examples, the volume of research into mobile technologies as platforms for delivering digital experiences at exhibitions, and the results they have produced, explicates the technical capacity and technological capability that these devices encompass.

Parallel to the technological advancements, the user participation barrier has also decreased. More and more users are now accustomed to carry and operate smart devices; the devices themselves have been revamped over time to deliver an increasingly positive user experience and include even the most novice users and enable them to complete tasks with relative ease. The decrease of interaction barriers means more users can access and experience digital layers that were not too long ago mostly aimed at tech savvy users. In other words, the digital divide has been decreased to a level where more users can participate in digital experiences. This enables new types of interactions, where a broader audience can participate, instead of letting cumbersome, hard to use devices set up blockades for user interest.

2

Chapter in Hansen, Jensen & Rosenstand (edt.) (In press) Gamescope: The potential for gamification in digital and analogue places. Aalborg University Press.

The parallel development of technologies, incrementally and iteratively reaching new levels of maturity with each leap forward, and the diminishing threshold of user participation combined, gives rise to re-evaluate and test previous experiments and concepts within the museum context, as earlier stages of the technologies might have lacked maturity to succeed.

For instance, using virtual reality might have been more disruptive to the visitors' experience, when it was a brick-top, with poor fidelity and a horrible user experience, that never fully matured until recently. Now the same technology can be presented on smartphones, that yield a significantly better experience, as it is technically more capable at delivering higher fidelity content. So instead of being disruptive to the social experience, as has been reported in user studies (Cosley et al 2008), it could potentially provide an experience that ties into social interaction (Haesler 2016).

However, by investigating these efforts into improving the visitors experience or creating attractions through new technological platforms or by improving existing, a new challenge arises; having the visitor put the developed product, system or service into operation. E.g. if it's an app, the user must first see the value in installing it and subsequently learn to use it and then actually use it. A review of the existing literature, dealing with the constellation of context, user and technology, in this paper museum, visitor and personal smart devices, such as smartphones, a gap has been identified in that there are no reports of the visitor acquire the digital experience layer, without any or sufficient guidance. Thus, this paper will add a third dimension that is concerned with visitors using the developed systems on their own volition. Or in other words, how to make them use it.

GAMIFICATION TO INCREASE ENGAGEMENT & FACILITATE ON-BOARDING

This paper will explore this gap, through two cases from a continuous research involvement with the Danish aqua zoo the North Sea Oceanarium conducted in 2012-14 and 2016 respectively. The first case is a mobile augmented reality smartphone application, designed to provide the visitors with a 'role', that put the visitor in the seat of a movie director while exploring the North Sea Oceanarium exhibitions and the second case is an experience layer designed to motivate the visitor to create user generated content through Instagram posts, thus have the visitor generate content to a larger transmedia experience across pre- during and post-visit.

Museums are, incidentally, an informal setting where play and entertainment is often a part of the experience, inextricably interwoven with the educational aspect. A number of recent studies have focused on the educational value and entertainment potential to visitors at interactive exhibitions (Horn et al 2014, Leong et al 2014, Moesgaard 2015, Göbel et al 2006). Additionally, the effects of gamification along with serious games and other research fields neighboring the game design arena (Hamari et al 2014, Lingnau et al 2012, Hassen et al 2012) – gamification understood as the use of game design elements and principles in non-game contexts to improve user engagement, flow and learning (Deterding et al 2011).

The emerging technologies, combined with a present and on-going problem of shifting exhibition sites to unmanned, self-facilitated visitor experiences, the challenge of on-boarding visitors to actively participate on their volition frames this study's three dimensions. Based on lessons learned from previous studies, that fits this framing, a potential in exploring motivational affordances as proposed by Deterding (2011) in a conceptual model for situated motivational affordances of game elements by extending upon Zhang's motivational affordances in ICT design and use (Zhang 2008), is investigated to further uncover the potential to weave in gamification elements to instigate a motivation that can assist in putting digital experience layers targeting exhibition in self-facilitated

contexts. Thus, this paper aims to contribute with practical lessons learned about applied gamification in an exhibition context, with a special focus on how visitors are on-boarded the gamified exhibition design.

RESEARCH DESIGN

The two cases of applying gamification in an exhibition context, are based on a four year long constructive design research study - based on the methodological consideration from Koskinen et al (2012) in which the constructive activity of design is seen as a vehicle for knowledge contribution within a specified area of concern. In this regard, we consider the two cases as design interventions - used to investigate how applied gamification in an exhibition context could facilitate and engage the visitor's experience.

The research data is gathered from a combination of field notes and design documents from the multiple design iterations of each of the two designed products, and design ethnography (Hughes et al 1997) from user studies both prior and after implementation of the products. The data from the iterations from the design process are further examined from use data collected during the first period of implementation, to support whether the gamified experience succeeded in increasing engagement during the visit. We analyze these data sources in regard to which lessons each case can teach us, about applying game elements in exhibition contexts, in order to increase engagement and initial on-boarding of digital products implemented in the exhibition.

The North Sea Oceanarium as context for the study

North Sea Oceanarium is an aqua zoo located in the city of Hirtshals in Denmark, and is Northern Europe's biggest aquarium measured by water capacity. The exhibition is covered by both the national and international laws and conventions of Zoo facilities and offers knowledge regarding the North Sea and its surroundings. The North Sea Oceanarium is a government approved zoo facility, and is a non-profit organization where profit is mainly dedicated the development of the exhibition. The North Sea Oceanarium comprise 35 full-time and plus 35 seasonal employees, and has between 150.000 and 175.000 visitors each year.

As part of the organizations 2020 strategy, a focus on researching digital extensions of the physical experience at the zoo was set in motion. The authors were involved as researchers in this initiative. Below we present two cases from the first four years of the collaboration, in which digital gamification was applied to either augment or extent the physical experience.

CASE 1: THE NORTH SEA MOVIE MAKER

The first part of exploring the digital potential of the exhibition on the North Sea Oceanarium was centered around creating a literal 'layer' of digital elements on top of the existing exhibition. Thus, our first case will detail the development of the mobile augmented reality application 'The North Sea Movie Maker', which used gamification as an approach to motivate pre-teen visitors.

The North Sea Oceanarium has a very broad group of visitors, ranging from entire families, single pairs, grandparents with grandchildren, school classes, and interest groups. This makes it hard to design an exhibition which encompass and delivers an optimal experience to all visitors - a challenge shared by many museums and zoo's (e.g. Brida et al 2013, Todd & Lawson 2001).

4

The physical zoo experience of sea animals and aqua culture in the exhibition was originally designed around a narrative metaphor of a 'North Sea Expedition' of different archetypical fictive personas. These included the role of an adventurous captain, a knowledgeable scientist, an attractive female diver, a cheerful ship cook, and a rough no-nonsense fisherman (figure 1).

Figure 1: The five fictive personas of the 'North Sea Expedition' (left), used to guide the visitor on the journey through the seven locations around the Oceanarium exhibition (right).

The exhibition experience was designed around following these personas on an expedition at thematic locations of the Oceanarium, accompanied by an 'expedition passport'. At the seven locations, the visitors were encouraged to look for a stamp post, and stamp their passport to mark the location as being visited. At the end of the visit, in the Oceanariums theme shop, the expedition pass could be exchanged into a diploma for finishing the North Sea Expedition journey. The main idea behind this journey was to act as guiding principle for the visitors, as well as a way to deliver a constant flow of factual information about the sea life and culture at the seven different locations. Thus, the existing exhibition at the North Sea Oceanarium already showed to be based on some of the mechanics and principles often explored in gamification research and practice, towards namely the use of 'badges' (the stamps) to show reward progression (figure 2) (Zichermann & Cunningham 2011).

Figure 2: The expedition pass, the stamp stations and visitors stamping their pass at one of the seven expedition locations.

This existing gamified experience of exploring the North Sea Oceanarium through the expedition concept had been in function since 2010, and had shown to successfully engage the younger visitors (<10-year-old). The young visitors actively sought to gather all the stamps at the seven locations, and the parents acted as facilitators via the hand-out exhibition map, which aided the children in finding the stamp spots.

5

Chapter in Hansen, Jensen & Rosenstand (edt.) (In press) Gamescope: The potential for gamification in digital and analogue places. Aalborg University Press.

The troublesome tweens

However, through initial observations in 2012, one visitor group in particular was identified as challenging to reach with the expedition concept, as well as the exhibition area in general. This was the so-called 'pre-teens' or 'tweens' visitors, who are between 10-14 years old, and thus not yet old enough to not join their families, parents and typically younger siblings, on their vacations and visits to attractions like the Oceanarium. However, when visiting the Oceanarium with their families, the majority of the tweens evidently showed little interest in the exhibition experience. Instead, the tweens tagged along their families, and sometimes helped their younger siblings in accomplishing the expedition tasks in the passport, without being particularly engaged themselves. We did however observe, how the tweens were actively engaged with their smartphones during the visit at the Oceanarium; texting with friends, taking selfies and checking out social media. Their smartphone behavior corresponds with Fowler & Noyes' (2014) investigation of the 'always on' mobile media use of children and young adults.

This led to the hypothesis, that we might engage the tween target group by integrating their smartphone as an active part in the North Sea Expedition narrative, by giving the tweens a specific role during the visit, which encouraged them to capture their family's visit in a fun way. To enable this, we sought to enhance the physical context through a digital augmented reality layer, in which animated special effects are extrapolated on top of real life footage from the user's smartphone. The augmented reality effects would act as 'hidden layer' on top of the exhibition, which could be revealed by recording small video clips of the family at the seven physical locations, and thus integrate the digital layer with the existing expedition journey.

Using digital layers, such as augmented reality, in attraction contexts like a museum or zoo, has been discussed in previous contributions by e.g. Wojciechowski et al (2004), Damala et al (2008), and Madsen et al (2012). Most of these studies has dealt with the *usability* and *utility* dimensions of working with digital layers in attractions, and has contributed by addressing issues such as for what types of content augmented reality is useful to extend upon, and which considerations must be made when appropriating a physical space to include digital content. While these issues are important, the utility potential of augmented reality as a technology, and the user friendliness of different applications only gives us knowledge about the technical, and rational aspects of creating digital layers in attractions. However, the *desirability* has been a more elusive object of study in HCI and design research, associated with the emotional impact, brand perception, and social capital what has been established as user experience design (Hassenzahl & Tractinsky 2006). Recently however, the discourse of gamification research has aligned much of the promise of gamification with that of desirability in user experience design, inspired by e.g. the Mechanics Dynamics Aesthetics (MDA) frameworks emphasis on the game aesthetics as an enabler of the desirable 'fun' (Hunicke et al 2004), but with a motivational focus (e.g. Hamari 2014, Walz & Deterding 2015, Seaborn & Fels 2014).

This use of gamification to enhance the desirability of a product was an intriguing point of venture for our experimentation with applying mobile augmented reality in the exhibition context to increase the motivation and engagement for the tween visitors.

Game elements in the North Sea Movie Maker application

After agreeing upon exploring the potential for a gamified mobile augmented reality application, targeted towards the tween visitors, the design process of what would become known as 'The North Sea Movie Maker' app was started. The concept was to assign the role as 'documentarist' to the

6

tweens, following their family's expedition to the seven locations, and at each location making a short augmented reality movie clip. From this followed the idea of designing a dedicated 'moviespot' sign on the floor in the exhibition to signify were in the physical context the digital layer could be activated. These moviespots removed some of the limitations of using augmented reality, such as camera tracking an object with the phone in the dimly lit setting of the Oceanarium (e.g. Mekni & Lemieux 2014). To encourage the visitors to immerse themselves in the capturing of the augmented reality sequence, a scenography was created, with spot lights resembling a movie scene. This scenography was furthermore in proximity to the physical stamps of the locations, while still being constrained as digital zone with enough space to explore the playful interaction between the tween user of the app, and the family acting in front of the scenography. Below the user scenario of the North Sea Movie Maker interaction is depicted (figure 3):
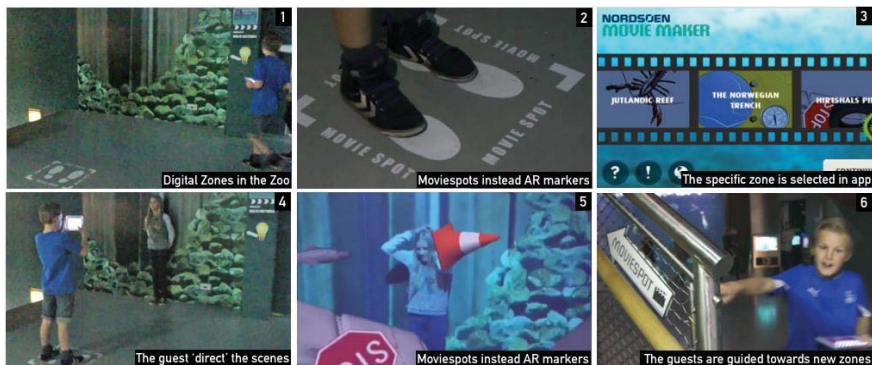

Figure 3: The user journey of the visitors using the augmented reality app 'North Sea Movie Maker'

Through the application, the user captures live video footage at each of the seven expedition posts. During capture, the footage becomes real-time distorted by the app, while animated special effects are put on top of the video, creating a digitally augmented scene where fish and other actors interact with the filmed visitors. The video is saved live onto the mobile phone, and are mixed together with clips from the other expedition spots into one coherent movie with special effects. This final movie output, which the user can customize with credits, title and video clips becomes the extrinsic 'reward' from completing the expedition journey through the exhibition.

A gameful design which enables play

Despite not being a game, the concept of the North Sea Movie Maker application made uses of several game mechanics in an effort to make both the interaction gameful, as well as achieve a behavioral quality of gamefulness (Deterding et al 2011). Below we have mapped a brief overview of the components used in the application, crossed with the game mechanic it uses to achieve a certain gameful interaction (figure 4)

7

Chapter in Hansen, Jensen & Rosenstand (edt.) (In press) Gamescope: The potential for gamification in digital and analogue places. Aalborg University Press.

COMPONENT	MECHANIC	EXAMPLE
Movie strip main screen	*Showing 'progression' between locations, like 'levels' in a game.*	
Digital stamps resembling the physical stamps from the expedition passport	*Giving 'badges' as rewards for completing the task.*	
Credits and title screen	*'Personalization' by including the social group into the product.*	

8

Chapter in Hansen, Jensen & Rosenstand (edt.) (In press) Gamescope: The potential for gamification in digital and analogue places. Aalborg University Press.

COMPONENT	MECHANIC	EXAMPLE
Aiming scope in capture mode.	*Constrains interaction, act akin to an aiming 'crosshair' in games, by letting the user enact some level of control of the augmented reality effects.*	
The physical moviespots and expedition metaphor	*Creates a 'journey' and a narrative around the context of the exhibition, supporting the digital moviespots role as 'levels'.*	
Social media sharing and gratification from the Oceanarium	*Establishes a modified 'Leaderboard' to compare against other families produced videos & establishes the foundation for various formalized 'Competition' elements.*	

Figure 4: Game mechanics applied in the North Sea Movie Maker.

From a motivational point of view, these applied game mechanics were designed to balance between the classic modes of '*playing*' and '*gaming*' (e.g. Deterding et al 2011), were a game design can lead to playful behavior, and switch back to the rule bound gaming again when encountering a new gameful interaction trigger. The application itself is ruled by a set of simple rules: Find a moviespot, record an augmented reality clip, find the next spot, and finish with a complete edited movie. However, following these rules when using the app does not inhibit moments when the explicit rules for a moment are suspended in more improvisational play. When e.g. the tween directs the family in front of the moviespot's scenography, and retakes the clip while giving new instructions, to explore new variations of the augmented reality, the rules of the gameful design break down and are replaced by a momentary playful interaction. The gameful design is restored in the moment that the tween

9

accepts the latest recorded clip, gets a completion stamp, and is transported back to the main screen, indicating the next spot to find in the expedition journey.

This potential dynamic between using the application as a playful and gameful element illustrate the mix of intrinsic and extrinsic factors we sought integrate into the app user experience. To create desirability about the visit for the tweens, the application seeks to establish an intrinsic motivation by creating a social role during the visit, which accommodates the tweens own media use an interest for visual media. Furthermore, small tidbits of factual information added before each capture situation in the application aim towards creating curiosity towards some of the little-known facts about the sea life and culture at the specific moviespot, coupled with a sense of achievement from having explored and captured the families visit in a fun way.

The intrinsic motivation is supported by the extrinsic factors stemming from the applied game mechanics. Each of the seven moviespot locations in a sense act as a level, which has to be completed, earning the user an achievement stamp (or in classic gamification sense, a badge), which remediates the physical stamp in the younger user's expedition passport. Furthermore, when collecting all the seven video clips, the app creates a final short special effects movie, with sound, music, as well as personalized title and credits screens, it can be regarded as the users receiving an extrinsic reward for participating the in (optimally) intrinsic family experience of exploring the seven locations. Finally, when the completed short movie is generated from the application, the users are asked to share the movie either by SMS, mail or via social media. If social media is selected, the application automatically generates the hashtag #northseaoceanarium, enabling the North Sea Oceanarium to locate user generated content, and emphasize the user's content on their social media pages.

Thus, this mix of intended intrinsic behavior, and the designed extrinsic elements provided by the application, sought to facilitate a change in engagement in the tween users, towards perceiving the visit to the North Sea Oceanarium not as family duty, but as a desirable fun activity. This design was implemented in October 2012, and used as the basis for a series of experiments, in which we observed families on site in the Oceanarium, and assessed whether the gamification elements of the application created the hypothesized intrinsic behavior.

Engagement through 'playing the visit'

Following the implementation of the application, we initiated a four-week design ethnography study in which we tagged along families using the application during their visit. Here we selected mainly visitor groups which included at least one family member in the 'tween age' between 10-14 years old. We observed their interactions when locating and exploring the seven moviespots, and their group dynamics around creating the augmented reality video clips. Upon exiting the exhibition area, we prompted them with a short in-situ interview, asking about the experience at the Oceanarium, as well as how the application influenced their visit.

When comparing our observations with the responses from talking to the guests we saw a qualitative pattern emerge of when the tweens, their parents, and their younger siblings (if any) could be assessed to perceive the experience with the application as desirable. When the parents were the 'user' of the application taking on the role of 'documentarist' capturing the augmented reality videos they found it to be a stressful thing to remember to do, and they often choose not to continue using the application unless specifically prompted by the children. This could be explained by viewing the parents as already having a specific role during the visit, and thus also in the expedition journey. The parents acted as facilitators of their children visit, organizing when to see what, where to go, and ensuring

10

Chapter in Hansen, Jensen & Rosenstand (edt.) (In press) Gamescope: The potential for gamification in digital and analogue places. Aalborg University Press.

that the family 'got their money's worth' during their visit. Adding the extra layer of a digital application, and an extra role during the visit, simply resulted in a stressful information overload. On the other hand, if the family also included a younger child (<10 years), who got the role of documentarist in the expedition, the parents would be engaged in the interaction, while the tweens remained passive. The parents were instructed by the younger children to act out in front of the moviespot scenography, but the tweens were less motivated, and to some extent seemed too embarrassed to act out in front of both their family as well as other visitors. The tweens however, were only indicating to be engaged, and enjoy themselves, when the they took on the documentarist role, directing the clips, while not participating on-screen themselves. Here, the tweens facilitated their family's enactments in front of the scenography, clearly pointing and verbally directing what do next. In these situations, we also observed the aforementioned dynamics in- and out mix between gameful and playful behavior - with the families sometimes spending longer periods of time at one location just playing with different compositions, before moving on to 'play by the rules' again.

We argue these three observed behaviors somehow correspond with the archetypical states in Cszikszentmihalyi's (2013) theory of flow. The parents had too many other roles to attend to during the visit, and thus saw interacting with the application to be stressful. On the other hand, when the tweens were not assuming the role of the documentarist, they were not challenged enough, even though they both had the capabilities and the desire to explore the mobile medium, resulting them being bored. The optimal flow state, between challenge and capabilities, was reached, when the tween had a role, and thus a set of goals, and the mobile application as a tool to fulfil the goals (figure 5).
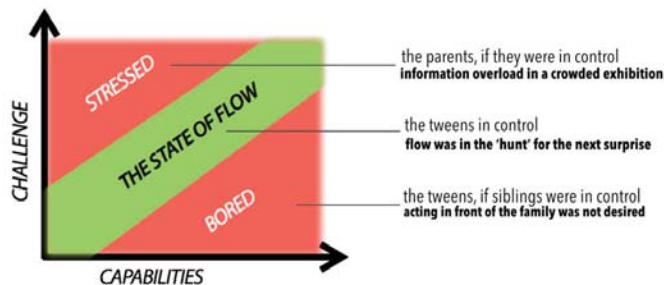
Figure 5: Visualization of the difference between parents, young siblings, and tweens in terms of reaching a state of flow when using the North Sea Movie Maker application.

Having a role supported the pre-teens' social interaction with their family as participators in the experience, and in reaching a state of flow throughout locating the moviespots, capturing augmented reality clips, and further investigating the exhibition for the next locations. Thus, our observations suggest, that the applied game elements work to create the motivation to be engaged through 'playing' through the visit.

From completion to wayfinding

An auxiliary finding from observing the visitor's experience with application, was a pattern of how the applied game elements such as 'completion stamps' seemed to have an unexpected effect on the user's wayfinding during the visit having a 'player role' during the visit, locating the digital zones at which the user would get a stamp for completing, the visitors proved to move around in less visited

11

areas in the zoo in order to locate the next 'levels' from the application (figure 6). This seemed to indicate, that the extrinsic, and rather rudimentary, mechanic of using badges to indicate progression towards finishing the augmented reality movie, also led to an intrinsic curiosity towards exploring more of the exhibition. While this might of course be extrinsically motivated (finding the next location to progress in the application), spending time exploring the exhibition together with one's family can also be seen as intrinsically rewarding in itself (spending time doing an engaging activity together).
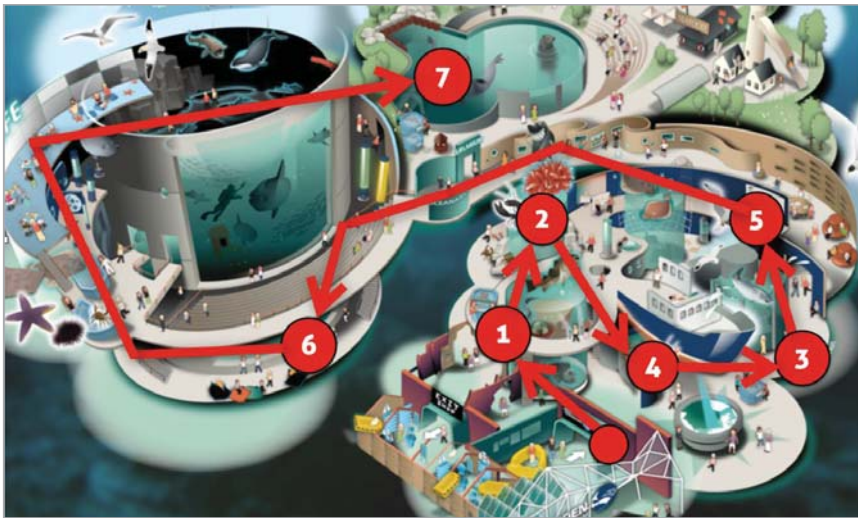
Figure 6: When observing the visitor's behavior with the North Sea Movie Maker application it was a clear pattern, how the application guided the visitors in their journey through the exhibition, seeking out all seven location, and through this also ventured through the majority of the physical exhibition - even less visited areas.

To investigate this behavior further, we examined to accumulated usage data from the application's analytics backend, to observe how many of the visitors using the application at the first of the seven moviespots, who also ended up finding and using the application at all seven moviespots. The usage data revealed that 78% of the users showed to reach all seven moviespots during their session (figure 7).

We argue, this high percentage indicate that in an exhibition context, the intrinsic motivation towards completion and experiencing a sense of flow due to the agency facilitated through the application can act as a latent wayfinding mechanism. However, this finding does also touch upon the possible 'exploitation' enabled by gamification (Bogost 2011) of unconsciously coursing the user to commit other actions than what he/she intents. While acknowledging this as an ethical consideration when designing with game elements, we do also argue that in an exhibition context, where the primary desired result can be argued to have an engaging and memorable family experience, latent effects like wayfinding through gameful completion of tasks is creating a desirable behavior for both visitors and attraction.

12

Chapter in Hansen, Jensen & Rosenstand (edt.) (In press) Gamescope: The potential for gamification in digital and analogue places. Aalborg University Press.

Skærmbilledenavn	Skærmbilledvisninger	Unikke skærmbilledvisninger	Gennemsnitstid på skærmen
	221.177	104.631	00:00:38
	% af total: 100,00 % (221.177)	% af total: 100,00 % (104.631)	Gns. for visning: 00:00:38 (0,00 %)
1. Overview	73.291 (33,14 %)	16.295 (15,57 %)	00:00:50
2. Post record: (1)Vraget Stornoway	11.999 (5,43 %)	6.736 (6,44 %)	00:00:30
3. Recording: (1)Vraget Stornoway	11.362 (5,14 %)	6.796 (6,50 %)	00:00:28
4. Post record: (6)Det Åbne Hav	10.550 (4,77 %)	5.682 (5,43 %)	00:00:30
5. Post record: (2)Jyske Rev	10.476 (4,74 %)	6.408 (6,12 %)	00:00:28
6. Post record: (4)Molen Hirtshals	10.455 (4,73 %)	6.069 (5,80 %)	00:00:30
7. Post record: (3)Norske Rende	9.705 (4,39 %)	5.844 (5,59 %)	00:00:27
8. Recording: (2)Jyske Rev	9.606 (4,34 %)	6.238 (5,96 %)	00:00:26
9. Post record: (7)Sælkoloni Limfjorden	9.600 (4,34 %)	5.370 (5,13 %)	00:00:28
10. Post record: (5)Doggerbanke	9.101 (4,11 %)	5.010 (4,79 %)	00:00:28
11. Input	8.814 (3,99 %)	5.352 (5,12 %)	00:00:27
12. Recording: (4)Molen Hirtshals	8.789 (3,97 %)	5.456 (5,21 %)	00:00:27
13. Recording: (6)Det Åbne Hav	8.676 (3,92 %)	5.181 (4,95 %)	00:00:27
14. Recording: (3)Norske Rende	8.314 (3,76 %)	5.432 (5,19 %)	00:00:28
15. Recording: (5)Doggerbanke	7.685 (3,47 %)	4.617 (4,41 %)	00:00:26

78%

Figure 7: Usage data from the North Sea Movie Maker, showing how 78 percent of users starting at the first moviespot ('Vraget Stornoway') also ended up recording an augmented reality clip at the other six movie spots.

The challenge of facilitating on-boarding

Until now, our findings from observing the families indicated that including the tweens in the expedition concept via the augmented reality application worked, as well as enabling an auxiliary wayfinding benefit for the entire family. While this gives credence to the benefits of applying gamification in the exhibition context to motivate challenging target groups, we did also face one significant obstacle after implementing the application.

Though the application engaged the visitors during their visit, a major obstacle was to create the initial motivation and awareness about the intrinsic value of using the application - an issue which relates to what Zichermann & Cunningham (2011) labels the 'on-boarding' of the gameful experience. When the visitors used the application, the desirable outcomes were clear, but these findings were all based on an initial implementation, which included the visitors being actively introduced to the application upon arrival. This had been integrated as part of the launch of the application, in which two guides supported the visitors in either downloading the North Sea Movie Maker to their own phones or borrowing a small tablet with the application installed. After the initial launch week, the facilitated on-boarding support was stopped, due to constrained resources, and instead a series of introduction posters, how-to leaflets as well as web and social media marketing took over. However, the effect of leaving the on-boarding to be self-facilitated by the visitors resulted in a significant drop in active users, evident in an overview of the app usage data (figure 8):

13

Chapter in Hansen, Jensen & Rosenstand (edt.) (In press) Gamescope: The potential for gamification in digital and analogue places. Aalborg University Press.

Figure 8: App usage data showing the difference between the manned and unmanned support of the app

Even though we saw no significant change in the completion rate of the active users there was a dramatic drop by an average of more than 50% of the total usage in days after the staff facilitated introduction stopped. Furthermore, from our observations in the following days the visitors actually did orient themselves towards the posters, and moviespots at the seven locations in the exhibit, indicating that they did become aware of the presence of the application, they just did not use it. We argue the problem here rose from a challenge of using new emerging technologies in an unfamiliar way, making it challenging to perceive the desirability of using the application during the visit. This was evident from response given from many guests during the manned setup with an oft-repeated inquiry of variations of 'what does it do?', before on-boarding the application.

Our first attempt to solve this challenge, was to remediate the static introduction posters, into a video poster. We build a hypothesis upon Chow's (1989) notion of video as a persuasive change agent, as well as Raijmaker's (2009) use of video to create empathy. The aim of the video poster was to provide a recognizable medium to facilitate the visitors decoding of the possible user experience of the application, by showing a step by step introduction to the moviespots and how to interact with them at the seven locations (figure 9). As such, the video poster acted as tutorial to the gameful experience, and showcased the extrinsic reward of the special effects videos created by the application.
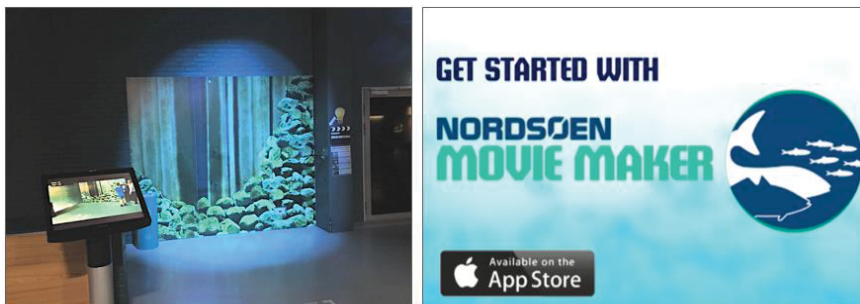
Figure 9: The video poster stander besides the digital zone (left) and the intro screen of the video guide loop (right)

While the video poster showed to attract attention from visitors, only a few of the observed visitors actually downloaded the application after seeing the poster. This was further supported from further examination of the app usage data, which showed no significant change in active users before and after the implementation of the video poster.

14

This lack of effect from the video indicates that the use of video itself, was not enough to create the hypothesized empathetic reaction in the guests, towards realizing the intrinsic value of using the application themselves. This might be due to the normative nature of video poster, being framed step by step, and showing a group of visitors which follows the 'rules' of the application without breaking out into the aforementioned playful interactions. This indicated that there might be a better potential for reaching visitors with a screen based medium, if the value of the extrinsic reward is mixed with the intrinsic value of play and fun arising from striving towards the reward.

We sought to explore this, by adding a very clear and present extrinsic reward from using the application, by setting up a competition event, where visitors uploading their augmented reality videos to the North Sea Oceanarium Facebook page would compete for a 1-year free pass to the exhibition (figure 10). Contrary to the video posters attempt to facilitate the desirability of making the guest intrinsically identify with the potential user experience, the competition instead sought to create a portfolio of visitor videos, for other visitors to be intrinsically motivated by, via an initial extrinsic reward to the participants.

On the day of the competition, we challenged the visitors to make an augmented reality movie during their visit, and share it on Facebook, and urge their own network to also share and like it.
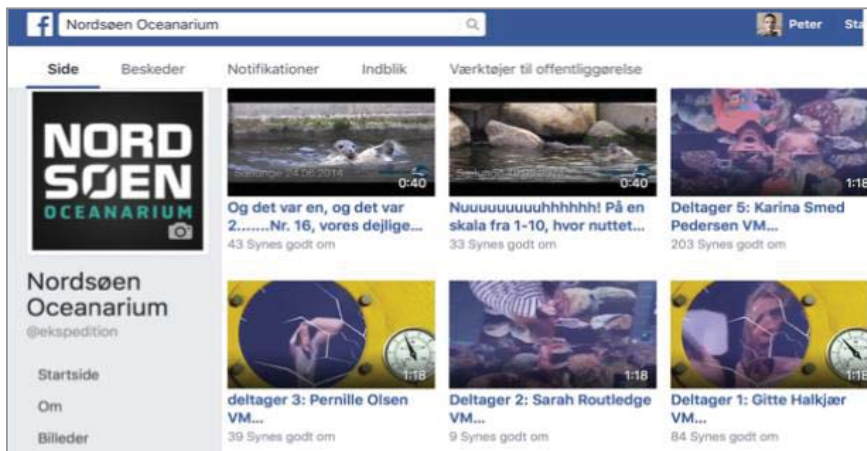
Figure 10: Augmented reality videos submitted to the zoo's Facebook page by guests during the competitive event, providing other users with other visitors experience of using the application, and providing inspiration for ways to interact with the augmented reality effects.

The augmented reality videos uploaded to Facebook created a substantial social media influence by reaching 6.664 profiles and gaining 508 likes on the videos alone. This seemed to indicate, that having a material extrinsic reward, which was much more concrete than the extrinsic rewards of badges and movieclips inside the application itself, did motivate the on-boarding. This was further supported in the application usage data, which showed a significant spike in active users on the day of the competition (figure 11):

15
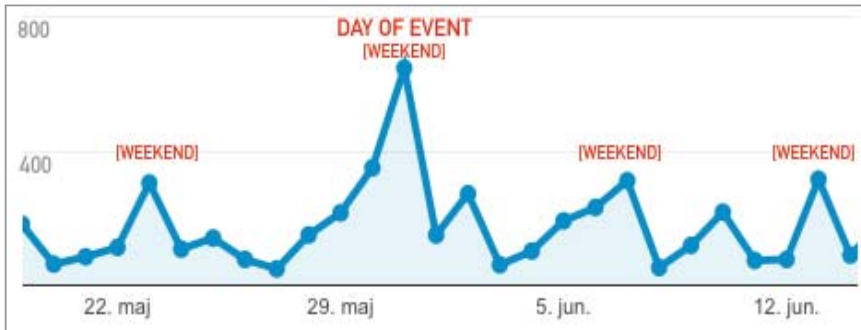
Figure 11: App usage data showing the spike in active users during the event, compared the otherwise stagnant use

That adding an extrinsic reward works to spark a momentary engagement and perceived value of the application is however not that surprising. Rather it presents the paradox that even though more visitors used the application, they did not necessarily do it for the intrinsic value of having a fun and memorable family experience, but 'just' the chased the reward. Intrinsic motivation, where visitors recognize the value of the potential family experience enabled by the application per se, is would arguably be preferable. But the actual facilitation of decoding this experiential value appeared challenging without an initial extrinsic motivation.

However, it also seemed that due to the increase of active visitors using the application due to the competition, they gradually seemed to attract the attention of other visitors. This seemed to generate momentum where the extrinsically motivated on-boarding spawned a second wave of more intrinsically motivated on-boarding.

These findings indicate a challenge when working with digital layers in physical context in general, but also reveal a challenge of creating gamified digital experiences in the first place. Due to the lack of experience with e.g. augmented reality, the perceived value of using the technology during the visit was simply too low for many of the visitors to decode how the application could benefit their visit to the exhibition. If the potential of the extrinsic motivational game elements (such as receiving a special effects movie in the end) are not easily perceived prior to the use, on-boarding visitors into users can be a challenge.

Furthermore, it seemed that rather than normative step-by-step motivators, real life examples of real visitors can create empathetic connections enabling the visitor to realize and interpret the intrinsic value by empathizing with previous visitors. This topic became the object of study for the second case study with the digital layer of the North Sea Oceanarium.

CASE 2: THE INSTAGRAM PHOTOBOOK

Following the long-term results from case 1, we initiated a new digital design intervention at the North Sea Oceanarium in the spring of 2016. This experiment is still active, and this section of the paper will therefore mainly focus on briefly documenting the aspects of the first two iterations, and how they support and substantiate the findings from case 1.

16

Chapter in Hansen, Jensen & Rosenstand (edt.) (In press) Gamescope: The potential for gamification in digital and analogue places. Aalborg University Press.

The second case took its point of venture from the strategic challenge exhibitions face in the direct competition with other tourism-stakeholders, collaterally framed 'the experience economy' (Mossberg 2003). This competition has created an expectation for new spectacular changes in the exhibition among the recurring visitors, contrary to previous foci on mainly attracting new visitors. To fulfill these expectations, exhibitions have implemented interactive experiences, seeking to engage the visitor in co-creation through user-centered design and expanded the interaction possibilities with cross-media initiatives (Opperman & Specht 1999, Simon 2010, Hall 2013).

Many researches argues and discusses innovative design techniques and present transmedia suggestions, among others, for improvement based on their case-studies (Simon 2010, Kidd 2014, Hall 2013, Kim & Hong 2013, Pardo 2011).

In the entertainment industry, different companies have successfully proved to enrich their products with transmedia concepts that binds the pre-, during- and post-activities to extend and deliver a coherence experience (The Dark Knight 2008, Tron: Legacy 2010, Halo 2 2004). Transmedia concepts typically contribute with extra content and normally used to promote products like feature films, TV-series, books and other similar entertainment products.

Novel ways to enhance the experience in exhibitions with certain aspects of transmedia are being investigated through experiments (Kidd 2014, Hall 2013). However, literature reviews, desk research and searching in databases with relevant search queries, the result on transmedia in an exhibition context, based on quantitative data were still limited. Furthermore, there were little research on visitors' pre-, during- and post-experience.

On this basis, we hypothesized that there was a potential to extend the exhibition experience by incorporating the pre- and post-activities as part of the experience, where the physical exhibition will function as the 'core media platform' (Davidson 2010). Another area with potential to expand the visitors' experience is through user-generated content, which also can increase the visitors' engagement and learning (Russo et al. 2007:26).

Currently, the North Sea Oceanarium does not have a tactical focus on the promotion of user-driven content on social media, but have only made limited experiments such as the North Sea Movie Maker competition, detailed in case 1. For example, the content generated on Trip Advisor, Facebook, and Instagram by the visitors about North Sea Oceanarium, are not systematically recognized by the organization.

Exhibitions usually value and use Facebook more than other social media services (Groneman 2014). North Sea Oceanarium is not an exception as their activity on Facebook is high, whereas the activity on other social media like twitter and Instagram is very low.

Instagram is a qualified media platform to explore user-generated content as a collection of user-generated photo material, can characterize the perspective of the visitors of the exhibition and thereby contribute and complement to the existing stories in the exhibition (Giersing 2014). This case will explore Instagram as the media platform due to its capacity to generate a valuable and distinctive contribution to the entire exhibition experience. Furthermore, this social media platform has not been sufficiently utilized by North Sea Oceanarium.

17

Chapter in Hansen, Jensen & Rosenstand (edt.) (In press) Gamescope: The potential for gamification in digital and analogue places. Aalborg University Press.

THE INSTAGRAM CONCEPT

The case study was carried out over two iterations. Its purpose was to promote Instagram activities as a constitutive part of the exhibition. It aimed at motivating the visitors during the visits to create content on Instagram. The goal was to extend the visitors' experiences across pre-, during and post-visit as presented in figure 12 and contribute to a wider transmedia experience.
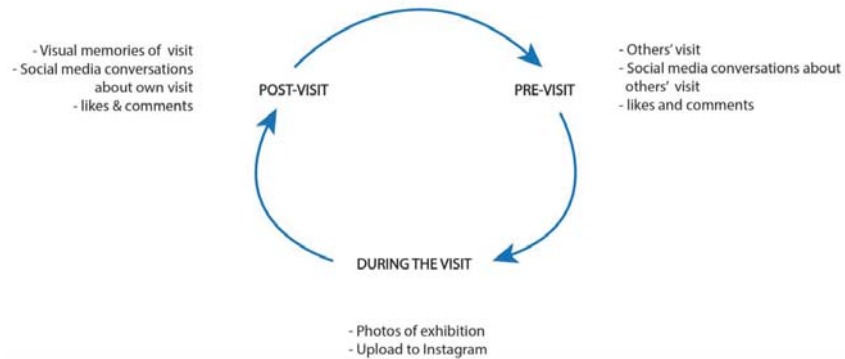
Figure 12. An illustration of the three visit phases and their different activities and content

The generated content during the visit activities are accumulated into post-visit content for previous visitors, as well as it becomes pre-visit content for potential future visitors. Hence, the content posted on Instagram represents entry-points before, during, and after the visit to the exhibition. Thus, not only the visitors' experience is extended, but there is a likelihood of a rise in number of future visitors as well.

During the Visit: The visitors are informed to take photos on six different Insta-spots in the exhibition and post them on their Instagram profile with a pre-created hashtag. The six Insta-spots have six different hashtags relative to the different locations and are noticeable through the green floor labels. Figure 13 shows one case of the Insta-spot.

Figure 13. A picture of one of the Insta-spot locations and the floor label with the hashtag and a small description in three languages; Danish, German and English.

18

Chapter in Hansen, Jensen & Rosenstand (edt.) (In press) Gamescope: The potential for gamification in digital and analogue places. Aalborg University Press.

Post-Visit: Following the visit, the visitors can compile, download and share a digital photobook with the uploaded Instagram photos. As shown in figure 14, hashtags enable the creation of a photobook that consists of different photos connected to their specific locations with additional facts and information. The photobook has 13 pages and communicates in Danish, English and German. The visitors also receive a link to the photobook which is automatically sent to their email. Furthermore, the uploaded photos generate activities on social media in the forms of likes and comments from the social network of the visitor.

Figure 14. A picture of one of the pages in the photobook.

Pre-Visit: Before coming to the exhibition, the visitors' can explore photos posted on Instagram thanks to the promoted hashtags, through their social media networks. Because of this, as presented in figure 15, the social networks will have an entry-point to the exhibition from the perspective of other visitors. The people participating in these social media networks are potential visitors of the exhibition, which is critical to marketing.

Figure 15: A photo collage of the Instagram photos with the hashtag #nordsøenoceanarium.

19

Chapter in Hansen, Jensen & Rosenstand (edt.) (In press) Gamescope: The potential for gamification in digital and analogue places. Aalborg University Press.

SOCIAL MEDIA IMPACT

In the first iteration, conventional methods were used to promote the Instagram activity to resemble any other promotion being conducted for new activities in the exhibition. The purpose of this was to distinguish between the effect of facilitated activity in contrast to self-facilitated activity.

The activity was facilitated by the exhibition guides, who offered an introduction at the beginning and helped the visitors. Printed flyers and big posters with the Instagram activity were located at the entrance. There were also flyers around Instagram spots as well. Figure 16 shows the printed flyer. The visitors' engagement was rewarded extrinsically with a digital photobook, which created a motivation to engage in the Instagram activity.

Figure 16. A picture of the two inner pages from the information flyer.

Iteration one was carried out from July 7th, 2016 to October 3rd, 2016, where 96.331 people visited the exhibition. Their Instagram activities resulted in 137 posts and received 1.199 likes and comments. In total, 15.034 users of social media were reached. The data for the six Insta-spots are given in figure 17.

	#hirtshals wind	#hirtshals fish	#hirtshals crab	#hirtshals cafe	#hirtshals seal	#ciao hirtshals	Totally
Posts	42	26	25	6	25	13	137
Reach	7.729	1.430	1.004	593	2.107	2.179	15.034
Likes & comments	531	164	103	61	201	139	1.199

Figure 17. A table with the results from the first iteration.

From the data, it is possible to conclude that the number of visitors who have completed all six Insta-spots are very low according to the number of visitors in the time period. It also possible to observe that the number of posts on the different Insta-spots varies from 42 posts on #hirtshalswind to six posts on #hirtshalscafe. The last Insta-spot #ciaohirtshals only have thirteen posts, which indicates that the visitors probably give up along the way. From the data obtained from the first iteration, it is evident that the content generated per visitor is generally very low. Upon the discussion in the organization, it was discussed that the low activity might have occurred because of the number of hashtags and the complexity level of the conventional communication methods. Together, these might

20

have lowered the motivation to engage. Furthermore, the photobook did not produce the expected extrinsic motivation among the visitors. A reason for this could be that the photobook couldn't be viewed before completing the entire activity and therefore made it hard for the visitors to see the value of the reward. All in all, the Instagram activity did not have the anticipated effect in producing user-generated content.

From the results obtained from the first iteration, we redesigned the Instagram activity to be self-facilitating and reduced the number of hashtags to one #nordsøenoceanarium. The promotional materials and the introduction from the exhibition guides where also removed. The photobook where replaced with a big screen installed in the hallway between two main exhibition halls with a controlled live feed. The screen displayed photos that visitors uploaded to Instagram with the given hashtag. A brief overview of the used components and the game mechanics are mapped in the figure 18.
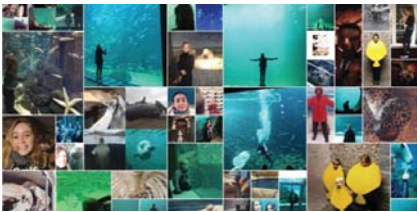
COMPONENT	MECHANIC	EXAMPLE
Big screen used in iteration two.	*Showing other visitors experience through the featured photos. It also gives the opportunity to be featured as well. This works as a reward for the visitors' engagement. The mechanic of showing 'playthroughs' are an increasing used element to engage players towards matching or besting other players.*	
Featured photos on the big screen used in iteration two.	*Establishes a modified 'leaderboard' to compare and or be inspired by other visitors' contributions. It also establishes the foundation for various formalised 'competition' elements.*	
Photobook rewarded in iteration one.	*Finding and posting photos from all Insta-spots releases a photobook. This can be related to collecting 'badges' that releases an 'achievement'.*	

Figure 18 Game mechanics applied in the Instagram activity

21

Chapter in Hansen, Jensen & Rosenstand (edt.) (In press) Gamescope: The potential for gamification in digital and analogue places. Aalborg University Press.

Both extrinsic and intrinsic motivation are utilized to engage the visitors in the Instagram activity. The previous visitors' Instagram photos inspires and reminds new visitors to take photos and works as intrinsic motivation, where the possibility to be displayed on the big screen works as an extrinsic motivation.

Iteration two was carried out from October 15, 2016 to November, 2016, where 14.376 people visited the exhibition. Their Instagram activities resulted in 57 posts and received 1.292 likes and comments. In total, 12.938 users of social media were reached. The data are given in figure 19.

	#nordsøenoceanarium
Posts	57
Reach	12.938
Likes & Comments	1.292

Figure 19. A table with the results from the second iteration.

Two parameters were changed in the second iterations; the number of hashtags and the way of motivating. The conventional promoting methods and the photobook where replaced with a big screen. Although the durations of iterations and numbers of visitors are not identical, it is possible to analyze them from the results produced per visitor. It can be seen from figure 20 that the social media impact of the second iteration was much higher. There was a significant rise in posts, comments, likes, and reach in the second iteration per visitor. In comparison to the first iteration, the second iteration likes and comments are 7.77 times more effective, the reach is 5.62 times more effective, and the number of posts are 2.79 times more effective. It proves the enhancement of both marketing and the experience. Due to the replacement of the conventional promoting methods with the big screen, the organizational effort was also minimized.

	Iteration 1	Iteration 2	Relative social media impact
Posts per 1000 visitor	1.42	3.96	2.79
Reach per 1000 visitor	160	899.97	5.62
Likes & Comments per 1000 visitor	12.45	89.87	7.22

Figure 20. A table with the overall effect and social media impact according to both iterations.

From the results of this case study it indicates, that the use of big screen and the reduced number of hashtags led to the increased impact. In this way, the Instagram activity was made less complex and stimulated more visitors to participate.

The photos on the large screen were created by previous visitors. Hence, it functions as a point for on-boarding the gameful experience for current visitors and creates expectations for them. The screen also reminds them to take their own pictures during their visit. A chance to have a picture displayed on the big screen is a significant extrinsic motivational factor for engagement. This echoes our results from case 1, where visitor created content seemed to offer much higher engagement, than normative pre-made content.

Also, the case demonstrated that it is much more efficient to have one instead of six hashtags, perhaps because it is easier for visitors to remember it – the engagement was so to speak amplified through simplifying the gameful interactions needed to participate fully. Furthermore, in the second iteration,

visitors were not confined to taking photos only in six Insta-spots, but in the entire space of the exhibition. This was also possible in iteration one, but the problem was that the idea behind it was to connect photos with Insta-spots. As it can be observed from the photos, in the second iteration, the green floor labels rather served as a reminder to take a picture. Bearing in consideration that there were no requirements from the activity itself in the second iteration. The visitors were more free to participate in the Instagram activity in contrast to the iteration one with the idea of the complete photobook.

The way the game mechanics where communicated in iteration 2 indicates to be more effective than the way it was communicated in iteration one. By presenting the result of previous visitors' experience, it was possible to motivate more new visitors to engage. The possibility to compare and be inspired by previous visitors' contributions, indicates to work as a leaderboard and opens the possibility for competition among the visitors as well. As such, the intrinsic motivation of capturing the memories and experiences of the visit, was enabled by ensuring that the extrinsic rewards were explicitly known and decoded prior to onboarding the Instagram concept – reinforcing our lesson learned about the on-boarding dynamic between intrinsic and extrinsic elements in gamified exhibition designs.

DISCUSSION - EXTENDING THE DISCOURSE OF APPLIED GAMIFICATION

As mentioned in the introduction, the exhibition context has a history of being used as a test bed, just as the two cases in this paper. Research into the effect of gamification, as *"...a process of enhancing services with (motivational) affordances in order to invoke gameful experiences and further behavioral outcomes."* (Hamari et al 2014, Houtari & Hamari 2012) has shown that there is indeed a potential in gamifying services, such as the exhibition at the North Sea Oceanarium. However, it is important to note that the context which is being gamified, as well as the users using it, impact the effect greatly (Hamari et al 2014). The two cases studied in this paper present a number of game mechanics, that have been identified in the implemented design solutions, and their effects have subsequently been explicated. The results of these implementations reveal potential incentivize mechanics to on-board new users to a digital experience layer, they are unfamiliar with, and thereby invoke an intrinsic motivation, through game design elements.

The first case presents results, where unintended 'side-effects' emerged, such as guidance/way-finding, with exploration of the exhibition through a completion mechanic; as well as incentivizing 'on-boarding' of new users, whom seemingly lacked the intrinsic motivation to acquire and use the Movie Maker app, through extrinsic rewards. Data analyzed from the Movie Maker app, revealed patterns related assistance from staff vs. self-facilitated acquisition of the app. Periods where there had been personnel present to assist the visitors in downloading or supplying a tablet with the app pre-installed, and instructing them on how to use the app versus a period where there had been no personnel to assist the visitor; the number of users dropped drastically. After having made this discovery, other related projects were revisited to explore the data with this new knowledge, and the same pattern emerged where a situation where the visitor has a staff (or in some cases a researcher) explain what the system does, they are willing to give it a go while being reluctant when they are introduced to it through posters and similar guides. This was revealed to be mainly because they did not understand how using the app would support their desired experience during the visit, because it was a less known type of technology interaction at the time, that was being explained through conventional means. The second case introduced a service layer to increase user-generated content, by utilizing Instagram as a platform where visitors could document and share their experiences at the North Sea Oceanarium. This revealed that by offering an open setting to let the visitors control and

23

Chapter in Hansen, Jensen & Rosenstand (edt.) (In press) Gamescope: The potential for gamification in digital and analogue places. Aalborg University Press.

create their own stories, instead of dictated Instagram spots and hashtags, the visitors were more willing to create and share their stories, combined with a large display to present the experiences that the other visitor's shares. Thus, when new visitors arrived and saw previous visitors' experiences, they were much more inclined to engage with Instagram at the North Sea Oceanarium.

In other words, the intrinsic value of the visitor's experience was veiled in a system designed to provide a digital experience layer that seeks to augment, drive, enhance an existing exhibition or be a self-contained exhibition. Optimally, the visitor would engage with and see the intrinsic value-potential offered by systems designed to deliver such experiences, but a key problem identified is that if the visitor does not understand the concept they are being presented with, they will simply skip it. But, as revealed through the two cases, building extrinsic motivational triggers, offered by game design components and mechanics, such as rewards, progression, sharing mechanics, into the digital experience layer, has shown resourceful in on-boarding and retaining the visitors' interest and engagement throughout the visit.

The mechanics identified through implemented components are in line with the most frequently studied mechanics in other gamification studies. A literature review of empirical studies on the effect of gamification reveals that the most frequently implemented mechanics for motivational affordances are leaderboards, points, badges, levels, rewards, story/theme, progress, challenge, clear goals and feedback, with positive results, if implemented appropriately (Carolei 2015, Hamari et al 2014, Sanchez 2015). However, gamification as a field of study is still relatively young. In 2010 the term gained traction in academic context and has slowly grown over subsequent years, to gain a momentum over the past few years (Hamari 2014). Most of the research still points at appropriating the trigger mechanics to the context in which they are being used (Hamari 2014). Other studies have shown gamification's prowess in guiding visitors around exhibitions with positive results, so there is reason in exploring the potential further. There does seem to be a lack of studies in implementing extrinsic on-boarding mechanisms, to have motivate the user to actively engage in a gamified system, especially in a self-facilitated setting.

CONCLUSIONS

Based on the two case's practical lessons learned, this paper has sought to contribute to the existing body of knowledge about applied gamification in an exhibition context, with a special focus on how visitors are on-boarded the gamified exhibition design. Our studies are in line with many previous contributions, when it comes to applying gamification to a service to instigate motivation, but by analyzing the results, new knowledge emerged that could benefit a specific design challenge that has not been covered in the existing body of research; namely on gamification as a method to target adoption and usage of services. Especially in a context where there are no assistance or instructors present to help the user understand and use the service. Although on-boarding has been explored in existing gamification examples, such as the initial interest and rewards to motivate users to dig deeper or spend more time with a new service, i.e. habit building, the mechanics have not been investigated in their potential to introduce and explain unknown concepts, such as new and emerging digital experience layers, at self-facilitated exhibitions with a barebone staff. This should be further explored with studies targeting adoption, acquisition and usage of digital experience layers through gamification, where the service itself is either unable to or challenged in that it cannot clearly communicate the intrinsic value for the visitor by using it.

24

Chapter in Hansen, Jensen & Rosenstand (edt.) (In press) Gamescope: The potential for gamification in digital and analogue places. Aalborg University Press.

REFERENCES

Brida, J.G., Disegna, M., Scuderi, R., 2013. Visitors of two types of museums: A segmentation study. Expert Systems with Applications 40, 2224–2232. doi:10.1016/j.eswa.2012.10.039

Antoniou, A., O'Brien, J., Bardon, T., Barnes, A., & Virk, D. (2015). Micro-augmentations: situated calibration of a novel non-tactile, peripheral museum technology. Educational Technology and Society, IEEE.

Bounia, A., Nikiforidou, A., Nikonanou, N., & Matossian, A. D. (2012). Voices from the museum: Survey research in Europe's national museums.

Carolei, P., & Schlemmer, E. (2015). Alternate Reality Game in Museum: A Process to Construct Experiences and Narratives in Hybrid Contexts. Edulearn.

Chang, Y.-L., Hou, H.-T., Pang, C.-Y., Sung, T.-T., & Chang, K.-E. (2015). Apply an Augmented Reality in Mobile Guidance to Increase Sense of Place for Heritage Places. 166-178.

Chen, G., Zhang, Y., Chen, N.-S., & Fan, Z. (2016). Context-Aware Ubiquitous Learning in Science Museum with iBeacon Technology. Learning, DEsign and Technology.

Chow, M.D., 1989. The role of the video professional in a research environment. ACM SIGCHI Bulletin 21, 83–87. doi:10.1145/70609.70622

Coenen, T., Mostmans, L., & Naessens, K. (2013). MuseUS: Case Study of a Pervasive Cultural Heritage Serious Game. ACM Journal on Computing and Cultural Heritage, 6.

Cosley, D., Lewenstein, J., Herman, A., Holloway, J., Baxter, J., Nomua, S., . . . Gay, G. (2008). ArtLinks: fostering social awareness and reflection in museums. ACM.

Damala, A., Marchal, I., & Houlier, P. (2007). Merging Augmented Reality Based Features in Mobile Multimedia Museum Guides. Anticipating the Future of the Cultural PAst, pp. 259-264.

Damala, A., Schuchert, T., Rodriguez, I., Moragues, J., Gilleade, K., & Stojanovic, N. (2013). Exploring the Affective Museum Visiting Experience: Adaptive Augmented Reality (A2R) and Cultural Heritage. Heritage in the Digital Era, 2(1), 117-142.

Damala, A., Cubaud, P., Bationo, A., Houlier, P., Marchal, I., 2008. Bridging the gap between the digital and the physical: design and evaluation of a mobile augmented reality guide for the museum visit, in: Proceedings of the 3rd International Conference on Digital Interactive Media in Entertainment and Arts. ACM, pp. 120–127.

Davidson, D. (2010). Tentpole. In D. Davidson, An Introduction to the Art of Creating Integrated Media Experiences. ECT Press.

Deterding, S., Dixon, D., Khaled, R., Nacke, L., 2011. From game design elements to gamefulness: defining "gamification." ACM Press, p. 9. doi:10.1145/2181037.2181040

Deterding, S. (2011). Situated motivational affordances of game elements: A conceptual model. CHI.

25

Chapter in Hansen, Jensen & Rosenstand (edt.) (In press) Gamescope: The potential for gamification in digital and analogue places. Aalborg University Press.

Deterding, S., Sicart, M., Nacke, L., O'Hara, K., & Dixon, D. (2011). Gamification: Using Game Design. CHI.

Falk, J. H., & Dierking, L. D. (1992). The Museum Experience.

Haesler, S., Obernesser, K., Raupp, T., Jahnke, C., Stapf, J., Bräker, J., . . . Steinicke, F. (2016). Edutainment & Engagement at Exhibitions: A Case Study of Gamification in the Historic Hammaburg Model. Mensch und Computer.

Fowler, J., and J. Noyes. 2014. Attitudes and use of mobile phones in tweens. in: Advances in the Human Side of Service Engineering: 40.

Freund, L., Cellary, W., 2014. Advances in The Human Side of Service Engineering. AHFE Conference.

Giersing, S. (2014). At dele autoriteten. Brugernes billeder som fremtidens kulturarv? (Sharing Authority. Users' photos as the cultural heritage in the future?) In *Sharing is caring : åbenhed og deling i kulturarvssektoren (openness and sharing in the heritage sector)* (pp. 199-207). Copenhagen, Denmark: Statens Museum for Kunst.

Groneman, S. T. (2014). Når museer prioriterer sociale medier. (When museums prioritize social media) *Nordisk Museologi, 1*, 37-53.

Hall, S. (2013). *Creating Strong Cross Media Concepts for Museum Exhibitions.* Cross Media Interaction Design, Department of informatics. UMEÅ University.

Halo 2. (2004). (Microsoft) Retrieved December 27, 2016, from 42 Entertainment: http://www.42entertainment.com/work/ilovebees

Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does Gamification Work? - A Literature Review of Empirical Studies on Gamification. IEEE.

Hassenzahl, M., Tractinsky, N., 2006. User experience - a research agenda. Behaviour & Information Technology 25, 91–97. doi:10.1080/01449290500330331

Horn, M. S., Routman, E., & Weintrop, D. (2014). Programming in the pond: A tabletop computer programming exhibit. Scopus.

Houtari, K., & Hamari, J. (2012). Defining Gamification - A Service Marketing Perspective. ACM.

Hughes, J., O'Brien, J., Rodden, T., Rouncefield, M., 1997. Ethnography, Communication and Support for Design. Lancaster University.

Hunicke, R., Leblanc, M., Zubek, R., 2004. MDA: A formal approach to game design and game research, in: In Proceedings of the Challenges in Games AI Workshop, Nineteenth National Conference of Artificial Intelligence. Press, pp. 1–5.

26

Chapter in Hansen, Jensen & Rosenstand (edt.) (In press) Gamescope: The potential for gamification in digital and analogue places. Aalborg University Press.

Juho Hamari, J.K., 2014. Measuring flow in gamification: Dispositional Flow Scale-2. Computers in Human Behavior 40, 133–143. doi:10.1016/j.chb.2014.07.048

Jung, T., Dieck, M. C., Lee, H., & Chung, N. (2016). Effects of Virtual and Augmented Reality on Visitor Experience in Museum. Information and Communication Technologies in Tourism, Springer.

Kidd, J. (2014). *Museums in the New Mediascape.* Ashgate Publishing.

Kim, J. H., & Hong, J. Y. (2013). *Analysis of Trans-media Storytelling Strategies* (Vol. 8). International Journal of Multimedia and Ubiquitous Engineering.

Koskinen, I., Zimmerman, J., Binder, T., Redström, J., Wensveen, S. (Eds.), 2012. Design Research Through Practice. Morgan Kaufmann, Boston.

Leong, Z. A., & Horn, M. S. (2014). Waiting for Learning: Designing Interactive Educational. IDC.

Leshchenko, A. (2015). Digital Dimensions of the Museum: Defining Cybermuseology's Subject of Study. ICOFOM.

Lindinger, C., Haring, R., Hörtner, H., Kuka, D., & Kato, H. (2006). Mixed Reality Installation 'Gulliver's World': Interactive. Technologies for Interactive Digital Storytelling and Entertainment.

Lingnau, A., van Dijk, B., Kockelkorn, H., Schmuch, J., & Ruthven, I. (2012). Enriching Children's Experiences During and After a Museum Visit. Advanced Learning Technologies (ICALT), 2012 IEEE.

Madsen, C.B., Madsen, J.B., Morrison, A., 2012. Aspects of what makes or breaks a museum ar experience, in: Mixed and Augmented Reality (ISMAR-AMH), 2012 IEEE International Symposium on. IEEE, pp. 91–92.

Mekni, M., Lemieux, A., 2014. Augmented reality: Applications, challenges and future trends, in: Applied Computational Science—Proceedings of the 13th International Conference on Applied Computer and Applied Computational Science (ACACOS '14) Kuala Lumpur, Malaysia. pp. 23–25.

Micklethwait, J. (2013, 12 21). Temples of delight. Economist. Retrieved 03 03, 2016, from http://www.economist.com/news/special-report/21591707-museums-world-over-are-doing-amazingly-well-says-fiammetta-rocco-can-they-keep

Moesgaard, T. G., Witt, M., Fiss, J., Warming, C., Klubien, J., & Schønau-Fog, H. (2015). Implicit and Explicit Information Mediation in a Virtual Reality Museum Installation and its Effects on Retention and Learning Outcomes. ECGBL, 387-394.

Opperman, R., & Specht, M. (1999). A nomadic Information System for Adaptive Exhibition Guidance . *Archives and Museum Informatics, 13*(2), 127-138.

Pardo, F. (2011). *New media and transmedia for documentary storytelling : a comprehensive approach.* Science and Natural History Filmmaking. Montana State University.

27

Chapter in Hansen, Jensen & Rosenstand (edt.) (In press) Gamescope: The potential for gamification in digital and analogue places. Aalborg University Press.

Raijmakers, R., Sommerwerk, A., Leihener, J., Tulusan, I., 2009. How sticky research drives service design, in: Service Design Network Conference in Madeira.

Russo, A., Jerry W., Lynda K., & Sebastian C. (2007). Social media and cultural interactivity experiences in museums. Nordisk Museologi, 1, 19-26.

Sanchez, E., & Pierreoux, P. (2015). Gamifying the Museum: A Case for Teaching for Games Based Learning. European Conference on Games Based Learning.

Seaborn, K., Fels, D.I., 2015. Gamification in theory and action: A survey. International Journal of Human-Computer Studies 74, 14–31. doi:10.1016/j.ijhcs.2014.09.006

Simon, N. (2010). *The Participatory Museum.*

Steffen P Walz, R. B. (2007). REXplorer.

The Dark Knight. (2008). (WARNER BROS) Retrieved December 27, 2016, from 42 Entertainment: http://www.42entertainment.com/work/whysoserious

Taul, B. (2014). Museer: Hovedtal. (Danmarks Statistik) Retrieved 03 03, 2016, from https://www.dst.dk/da/Statistik/emner/museer-og-kulturarv/museer

Todd, S., Lawson, R., 2001. Lifestyle segmentation and museum/gallery visiting behaviour. Int. J. Nonprofit Volunt. Sect. Mark. 6, 269–277. doi:10.1002/nvsm.152

Tron: Legacy. (2010). (Disney) Retrieved December 2016, 2016, from 42 Entertainment: http://www.42entertainment.com/work/flynnlives

Vlahakis, V., Karigiannis, J., Tsotros, M., Gounaris, M., Almeida, L., Stricker, D., . . . Ioannidis, N. (2002). ARCHEOGUIDE: First results of an Augmented Reality, Mobile Computing System in Cultural Heritage Sites. ACM.

Walz, S.P., Deterding, S., 2015. The Gameful World: Approaches, Issues, Applications. MIT Press.

Wakkary, R., Hatala, M., Muise, K., Tanenbaum, K., Corness, G., Mohabbati, B., & Budd, J. (2009). KURIO: A Museum Guide for Families. ACM.Wojciechowski, R., Walczak, K., White, M., Cellary, W., 2004. Building virtual and augmented reality museum exhibitions, in: Proceedings of the Ninth International Conference on 3D Web Technology. ACM, pp. 135–144.

Zhang, P. (2008). Motivational Affordances: Reasons for ICT Design and Use. Communications of the ACM, 145-147.

28

Balancing Enlightenment and Experience in Interactive Exhibition Design

Peter Vistisen
Aalborg, Denmark
vistisen@hum.aau.dk

Vashanth Selvadurai
Aalborg, Denmark
vashanth@hum.aau.dk

Jens F. Jensen
Aalborg, Denmark
jensf@hum.aau.dk

ABSTRACT

This paper presents insights from a collaborative design research project, in which a zoological aqua park in Denmark integrated multiple gamified digital installations in their new exhibition design. We document how these designs are in a tension between allowing game-based interactions, and the didactic communication about facts in the exhibition. We study the implemented solutions based on qualitative interviews with visitors, and with quantitative data from the backend game analytics of the installations. From triangulating these data sets we show, how attempts to deliver purely fact-based information through didactic design elements fail to succeed in engaging the visitors, while a more informal delivery through embodied interactions with the content sparks enlightenment about the subject matter. Our results suggest that this is true both in cases in which users fully understand and play through the intended interactions, as well as when more negotiated interpretations of the digital installations are performed. From this our contribution are guiding principles for the balance, between experience and enlightenment in gamified exhibition designs.

CCS CONCEPTS

• **Human-centered computing~Empirical studies in interaction design** • Human-centered computing~User studies

Author Keywords

interactive exhibitions; enlightenment; experience design; informal learning

INTRODUCTION

Museums are historically created and developed in a field of tension between a perception of the museum as a means of public information and enlightenment, and as a facility for visitors' experiences and entertainment. This tension field becomes especially visible in the museums' dissemination and exhibition design as a number of dilemmas that contemporary exhibitions and dissemination practices seek to deal with [10]. The discussion about 'enlightenment' versus 'experience' has therefore always played a major role in the discourse around museums. 'Enlightenment' is here connected to the informative, factual, forming, educational, and didactic, while 'experience', on the contrary, is associated with the engaging, involving, emotional, narrative, imaginative, playful, and entertaining. The experiential dimension has in recent years been associated with adding more interactive experiences through applying digital technologies - often by providing game elements such as quizzes, scavenger hunts or actual video game interactions in installations in the museum context. These gamified experience design has seen a widespread popularity among audiences, and especially shows to engage and motivate younger audiences in a field, which have grown up in a significantly more entertainment-oriented media landscape than just a few decades ago. Through games and interactive exhibitions, these new audience are becoming 'users' of the museum exhibition a performative arena, in which experience-oriented content is seen as a platform to deliver the enlightenment of the museums subject matter.

However, in the museum context, this trend towards increased used of gamified experience, are facing opposition from traditions favouring more traditional means for assuring an ordered, factual and authoritative delivery of educative content to enlighten our societies. While the degree of resistance varies, the debate between enlightenment and experience can be found in most modern museum context often leading to compromises made when creating new exhibitions. These compromises often result in arbitrary mixes of experience-based and enlightenment-oriented form and content - especially when making decisions about designing interactive digital exhibitions. If designing a primarily experience-oriented feature, such as a game element is added, the designer will often meet the demand for also including a clear and present layer of enlightenment too - e.g. by adding a text page with facts to read before playing. In this regard, the enlightenment is forced into the experience-based interaction design, and

would be true also in the opposite situation, in which simple gamified elements (e.g. so-called 'badgification') is added as a superficial add-on to an exhibition.

It is our hypothesis, that this tension of traditions, and its resulting compromises in design, are not optimal for either tradition, and only serve to create inadequate interactive exhibition design. Instead, interactive exhibition design needs to balance the traditions, by allowing for other types of enlightenment than authoritative fact delivery, while the gamified installations should also not transcend into straying too far away from communicating a message about the subject matter.

This paper presents insights from a collaborative design research project, in which a zoological aqua park in Denmark integrated multiple digital installations in their new exhibition design. We show how decisions were made about the digital installations in regard to forcing features aimed at traditional didactic communication into game-based installations, to ensure facts. From studying the user behaviour through both qualitative and quantitative research, we show how such attempts to deliver purely fact-based information through didactic design elements fail to succeed in engaging the visitors, while a more informal delivery through embodied interactions with the content sparks enlightenment about the subject matter.

ENLIGHTENMENT OR EXPERIENCE? AN ONGOING DISCOURSE IN MUSEUM RESEARCH
This section details the background for the design space, showing the debate, between enlightenment and experience design, through four archetypical positions.

The Norwegian Museolog, Gjertrud Sæter, discusses the museums' basic values and objectives in a historical perspective in the article, "Between Conservation and Consumption. New challenges for museums" (Our translation) [5]. She describes a major historical movement 'From enlightenment to entertainment', as it is called in a headline; i.e. from the modern museum where the basic values and objectives were to teach and educate the public through displays, to the present day post-modern museum that moves towards becoming a "commercial entertainment product"" (Our translation) [5]. Among other things, she writes: "The overall objective for the modern museum has been to be educative and enlightening, and the basic values are rooted in the belief in development, culture, formation, and progress. In contrast, the objective of the non-constructive, or post-modern museum, is entertainment, and the basic values are lack of worry, freedom and openness" (Our translation) [5]. She even speaks – with reference to Belk [3] – of a 'disneyfication' of museums: "In order to safeguard themselves economically, museums have to give

in to the public's desire for entertainment. A disneyfied museum has sacrificed education and enlightenment for superficial entertainment based on illusions. In the competition for the audience, museums create an illusory hyped-reality …" (Our translation) [5]. The first position in the debate between enlightenment and experience, exemplified by Sæter, is thus for the museum's classical enlightening, educational functions and strongly opposed the use of experience and entertainment-based dissemination and exhibition design.

Diametrically opposite is the case with Kirschenblatt-Gimblet, who describes a paradigm shift: "From an informing to a performing museology" [23]. The shift is characterized by a movement from 'information' to 'experience', from 'knowing' to 'feeling', from 'things' to 'stories', and from 'display' to '*mise-en-scène*'. The new museology is characterized by, among other things, a more theatrical or dramatic approach to the museum experience – what is here called 'museum theatre' [23] – that, instead of merely presenting objects, makes use of museum practices such as scenography, *mise-en-scéne*, tableaux, scenarios, installations and 'habitat displays'. This approach gives pride of place to drama, the narrative and emotional engagement and, in place of the cognitive and visual, focuses on the somatic and affective. "This is a special kind of theatre", writes Kirschenblatt-Gimblet, "and its point is not information but 'experience', a term that is at once both ubiquitous and under-theorized. 'Experience' indexes the sensory, somatic, and emotional engagement that we associate with theatre, world fairs, amusement parks, and tourism". Therefore, this new *modus* is also called "the expo style" [23] or "the expo mode of the new generation museum" [23] with a reference to 'world fairs' and the Expo-World's more performative oriented display forms that are also far more 'customer focused' and 'commercially positive' [23]. That is to say, a shift from the traditional enlightening, information-oriented museum to a more experience-oriented museum. The second position, exemplified by Kirschenblatt-Gimblet, is thus – diametrically opposite Sæter – critical of the classical museum's informative and educational functions, and in favour of a more performative, experience-oriented, engaging exhibition practice.

In a Danish context, Dorthe Skot-Hansen has set out to illuminate and discuss the current situation in which the Danish public museums find themselves, and in particular their role in the experience economy [33]. The experience economy is here seen as both the cause of and solution to

the current challenges facing the museums. The point of departure is that the state-subsidized museums are under both economic and political pressure, in part because of the experience economy. The museums are challenged by the experience economy, partly by competition from other more commercial experience-oriented attractions, as well as an audience who is increasingly pampered by more engaging and sensational experiences, partly in the form of demands to enter into the experience economy as well as the economic development of cities and regions. Therefore, according to Skot-Hansen, the museums must "re-evaluate their classical role as institutions of enlightenment and education" (Our translation) [33]. The museums, hence, find themselves in a tension field between what can be described as enlightenment on the one hand and experience on the other. Skot-Hansen expresses it in this way: "The discussion on enlightenment versus experience … permeates the public debate on the role of museums; not least the question of where the boundaries lie" (Our translation) [33]. Or, as further elaborated later in the book, where she writes: "The museums are moving in a field of tension between being cultural institutions based on the five pillars (collection, registration, preservation, research and dissemination), and being experience-saturated attractions that contribute to the Danish experience economy's continued development" (Our translation) [33].

But, at the same time, experiences and the experience economy are seen as the solution to the challenge, among other things, in that the museums can and must learn to work strategically with experience development, i.e. learn from the instruments of the experience economy in relation to using experiences such as staging and strengthening experience value and use orientation. It should not be done solely for creating an economic surplus or added value, but primarily to create relevant, challenging and lasting experiences for the audience. Therefore, one of the main conclusions of the report is that the experience-economic performance of museums should not be judged only on their contribution to the local and national economy, but should be judged according to artistic and cultural criteria: "But that is precisely why it is necessary that they develop their experience potential, and here they can learn from the experience economy. The museums must learn to navigate in a whole new knowledge and experience society, so that their basic tasks concerning collection, preservation, research and dissemination are integrated into good experiences" (Our translation) [33]. The third position, represented by Skot-Hansen, is thus not a simple 'for' or 'against', respectively, enlightenment and experience.

Rather, the relationship between the two approaches takes the form of a means to an end, i.e. using experiences and the experience economy as instruments to promote the core purpose: enlightenment.

Finally, the fourth and final position is represented by Floris and Vasström and their book *At the Museum – between enlightenment and experience* (Our translation), which – as far back as 1999 – discussed whether the objective of museums is enlightenment or experience [15]. Floris and Vasström associate the genesis of museums to the modern society's formation project and the modern democratic nation states' narrative of progress and freedom. Just as they point out, that the modern project and the narrative about the necessary course of development and continuous progress in the present time have collapsed. The enlightenment element relates particularly to the museum's original, historical form: "Providing enlightenment to the museum's visitors has always been part of the museum's history production", they write, and continue: "Often there has been talk of enlightenment in a pure, next puritanical form, where the experience aspect had only a subordinate role" (Our translation) [15]. On the other hand, they link the experience element to more current practices: "Many museums have, in recent years, to a much higher degree, made use of entertaining and activating elements of dissemination in exhibitions and in their overall work" (Our translation) [15]. A practice they particularly associate with *experience centres* and the new *visit centres* with historical themes. Even so, the attitude is that the museums should also learn from the experience aspects and implement the lessons learned; i.e. "… the museums should take up the challenge instead of blindly distancing themselves from the experience centres etc., and stamping them as disneyfication" (Our translation) [15]. In conclusion, the book advocates a synthesis of the two aspects into a new formation or educational project: "It is necessary to have both enlightening and entertaining experiences; it isn't a question of either or" (Our translation) [15]. This fourth and final position, represented by Floris and Vasström, is thus not characterized by a 'for' or 'against' enlightenment and experience, respectively, or a suggestion to instrumentalise one as a means for the other as an end. Rather, the case is that the contradiction or conflict between enlightenment and experience dissolves in favour of a new more nuanced and complex understanding of a possible synthesis of enlightenment and experience, where one can obtain enlightenment and learning through experiences – as in 'experience-based learning' – and get experiences and

enjoyment through enlightenment, information and learning – as in 'learning-based experiences' or 'edutainment'.

As can be seen from the above, the discussion about enlightenment versus experience is an ongoing and dominant discourse within the museum area and in the scientific literature on exhibitions. The tension of the position becomes even more apparent, when the discourse of experience is addressed from an interactive media perspective - putting digital technology front and centre in the design of modern exhibitions.

INTERACTIVE EXHIBITION DESIGN

The recent discourse of exhibitions elaborates a partial and complementary picture of the complexity in balancing between enlightenment and experience. Being a learning environment or an educative space is still a major purpose of contemporary exhibitions. However, the experience aspect has reached an equal importance in the recent years. Thus, necessitated the exhibition organisations to focus on the experience aspects in the direction required by the visitors [33,34]. As such, the past two decades, the exhibitions have explored different methods to comply the requirement without compromising the enlightenment aspect. Starting from film and audio guides to integrating number of digital technologies to enrich visitors' experience [11].

Already a decade ago, Tallon argued that exhibitions can enhance the exhibition experience by providing involving experiences through new digital technologies [35]. Users are increasingly engaged and actively involved, among other things through interactivity and active contribution [1,6,7,32]. As such, today, it is almost unavoidable to interact with a number of digital technologies during an exhibition visit, which have enabled new kinds of interaction between exhibition and its visitors. Although the post digitization phase of exhibitions reflects a more thorough incorporation of digital content in exhibition practices [29], the expectation by exhibition visitors for new digital experiences are increasing parallel to the technological advancement. The potential of digital technologies not only contains qualities in providing involving experiences, but also richly authentic learning experiences that enrich visitors' enjoyment and learning, which would be difficult to provide through other media [17,31]. As such, this area has in recent years attracted international attention and investments on digital experiences in exhibitions [18,19,28,36,38].

Studies have shown that digital technologies can facilitate knowledge acquisition, especially interactive digital technologies have shown to enhance visitor interaction and substantiate learning [2,8,14,27]. Studies with focus on design and evaluation have provided insight into how

visitors interact with digital technologies in exhibitions [9,21,22]. However, knowledge regarding how visitors understand, apply and respond to new digital technologies is still limited [18,28], and knowledge regarding digital installations in exhibitions is even more limited. Ben Gammon and Alexandra Burch emphasize the importance of hardware, software and content being based on an understanding of users' needs, desires, expectations and behavioural patterns [17]. Obviously, this does not sound like a particularly surprising conclusion. However, reality is often that many digital exhibition projects are not based on actual user tests or reconciliations with users' expectations, who have to use the digital offers [18,19,28,30,37]. Compared to this view, it does not seem surprising when Gammon and Burch point out that users often respond unexpectedly and surprisingly to digital installations in relation to exhibition organisation's expectations, intentions, and desires [17]. A large amount of literature exists about museum visitors' experience in the physical exhibition space,

However, research into what characterises the exhibition visitors' digital interactive communication, as well as what wishes and expectations museum users have for digital communication, is still scattered. Heath and Lehn's studies are another example of more critical studies of digital exhibitions [18,19]. They conclude that it is often the case that digital installations in museum rooms facilitate interactivity between one user and a machine and thus do not involve other surrounding museum users. They justify that much technology in museums is based on home computers, and they emphasise the importance of developing new technologies that are adapted to the particular social interaction that one wants to create in exhibition contexts. As such, both Gammon and Burch, as well as Heath and Lehn, point out that where there has been much research in computer software and hardware for home use, it has not applied to the same extent in exhibitions which is a significantly different context. A number of studies show that users' use of and expectations for computer-based technology is very different when it takes place in an exhibition than when it takes place at home [16,25].

Concordantly to the increased focus on digital technologies, there is also a rising critic on the increased focus on digital technologies instead of the content that is to be communicated [12,13]. The research regarding evaluating educational effectiveness of digital technologies are also limited [35]. Thus, there is a need to focus on the engagement, interaction, and knowledge dissemination, involving experiences can craft through new digital technologies [12]. Interactive digital technologies have proven to provide involving experiences and also proven to facilitate knowledge acquisition. However, there is little empirical research on the types of educational outcome resulting from the use of digital technologies in an exhibition.

INVESTIGATING THE TENSION: THE HUNTERS OF THE NORTH SEA CONCEPT

To investigate the hypothesis, of inadequacy of the compromises made when forcing a strict balance between enlightenment and experience aspects in exhibition design, the authors has been involved in a major recent re-design of an exhibition area the Danish aqua zoo 'The North Sea Oceanarium'(Oceanarium). The Oceanarium is an aqua zoo facility in Denmark disseminating the wildlife in North Sea through a combination of learning and entertainment. The aqua zoo driven by 35 full-time employee and is reinforced with additional 35 seasonal employees on high season periods. The place has around 160.000 visitors every year [39].

In 2017 the Oceanarium initiated a renewal project of an old exhibit dated back to 1998. The desire was to create an involving family experience that enlightened about the food chain in North Sea from predators to prey between the coast and sea. The exhibit extends over a larger area in the exhibition, and therefore was divided into smaller areas with different media platforms to disseminate the content and provide an involving experience respectively to children, youths and adults. As such, the desire was to explore the potential of emerging digital technologies to create involving digital experiences that enlightened about the food chain in North Sea.

The design process was characterised with compromises made between enlightenment and experience to seek a balance that met the requirement of exhibition curators and experience designers. Below we will detail the design of the four interactive installations in the new exhibition.

The four gamified installations

Today, play and entertainment is often a part of an exhibition experience. Various studies have demonstrated the potential of play and entertainment to instigate learning at interactive exhibitions [20,24,26]. As such, four game installations were designed to enrich the visitors in the new exhibit: The Big Ocean Window, Seal Hunter, Seal Nursing, and Hold Your Breath, See figure 1.

Figure 1: The four interactive installations in the new 'Hunters of the North Sea' exhibition area.

The Big Ocean Window (BOW) disseminates the food chain of predators and prey between cost and deep sea. The installation consists of a 100m^{20} led screen connected with six individual control units, where the visitors can interact with the shared big screen by taking role as a mackerel hunting for food, but also avoid being eaten by bigger predators. The control units consist of a screen with a first-person view (the maceral), joystick to control the directions, and a button to attack, see figure 2.

Figure 2: The start screen of the touch-screen controllers (left), and the 3. person perspective of the mackerel player avatar, controlling one of the hunting fishes on the big 100 m2 main screen.

The big screen provides a third-person view giving an overview of the virtual space. The visitors have to orientate where the food and predators are on the big screen and use the control unit screens to attack or escape. Points are given for the number of fishes the visitor catches, and if visitor gets eaten by a predator, the game ends. The game can be played collaboratively by some helping with the navigation on the big screen while one is controlling the maceral. It can also be played against other players on the other units competing on number of fishes caught. Apart from the game aspect, visitors can also access a didactic lexicon feature, where information about different animals in and around North Sea can be found. Furthermore, it also gives possibility to inspect the animals through 3D models, see figure 3.

Figure 3: The BOW's didactic lexicon, featuring fact-based information, and detailed 3D visualizations of the animals present in the virtual aquarium's play sessions.

The Seal Hunter installation is a dual player game with two touch screens facing away from each other. On the one side, a seal can be controlled through a first-person view hunting for fishes, where the controller vibrates in the direction of fishes imitating the way seals navigate with their whiskers, see figure 4, picture four showing the control system. On the other side, another visitor controls several fish groups through a third-person view, where the fish groups can be navigated towards the seal as a collaborative game, or prevent the seal in catching the fishes, by navigating the fishes away from the seal.

Seal Nursing game is about nursing the seals by feeding them. Concretely, the visitors have to throw fish to the seals. The visitor gets one point every time a seal catches a fish, and if the visitor manages to feed a seal pup, it is awarded with 10 points. This resembling the importance of feeding the seal pups in a zoological facility as the bigger

seals usually steals the food from the pups. The game installation can be played as a single player game or dual player competitive game, see figure 4, picture 3.

Figure 4: To the left 'Hold Your Breath' installation, followed by the screen presenting the augmented photos of the players. Third picture shows the 'Seal Nursing' installation, and the last picture shows the controller of the 'Seal Hunter' installation.

The last game installation is about how long the visitors can hold their breath. According to the time they can hold their breath, their face will be augmented with a respective animal that can hold the breath equally. The interaction happens through a button, which the visitors have to hold down while they are holding their breath. The visitors face is captured through a camera and presented on a screen with the changing augmentation on their face in real-time, see figure 4.

METHOD - STUDYING THE USERS IN CONTEXT
The user study, of how the visitors interacted with the new digital installations in the exhibition was based on both a qualitative and quantitative strategy.

The Oceanarium has over the years gone from just evaluate their performance through employee impression and gut feelings to be a more data-driven organisation. Today, most of their exhibits and the digital installation logs data, which are used to improve the usability and the visitor experience. Thus, they agreed to prioritize a rather detailed data analytics back-end to be implemented in the four installations to enable us to perform a quantitative overview of the user behaviour.

The quantitative data collection was based on tracking these data points and modelling them into a series of graphs showing the relationships between the experience-based and enlightenment-oriented interactions. With one of the installations, the Big Ocean Window, our data tracking module was ready to be implemented alongside the summer launch of the exhibition, while data tracking modules of the three other digital installations were first implemented in the late summer/early fall. The Big Ocean Windows dataset is thus based on 121.538 playthroughs (one-six players a time), while the Seal Hunter set is based on 8.967 playthroughs (with two persons a time), and the 'Hold Your breath' installation data set was based on 12.601 playthroughs (one player a time).

To complement the quantitative data set, a series of field study days were planned, and conducted in the fall of 2018. The exhibition was implemented in the summer of 2018, but the study itself was postponed to the fall in order to let the amount of visitors, the technical adjustments of the installations, and the zoo personals own behaviour around the exhibition stabilize to a 'new normal' before observing and interviewing the visitors in situ. The observations days were further based on a premise of 'not to few, not to many' visitors present in the zoo to optimally represent a typical visitor and event flow of a day in the zoo. We conducted video observations of the exhibition area to identify patterns of user flow among the installations, and to identify specific behaviours to be investigated further through interviews. The concurring interviews where performed in the exhibition context based on a semi-structured interview guide asking questions detailing aspects of the interaction design, the visitors understanding of what they experienced, and an assessment of both if they had fun as well as felt informed about the subject matter. The interviews where group-based in the families, being prompted for an interview immediately after leaving the exhibition area, and where generally aimed a being short a concise at a maximum duration of five minutes per interview.

DATA ANALYSIS
The following section will present our analysis of the empirical data collected from the digital installations, with the aim of exploring user behaviour in relation to experiential gameplay, and didact enlightenment. We structure the analysis by first presented the quantitative data collected from the installations themselves, and how we modelled the data sets to address issues of experience vs. enlightenment in regard to the subject matter of the installation.

The Big Ocean Window
The BOW had six separate touch screen stations, from which the visitor could interact with the virtual 100m2 aquarium on the primary screen. Each of these stations provided a total of 31 possible data tracking points, which we modelled into data set combining seven data points which would provide data on both the gameplay elements, alongside the use of the fact-based lexicon features of the installation.

Based on the gathered data on BOW, it was possible to determine that 30-50% of the play sessions ends with the player 'completing' the game without being eaten during the game's total play session of 120 seconds. The other two types of play sessions end of inactivity or by the visitor's fish being eaten, which together constitute 50-70%. Thus, it can be noted that the majority of the players managed to complete the game, which indicate that the difficulty of the game seems to be appropriate for the target audience by not being too easy to complete nor too hard to accomplish. An initial hypothesis was, that several visitors will find it

difficult to navigate precisely due to the inverted control of the x-axis in the game and the third person perspective on the big screen. However, in the interviews, it turned out to be mixed as to whether it is actually experienced as difficult to control the game. Especially children between the ages of 5 and 12 seem to have an easier time getting used to the controls, which does not indicate any usability problems.

It was not possible to quantify how many play sessions one player was associated with since no user logins data was required to play in order to ensure a quick onboarding. Although from the video observations it was possible to observe a clear tendency, where the majority of players played more than one session. Especially the children played more than one game and were often inspired by watching how others played, which kept them continuing playing. Concordantly, there were also observed number of situations, where more than one child participated in the same play session. Here, they spotted the predators on the big screen and warned the playing child on the individual unit. This social dimension was particularly evident in families with more than one child, which also was the group with most repetitive play sessions.

Based on the observations, it seemed only a few of the visitors actively interacted with the didactic lexicon section of the BOW screens. Although a larger group of visitors were observed to have found the way to the front page of the lexicon, they quickly clicked away without spending time reading or exploring the 3D models. This is further substantiated with the gathered statistical data of 121538 play sessions, where 23% of the play sessions shows an activation of the lexicon, which gives a picture of a relatively large use of the lexicon in interaction with the game section. However, only 23%, of those who activated the lexicon, actually did interact with the lexicon's 'examine' functions (e.g. clicking around and exploring the 3D models), which only accounts for 7% of the total play sessions. Thus, the reason for the high activation of the lexicon, was clarified in the interviews, where several revealed that they had interpreted the images of the maritime animals in the lexicon as an opportunity to actively select animals for the game on BOW. In the 7% of the play sessions where the 'examine' function were used, the visitors primarily interacted with whales and sharks, which accounts for 56.5% of the play sessions where the 'examine' function were used. Based on the interviews, it was clear, that these animals are the ones that attract the relatively few visitors who choose to dive deeper into the lexicon.

To the questions, about the non-use of lexicon, several interview persons replied that they did not find the lexicon's factual part essential to their ability to feel enlightened by the BOW. They expressed that they saw the experience with the BOW as a way for their children to be able to put themselves in relation to the biologically realistic and correct interactions with the animals in the BOW and thus function as a good supplement to the more facts-based learning they could get in other parts of the exhibition. They did however point to, that they assessed that they children did learn 'something' through playing the game, by being able to set themselves in relation to the portrayed food chain, and through seeing themselves in relation to the comparable sizes of the marine animal avatars of the game. Similar comments were given from a
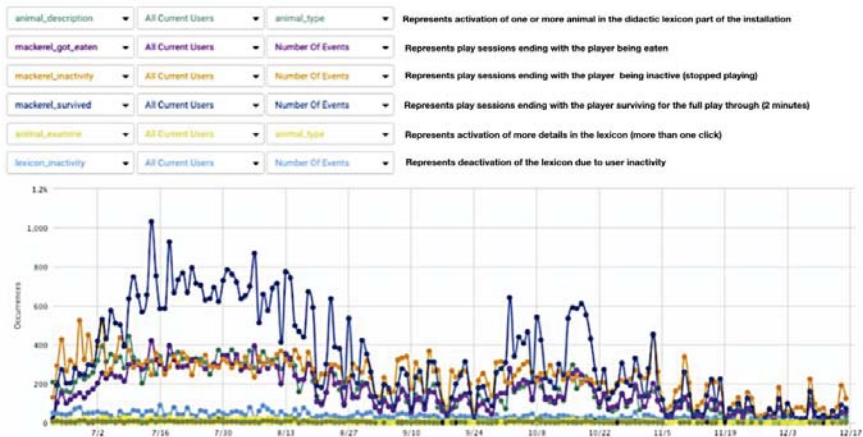

Figure 5: The data model from the 'BOW'

larger group consisting of three families with children, who also stated that the BOW for them was a way for the children to experience on their own body, how complex the food chain is and how fast it can go from hunter to the hunted.

These comments nuance the image of game sessions that activated the lexicon, as well as who interacted deeper with the 'examine' functions. The low usage of the lexicon could be interpreted as a lack of learning and information potential in BOW, where the gaming experience is the only prominent element. But with the visitors' comments in the interviews, as well as the observations of their behaviour interacting with BOW, it is evident that there is another form of learning and enlightenment taking place. Here, it is about the BOW giving the visitors the opportunity to experience themselves in relation to the animals (both in terms of size, behaviour and mutual interaction) and in this way achieve a more informal learning. Based on the visitors' opinions, it is not because they feel they lack fact-based learning during their visit, but rather sees experience-based learning, like the BOW, to support the fact-based learning in other parts of the exhibition.

Seal Hunter & Nursing

The Seal Hunter & Nursing installation had two connected stations, with physical controls of the shared big screen in which the simulated seals hunted for food. The installation provided a total of 25 data points, from which we build a data model of six data sets, which would reveal how the playthrough took place, and what 'feeding strategies' the users applied during their playthrough. We triangulated this with the answers provided from users right after having interacted with the installation in order to supplement the behavioural data with attitudinal statements. Specifically, we sought to probe for whether the visitors had actually realised the defining features of how seals hunt for food, how the seals were different - e.g. the baby seals needing different kinds and amounts of food, but where harder to feed due to the competition for food from the adult seals.
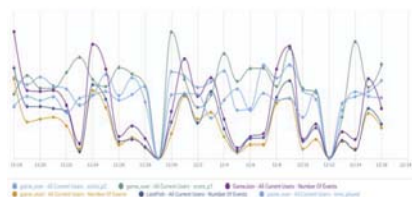

Figure 6: The data model from the 'Seal Nursing' installation.

According to the 'Seal Hunter' and the 'Nursing' installations, the majority of the games were played by two players. Here, a general behaviour was observed among the players. There were very few actually seemed to understand

the purpose and therefore also can be argued to have missed the communicative elements along the way. It was only on the Seal Nursing installation, where these observations could be substantiated via the gathered statistical data, since the Seal Hunter analytics only provided data regarding how the seal was navigated in the game. As such, according to Seal Nursing, there was a clear pattern illustrating a low success rate of collecting points during the play sessions, which was between 9-23 points on average in every play session on a day.

This can be linked to the fact that no gaming sessions actually reach the full 60 seconds, but most often ends 10-15 seconds before as a result of running out of fishes. In combination with the observational studies, this revealed that most players did not discover the difference between the points they get in relation to the size of the seals (for example, the baby seals get 10 points and the other seals gets 1 point). They throw the fish quickly in the belief of having endless amount of fish. This was a result of not reading the guidelines for the games, neither the physical nor the digital displayed on the screens. This trend was general for the two installations, where they start playing without knowing what the games are about. In the Seal Hunter there was a great doubt whether it was a collaborative game with each other or a competitive game against each other. At to this point, a family explained that it was not a problem that they should explore the game, in which they found the value of helping each other in their situation. As such, in some cases, they decode the games and adjust the game strategy, but in many cases, they never really decode the purpose and either abandoned or played with their own terms. Here, the information part is lost pretty quickly, as the experience part is not easily understandable.

Hold Your Breath in Augmented Reality

The 'Hold Your Breath' installation was by far the simplest installation in terms of data output from the installation, which mainly registered time of breath hold, the augmented reality effect obtained, and whether the user had any interaction with the augmented reality photos afterwards. However, we modelled the data to compare the frequency of the different obtained augmented reality effects in order to learn if the progression between the easiest to obtain (the 'Gannet') was proportional to the hardest to obtain (the 'Whale').

When tracking on the play session it was evident that the majority of sessions achieved none of the four augmented reality milestones. The second highest is not surprisingly the first milestone 'Gannet', which is achieved after 30 seconds while holding the breath. On average, it is approximately half of the game sessions that reaches the first milestone and gets rewarded with the augmented effect on the screen. From here, it falls quite drastically, where only between 5-10% of the players reach the second

milestone 'Porpoise', 'Seal' and 'Whale' as a milestone. This gives an indication of the time of holding the breath is logarithmic to the 'Whale' which means the difficulty of having to stay for more than 30 seconds is too great for most players. From the observations, it was evident that when groups of visitors tried the game together, a fast competition emerged, and the game was generally played by almost all visitors more than once. This indicates that the interaction and social dynamics of the game seem to work, but part of the enlightenment aspect disappears, when so few visitors earn milestones other than 'Gannet'.
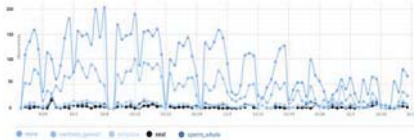

Figure 7: The data model from the 'Hold your Breath' installation.

The interesting in the data is that the whale appears more often as a milestone than the 'Seal' and the 'Porpoise'. This shows that there are more users, who reach the last milestone than the two in the middle. This corresponds to the observations, where it was clear that the players in groups competed to hold their breath longest. In contrast, another pattern was also observed in which the players, after the first few real attempts to hold their breath, actively began to make their own interpretation of the installation's use. Here, the players simply choose to pretend that they hold their breath, while the button is held down and the various milestones were achieved. The players then breathe out, although during all 2 minutes of interaction, they have just pretended to not have breathed. This creative play with the installation testifies that the player understands both the intent and the interaction with the installation, but freely interprets the situation to play with on the premise of holding the breath. These players thus reach the whale as a milestone which explains why the last milestones were experienced more often than the middle ones.

This again points to the relationship between enlightenment and experience in the installation. The difficulty of the installation obviously prevents a number of players from achieving all the milestones, and thus also prevents the total amount information. Conversely, the play with the installation also shows that the players freely interpret the rules, immerse themselves into the interaction, reaching the milestones, and thus obtain the factual information.

SYNTHESIS

This section seeks to identify and elaborate the conditions and dependencies between enlightenment and experience as seen in our analysis with the previous state of art, and the four introduced positions in museum research.

The analysis illuminates a number of issues regarding the conditions and dependencies between enlightenment and experience, that have been identified in the implemented design solutions, and their effects have subsequently been explicated. From studying the user behaviour through both qualitative and quantitative research, the results of these implementations reveal how such attempts to deliver purely fact-based information through didactic design elements fail to succeed in engaging the visitors, while a more informal delivery through embodied interactions with the content sparks enlightenment about the subject matter in the form of a more reflective relation between user and subject matter of the installation. As such, from the gathered insights, we can point to three guiding principles for the balance, between experience and enlightenment in gamified exhibition designs.

1. Avoiding adding 'forced' fact-based features and content as an add-on to gamified exhibition designs, since these run the risk on only seeing limited or mis-interpreted use. If factual content is to be presented in an authoritative way it should be done either through design placed prior to or after the game-based interactions as preparation or debriefing of the player.

2. Letting the informal learning be front and centre for gamified interactive exhibition design, which has been shown to arise from users being engaged in embodied interactions in a playful manner, being enlightened about their own relation to the facts through performative play which promotes reflection. This requires a discussion in relation to the four positions of what the role of museums should be in society, and whether we can accept less formal facts to be delivered if the visitors leave the museum with their own subjective reflections on the subject matter experienced.

3. If informal learning is not desired, and authoritative enlightenment is needed, the two are better separated, letting the experience design deliver entertainment, and the facts deliver enlightenment on their own respective premises. This requires a more strict discussion about when and where, in a museum context, interactive experience design could be used to give visitor a 'break', potentially avoiding so-called 'museum fatigue' [4].

The first principle encourages a mix of second and third positions in current discourse about exhibition design at museums, favouring more experience-oriented practices, where the experience is an instrument to promote the enlightenment. The second principle encourages the fourth

position, where one can obtain enlightenment and learning through experiences – as in 'experience-based learning' – and get experiences and enjoyment through enlightenment, information and learning – as in 'learning-based experiences' or 'edutainment'. Finally, the third principle encourages the first and second positions, where enlightenment and experience are strictly separated to focus on what each one is best at.

CONCLUSION

We initiated this research through the hypothesis, that the tension of traditions in exhibition design, and its resulting compromises in the design process, are not optimal for either traditions, and serve to create inadequate interactive exhibition designs in which either the experiential or enlightenment-oriented parts are forced upon each other. This study focused on the engagement, interaction, knowledge dissemination, and the educational effect of interactive experiences can craft through gamified installations in an exhibition context. Through the large quantitative data set, triangulated with situated interviews, the study shed light on how visitors understand, respond, and acquire knowledge based on actual users' reactions and expectations over time. The data has shown a clear pattern supporting our hypothesis by demonstrating how attempts to deliver purely fact-based information through didactic design elements fail to succeed in engaging the visitors, since it either competes unfavourably against the play-oriented part of the experience. The interviews however did indicate the presence of a more informal delivery, through the embodied interactions during playthroughs, sparking enlightenment about the subject matter not through the delivery of facts, but through users seeing themselves in relation to the subject matter, and reflecting upon it through playing the games. This might not be the authoritative ideal of traditional museum discourse but gives empirical basis for gamified exhibition design as an enabler of experience-based learning, in which enlightenment is assessed through gained reflections, wonderment and new questions sparked, rather than the transfer of facts alone. This is not to be seen as the only design strategy going forward, but rather a data supported argument for allowing player-based experiences in exhibitions to function on their own terms, and not be forced to adhere to authoritative fact delivery. Rather, interactive exhibition design needs to balance the traditions, by allowing for other types of enlightenment than authoritative fact delivery, while the gamified installations should also not transcend into straying too far away from communicating a message about the subject matter. Our study shows that certain type of enlightenment can arise from building gamified experiences around the facts, but without forcing the facts upon the users.

REFERENCES

[1] Bill Adair, Benjamin Filene, and Laura Koloski (Eds.). 2011. *Letting Go?: Sharing Historical Authority in a User-Generated World* (1 edition ed.). Routledge, Philadelphia.

[2] Panagiotis Apostolellis and Doug A. Bowman. 2015. Small Group Learning with Games in Museums: Effects of Interactivity As Mediated by Cultural Differences. In *Proceedings of the 14th International Conference on Interaction Design and Children* (IDC '15), 160–169. DOI:https://doi.org/10.1145/2771839.2771856

[3] Russell W. Belk. 1995. *Collecting in a Consumer Society*. Psychology Press.

[4] Stephen Bitgood. 2009. Museum Fatigue: A Critical Review. *Visitor Studies* 12, 2 (September 2009), 93–111. DOI:https://doi.org/10.1080/10645570903203406

[5] Trond Bjorli, Inger Jensen, Espen Johnsen, and Gjertrud Sæter (Eds.). 2004. Mellom konservering og konsum. In *Museum i friluft*. Norsk folkemuseum, Oslo.

[6] Graham Black. 2005. *The Engaging Museum : Developing Museums for Visitor Involvement*. Routledge. DOI:https://doi.org/10.4324/9780203559277

[7] Graham Black. 2011. *Transforming Museums in the Twenty-first Century* (1st edition ed.). Routledge, Milton Park, Abingdon, Oxon ; New York, NY.

[8] Brian A. Danielak, Adam Mechtley, Matthew Berland, Leilah Lyons, and Rebecca Eydt. 2014. MakeScape Lite: A Prototype Learning Environment for Making and Design. In *Proceedings of the 2014 Conference on Interaction Design and Children* (IDC '14), 229–232. DOI:https://doi.org/10.1145/2593968.2610459

[9] Kirsten Drotner (Ed.). 2011. *Det interaktive museum* (1. udgave ed.). Samfundslitteratur, Frederiksberg.

[10] Kirsten Drotner. 2015. *Vores Museum. Projektbeskrivelse*. Odense.

[11] Kirsten Drotner, Vince Dziekan, Ross Parry, and Kim Christian Schrøder. 2018. Media, mediatisation and museums. In *The Routledge Handbook of Museums, Media and Communication*. Routledge.

[12] Kirsten Drotner, Vince Dziekan, Ross Parry, and Kim Christian Schrøder. 2018. *The Routledge Handbook of Museums, Media and Communication*. Routledge.

[13] Kirsten Drotner and Ditte Laursen. 2011. Introduction. *Journal of media and communication research* 27, 50 (2011), 1–6.

[14] John H Falk and Lynn D Dierking. 2008. Enhancing Visitor Interaction and Learning with Mobile Technologies. In *Digital Technologies and the Museum Experience: Handheld Guides and Other Media*, Loïc Tallon (ed.). Rowman Altamira, 19–33.

[15] Lene Floris and Annette Vasström. 1999. *På museum: mellem oplevelse og oplysning*. Roskilde Universitetsforlag.

[16] Olivia C. Frost. 2010. When the Object is Digital. Properties of Digital Surrogate Objects and

Implications for Learning. In *Museums in a Digital Age*, Ross Parry (ed.). Routledge, 237–246.

[17] Ben Gammon and Alexandra Burch. 2008. Designing Mobile Digital Experience. In *Digital technologies and the museum experience: handheld guides and other media*, Loïc Tallon and Kevin Walker (eds.). AltaMira Press, Lanham, 35–60.

[18] Christian Heath and Dirk vom Lehn. 2008. Configuring "Interactivity": Enhancing Engagement in Science Centres and Museums. *Social Studies of Science* 38, 1 (2008), 63–91. Retrieved March 9, 2019 from https://www.jstor.org/stable/25474565

[19] Christian Heath and Dirk vom Lehn. 2010. Interactivity and collaboration. New forms of participation in museums, galleries and science centers. In *Museums in a Digital Age*, Ross Parry (ed.). Routledge, 266–280.

[20] Michael S. Horn, David Weintrop, and Emily Routman. 2014. Programming in the Pond: A Tabletop Computer Programming Exhibit. In *Proceedings of the Extended Abstracts of the 32Nd Annual ACM Conference on Human Factors in Computing Systems* (CHI EA '14), 1417–1422. DOI:https://doi.org/10.1145/2559206.2581237

[21] E. Hornecker. 2008. "I don't understand it either, but it is cool" - visitor interactions with a multi-touch table in a museum. In *2008 3rd IEEE International Workshop on Horizontal Interactive Human Computer Systems*, 113–120. DOI:https://doi.org/10.1109/TABLETOP.2008.4660193

[22] Eva Hornecker and Matthias Stifter. 2006. Learning from Interactive Museum Installations About Interaction Design for Public Settings. In *Proceedings of the 18th Australia Conference on Computer-Human Interaction: Design: Activities, Artefacts and Environments* (OZCHI '06), 135–142. DOI:https://doi.org/10.1145/1228175.1228201

[23] Barbara Kirshenblatt-Gimblett. 2000. The Museum as Catalyst. Keynote address, Museums 2000: Confirmation or Challenge. In *Swedish Museum Association and the Swedish Travelling Exhibition/Riksutställningar*. Vadstena, Sweden. Retrieved March 30, 2019 from http://www.nyu.edu/classes/bkg/web/vadstena.pdf

[24] Zeina Atrash Leong and Michael S. Horn. 2014. Waiting for learning: designing interactive education materials for patient waiting areas. In *Proceedings of the 2014 conference on Interaction design and children - IDC '14*, 145–153. DOI:https://doi.org/10.1145/2593968.2593970

[25] Paul F. Marty. 2008. Museum websites and museum visitors: digital museum resources and their use. *Museum Management and Curatorship* 23, 1 (March 2008), 81–99. DOI:https://doi.org/10.1080/09647770701865410

[26] Tomas Gislason Moesgaard, Mass Witt, Jonathan Fiss, Cecilie Warming, Jonathan Klubien, and Henrik Schønau-Fog. 2015. Implicit and Explicit Information Mediation in a Virtual Reality Museum Installation and its Effects on Retention and Learning Outcomes. In *Proceedings of The 9th European Conference on Games-Based Learning : ECGBL 2015*, 387–394. Retrieved March 30, 2019 from http://vbn.aau.dk/da/publications/implicit-and-explicit-information-mediation-in-a-virtual-reality-museum-installation-and-its-effects-on-retention-and-learning-outcomes(b175b650-2cab-40fa-9788-b6ba40d94687)/export.html

[27] Kevin Muise and Ron Wakkary. 2010. Bridging Designers' Intentions to Outcomes with Constructivism. In *Proceedings of the 8th ACM Conference on Designing Interactive Systems* (DIS '10), 320–329. DOI:https://doi.org/10.1145/1858171.1858229

[28] Tobias Olsson and Anders Svensson. 2013. Reaching and including digital visitors: Swedish museums and social demand. In *The Digital Turn: User's Practices and Cultural Transformations*, Pille Pruulmann-Vengerfeldt and Piret Viires (eds.). Peter Lang GmbH, New York, 45–57.

[29] Ross Parry. 2013. The End of the Beginning: Normativity in the Postdigital Museum. *Museum Worlds* 1, 1 (July 2013), 24–39. DOI:https://doi.org/10.3167/armw.2013.010103

[30] Maja Rudloff. 2013. Formidling i forandring. Syddansk Universitet.

[31] David Williamson Shaffer and Mitchel Resnick. 1999. "Thick" Authenticity: New Media and Authentic Learning. *J. Interact. Learn. Res.* 10, 2 (December 1999), 195–215. Retrieved March 22, 2019 from http://dl.acm.org/citation.cfm?id=325370.325387

[32] Nina Simon. 2010. *The Participatory Museum*. Museum 2.0.

[33] Dorte Skot-Hansen. 2008. *Museerne i den danske oplevelsesøkonomi*. Samfundslitteratur. Retrieved March 7, 2019 from https://www.plusbog.dk/museerne-i-den-danske-oplevelsesoekonomi-dorte-skot-hansen-9788770710053/

[34] Dorte Skot-Hansen. 2009. Danske museer som børs eller katedral:-udfordringer fra oplevelsessamfund og oplevelsesøkonomi. *Nordisk Kulturpolitisk Tidskrift* 12, 1 (2009), 140–167.

[35] Loïc Tallon. 2008. Introduction: Mobile, Digital, and Personal. In *Digital Technologies and the Museum Experience: Handheld Guides and Other Media*, Loïc Tallon (ed.). Rowman Altamira, Xiii–XXV.

[36] Fonden Velux. 2018. *Museumsprogram Bevillinger 2015-2018*. Retrieved March 9, 2019 from https://veluxfoundations.dk/sites/default/files/museumsprogram_bevillinger_2015-2018.pdf

[37] Arnold Vermeeren, Licia Calvi, and Amalia Sabiescu. 2018. *Museum Experience Design: Crowds, Ecosystems and Novel Technologies*. Springer.

[38] 2019. Our Museum. *Our Museum*. Retrieved February 20, 2019 from http://ourmuseum.dk/

[39] The North Sea Oceanarium. *Nordsøen Oceanarium*. Retrieved February 20, 2019 from https://en.nordsoenoceanarium.dk/

Towards Designing Self-Facilitated Systems for Exhibition Sites

Rameshnath Krishnasamy

Center for Interactive Digital Media and Experience Design, Institute for Communication & Psychology/Aalborg University, Aalborg, Denmark, krishnasamy@id.aau.dk

Vashanth Selvadurai

Center for Interactive Digital Media and Experience Design, Institute for Communication & Psychology/Aalborg University, Aalborg, Denmark, vashanth@hum.aau.dk

Peter Vistisen

Center for Interactive Digital Media and Experience Design, Institute for Communication & Psychology/Aalborg University, Aalborg, Denmark, vistisen@hum.aau.dk

ABSTRACT

Mobile guides have been part of cultural heritage sites and museum exhibition communication strategy since it was first introduced as a tool for facilitation of the visit and mediation of the content. The mobile guides are part of a technological arsenal in the middle of an ongoing debate about whether exhibitions should focus on 'enlightenment' or 'experience' - and where the user's experience is best balanced between these two outer positions. Human-exhibition interaction has a rich history of designing and developing digital experiences to support users in various exhibition contexts. As such, this study takes its point of departure in examining how to design digital systems that can support users in self-facilitated exhibitions, i.e. sites where there are no personnel present to support the users. We have developed a location-aware smartphone guide, Aratag, that utilizes Bluetooth beacons to serve contextual information at the users request. We have investigated what type of content the institutions perceive as relevant and what the users actually find relevant through user study, which also contributes to the user's attitude towards using smartphones to support self-facilitation in exhibitions. We present the results here, that provide insight about how to design for interplay between the physical setting and the digital platform, that informs the utility, desirability and usability of mobile guides.

CCS CONCEPTS

• **Human-centered computing~Empirical studies in ubiquitous and mobile computing**   • Human-centered computing~Human computer interaction (HCI)   • Human-centered computing~Mobile computing

KEYWORDS

mobile guide, human-computer interaction, exhibition site, context-aware, user experience,

1

1 Introduction

Mobile guides have become synonymous with exhibition communication technology for exhibitions ever since the first electronic audio guide was presented in Amsterdam's Stedelijk Museum. It was a shortwave radio system from 1952 that via a handheld receiver with a connected headset, approximately the size of a current day smartphone, that could link the user to the exhibits through voice-recorded expositions of presented items [69]. Since the introduction of technologies into exhibitions, a long and tempestuous history of technology's role in the exhibition context has shaped current day implementation; there are examples where the technologies are seen as disruptive for the social experience, thus perceived as detrimental to the overall visiting experience [13,54]; and there are examples of how technologies can provide interactive experiences that support users in social and practical situations [2,8] and even attract new users with new and novel ways of experiencing exhibitions [77,78,80].

The world has never been more mobile than today. A multitude of interconnected digital devices and context aware technologies are infiltrating and influencing everyday life, enabling anywhere, anytime access to services and information. The way we think about and use computers has been changed with emerging paradigms such as pervasive and ubiquitous computing. With these paradigms, novel applications built on context-awareness and adaptive interfaces have surfaced. There has been a surge in the number of services and systems, that have sprung up and shaped entire ecologies which utilize the application potential enabled by the mobile centric technological revolution, we have witnessed over the past decade.

Rapid technological advancements and innovations have resulted in devices that have accelerating computational capabilities packed into a small form factor. These devices are armed with a continuously improving arsenal of battery life, memory, processing power, expansive storage, progressively faster networks and increasingly sophisticated built-in sensors. The hardware capacity is extended by development into data mining algorithms, artificial intelligence and machine learning, expanding upon current human-computer interaction (HCI) research.

A trend in convergence of features and functions have resulted in pervasive and ubiquitous personal mobile devices that have extended far beyond their original role as interpersonal telecommunication devices. Today, smartphones have come to epitomize this trend in convergence, leading to adept computing companions that connects the user's physical abilities and cognitive capacities with computational capabilities.

A motivation behind context-aware computing is to identify ways of compensating for limitations in human cognition, e.g., attention, memory, learning, comprehension, and decision-making, through the use of sensor-based and computational tools. 'For example, augmented cognition - originating from military research – seeks to develop methods "to open bottlenecks and address the biases and deficits in human cognition" by continually sensing the ongoing context and inferring what strategies to employ to help people in their tasks' [18,58].

Today, smartphones provide a growing collection of tools for our working lives, social lives, and personal entertainment [28] that can augment, extend and support the cognitive capacity of humans through computational capability offering support for e.g. habit-changing, problem-solving, learning or performing a skill [58] spanning areas such as healthcare, education, entertainment, tourism, banking and governance. The past decade has seen a massive expansion of smartphones worldwide. The most recent reports show that worldwide mobile users will reach 4.68 billion in 2019 [83,84]. The

2

widespread adoption of these devices marks them as one of the most prominent pervasive and ubiquitous platforms in the world.

Emerging digital technologies revitalize past and existing research agendas on using mobile guides in exhibitions. In the light of rising challenges due to budget cuts and a shift towards more automation and self-facilitation, which we will elaborate in the coming sections, to reduce expenses, designing mobile guides needs articulation in order to complement existing agendas related to the use of digital technologies in exhibitions to facilitate the visit. For each incremental iteration of mobile technologies, computational capacities and context-sensing capabilities are improved and expanded upon, that in turn invites topics regarding emerging challenges into the mobile guide research arena.

A topic that persists in the exhibition context is the articulation of communication strategies. Over time, exhibitions have undergone paradigm shifts, that has transformed the practices and roles of sites and personnel. In extreme brief retrospect, we could say that exhibitions have transitioned from "temples of enlightenment" [47,63] where users were invited into a place of knowledge and was enlightened, to a space where users are treated as visitors who are there on their own volitions to fulfil their own needs and wants with attention to the experience [22,61]. This is often referred to as two opposing positions within the exhibition context, namely enlightenment and experience. We will elaborate these two positions from their respective traditions in the following subsection.

Digital technologies are critical to the latter; as exhibitions have struggled with retaining users and their attention throughout a visit, novel mediation techniques, with a strong technological focus have been tried and tested as solutions to invite, educate and entertain visitors. In addition to this, users have been influenced and shaped by the technological advancements in their everyday life, which affects their perception of and expectations to exhibitions. This means that any communication strategy that is the "right one" at any given time will shift because the specification and requirements will change over time as human-computer interaction paradigms changes over time too. Thus, communication strategies for the world today, must investigate current and future trends in technology to arrive at a new status quo that can support exhibition communication for contemporary users. When we say communication, it is implied that mediation and facilitation are parts of that strategy.

Modern mobile phones offer a link between physical places and digital spaces because of their mobility, ubiquity of use and sensitivity to context in which they are used [36]. This close coupling has enabled the development of many applications - both in research as well as the commercial sector. There are games that penetrate the digital-physical barrier to offer new ways of exercising. For example, a mixed reality, location-based game targeting users with sedentary lifestyles to promote physical activity through pervasive and persuasive play [35][37], referred to as exertion games [49]. There are mobile applications targeting tourism to assist exploration [34,39] and a myriad of smartphone services and systems that target human-exhibition interaction (HEI) [79], such as the markerless augmented reality application MovieMaker [76], that uses the exhibition as a backdrop to enable users to shoot a movie with digital augmented layers to enrich the visiting experience.

1.1 Enlightenment and Experience

Smart devices and mobile technologies have in the recent years acquired prime attention because of the context aware technologies that contain the quality to communicate location specific content through multiple media formats e.g. text, audio, video. As such, exhibitions are in a process of deep transformation as a result of the technologically mediated forms of communication [20]. However, the increased focus on new technologies does not come without critic, where practitioners and scholars are concerned about the intense focus on the digital technologies instead of the knowledge that is to

3

be communicated [20,21]. Even though, studies show that digital technologies can substantiate knowledge acquisition [5,14,23,50], the knowledge on educational effect of digital technologies is limited [68], and knowledge about how visitors understand, apply, and respond to new digital technologies is even more limited [29,53]. As such, the need of knowledge is immense about the engagement, interaction, and knowledge dissemination new digital technologies can facilitate [20].

The current need to acquire deep insight into new digital technologies is even more critical by being continuously challenged by the experience economy. Although, the exhibitions have been in competition with the commercial experience providers for almost two decades [44,59,64,65], the discussion still continues on how to retain the classical role as knowledge institutions in the experience economy. The discussion is far from new, and draws on a history dating back to 1970's [46,70]. Since then, the function and evolvement of the exhibitions are characterized by two traditions namely enlightenment- and an experience tradition. The enlightenment tradition is rooted in the Enlightenment's view of culture as a civilized society of informed and culturally formed citizens. In that tradition, exhibitions and other public cultural institutions play a decisive role as institutions of public service. They are guarantors of ensuring what is normatively defined as good cultural quality, and they possess the necessary competence to select and convey the results of their choice to all citizens. That tradition defines culture as a quality, people possess - or can access and learn to appreciate. The users of culture are defined as citizens of a society that priorities information and a particular form of cultural quality. The exhibitions are thus, a gateway to all citizens gaining access to the natural and cultural heritage of society, as defined by the institutions' professional staff [19].

The experience tradition is based on a cultural concept that defines culture as products in a market that competes with other products about the consumer's favor, e.g. concerts, cinema theatres, theme parks [25,64].In this tradition, one is less concerned with a well-defined quality as a tool for social and personal development. Instead, the focus is on culture as a means of understanding and interpretation through in which the users of the cultural product find joy, pleasure or enrichment. These users are not defined as citizens, as seen in the enlightenment tradition, but as consumers, whose access to culture is defined by their economic situation [19].

Both traditions focus on cultural users, where in the enlightenment tradition they are considered citizens, whereas in the tradition of experience they are considered consumers. As such, today, exhibitions maneuver between different, and often conflicting, cultural views and concepts and try to deal with the dilemmas these maneuvers invariably create.

Enlightenment is still a primary function of contemporary exhibitions. But the experience aspect has acquired equal importance in the recent years [64,65,74]. This draws a partial and complementary picture of the complexity and challenge the exhibitions are facing in balancing between enlightenment and experience. The debate on the relationship between enlightenment and experience reflects and underpins the discussion that is taking place not only in Denmark, but also internationally [59,64,65]. This debate has been accelerated because of advancements and adoption rate of technologies. Recent Danish survey shows that non-users of exhibitions often prefer the cinema and music events.

1.2 Background

Guided tours have become an expected visitor service offered in exhibition sites. Although a common activity in most exhibition sites, there is not nearly as much research on the topic of tour guides in the same way visitor studies and educators in exhibitions have been covered [26,30,31,51,71,82], Particular types of guides have been studied, such as safari guides and holiday guides [32,81], but tour guides in a museological context have not been studied in a similar degree [9].

4

As mentioned in the introduction, audio guides were one of the earliest examples of electronically enhanced exhibition technologies that verged into a future of technological mediation, ranging from analog to digital. Although there are several ways of implementing and integrating any technology, the mobility aspect has been a core component of exhibition communication.

In parallel to the technological development, exhibitions have seen major shifts in the way they as institutions view the user. Traditionally, these institutions have been places of "enlightenment" as discussed in the previous section, but over time, they have gradually changed to become spaces for user centered experiences. This extends the technological presence in exhibitions, as both research and practice has showed that interaction within these spaces, whether tangible, in-tangible, analog or digital, can provide beneficial attributes to the overall user experience. This is evident in the explosion of games and playful systems and services that have emerged over the past decades [3,8,27,52]. This also adds a dimension of user *expectations* to the exhibition experience. We argue that the users have become accustomed to a degree of entertainment as part of the leisurely activities.

In more recent times, with the development of digital technologies an aggressive expansion into context-aware guides, that retain the mobility aspect while linking the user with the exhibit, can be observed in both literature and practice. For example, the past ten years have seen an increase in research projects that utilize global positioning, Wi-Fi meshes and Bluetooth beacons to improve or modify the user's experience through location specific content [2,9,67,69,73]. Likewise, as a result of recent development into augmented reality being supported by technology providers such as Apple and Google, an abundance of mixed reality experiences has emerged in both the literature as well as commercial services.

In related literature, the increased learning potential of guided tours are argued for, but also provides critical insight into the drawback of tour guides; it limits the users freedom to engage with the exhibition [15,45]. We see a gap here that could be bridged with smart guides for mobiles as seen in the system presented by Walker [2008]. Removing the role of guidance could prove detrimental to the user's experience, but at the same shifting away from human-facilitated guidance could be beneficial to users who want to take control of their own visit and chose how and when they want to access information pertinent to the exhibition. Walker (2008) presented a system that builds on the notion of exhibitions as "free-choice learning environments" [69] for visitors without any specific objectives. This is interesting because the technology imbues the user with freedom, in a system that offers structure. Past research was however not addressing how to design a system for self-facilitation and the technology is outdated, which makes this particularly interesting to re-examine with new technologies and in a related field of research.

This tells us that the relevance of guidance for facilitation is clearly a required attribute to the exhibition as argued by Best [9], but it is unclear how the current practice of guided tour can properly support this practice through digital technologies [9].

It also raises the question of *content preference* from a user's perspective. The literature is ripe with examples of content designed around testing a specific type of technology, for instance the past decade has seen a massive resurgence in augmented reality applications for mobiles in the exhibition space [1,3,7,77]. However, we have not yet seen an updated articulation of the key that specifically examines self-facilitation in exhibitions. Admittedly, challenges many of the existing services and systems could narrow this gap, but no study aims to investigate this. In particular, we could not find studies that examines content preferences for mobile guides from *both sides of the screen*, where the user's *actual* preferences are studied and what the exhibition personnel *perceive* as the right content. This study investigates this by designing and testing a smartphone guide with content preference in mind.

5

Additionally, we will also investigate the users' attitude towards using mobile guides, in a situation that requires self-facilitation, to gain insight about the use of smartphones in this situation. First, we will present and explain what the elusive term 'self-facilitation' entails in the following section.

1.3 Self-facilitated Exhibition Sites – A Challenging Context for Mobile Guidance

Recent reports indicate that the number of exhibition sites have doubled between 1992-2012 [47] with an estimated 55.000 exhibitions worldwide [72] and are known to serve as international icons for tourism [56] and for developing local and national culture. In recent times, many sites and landmarks have come under 'severe long-term challenges', due to economic and political reasons [43], citing changes in experience economical tendencies [63]. This has led to centralization strategies and efficiency measures, that imply a decommissioning of smaller exhibition sites [42] or reducing personnel in order to free up resources.

This development is in stark contrast to studies that present health benefits and socio-economic impact [4,16,17,60] with predominantly positive implications for human well-being [12] as a result of visiting exhibitions. In response to the rising challenges, institutions consider automation and self-facilitation strategies for extant exhibitions [42]. As such this study was articulated to address the challenge of self-facilitation, drawing on past and existing technological trends. The result is the design and development of a mobile guide.

This study began through collaborative design processes with five institutions responsible for attractions and exhibition sites around Denmark, ranging from cultural heritage sites, museums, zoos and outdoor nature parks. Here one of the (perceived) key challenges articulated by the participating institutions, is wayfinding. The desire to devise a wayfinding solution is tempered by concerns about negatively impacting the visiting experience, by introducing self-facilitated systems, such as an application. Many exhibition sites have 'so much' content that some of the users experience it as 'noise', which could contribute to physical fatigue [10]. Adding another layer could easily be seen as 'more noise'. Additionally, many sites have very authentic and visceral exhibitions and do not desire digital tools or experience design to take center-stage. Related problems have been investigated in projects such as [55] but where three different implementations of digital technologies were tested out in a comparative study. One was a smartphone app, the other a smart card and the third a bespoke item that was a part of the exhibition with an NFC/RFID tag embedded [55]. This presents an example of ways to integrate technology with careful consideration to the exhibition.

We view the two positions, enlightenment and experience in the exhibition context as a place for *information and enlightenment* and a space for *experiences and entertainment*. However, the word enlightenment is seldom used in general definitions, where it is often replaced with education, information, dissemination of knowledge and communication. Likewise, experience is a complex catch-all that in the exhibition context is referred to as enjoyment and entertainment. The point of defining exhibition sites is to be able to broadly refer to a context of complex user experiences due to the duality of intentions; one is to educate the other is to entertain. Thus, exhibition sites are defined as "an environment where institutions communicate exhibits to enrich the user through education and enjoyment".

The definition is a unification of three statements. One statement is from "The Museum Experience", another from the International Council of Museum's definition, and a third statement is from the Danish legislation act for exhibitions in Denmark. The latter is included, as this study is conducted in a Danish context, we studied the requirements and included them in the overall study via this definition [24,33,66].

6

This can be further specified into the following parts, that we argue are integral to designing mobile guides for self-facilitation:

- **Environment** refers to the physical setting operated by an institution. It is "an inclusive term, including a wide range of museum-like institutions such as historical homes and sites; science and technology and nature centers; aquaria, zoos, and botanical gardens; national parks and other such similar settings, as well as the traditional art, history, and natural history museums [24]. The environment requires careful consideration and attention to the setting we operate in, such as, is it an aquarium filled with water tanks? Is it a house museum where we must treat artifacts with care and keep them away from users?
- **Communication** refers to the dissemination of knowledge. This implies considerations regarding facilitation and mediation. Facilitation carries dual sentiments in this context; navigation (e.g. guidance, wayfinding) and learning. Can the user navigate the exhibition? How is learning supported? Mediation relates to how the information is delivered to the user. E.g. physical maps, manuals, labels, signage, or as it is in this case, digital mobile guide.
- **Enrichment** is the (end) result of the interplay between experience and enlightenment. This is the user experience that is modified through the visit, relating to education and enjoyment.

We argue that these three parts of the visiting experience are the central areas of concerns that we need to examine in order to address the challenge of shifting the role or responsibility of facilitation to the user, mediated by a mobile guide.

1.4 Research Questions / Hypotheses

With the current trend in digital technologies, is it possible to design self-facilitated exhibition applications to become useful, usable and desirable for the user? What then are the criteria for the content of mobile exhibition applications to best engage the visitors? How can (perceived) requirements and key challenges, seen from the institution, better be aligned with the actual (realized) user experience of visitors? What are the perceived key challenges?

In order to tackle the challenge of self-facilitation, but without adding extraneous noise to the visit we propose the following two hypotheses to guide the study:

1. the communicated content must first and foremost provide the visitor with a more functional dimension to support their visit (e.g. wayfinding, guidance, practical information, discounts etc.) if self-facilitation use is to be expected. That is unless enough content is removed from the physical contexts and moved into the digital appliance, as some recent state of art has suggested, such as the digital mobile guide in the Museum of New and Modern Art (MONA) where all labels and signage has been removed and the only way to access any information is through the application [48].
2. there is a difference in user experience between different media modalities of content (e.g. long text, short text, audio book, and video snippet). These differences can be understood through the lens of environment communication (facilitation and mediation), and enrichment.

The current state of art of both academia and practice suggest that mobile self-facilitated exhibition design is still challenging to implement successfully – understood as a challenge of not creating the digital component itself, but rather to make it useful, usable and desirable enough to ensure a widespread use by visitors. This is evident in the growing literature that investigates different mediation techniques in combination with past, current and emerging technologies. For example, a game that uses the technical limitations of Bluetooth beacons as a game mechanic to offer a game

7

experience [52], development of personalized guides that provides the user with a tailored visit through context-aware technologies such as [66] and [38] with some aiming to extend the visiting experience by suggesting a subsequent destination for future visits [80], while others try to tackle learning via mobile systems [78].

Thus, we aim to investigate the challenge of self-facilitation by proposing the following research question: how can emerging technologies support users in self-facilitated exhibition sites?

2 Design Research – The Aratag Project

2.1 The Collaborative Research Setup

In the study we participated in a co-design process [62], together with both exhibition stakeholders, software developers, business developers, and the innovation network for experience economy. The authors were thus actively involved in the design process from the first ideation sessions, throughout different design sprints, and till the first live user testing in the context of one of the participating exhibitions.

In 2018, the authors became involved in the collaborative effort together with the company 'Pangea Rocks', who was financing a new venture intro creating a shared application platform for cultural heritage and zoological sites. This constellation involved both a primary technology provider, and a range of exhibitions acting as 'beta-clients' to be involved in a series of co-design design sprints, and to act as field testing context for the development of the mobile platform (see fig 1).
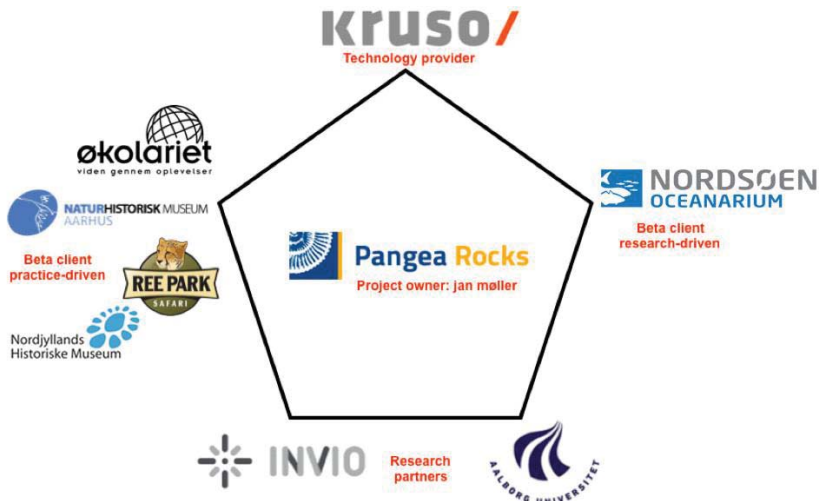
Figure 1: This is an overview of all the collaborating institutions with Pangea Rocks as the project owner, Aalborg University as associated research unit and the "beta-clients".

While the majority of the beta-clients primarily acted as participants in the co-design process, the authors where especially involved and invested in one of the exhibition contexts: The North Sea Oceanarium (NSO). The North Sea Oceanarium has 35 full-time plus 35 seasonal employees and has 150.000 to 175.000 annual visitors. To qualify their 2020 strategy, with a focus upon becoming state

8

of the art regarding digital exhibition technologies by, a collaborative design research cooperation was established with Aalborg University since 2012. From this involvement, the organization has since employed an industrial PhD, which promoted the on-site efforts at this specific exhibition context to be more research-driven than the other three participating organizations in the co-design process. Thus, the initial user studies conducted where also taking place in this research-driven context, prior to testing the platform design as a whole amongst all the involved beta-clients.

2.2 The Aratag Application

The designed application, named Aratag [85], which co-designed and evaluated in this study, is a mobile application for iOS and Android with a web-based CMS platform to create, edit and distribute content across multiple content formats, and with location-aware features available in the exhibition contexts through both Bluetooth beacons and GPS. The application is created as a multi-attraction platform, where different institutions can create their own individual 'shell' to be presented on the applications start screen.

It is a location-based application that utilizes GPS- and Beacon technology to provide location specific content to the users. Concretely, GPS is used to position the device anywhere on the planet (www.gps.gov), which is used to trigger location specific content in the application in outdoor areas. Beacon technology is used to trigger location specific content in indoor areas. Specifically, a beacon emits a unique ID at a given distance, this ID number is captured by a smartphone via Bluetooth, which triggers a local action in the application (source?). Beacon technology can also be used in outdoor areas as well, where GPS technology is limited in indoor areas. Beacons are inexpensive and the battery life usually last for 1-5 years, which makes the technology cost efficient and sustainable.

The Aratag application consist of a main screen presenting the different attractions the user can chose to explore, see figure 2. When clicking into an institution, there are different information available for the user.
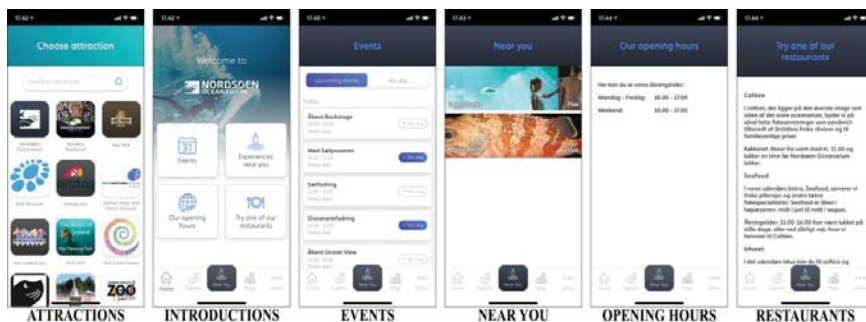
Figure 2: Screen states showing the click-flow from left to right.

The introductions screen presents 'Events', where the user can favorite the events they want to attend. In the 'Experience near you', nearby points of interest (POI) are shown with an approximate distance to the place. In 'Our opening hours' the users can access the opening hours of the day and other related information. ´Try one of our restaurants', presents the available restaurants and their menu. The 'Explore' tab in the bottom shows all the POIs available, see figure 3.

9
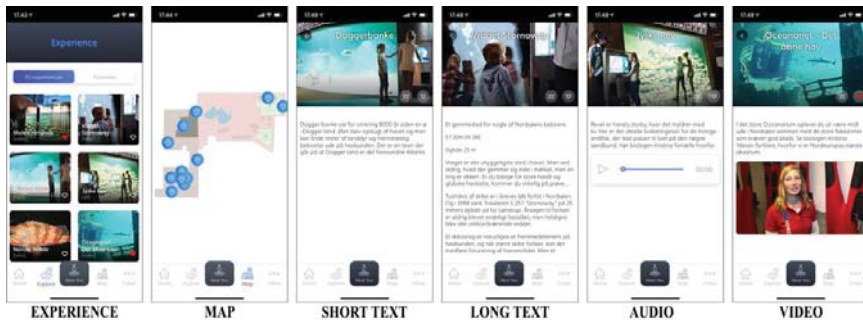
Figure 3: These six screenshots presents the screen states linked to the buttons in the bottom-bar.

'Near You' brings the users to 'Experience near you' tab. 'Map' contains a map of the place, showing the location of the POIs. The users can click on any POI on the map and see the information for that specific location. When reaching a POI, the user can be presented with different content; text, photos, audio, and video. Beacon technology is used to inform the application about the user's location. When the user approaches a specific location specific beacon, the distance to that specific POI decreases and the updated distance is shown in the tap "Near You". The application uses four formats to communicate; short facts, longer text, audio, and video.

3   Research Design

An important aspect to consider, when designing mobile application for use in exhibitions is the challenge of on-boarding users – especially the procedure of facilitating 'the first use' of downloading an application, opening it an immediately realizing its value in the context has proven challenging (e.g. [40,75,76]. The platform design of Aratag, designing a shell for multiple cultural institutions to share, adds a service design dimension of being usable across a multitude of different sites and attractions, with the same user interface standards, interaction modalities, and conventions for the user for all sites. This potentially overcomes one of the oft-repeated onboarding challenges of self-facilitated use: the on-boarding of getting the user to download a mobile application to their own phone while. While not the area of interest in this study, we argue the platform-oriented design of the application has potentially affected the study, since the researched user groups all were aware of the other attractions available on the platform, and also made remarks about the potential effects this availability might have on the desire to use their phone during visits to attractions. As such, we do not study the on-boarding experience of self-facilitated mobile applications but leverage on the platform characteristic of the platform in assessing certain aspects of how the platform might affect the user's evaluation of their user experience with the application.

We reckon that this pre-facilitated on-boarding does create a bias, when assessing the user's behavior with the application in the self-facilitated context of the study, since the 'self-facilitation' becomes restricted to what happens after the application on-boarding has happened. However, we have sought to account for this how the evaluation was conducted, limiting the areas of concern to the following main topics:

- Which content types engaged the visitor most during their visit?
- What are the content preferences for fact-based information through the mobile application?
- How did the visitor experience the use of a mobile app during their visit? (extension, disturbance, tool, personal vs. shared device etc.).

10

- How did the visitor's user experience reflect what they need from a self-facilitated digital exhibition design?

As such, the research design focuses on addressing the content preferences, and assess the use of mobile applications as a guiding tool for visitors when no personnel or other facilitators where present.

3.1 Methods and Frameworks Applied

The user study of Aratag was conducted as field experiment [41], in an authentic exhibition context, with the hypothesis of this being able to reveal unforeseen consequences of users being left with only a digital device to support their experience during a visit, and to observe what the actual behavior is, how they use the content provided, and when and if break downs occur in the user experience.

In preparation for the user studies we created a specific experimental setup of different content types (varying text lengths, audio logs, and video presentations) and paired these different physical locations spread around the exhibition context of the North Sea Oceanarium Aqua zoo. Each content pages were connected to a Bluetooth beacon, prompting the user when they were near-by as well as providing an approximate measure of how far they were from near-by points of interest. The beacon point of interest were spread throughout the entire exhibition context (see figure 4) to enable the assessment of, whether the mobile application, and the location-dependent content, could facilitate the visitors to move around and experience the entire exhibition area (both indoor and outdoor) without any further facilitation or guidance.
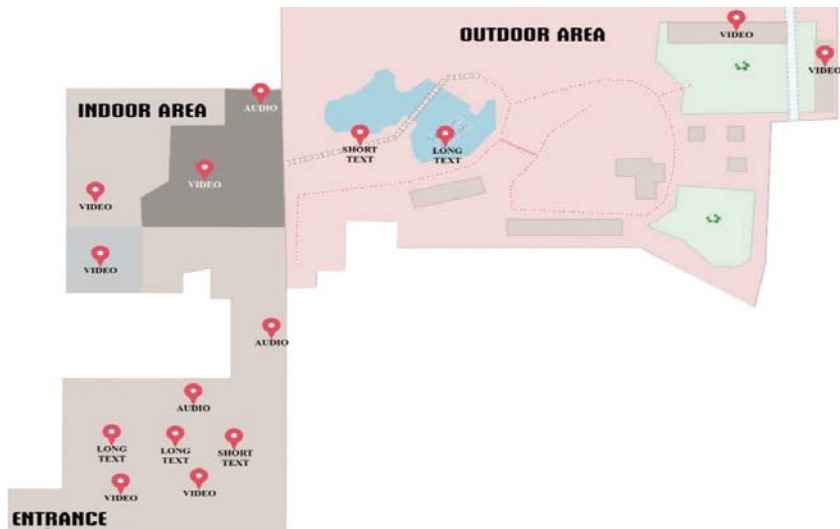
Figure 4: A map of the entire exhibition site with placement of beacons marked out, with a label indicating the content type linked to that beacon.

Together with the curators of the North Sea Oceanarium we enlisted seven families to participate in the field experiment. The enlisted families where a mix of frequent visitors (multiple visits to the exhibition each year), infrequent visitors (visits approximately one time a year), and new comers (first visit to the exhibition). The families consisted of two parents, and children of varying ages, but all in the target audience age of the context of the North Sea Oceanarium.

11

Family	Adults	Children	Total
Family 01	2	2 (6 & 8 year old)	4
Family 02	2	2 (3 & 8 year old)	4
Family 03	2	2 (5 & 7 year old)	4
Family 04	2	2 (11 & 3 year old)	4
Family 05	2	2 (10 & 12 year old)	4
Family 06	2	2 (10 & 13 year old)	4
Family 07	2	1 (3 year old)	3

Table 1: A table with all the participants.

The families were invited to drive at the exhibition at different times in the morning, where the authors gave them a brief introduction to the exhibition context, gave them a mobile device with the Aratag application installed, and gave them a specified time in the afternoon where they were invited to rejoin the authors for a debriefing focus group. Besides, the short introduction, there were no further information given, and no detailed walk-through of the application was given either to avoid facilitating the application use and promote a specific strategy for pursuing the location aware content.

When each of the seven families had been brief and started their journey through the exhibition, two other authors, who were not present at the introduction, used contextual shadowing observation [57] to blend in among the visitors taking field notes about noteworthy interactions, behaviors or conversations happening during their interaction with the application in the exhibition. Some of these field notes were based on actual quotes made by visitors, indicating e.g. frustration or wonderment over something related to using Aratag. Other instances however where based on the authors interpreting non-verbal interactions with both the application, but also the social interactions between the family observed.

The debriefing focus groups where conducted through four setups: one with only one family of four participating, and three with two families participating in each. The focus groups where based on a semi-structured interview guide, following the funneling principles of Morgan [11] by asking initial open questions about their journey through the exhibition, before narrowing down to challenge their opinions about specific point of interest, content types, and interactions between the application, the family and the physical exhibition. The initial broad questions where based on the four general research questions mentioned above, paraphrased into interview questions [6]. The interview questions asked in the latter part of the focus group where based on the more specific behaviors and social situations observed through the contextual shadowing, and where thus not part of the interview guide, but rather based on the field notes of the three authors, merged together to challenge the specific families about details they did, say or omit from our observations.

3.2 Analytical Approaches and Limitations

The user study's observations and concurring focus groups resulted in 2Hrs 15mins of empirical material for analysis in regard to the four overarching research questions in the study. The material was transcribed with annotated time codes and anonymized the participants but identifying they family relation to each other. The data was further codified in themes, acting as broad categories induced based on their relation to each other as well as in regard to the research questions. Each of the overarching themes where codified into sub-topics, which specified more specific instances of e.g. content preferences or wayfinding guidance through the application. Each instance was counted, and visually categorized in an affinity diagram, clustering topics together into the analytical topics covered in section 4.2.

12

4 Results

The following is a presentation of the data collection and a subsequent analysis.

4.1 Presentation of Data

THEMES		TOPICS		INSTANCES		
CONTENT	PRACTICAL INFO	Practical problem first, dissemination secondary	18	45	153	
		Overview and Planning	07			
		Checklist	20			
	MEDIATION	Apps are not attractions	04	77		
		Content value	11			
		Text	14			
		Audio	20			
		Video	19			
		Mixed content	09			
	EXPERIENCE	Experience over enlightenment	01	14		
		Experience can be enlightenment	04			
		Coherent content over the same communicator	05			
		More experience content	04			
	AMBIGUOUS	Enlightenment vs Experience	07	17		
		Discovery through wayfinding	10			
TECHNOLOGY	MOBILE DEVICE	Self-facilitation	07	96	169	
		Social vs Individual	08			
		Disturbance vs Amplification	23			
		Bring your own Device	14			
		Up and Down	27			
		Mostly for Adults – disseminates to children	17			
	WAYFINDING	Usability	06	28		
		Usability enabler	03			
		When does wayfinding give meaning?	19			
	TECHNICAL EVALUATION	Push & Pull messages	16	45		
		Feature Request	10			
		UX & Usability Inhibitor	06			
		More vs less content	13			

Table 2: Here the themes that emerged are ordered in a table that provides a separation of content- and technology-related themes which is further specified into subthemes identified through thematic analysis that relate back to the three areas of concern.

The overarching topics relating to designing mobile guide is the type of content and the use of technology. We identified several themes from our analysis, which were grouped up and subsequently 'dot-voted' to be either included or excluded, from their relevance in relation to the area of concern. The areas of concern are environment, communication and enrichment.

4.2 Analysis of Findings

4.2.1 CONTENT

An exhibition visit starts at the entrance, where pamphlets with practical information can be found, such as opening times, time of special events, and a map of the place showing point of interests, toilets,

13

ice-cream stores, lunch places, play grounds, etc. This is a service that is often complied to help visitors with the most essential information. As such, it was also evident that the families expect all this practical information to be in the application, so they could evade the need to keep track of all the pamphlets, the requirement to visit the website during the visit, or find a guide that could help, etc. Thus, the practical information in the application had a valuable effect on the families, because most of the practical information were gathered in one place. To this point, they did ask for more practical information, such as a calendar with special activities and special deals to plan their visit accordingly. The importance of planning, where also expressed through the way visitors used the experience tab. For example, one of the family members said:

"I especially like the 'experience' tab where you can plan the day's trip, because you cannot remember all those feeding times, so it is better to plan what you want to see" (Appendix)

Some families favored the places they wanted to see in advance, which made the app experience much more personalized for them. Others used the same feature to check if they had been all places. Another set of families took the POI one by one and never made it up to the second floor, as there was no POI there. In particular one said:

"I would probably say that if I went to another attraction in Denmark, where we have not been or have not been for a long time, I think we will take it one by one, so we do not miss anything." (Appendix)

These families placed their trust in the application to navigate them through the entire exhibition. This shows the practical responsibility an application is assigned by a set of users, which must be taken into account in the design process. In addition to planning, a notification system was requested to substantiate the planned journey. The families expressed that it would be convenient for them to be notified when they were approaching a POI or something that needed their attention. However, they also expressed, that it should be in a reasonable amount and be an optional feature. The value of a notification system relies on how it supports the visitors to balance the use time in the exhibition.

In general, the families' opinion was, that the practical needs have to be met before they were motivated to explore other mediated content. This supports the hypothesis that the communicated content must first and foremost provide the visitor with a more functional dimension to support their visit.

There are lot of factors that have to be considered when selecting the formats to mediate content through a smartphone application in an exhibition context. The Oceanarium is a family-oriented exhibition, and therefore their primary target group is families with children. In this situation, children have a major role in how families interact with a smartphone application during an exhibition visit. As such, according to the text format, the families mainly preferred short facts, as longer text was time consuming and already widely available in the exhibition. But they were also increasingly occupied with looking after their children, who were not interested in longer texts. If they used much time on reading the long texts, they were afraid of losing track of their children. In particular one said:

"No, I will never be able to make time for long texts when I have the kids. But it's fine with the small texts so you can read more if you want to know more." (Appendix)

However, some of the visitors did mention that the longer text was more detailed, and therefore preferable for those who wanted to know more. Short texts enriched the families with the most essential facts, who did not have the time and interest to dive deep into certain elements. Longer texts

14

are probably more appealing to enthusiasts, who have a deep interest and want to know more than the available information in the exhibition.

The audio format functioned as an audio guide, which the parents found value in listening when looking into an aquarium that was being mediated about. In particular one said:

"The one who has made the most impression on me is the sound file, where I stood and looked at the little sharks, while she talked about them. This gives a really good understanding of what you stand and look at." (Appendix)

The children did not have that much interest in listening to audio. However, in this situation the parents could hear the audio while also looking after their children. Most often, if the parents had heard something interesting, they passed on the information to their children. Even though, it does not call for a shared listening experience, it however becomes a shared learning experience when the knowledge is pass on. The constraint with the audio format was that it required a less noisy area to be preferable. The families did suggested headphones to solve this problem and also prevent disturbing other visitors. However, it can be argued that headphones might limit a shared family experience.

The video format was the most preferable for families. Especially, the short length of 1-2 minutes appealed well for both the parents and their children. The videos were often watched together, which created a dialogue between the family members about the topics. The parents explained that their children are normally not receptive for signages in exhibitions because they are too long, unappealing, or difficult. In particular one said:

"But I also think in the long term that not many children bother to stand and read long texts. But to see a small video would appeal more, so they can get something more than just looking at a skeleton, and only know how it looked like." (Appendix)

The children are normally distracted by other attractive entertainment that catches their attention more than information posters. In contrast, the videos were much more enriching for their children over the usual posters and signages. To this point, the families also expressed that even smaller videos around 30 seconds would be more preferable with the option to dive into a longer video according to their interest. The video format also sufferers from the same constraint as the audio format in loud areas. However, the families did express that subtitles would have solved this issue for them. In particular one said:

"It would be good if there were subtitles. Because just that you have text, if you miss a little bit because of the surrounding people's sound, you can still easily follow. It could be the last thing that helps it to work optimally." (Appendix)

This somehow contradicts with the attitude towards longer texts. But when the longer texts are facilitated through a video format, the families are much more receptive. It can be argued that the longer text has a characteristic of more education than entertainment, whereas when it is encapsulated in a video substantiating the footage, it is balanced between education and entertainment providing the optimal circumstance for enrichment.

According to a coherent experience, the families expressed that the mediating guide in the video and audio to be an element that created cohesiveness. Especially the guide in the video functioned as a tour guide, that took the families around in the exhibition. Having the same person does add reliability and coherence but could also become too monotonous as well. In particular one said:

<div align="center">15</div>

"Well, I can see the coherence having the same one to communicate, but it can also be monotonous ... so I do not think necessarily it needs to be the same, but that it is the content that have to be coherent." (Appendix)

Therefore, they mostly preferred the cohesiveness to be in the content, in form of theme, difficulty, and length. According to the majority of visitors, a human guide still adds a unique value for the exhibition experience, but they did not find them self in a position, where they needed critical assistance from the guides during their visit at the test day. In particular one said:

"A guide gives great value in special events, e.g. when backstage is open, because it is a real person who stands in front of you and communicates, which makes it memorable. But it is not something you will miss." (Appendix)

Even when families could see the guides in the exhibition, they did not feel to ask them about anything. As such, there is not an immediate need for the visitors to get loaded with information from a guide. It is something they only want, when they ask for it.

In general, the visitors were convenient with the stable level of content difficulty and the way the guide mediated the content. The families expressed that the content was well communicated and easy to understand. It was not too complex nor too simple, but in a level that it both added value for the parents and their children. The families who had visited the Oceanarium before, appreciated the inaccessible knowledge communicated through the application. In particular one said:

"It is always better with more info because we can know more. We have been here many times, and this time we got to know more than we usually do. So, we have learned new things today." (Appendix)

Thus, they express that they learned something new. As such, there was not only an increased interest towards more POI throughout the exhibition but also season-based updates supporting revisits. However, it was also expressed that regular updates only would not initiate a revisit. This clearly shows that the smartphone application is seen as a supporting element for their experience and not the experience itself.

Summing up, a smartphone application has to fulfil the practical needs of the visitors to be considered. The different media formats on a smartphone application have different strengths and weaknesses in an exhibition context. Short texts enrich both parents and children and adds value especially in loud areas. Audio format works best in less noisy areas, where video can include subtitle to be preferable in both quiet and loud areas. This support the second hypothesis about there is a difference in user experience between different media modalities of content, especially in a family-oriented exhibition context. Generally, the families expressed their interest towards having the option to choose the content format, length, and difficulty according to their needs. In particular one said:

"It could be very cool if there were different kinds of content. Because I think some would rather read and others would rather watch a video and vice versa. If you stand with two children, or if there is a lot of sound around you, then it may not be easy to hear, so it will be nice to be able to read it." (Appendix)

This option to choose format arose through their previous experiences with audio guides, which initially was interesting for them but became boring and redundant with the time during the visit. As such, different visitors have different needs, therefore, the possibility to choose content format, length and level of difficulty, were preferred.

16

4.2.2   Technology

All of the visitors were familiar with using different technologies during a visit in an exhibition context and had also explored different smartphone application that supported specific exhibition activities. The visitors had also a good insight in the possibilities a smartphone contained through their everyday use of it. As such the technological feedback from the visitors embarked from this base of acquired experience.

As the expectations for practical information, it was also evident that there were several practical expectations that needed to be fulfilled according to using well-known technologies. One of the major practical expectation is that the technology can support navigation. Not only the test families but most are accustomed users of navigational applications today, such as google- and apple maps. Thus, the navigational feature is a critical element when considering smartphone applications in exhibitions. To this point, the map in the application was criticized not to support neither orientation nor navigation. In particular one said:

"The smartphone knows where you are, but you just miss the dot on the map in the application. The outdoor are is fine, there are paths you can follow, but inside it is just a square and you do not know where you and what level you are on in that square." (Appendix)

The map in the application shows the outlines of the halls in the exhibition, but no indication of where and which floor the families were on. To compensate the limited navigational option, some families tried to use the rangefinder in 'Near You' as a navigational tool to find the POI but became demotivated by the inaccurate distance without any direction to follow. In contrast, one of the families who have visited the exhibition before, expressed that they discovered new areas and exhibits they have not seen on their previous visit through the rangefinder feature. In particular one said:

"That big screen you have, I only discovered it because of the 'Near You' feature. Thought it was a narrative in the aquarium at that location, but I found it to behind the aquarium because of the 'Near You' feature. It was not there the last time we were here. "

However, common to all the families, it is compulsory to know where you are on a virtual map to at least orientate their location in the exhibition. Whereas the rangefinder is expressed to be a good feature for exploration and could be more valuable with an orientation feature. Additionally, to the 'Near You' feature, the visitors also recommended the option to mute the POI that they had visited, so it does not show up multiple times. Furthermore, the families also requested the option to select predefined guided tours, or just have the possibility to choose some recommended routes, as it would add value for those that do not know the place in beforehand. In particular one said:

"I often find that when you come to a place you haven't been to before; it can be hard to navigate or find a good route to follow. Here, I would like to be recommended tours, that I can follow." (Appendix)

These all together elaborates the importance of wayfinding in an exhibition context, which the visitors expect the application to support through the smartphone technology. This also support the hypothesis about the communicated content must first and foremost provide the visitor with a more functional dimension to support their visit.

In general, the families had prior experience in using applications in exhibition contexts. Therefore, it was not disruptive for the visitors to use an application during their visit. Even though the visitors had

17

tried similar products some other places, they expressed that the scale of this application was larger than what they have tried prior. The advantage with this application was, that it communicated through different formats that made good sense in an exhibition. They especially preferred the video and the audio formats in contrast to information heavy signages in the exhibition. Some visitors who did not had the great interest in aquariums and fishes, did expressed that the application motivated them to explore as they had a great interest in new technology. The disadvantage was the required attention that could cause the visitors to lose track of their children. The Oceanarium was also very noisy, which was a challenge to hear the content. The instability with some features and the few numbers of point of interest was a demotivating factor for most of the visitors. In particular one said:

"If you want people to have the application open all the time, you have to provide something all the time. Well. Otherwise you will be lost in this zapper generation." (Appendix)

They expressed that; in a normal use scenario it would have caused the mobile device being put away. As such, it was important for the families that the technology was stable and flawless. Another requirement was that the technology was consistent in providing content throughout the exhibition and not only in certain areas. This show that the visitors want the freedom to choose and not be restricted by limited content.

Usually, when it comes to new technologies, exhibitions provide the needed technology to support the visitor experience. However, the families expressed, that using their own device were more attractive rather than borrowing one for several reasons. Firstly, they are more familiar with their own device. Secondly, they can avoid thinking about sensitive personal elements like photos taken by their children etc. However, they did also express their concern about conflicting interests if everyone in the family had the application. This show how the parents prioritizes a shared family experience and not individual experiences. Normally, the visitors would like to have the mobile device away on family tours, but when it comes to an application made for the purpose, they are more motivated to use it and do not feel it steals the focus. In contrast, they express that it amplifies the accessibility to information, as there is no need to wait for others to move away from the signages or info-screens in the exhibition. As such, the content was the primary element that made the families continuously use the mobile device during their visit. They expressed, that if, it was a first-time visit, they would use the application all the time to explore the exhibition. In particular one said:

"We went with the application open all the time, to see what appeared. I did not pack it away and took it back to look for something new. It was more about exploring exciting things she could tell me that I didn't bother to read about." (Appendix)

Although, one family did mention, that the intense use might also have been caused by being part of the experiment, on a normal visit they might have used it less. At the current state, the interface of the application was mainly expressed to be aimed for the adults. Thus, there was a consensus on that the application had to appeal to all age groups, where different interface designs for different age groups were preferred.

Summing up, it is possible to identify the importance of practical functionality has for smartphone applications in an exhibition context. Peoples accustomed use of mobile devices and applications has created a set of predefined requirements, which they expect to be met by an application using these technologies.

18

5 Discussion

With this study we addressed a very specific challenge, self-facilitation through digital technologies in exhibitions, mediated via smartphones in a guide application. To investigate this field, we designed and developed a system that utilizes Bluetooth beacons that acts as points of interest around the exhibition. There was no particular sequence that the user should access these points, they were there to serve information on the user's behest. That information, relating to the communication aspect of our areas of concern relating to self-facilitation, influenced the way the content was shaped. We were guided by a hypothesis about the content: it must support the user with a functional dimension (e.g. wayfinding, guidance, practical information, discounts etc.) in order for the user to see an initial value of the system.

Therefore, the system had in its backbone a wayfinding feature, that should provide the user with precise information about location. This aspect sought to support the user's navigation within the exhibition. For example, the map in the application shows the outlines of the halls in the exhibition, but no indication of where and which floor the families were on, which did not meet requirement due to inadequate implementation.

Another important factor is that users today have appropriated smartphones as daily drivers for many tasks and activities. As such, when the map function failed to deliver, or met standards they are used to in Apple/Google map apps, it can trigger frustration, negatively impacting the user experience and the reliability of the system. Examples are interaction with the map, such as rotating and scaling functions that did not adhere to standards. This is however something that relates more to the usability aspect and should not be present in a more polished version that has been tested.

The other guiding hypotheses was that the user experience is affected by different media modalities. In a self-facilitated exhibition, where a smartphone application takes the role as the guide, there are several media modalities that can be taken into use to mediate content. As such, in an exhibition context, the different media formats have different strengths and weaknesses. Short texts enrich both parents and children and adds value especially in loud areas. Audio format works best in less noisy areas, where video is the most preferable format and by including subtitle it can become more effective in both quiet and loud areas. This support the second hypothesis. Generally, the families expressed their interest towards having the option to choose the content format, length, and difficulty according to their needs.

Normally, the visitors would like to have the mobile device away on family tours, but when it comes to an application made for the purpose, they are more receptive if it amplifies the accessibility to information and/or provides additional content that is inaccessible in the exhibition. Apart from providing general information, which also have to be in the application, there are an increased desire to access unique/new/seasonal content.

Ultimately, our findings point toward design insights that should be taken into careful consideration, regarding the physical setting, the content and how the user's interaction with the exhibition can result in an enriched experience. The users showed content preferences, with a predilection towards shorter texts and more video, but that does not imply that the institutions should 'dumb down' on information, merely make it accessible, but at the user's request and not by straining their cognitive load by having everything in the exhibitions physical space.

19

6 Conclusion

Backed by the two hypotheses discussed in the previous section, this study was guided by the research question, "how can emerging technologies support users in self-facilitated exhibition sites?".
We targeted the challenge of designing a system that can support the user in self-facilitated exhibitions, by investigating state of the art technologies as platforms for mediation. The resulting application used smartphones and Bluetooth beacons, to offer a context-aware mobile guide.

We found that the users' attitude was positive towards the use of smartphones in exhibitions, and on several occasions voiced that they would indeed have preferred to use the application on their own devices, signaling openness towards institutions implementing a "bring your own devices" strategy. Their content preferences varied, but in general, there was unity regarding entry-level "bite-size" content to sample whether or not the information interests the individual user, and if it does, a possibility to deep-dive into specific content they want to. We see this as an indication for desire to be able to explore more content on their own volition instead of having it thrust upon them by the institution. In out setup, video was the preferred type of content, because it could engage with both the kids as well as the adults, thus enabling situations where the operator of the mobile guide would share it with other members of the family. These insights relate back to the desirability and utility dimensions. The usability dimension, although not something we investigated, did return insight about the use of beacons. Bluetooth beacons themselves were not under scrutiny in this study but was chosen based on market reports and trending consumer technologies. This specific type of technology is highly unreliable at its current stage, and signal strength is inconsistent between devices making it hard to rely on as a stable reliable technology to deliver a consistent user experience across a host of different types of smartphones.
From our findings in this study, we point towards future work where the content size and type on the mobile guide, must be equilibrated with the content size and type in the exhibition, so there is an actual need for an application, and reversely the physical exhibition must not overload the users cognition with a plethoric information. A balance can provide the user with the freedom they need to experience the exhibition as they see fit, while still being enticed to explore the site, and let the technology alleviate the cognitive load from the user by facilitating between the exhibition content and the user.

Future work should aim to better balance the content, the user and the exhibition to be removed from the exhibition and into a mobile guide system. Additionally, the technological landscape should be surveyed to find a better suited delivery system than beacons.

REFERENCES

[1]   A. Damala, T. Schuchert, I. Rodriguez, J. Moragues, K. Gilleade, and N. Stojanovic. 2013. Exploring the Affective Museum Visiting Experience: Adaptive Augmented Reality (A2R) and Cultural Heritage. *International Journal of Heritage in the Digital Era* 2, 1 (March 2013), 117–142. DOI:https://doi.org/10.1260/2047-4970.2.1.117
[2]   Gregory D. Abowd, Christopher G. Atkeson, Jason Hong, Sue Long, Rob Kooper, and Mike Pinkerton. 1997. Cyberguide: A Mobile Context-aware Tour Guide. *Wirel. Netw.* 3, 5 (October 1997), 421–433. DOI:https://doi.org/10.1023/A:1019194325861
[3]   Ajay Aluri. 2017. Mobile augmented reality (MAR) game as a travel guide: insights from Pokémon GO. *JHTT* 8, 1 (March 2017), 55–72. DOI:https://doi.org/10.1108/JHTT-12-2016-0087
[4]   American Alliance of Museums. 2017. *Museums as Economic Engines: A National Report*.
[5]   Panagiotis Apostolellis and Doug A. Bowman. 2015. Small Group Learning with Games in Museums: Effects of Interactivity As Mediated by Cultural Differences. In *Proceedings of the 14th International Conference on Interaction Design and Children* (IDC '15), 160–169. DOI:https://doi.org/10.1145/2771839.2771856

20

[6] Interview Guide Aratag. 2018. Interiew Guide - Aratag. Retrieved from
     https://www.dropbox.com/s/ppi5rim8ulwff4f/Interview%20Guide.docx?dl=0
[7] Clemens Arth, Raphael Grasset, Lukas Gruber, Tobias Langlotz, Alessandro Mulloni, and Daniel
     Wagner. 2015. The history of mobile augmented reality. *arXiv preprint arXiv:1505.01319*
     (2015). Retrieved June 13, 2017 from https://arxiv.org/abs/1505.01319
[8] Rafael Ballagas, André Kuntze, and Steffen P. Walz. 2008. Gaming Tourism: Lessons from
     Evaluating REXplorer, a Pervasive Game for Tourists. In *Pervasive Computing*, Jadwiga Indulska,
     Donald J. Patterson, Tom Rodden and Max Ott (eds.). Springer Berlin Heidelberg, Berlin,
     Heidelberg, 244–261. DOI:https://doi.org/10.1007/978-3-540-79576-6_15
[9] Katie Best. 2012. Making museum tours better: understanding what a guided tour really is and
     what a tour guide really does. *Museum Management and Curatorship* 27, 1 (February 2012),
     35–52. DOI:https://doi.org/10.1080/09647775.2012.644695
[10] Stephen Bitgood. 2009. Museum Fatigue: A Critical Review. *Visitor Studies* 12, 2 (September
     2009), 93–111. DOI:https://doi.org/10.1080/10645570903203406
[11] Michael Bloor, Jane Frankland, Michelle Thomas, and Kate Robson. 2001. *Focus Groups in Social
     Research*. SAGE Publications Ltd, 1 Oliver's Yard, 55 City Road, London England EC1Y
     1SP United Kingdom. DOI:https://doi.org/10.4135/9781849209175
[12] Roger Crisp. 2008. Well-being. *Stanford encyclopedia of philosophy* (2008). Retrieved June 13,
     2017 from https://stanford.library.sydney.edu.au/archives/sum2008/entries/well-being/
[13] Areti Damala, Pierre Cubaud, Anne Bationo, Pascal Houlier, and Isabelle Marchal. 2008.
     Bridging the Gap between the Digital and the Physical: Design and Evaluation of a Mobile
     Augmented Reality Guide for the Museum Visit. (2008), 8.
[14] Brian A. Danielak, Adam Mechtley, Matthew Berland, Leilah Lyons, and Rebecca Eydt. 2014.
     MakeScape Lite: A Prototype Learning Environment for Making and Design. In *Proceedings of
     the 2014 Conference on Interaction Design and Children* (IDC '14), 229–232.
     DOI:https://doi.org/10.1145/2593968.2610459
[15] Christian Dindler and Ole Sejer Iversen. 2009. MOTIVATION IN THE MUSEUM - MEDIATING
     BETWEEN EVERYDAY ENGAGEMENT AND CULTURAL HERITAGE. (2009), 11.
[16] Jocelyn Dodd, Ceri Jones, Andy Sawyer, and Maria-Anna Tseliou. 2012. Voices from the
     museum: Qualitative research conducted in Europe's national museums. (2012).
[17] Jocelyn Dodd and Research Centre for Museums and Galleries. 2014. *Mind, body, spirit: how
     museums impact health and wellbeing.*
[18] Engelbart Douglas Carl. 1962. *Augmenting Human Intellect: A Conceptual Framework.*
[19] Kirsten Drotner (Ed.). 2011. *Det interaktive museum* (1. udgave ed.). Samfundslitteratur,
     Frederiksberg.
[20] Kirsten Drotner, Vince Dziekan, Ross Parry, and Kim Christian Schrøder. 2018. *The Routledge
     Handbook of Museums, Media and Communication*. Routledge.
[21] Kirsten Drotner and Ditte Laursen. 2011. Introduction. *Journal of media and communication
     research* 27, 50 (2011), 1–6.
[22] John H. Falk. 2009. *Identity and the museum visitor experience*. Left Coast Press, Walnut Creek,
     Calif.
[23] John H Falk and Lynn D Dierking. 2008. Enhancing Visitor Interaction and Learning with Mobile
     Technologies. In *Digital Technologies and the Museum Experience: Handheld Guides and Other
     Media*, Loïc Tallon (ed.). Rowman Altamira, 19–33.
[24] John Howard Falk and Lynn Diane Dierking. 1992. *The Museum Experience*. Howells House.
[25] Lene Floris and Annette Vasström. 1999. *På museum - mellem oplevelse og oplysning.* Roskilde
     Universitetsforlag.
[26] Alan J. Friedman. 2007. The Great Sustainability Challenge: How Visitor Studies Can Save
     Cultural Institutions in the 21st Century. *Visitor Studies* 10, 1 (May 2007), 3–12.
     DOI:https://doi.org/10.1080/10645570701263396
[27] Filippos Giannakas, Georgios Kambourakis, Andreas Papasalouros, and Stefanos Gritzalis. 2018.
     A critical review of 13 years of mobile game-based learning. *Education Tech Research Dev* 66, 2
     (April 2018), 341–384. DOI:https://doi.org/10.1007/s11423-017-9552-z
[28] Richard Harper (Ed.). 2008. *Being human: human-computer interaction in the year 2020*.
     Microsoft Research, Cambridge, England.

21

[29] Christian Heath and Dirk vom Lehn. 2008. Configuring "Interactivity": Enhancing Engagement in Science Centres and Museums. *Social Studies of Science* 38, 1 (2008), 63–91. Retrieved March 9, 2019 from https://www.jstor.org/stable/25474565

[30] Eilean Hooper-Greenhill. 1999. *The Educational Role of the Museum*. Psychology Press.

[31] Eilean Hooper-Greenhill and Eilean Hooper-Greenhill. 1994. *Museums and their visitors*. London ; New York : Routledge. Retrieved March 26, 2019 from https://trove.nla.gov.au/version/44621258

[32] Karen Hughes. 1991. Tourist Satisfaction: A Guided "Cultural" Tour in North Queensland. *Australian Psychologist* 26, 3 (1991), 166–171. DOI:https://doi.org/10.1080/00050069108257243

[33] International Council of Museums ICOM. 2017. *ICOM: Museums*. Retrieved March 5, 2019 from https://icom.museum/wp-content/uploads/2018/07/2017_ICOM_Statutes_EN.pdf

[34] Alessandro Inversini and Roland Schegg (Eds.). 2016. *Information and Communication Technologies in Tourism 2016*. Springer International Publishing, Cham. DOI:https://doi.org/10.1007/978-3-319-28231-2

[35] Kasper Løvborg Jensen, Rameshnath Kala Krishnasamy, and Vash Selvadurai. 2010. Studying PH.A.N.T.O.M. in the Wild: A Pervasive Persuasive Game for Daily Physical Activity. DOI:https://doi.org/10.1145/1952222.1952228

[36] Kasper Løvborg Jensen and Lars Bo Larsen. 2008. The Challenges of Evaluating the Mobile and Ubiquitous User Experience. (2008), 11.

[37] Alexander Kan, Martin Gibbs, and Bernd Ploderer. 2013. Being Chased by Zombies!: Understanding the Experience of Mixed Reality Quests. In *Proceedings of the 25th Australian Computer-Human Interaction Conference: Augmentation, Application, Innovation, Collaboration* (OzCHI '13), 207–216. DOI:https://doi.org/10.1145/2541016.2541038

[38] J. H. Kang, J. C. Jang, and C. Jeong. 2018. Understanding museum visitor satisfaction and revisit intentions through mobile guide system: moderating role of age in museum mobile guide adoption. *Asia Pacific Journal of Tourism Research* 23, 2 (February 2018), 95–108. DOI:https://doi.org/10.1080/10941665.2017.1410190

[39] Chris Kerr. 2018. Niantic partners with United Nations to boost tourism using AR games. Retrieved November 21, 2018 from /view/news/331088/Niantic_partners_with_United_Nations_to_boost_tourism_using_AR_games.php

[40] Sara Khan, Rameshnath Krishnasamy, and Claudio Germak. 2018. Design challenges in promoting inclusion for cultural heritage contents through low cost technology. *DS 91: Proceedings of NordDesign 2018, Linköping, Sweden, 14th - 17th August 2018* (2018). Retrieved December 11, 2018 from https://www.designsociety.org/publication/40914/Design+challenges+in+promoting+inclusion+for+cultural+heritage+contents+through+low+cost+technology

[41] Ilpo Kalevi Koskinen (Ed.). 2011. *Design research through practice: from the lab, field, and showroom*. Morgan Kaufmann/Elsevier, Waltham, MA.

[42] Rameshnath Krishnasamy. 2016. Project 07: Self-facilitation in Automated Exhibition Sites. Aalborg University. Retrieved January 8, 2018 from http://ourmuseum.dk/projects/programme-projects/unmanned-exhibition-sites/

[43] Katja Lindqvist. 2012. Museum finances: challenges beyond economic crises. *Museum Management and Curatorship* 27, 1 (February 2012), 1–15. DOI:https://doi.org/10.1080/09647775.2012.644693

[44] Sharon Macdonald. 2002. *Behind the Scenes at the Science Museum* (First Edition edition ed.). Berg Publishers, Oxford ; New York.

[45] Caroline McCaw, Morgan Oliver, and Leyton Glen. 2014. Restaging a Garden Party: Sharing Social Histories through the Design of Digital and Material Interactive Experiences. *NODEM* (2014). Retrieved March 26, 2019 from https://s3.amazonaws.com/academia.edu.documents/36436443/NODEM_2014_Proceedings.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1553643282&Signature=J%2Fly m2GkQQczDaDGkUKJyrE6euM%3D&response-content-

22

disposition=inline%3B%20filename%3DConference_Proceedings_Chapter_Lanz_Fra.pdf#page
=19

[46] Kathleen McLean. 1993. *Planning for People in Museum Exhibitions*. Assn of Science Technology
Ctr, Washington, DC.

[47] John Micklethwait. 2013. Temples of delight - Museums. Retrieved January 8, 2018 from
https://www.economist.com/news/special-report/21591707-museums-world-over-are-
doing-amazingly-well-says-fiammetta-rocco-can-they-keep

[48] MONA MONA. 2019. The O. *MONA*. Retrieved March 26, 2019 from
https://mona.net.au/museum/the-o

[49] Florian Mueller, Rohit Ashok Khot, Kathrin Gerling, and Regan Mandryk. 2016. Exertion Games.
Found. Trends Hum.-Comput. Interact. 10, 1 (December 2016), 1–86.
DOI:https://doi.org/10.1561/1100000041

[50] Kevin Muise and Ron Wakkary. 2010. Bridging Designers' Intentions to Outcomes with
Constructivism. In *Proceedings of the 8th ACM Conference on Designing Interactive Systems*
(DIS '10), 320–329. DOI:https://doi.org/10.1145/1858171.1858229

[51] Mary Ellen Munley and Randy Roberts. 2006. Are Museum Educators Still Necessary? *The
Journal of Museum Education* 31, 1 (2006), 29–39.

[52] Tommy Nilsson, Alan Blackwell, Carl Hogsden, and David Scruton. 2016. Ghosts! A Location-
Based Bluetooth LE Mobile Game for Museum Exploration. *arXiv:1607.05654 [cs]* (July 2016).
Retrieved February 9, 2019 from http://arxiv.org/abs/1607.05654

[53] Tobias Olsson and Anders Svensson. 2013. Reaching and including digital visitors: Swedish
museums and social demand. In *The Digital Turn: User's Practices and Cultural Transformations*,
Pille Pruulmann-Vengerfeldt and Piret Viires (eds.). Peter Lang GmbH, New York, 45–57.

[54] Daniela Petrelli and Sinead O'Brien. 2016. "Mobiles for Museum Visit Should Be Abolished": A
Comparison of Smart Replicas, Smart Cards, and Phones. In *Proceedings of the 2016 ACM
International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct* (UbiComp '16),
1513–1519. DOI:https://doi.org/10.1145/2968219.2974049

[55] Daniela Petrelli and Sinead O'Brien. 2018. Phone vs. Tangible in Museums: A Comparative
Study. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*
(CHI '18), 112:1–112:12. DOI:https://doi.org/10.1145/3173574.3173686

[56] Hannu Piekkola, Otto Suojanen, and Arttu Vainio. 2014. *Economic impact of museums*.
University of Vaasa LEVON INSTITUTE.

[57] Elizabeth Quinlan. 2008. Conspicuous Invisibility: Shadowing as a Data Collection Strategy.
Qualitative Inquiry 14, 8 (December 2008), 1480–1499.
DOI:https://doi.org/10.1177/1077800408318318

[58] Yvonne Rogers. 2006. Moving on from Weiser's Vision of Calm Computing: Engaging UbiComp
Experiences. In *UbiComp 2006: Ubiquitous Computing*, Paul Dourish and Adrian Friday (eds.).
Springer Berlin Heidelberg, Berlin, Heidelberg, 404–421.
DOI:https://doi.org/10.1007/11853565_24

[59] Maja Rudloff. 2016. Formidlingsbegrebets digitalisering i Danmark. Diskursive implikationer
og praktiske konsekvenser. *Nordisk Museologi* 0, 2 (June 2016), 21.
DOI:https://doi.org/10.5617/nm.3012

[60] Lois H. Silverman. 2010. *The Social Work of Museums* (1 edition ed.). Routledge, London ; New
York.

[61] Nina Simon. 2010. *The participatory museum*. Museum 2.0, Santa Cruz, California.

[62] Jesper Simonsen and Toni Robertson. 2012. *Routledge International Handbook of Participatory
Design*. Routledge. DOI:https://doi.org/10.4324/9780203108543

[63] Dorte Skot-Hansen. 2008. *Museerne i den danske oplevelsesøkonomi*. Samfundslitteratur.

[64] Dorte Skot-Hansen. 2008. *Museerne i den danske oplevelsesøkonomi*. Samfundslitteratur.
Retrieved March 7, 2019 from https://www.plusbog.dk/museerne-i-den-danske-
oplevelsesoekonomi-dorte-skot-hansen-9788770710053/

[65] Dorte Skot-Hansen. 2009. Danske museer som børs eller katedral:-udfordringer fra
oplevelsessamfund og oplevelsesøkonomi. *Nordisk Kulturpolitisk Tidskrift* 12, 1 (2009), 140–
167.

23

[66] Slots- og Kulturstyrelsen SLKS. 2013. *SLKS, DK: Museums*. Retrieved March 5, 2019 from https://www.retsinformation.dk/Forms/R0710.aspx?id=162504

[67] Yasuyuki Sumi, Tameyuki Etani, Sidney Fels, Nicolas Simonet, Kaoru Kobayashi, and Kenji Mase. 1998. C-MAP: Building a Context-Aware Mobile Assistant for Exhibition Tours. In *Community Computing and Support Systems: Social Interaction in Networked Communities*, Toru Ishida (ed.). Springer Berlin Heidelberg, Berlin, Heidelberg, 137–154. DOI:https://doi.org/10.1007/3-540-49247-X_10

[68] Loïc Tallon. 2008. Introduction: Mobile, Digital, and Personal. In *Digital Technologies and the Museum Experience: Handheld Guides and Other Media*, Loïc Tallon (ed.). Rowman Altamira, Xiii–XXV.

[69] Loïc Tallon and Kevin Walker (Eds.). 2008. *Digital Technologies and the Museum Experience: Handheld Guides and Other Media*. AltaMira Press, Lanham.

[70] John Terrell. 1991. Disneyland and the Future of Museum Anthropology. *American Anthropologist* 93, 1 (1991), 149–153.

[71] Lynn Uyen Tran. 2007. Teaching science in museums: The pedagogy and goals of museum educators. *Science Education* 91, 2 (2007), 278–297. DOI:https://doi.org/10.1002/sce.20193

[72] UNESCO. 2016. UNESCO: Museums. *UNESCO*. Retrieved March 6, 2019 from https://en.unesco.org/themes/museums

[73] Hamed Vahdat-Nejad, Mohammad Sadeq Navabi, and Hosein Khosravi-Mahmouei. 2018. A Context-Aware Museum-Guide System Based on Cloud Computing. *IJCAC* 8, 4 (October 2018), 1–19. DOI:https://doi.org/10.4018/IJCAC.2018100101

[74] Arnold Vermeeren, Licia Calvi, and Amalia Sabiescu. 2018. *Museum Experience Design: Crowds, Ecosystems and Novel Technologies*. Springer.

[75] Peter Vistisen. 2018. Applied Gamification in Self-guided Exhibitions. *Proceedings From the 1st Gamescope Conference* (2018).

[76] Peter Vistisen, Claus Pertou Østergaard, and Rameshnath Kala Krishnasamy. 2017. Adopting the Unknown through the Known Supporting user interaction of non-idiomatic technologies in exhibitions through known idioms of conventional technologies. *The Design Journal* 20, sup1 (July 2017), S3696–S3706. DOI:https://doi.org/10.1080/14606925.2017.1352875

[77] Vassilios Vlahakis, M. Ioannidis, John Karigiannis, Manolis Tsotros, Michael Gounaris, Didier Stricker, Tim Gleue, Patrick Daehne, and Luís Almeida. 2002. Archeoguide: an augmented reality guide for archaeological sites. *IEEE Computer Graphics and Applications* 22, 5 (2002), 52–60.

[78] Ron Wakkary, Marek Hatala, Kevin Muise, Karen Tanenbaum, Greg Corness, Bardia Mohabbati, and Jim Budd. 2009. Kurio: a museum guide for families. In *Proceedings of the 3rd International Conference on Tangible and Embedded Interaction*, 215–222. Retrieved June 13, 2017 from http://dl.acm.org/citation.cfm?id=1517712

[79] Nan Wang and Liang Xia. 2019. Human-exhibition interaction (HEI) in designing exhibitions: A systematic literature review. *International Journal of Hospitality Management* 77, (January 2019), 292–302. DOI:https://doi.org/10.1016/j.ijhm.2018.07.009

[80] Alan J. Wecker, Tsvi Kuflik, and Oliviero Stock. 2017. AMuse: Connecting Indoor and Outdoor Cultural Heritage Experiences. In *Proceedings of the 22Nd International Conference on Intelligent User Interfaces Companion* (IUI '17 Companion), 153–156. DOI:https://doi.org/10.1145/3030024.3040980

[81] Betty Weiler and Sam H. Ham. 2002. Tour Guide Training: A Model for Sustainable Capacity Building in Developing Countries. *Journal of Sustainable Tourism* 10, 1 (March 2002), 52–69. DOI:https://doi.org/10.1080/09669580208667152

[82] Steven S. Yalowitz and Kerry Bronnenkant. 2009. Timing and Tracking: Unlocking Visitor Behavior. *Visitor Studies* 12, 1 (April 2009), 47–64. DOI:https://doi.org/10.1080/10645570902769134

[83] 2018. Ericsson Mobility Report November 2018. (2018), 32.

[84] Global smartphone shipments 2010-2022 | Statistic. *Statista*. Retrieved February 20, 2019 from https://www-statista-com.zorac.aub.aau.dk/statistics/263441/global-smartphone-shipments-forecast/

[85] Aratag. Retrieved February 8, 2019 from https://aratag.com/#home

24

EAD 2019

Running with Scissors, 13th EAD Conference University of Dundee, 10-12 April 2019

Fruitful Gaps in Digital Literacy: Interpreting gaps in digital literacy among stakeholders in collaborative design research projects as an evolving innovative capacity

Vashanth Selvadurai[ab], Peter Vistisen[b], Claus Andreas Foss Rosenstand[b]

[a]North Sea Oceanarium – Aquarium in Hirtshals, Denmark
[b]Aalborg University – Department of Communication & Psychology
*Corresponding author e-mail: vashanth@hum.aau.dk

Abstract: This paper discusses the problem of assessing shared value from collaborative design research projects through the lens of evolving digital literacy. Through mapping a seven-year co-design case study, based on multiple collaborative design research interventions in the same organisational practice at the Danish aqua zoo 'The North Sea Oceanarium'. The development of contextual literacy is identified as an important dimension when discussing co-design, but also an issue in which the stakeholders rarely will reach equal literacy. However, we argue this gap is not a fault of co-design, but rather an indicator of a gradual mutual increase in innovative capacity among project stakeholders. We argue that the gaps in digital literacy, which may initially be seen as an inhibitor, might evolve to one of the strongest value propositions of collaborative design research projects within the broader area of interest; design of digital media systems.

Keywords: Collaborative Design Research, Co-design, Digital Literacy, Organisation, Exhibition

1. Introduction

This paper discusses the problem of assessing shared value from collaborative design research (co-design) amongst an often-diverse set of stakeholders concerned with design of digital media systems. We discuss the divide as a gap in digital literacy among stakeholders when collaborating during the design process. That is the ability to reflect on opportunities and challenges with a given digital technology in a practice context. This ability is typically not equal among stakeholders of a design research project. A design researcher might have state of the art knowledge about a technology, and a technology provider might have state of art experience in practical issues of the technology. Furthermore, the organisation for which the digital technology might be aimed, might be constituted by both a staff and an organisation culture with little experience of said technology. Finally, the staff of the organisation, or in other cases the customers of the organisation, are also the users, often being spread across a spectrum of e.g. early adopters and late majorities (Rogers, 2003).

AUTHOR'S NAMES (Vashanth Selvadurai, Peter Vistisen, Claus Andreas Foss Rosenstand)

Thus, the diversity of stakeholders creates a challenging mix of different levels of digital literacy towards realisation of a digital technology. This is often seen as a weakness (e.g. Knobel 2008; van Dijk 2005), and as an incentive to focus the collaborative process on creating an equilibrium of literacy amongst stakeholders as soon as possible. However, we argue that difference in digital literacy is not a process of synchronisation, but a process of recognising dynamic gabs between how stakeholders develop digital literacy gradually throughout collaborative research at different reflection levels.

1.2 Challenges of Collaborative Digital Design Research

In design research, one of the oft-repeated challenges is the assessment of what constitutes a contribution (e.g. Cross 1999; Gaver 2012; Wensveen and Matthews 2015). Since Frayling's (1993) division of research on, for, and through design, especially the latter has evolved into an effective methodology of organising design research around active intervention into practice. Research through design reflects on Cross's (1999) suggestion that design knowledge actually resides in artefacts, induced from the process of realising said artefact. A core aspect of this is that it allows researchers to engage with wicked design problems (Buchanan, 1992), becoming active agents in the process, as they attempt creating 'the right thing' (Zimmerman, Forlizzi, & Evenson, 2007).

Later, research programs has arisen to show how multiple design interventions connect to the same general research problem (e.g. Binder and Redström 2006). This served to clarify the role of design experiments (Krogh, Markussen, & Bang, 2015), and how the motivational context of designers influence research practices (Bang, Krogh, Ludvigsen, & Markussen, 2012).

However, less focus has been on the role of literacy in the fast and ever-changing digital design research programs, and how participants evolve digital mindsets. We argue, this is an issue of building a shared literacy of the material design practice, which often divides the stakes between value for practice and value for the design research program (e.g. Vink, Imada, and Zink 2008). This is especially a challenge due to the significant complexity and multidisciplinary nature of digital media projects (Rosenstand, 2001). Thus, the challenge in a co-design research program is how the participating agents have different points of departure according to digital literacy - ranging from state of art research knowledge to novice level from stakeholders not literate as either digital users or producers. This diversity, of digital literacy, can further be seen as both concerning organisational infrastructure (Krishnan & Prahalad, 2008), organisational competency (van Dijk, 2005), and perceived user relevance of media technologies (e.g. Niehm et al. 2010).

1.3 Research Question

We are inspired by how Crossick & Kaszynska (2016) see research value as also being the ability to evolve an organisation's reflective practice, through own individualised learning process. We build on this, by tracing how a multitude of different involvements in the same design program, gradually changed the organisation's mindset, both towards the initiated design interventions, as well as broadening the proficiency in adopting and appreciating research insights.

We examine this through the lens of how digital literacy of a diverse set of stakeholders evolve, and how this literacy is an asynchronous process, involving dynamic gabs between e.g. digital literacy of design researchers and organisational staff. Thus, to assess shared value, in both research and practice, we argue the process is highly dependent on the ability to intertwine the co-design research practice into a shared understanding of how digital literacy eventually catches up while new digital literacy gaps are continuously produced. This proposes an agile process that must be gradually unfolded over time. Such agility to the research practice becomes increasingly important, when the

design process oscillates between e.g. a tangible product focus and more systematic and strategic issues regarding the tangible products as seen in e.g. Nylén, Holmström & Lyytinen (2014).

As such, the research question is: How do collaborative design research projects establish a shared digital literacy over time?

2. Collaborative Design and Digital Literacy

A collaborative design research program contains a multitude of active agents like organisational stakeholders, users, designers, researchers, etc. that collaborate in one or several design projects to share ideas, resources, and capabilities to create interventions (Simonsen & Robertson, 2013). Today one of the crucial issues of collaborative design is supporting digital transformation (Perez, 2002; Brynjolfsson & McAfee, 2012). The digital revolution has not only changed many people's life but also the reality for organisations, as consumer products of today broadly contain digital technologies at their core. Therefore, it is necessary for organisations to adopt new digital technologies from the current economic environment (Brynjolfsson & McAfee, 2012).

Today digital literacy implies a certain set of skills to search, seek, and learn, which requires a cultivated mindset, where it is acknowledged that "... *the way in which disciplines are connected in relation to different challenges are infinite.*" (Rosenstand, Rosenstand, & Øgaard, 2007).

The contemporary conceptualisation of digital literacy cannot be separated from technology in a society where rapid technological change is the norm (Brynjolfsson & McAfee, 2012). The size of the organisation, its culture, differentiation, and managerial attitudes to technology are some of the elements influencing the adoption of technologies. Today building digital literacy is necessary both at an individual- and organisational level in the digitalised society (Jenkins, 2009). Gilster (1997) formulates digital literacy as the ability to use and understand digitised information. Digital literacy is thus concerned with the knowledge possessed about digital technology, the skills necessary to use it and the ability to reflect on digital opportunities and challenges.

3. Case Study - The North Sea Oceanarium

Figure 1. Entrance of North Sea Oceanarium

The setting for the case study is a seven-year collaborative design research involvement with the Danish aqua zoo 'The North Sea Oceanarium' (NSO). The organisation has 35 full-time plus 35 seasonal employees and has 150.000 to 175.000 annual visitors. To qualify their 2020 strategy, with a focus upon becoming state of the art regarding digital exhibition technologies by, a collaborative design research cooperation was established with Aalborg University in 2012. The cooperation from 2012-present has been constituted by participating in the design and implementation of multiple digital projects and reflecting on the challenges of being first mover in providing experiences based on cutting edge technologies in an exhibition context. The projects have involved various

3

AUTHOR'S NAMES (Vashanth Selvadurai, Peter Vistisen, Claus Andreas Foss Rosenstand)

constellations of researchers and organisational stakeholders as leads, but with a core group being involved throughout all activities. The knowledge gained from prior individual collaborative projects in the organisation was taken in as a base for departure. Thus, we argue this case is exemplary to account for the temporal aspects of assessing shared digital literacy in collaborative design research among a broad spectrum of stakeholders of both research and practice - including users (zoo visitors) and digital suppliers.

Data Collection

The basis for the analysis is reflection-on-practice amongst stakeholders during the collaborative research. We see the totality of the collaborative practice as the portfolio of the sum of decisions, constructive activities, and social interactions throughout more than seven years, in an often interwoven and oscillating mix of research and practice activities.

Figure 2. Workshop at North Sea Oceanarium

To outline the co-design, we created a timeline from 2012 to 2018, detailing activities and their relations (Figure 3). This timeline was the basis for hosting a retrospective workshop with key stakeholders, some having been involved in the period from 2012-present.

[Figure 3 moved to next page]

4

	RESEARCH IMPLICATIONS		PRACTICE IMPLICATIONS	
WORKSHOP WITH RESEARCHERS	**Initiation of research program 'The Digital Layer'** User studies and stakeholder workshops mapping the potential for digital experience design at the zoo.	**2012**	**User study report** Initial findings about the existing exhibition.	**WORKSHOP WITH RESEARCHERS**
PARTICIPATION IN PHD PROGRAM	**Upscale to include a 3-year PhD study** Studying different methods to test and simulate contextual experience design in the early stages of design.		**Prototypes of multiple different digital app concepts** Assessing and testing potentials for e.g. augmented reality (AR).	**PARTICIPATION IN PHD PROGRAM**
		2013		
PARTICIPATION IN PHD PROGRAM	**EU funded research project 'AR DOC'** Funds given by the European Union to investigate new forms of digital exhibitions.		**Steering committee** Formation of group of stakeholders meeting quarterly, involving various stakeholders to assess and reframe research and practice goals.	**PARTICIPATION IN PHD PROGRAM**
STUDENT PROJECTS	**Sub-projects with university students** Multiple groups of projects students explored various themes of digital exhibition content - e.g. learning & gamification		**Learning launch of first version of augmented reality app** Workshops and service journey prototyping with staff in the exhibition area, and presentation and demonstrations at staff seminars.	**WORKSHOP WITH RESEARCHERS**
STUDENT PROJECTS	**Innovation workshop exploring 'digital way-finding'** Three weeks of user studies, ideation and prototyping around new digital forms of way finding in exhibitions.		**Video prototypes presented** Video prototypes of way finding concepts are presented for key staff in workshops on further concept development.	**PARTICIPATION IN PHD PROGRAM**
		2014		
PARTICIPATION IN PHD PROGRAM	**Reframing of purpose of digital exhibitions** Studying data on how users' on-board digital exhibition experiences.		**Re-designed material for introduction of augmented reality app** Implementation of signs, monitors, social media campaigns, etc.	**PARTICIPATION IN PHD PROGRAM**
STUDENT PROJECTS	**New project initiated 'Designing the digital restaurant'** Multiple groups of projects students explored digital extensions and experiences in experience park restaurants.		**Mini conference** Presentations and stakeholder debate about prototypes, analytical findings and further development of the restaurant concepts.	**STUDENT PROJECTS**
STUDENT PROJECTS	**Innovation workshop exploring 'Cross Media Storytelling'** Three weeks of user studies, ideation and prototyping around how to tell coherent stories in exhibition service journeys.		**Video prototypes presented** Video prototypes of way finding concepts are presented for key staff in workshops on further concept development.	**STUDENT PROJECTS**
		2015		
STUDENT PROJECTS	**New project initiated 'Mapping Guest Experiences'** Full time user studies and interviews mapping how guests use digital media during a visit in the exhibition.		**Conference presentation** Presenting insights from the AR DOC project for business and experience economy stakeholders at the BizMedia Conference.	**PARTICIPATION IN PHD PROGRAM**
			Persona posters introduced to organisation Insights are combined together with organisational stakeholders into persona posters for internal reference.	**STUDENT PROJECTS**
PHD PROGRAM	**Preparation for hand-off of PhD into new Industrial PhD** Preparation of fund application for large scale exhibition re-design, merged together with new research project within the program.		**Executive summary with strategic recommendations** Reporting the insights of the 'AR DOC', 'Designing the digital restaurant', 'Cross Media Storytelling', and 'Mapping Guest Experiences'.	**PARTICIPATION IN PHD PROGRAM**
		2016		
PHD PROGRAM	**Initiation of 3-year Industrial PhD Study** Studying how to implement a transmedia exhibition design, funded by the Danish ministry of Innovation.		**Launch of new web-site** Co-developed with organisation stakeholders, user tested, and build around the exhibition as transmedia tent pole.	**PHD PROGRAM**
PARTNER IN RESEARCH PROGRAM	**Association with national Museum Research Hub** National project 'Vores Museum' with 5 universities and 8 museums funded by the Velux and Nordea funds.		**New Instagram exhibition implemented** Engaging users through visible Instagram spots throughout exhibition area - iterating based on user study and use statistics.	**PHD PROGRAM**
STUDENT PROJECTS	**Sub-projects with university students** Multiple groups of students explored various themes - e.g. way-finding insights connect with transmedia storytelling.		**Logo re-design** Based on insights from first year of study, a multitude of design proposals were evaluated by organisation stakeholders in workshops.	**PHD PROGRAM**
		2017		
PHD PROGRAM	**Funds received for creating new large-scale exhibition area** Funds given by the Nordea, AP Møller and Vækstforum Nordjylland to create a testbed for new exhibition design with digital transmedia layers integrated from the start.		**Workshop on transmedia universe** Forming the basis for coherent 'North Sea Universe' through employee workshop ideation.	**PHD PROGRAM & WORKSHOP WITH RESEARCHERS**
			High-end iteration on Instagram exhibition Big screen implemented to add visibility in the exhibition context.	**PHD PROGRAM**
STUDENT PROJECTS	**Innovation workshop about Interactive Exhibition elements'** Three weeks of user studies, ideation and prototyping around how to enrich the new funded exhibition area with digital experience design.		**Beacon Technology test** Pre-cursor for the Aratag project - stress testing beacon technology in the exhibition.	**PHD PROGRAM & WORKSHOP WITH RESEARCHERS**
PHD PROGRAM & WORKSHOP WITH RESEARCHERS	**Aratag attraction application** Steering board member and co-creation participant of new app platform for using context aware technologies in exhibitions.			
		2018		
PHD PROGRAM & WORKSHOP WITH RESEARCHERS	**BIG OCEAN WINDOW (BOW)** One of the world's biggest interactive screen. Co-designing with the exhibition staff, concept developers and the technology provider.		**Aratag app test** User test of the app and the content form in the exhibition.	**PHD PROGRAM & WORKSHOP WITH RESEARCHERS**
			Implementing Big Ocean Window Implementation, test and evaluation.	

Figure 3. Timeline with activities from 2012 to 2018

5

AUTHOR'S NAMES (Vashanth Selvadurai, Peter Vistisen, Claus Andreas Foss Rosenstand)

The workshop was explorative and semi structured with prepared themes, while also being open to new themes. The workshop resulted in a mapping of how the NSO CEO, the chief of marketing, the chief of exhibition, and various researchers (PhD-student, assistant professor, and associate professor) reflected upon common activities, and assessed value of contributions (Selvadurai & Rosenstand, 2017; Vistisen, 2016; Vistisen, Østergaard, & Krishnasamy, 2017; Vistisen, Selvadurai, & Krishnasamy, In Press; Vistisen & Rosenstand, 2016).

3.2 Analysis

In this section, we analyse insights from the workshop into a series of themes. The themes were codified by the authors by clustering data with similar arguments or topics. Below, we present the processed themes in a descriptive analysis, and pair these with the gradual realisation of how assessment of value was very much connected to the evolvement of digital literacy amongst the multitude stakeholders.

Motivation for becoming digitally literate

> "What I think has happened is, over the last 5-6 years, is a growing realisation of our visitors' preferences, their lives and the way their lives change. This is where we have had the need to get increased [digital] knowledge into our exhibition. Here we are talking about the digital layer and it is a process of recognition with us, that we need to know something more about what is going to happen and how we can impart extra value to our visitors." – NSO CEO (Laursen, 2017).

NSO sensed that analogue technologies converted increasingly to digital technologies from 2000 and realised that digital technologies were becoming a need to have. They also witnessed the change in their visitors' preferences accordingly and also their digital literacy. This was a primary factor that motivated NSO to increase digital value proposition as well as their digital literacy within the organisation. Even though they had engaged in digital projects since 2010, the relevance of becoming more digitally literate arose when they saw the behaviour of their visitors to surpass their current digital state of art. In other words, the organisation began to fall behind the rapid adoption of e.g. mobile and social media.

The strategy from NSO was an attempt to increase in-house knowledge through cooperation with researchers, and thus increase the competitive advantage. This initiated the cooperation with Aalborg University by 2012. By reflecting back on the cooperation period, the organisation acknowledges that it has also gradually evolved the organisation, where the culture and attitude of the organisation of today are significantly more receptive to digital design interventions (Ydesen, 2017).

Not only technology, but just as much about process

Another theme showed how digital literacy is highly determined by the process of digitalisation, and not just the technology itself. The research institution has to share ownership with the organisation through e.g. applying for funding both for research projects like a PhD, as well as for smaller design experiments not only to realise, but also to anchor the co-design in the organisation. Thus, the employees must be involved to understand the value of research projects to reach a shared ownership, which is paramount to achieve a proper anchoring. Without employees' involvement, the products will be something strange forced into the exhibition and which distance employees to engage in and promote it (Laursen & Berglund, 2017).

6

However, the shared ownership also indicated one of the core challenges of collaborative research effort in terms of negotiating what was the core value to pursue. For instance, there was continuous discussion about the relationship between the enlightenment and entertainment of visitors, and the compromises the organisation was willing to make. The design researchers argued for dissolving this discectomy into a more experience-oriented strategy in which education arose from the experience and interaction with staff. This negotiation was mediated through gradual introduction of different research initiatives like user studies, prototypes being developed and tested, and workshops being held with employees. Thus, a search for a shared value in a research project was articulated as an organisational experiment.

> "The augmented reality app (AR-app) project is a very exciting organisational experiment in relation to which types of compromises one is willing to make when talking about relationship between experience and enlightenment, and where I am the representative for content quality." – Chief of exhibition (Ydesen, 2017).

During the period of the cooperation, the value of co-design evolved understanding for NSO – from being focused on developing a digital layer to actually becoming more digitally literate in working with co-design as a method for gaining better digital literacy. Even though the different projects were product oriented, the processes were just as valuable.

> "In the beginning, the PhD collaboration and the AR-app were not the final result for the PhD project or for us, but it gave a lot of knowledge about implementation and organisational challenges." – Chief of marketing (Berglund, 2017).

> "Had the digitally literate designer not been here, our cooperation could have ended after the first PhD collaboration." – NSO CEO (Laursen, 2017).

The experience acquired from the cooperation with academics from the research institution had its impact on the organisation when employing a digitally literate designer. This was a difference from earlier employees, as their secondary intention was to improve their in-house digital knowledge. This employee can be seen as the digital manager with the responsibility for minimising gap in digital literacy when co-designing with other stakeholders and research institutions.

Suppliers as co-design stakeholders

When assessing the potential value of new technology, it is important that suppliers are selected, not only based on state of the art, but also by assuring that they understand the contextual needs of the organisation and its digital pre-conditions. It defines how well a digital product can be integrated and received by employees with responsibility for creating and sustaining interest. It is not just a question of technology, but also of synchronising the expectations of what value technology can and should realise in the organisation. In co-design projects like these, the supplier becomes a stakeholder whose digital literacy is mutually evolved with the research institution and the organisation. The role of the supplier is more like an advisor who contributes with practice knowledge on the realisation of ideas that are being jointly developed. In other words, the stakeholders' ability to use, understand and reflect on digital opportunities and challenges are on different levels in co-design (Laursen & Berglund, 2017).

NSO acknowledges that the research collaboration has made them better able to differentiate between what the value can and cannot add in terms of actual technology and knowledge (Laursen & Berglund, 2017). This is an important organisational recognition, that digital literacy of the organisation is developed through the process, where the organisation now contains ability to assess what value technology might add, and following that, when to say yes and no to adding technology.

7

AUTHOR'S NAMES (Vashanth Selvadurai, Peter Vistisen, Claus Andreas Foss Rosenstand)

The experience of the organisation has furthermore enlightened the value that design research can infuse into their practice. The in-depth state of the knowledge combined with a broad understanding of practice assisted comprehensive communication with suppliers that spanned the foundation for constructive co-design. The involvement and engagement of a research institution assured better product quality. The positive experience has caused the organisation to enter a new state of the art digital project as a pilot partner, where the involvement of the research institution is the primary reason for engagement. NSO would not have engaged with the state-of-the art knowledge without the research institution as a stakeholder (Laursen & Berglund, 2017). The engagement of the research institution here is perceived as a guarantee for valuable results. This positions the research institution to take part in quality assurance for the organisation, in terms of evolving ability to develop contextual digital potential. This indicates that the organisation is starting to acquire a technology-creating ability with support from a research institution.

Research Complexity

Following the theme of how stakeholders also have co-design stakes in the project, a theme formed around the challenge of merging research perspectives with the practical context of non-design and non-research stakeholders. It was discussed whether the seven years of increase in research activities could be seen a co-evolving reflection on practice, where the increased experience of the organisation with collaborating design processes, enabled their further engagement from e.g. hosting small research experiments, to hiring an in-house industrial PhD student. However, NSO CEO did not see it as an issue of organisational maturity – in which the organisation had to go through interdependent steps (Laursen & Berglund, 2017). Instead, it was articulated as an issue of becoming literate in terms, processes and methods of design research, and thus being able to see ways to implement them in practice.

A core challenge is alignment of language, from the often-academic discourse of design researchers to the day-to-day practical language of the organisation. This alignment does not happen in an instant and has to be co-developed alongside the collaborative design research activities. But even though the establishment of a common discourse is important, it is also articulated as something that cannot rely solely on 'getting everyone onboard' one by one throughout the process. Integration of research perspectives and involvement of research discourses should not be person-dependent, but rather be part of a management initiative to ensure that both practical and academic experiences are anchored in the organisation. As such, the organisational capability to adopt and implement research contributions, are seen as a co-evolving part of increasing organisational literacy in adopting digital technologies. In other words, research knowledge is adopted through a gradual increase in literacy towards the area of research interest. This was visualised during the workshop as how the activities had evolved in complexity (figure 4).
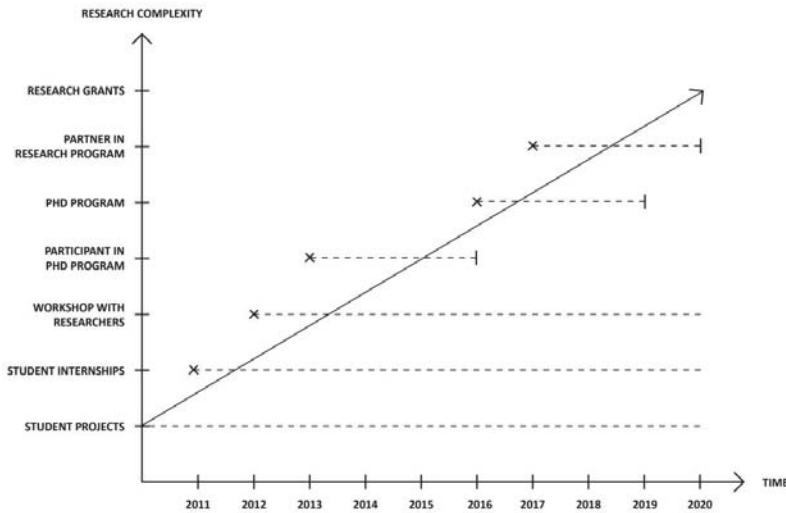
8

Figure 4. Re-drawn version of hand drawn diagram with duration of different activities from 2011 to 2020

This pattern was further evident in how NSO now operates with digital development project, in which they see co-design as a type of 'quality assurance'; not only for getting new digital exhibition elements, but also for gaining knowledge of how to build digital literacy needed to effectively utilise new digital elements. In fact, many of current digital projects being planned within the organisation, can be traced back conceptually to as early as 2012, from early master-student projects and short research workshops. This shows that building digital literacy is not necessarily 1:1 aligned with current collaborative research efforts, but utilised with a certain gap between research activities and organisational implementation. To this point, digital literacy is accumulated.

Dynamic gaps in Digital Literacy among Stakeholders in Co-Design

Co-design requires multiple stakeholders to actively collaborate to create and improve. Collaboration is more than tapping into individual knowledge of internal and external stakeholders. It's also discovering collective perspectives to span the foundation for innovation (Rosenstand, 2012).

> "Organisational learning and readiness are important. It is also about language usage in relation to whether employees understand when you speak. If you come with an academic language different from the language that prevails here. How we can then create common language, should also be considered." - NSO CEO (Laursen, 2017)

The cooperation with the research institution was initiated by some internal advocates of digital transformation in the organisation in 2012. At the start-up, some of the internal managers were reluctant to cooperate with the research institution, since value of digital transformation was not evident at that time - the digital literacy divide between stakeholders was too wide. This was an obstacle to establishing a constructive co-design. The AR-app project started in 2012 is a good example, as the biggest challenge was organisational anchoring, as many employees were reluctant to take ownership because of missing focus on involving staff in the process. Ideally It would have been optimal to anchor the project from the beginning, to reinforce the foundation for co-design

9

AUTHOR'S NAMES (Vashanth Selvadurai, Peter Vistisen, Claus Andreas Foss Rosenstand)

without organisational obstacles. Because of the organisation being the first mover in its field, there were several digital transformation challenges. The organisation had no prior experience or state of art knowledge and only some users were ready for the AR technology in 2012, which made it hard to create broad user interest. Therefore, it was potentially valuable to work with researchers to gain knowledge and collaborate to become a state of art example.

Another digital transformation challenge was not to focus solely on what technology can do, but what the purpose of the technology should be. It is about balancing literacy between researchers, NSO employees, suppliers, and users. During the workshop, the NSO CEO drew two learning curves regarding digital literacy between NSO and research institution, which illustrated a dynamic gap (Figure 5). The gap between organisation and research institution was debated as a measure of digital innovation capacity. If the gap of digital literacy between researcher and organisation is constant over time, it was a consensus that the gap represents an increase in innovation capacity. The research value is assessed from post-reflections; even though the dynamic literacy gap can be a challenge, it is essential to continuously increase the innovative capacity and the common denominator of shared digital literacy in co-design.
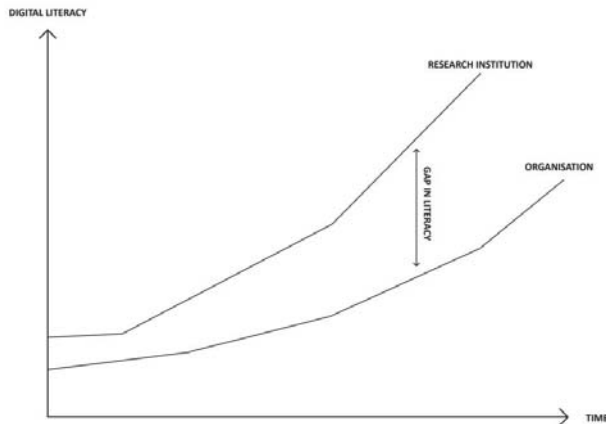

Figure 5. Learning curves drawn during the workshop by the director of the North Sea Oceanarium

The time delay in utilising gathered knowledge from research projects in practice led to a debate about whether it is natural, that it takes time to get different levels of digital literacy to catch up with each other. Many good research results are stored in the organisation and then used *later when* results can be utilised in a practical context. In NSO examples, a two-year gap was mentioned (Laursen & Berglund, 2017). However, it depends on continuous co-creation across different research projects to realise, which apparently also picks up unapplied knowledge. A project, concerning mapping of visitor experiences in 2015 (Figure 3), is a good example as the generated knowledge was not applied when introduced, but was incorporated in a new digital experience guideline in 2018. However, it requires an active effort to gather generated knowledge when the organisation is ready. A precondition is, that generated knowledge can be accessed through formats saved as co-creation design results. An example is how earlier, smaller student projects and design workshops have addressed potentials for digital wayfinding, while the problem is not yet solved, but is a recurring issue in focus, and is now being picked up through active development in 2018.

10

Gaps in Literacy as Innovation Potential?

From analysing the workshops, we have induced how development of digital design maturation of different stakeholders is an important dimension of co-design; we argue that the maturity discussed can be described as a measure of digital literacy.

Four key stakeholder categories of digital co-design have been identified through the workshop: visitor, organisation, supplier, and researcher. Normally and generally digital literacy of researchers is highest, then supplier, then organisation, and finally the visitor. The four key stakeholders represent different steps on what we, inspired by (Schön, 1990), term the *co-design ladder of reflection*. With the following main functions of the key stakeholders on the four steps of the ladder:

Table 1: The co-design ladder of reflection inspired from Schön's ladder of reflection

Schön's ladder of reflection		The co-design ladder of reflection
4	Reflection on reflection on description of designing	The researcher is reflecting on reflection on description of design
3	Reflection on description of designing	The organisation is reflecting on description of design
2	Description of design	The supplier is describing design
1	Designing	Visitors express design needs

Ultimately for developing the co-design ladder of reflection, researchers must, as we do in this discussion, reflect on the whole system of design, description, and reflection. In conclusion, we have a normal and general digital literacy hierarchy as follow: Researcher > organisation > supplier > visitor.

An anomalous situation will make a key stakeholder with less than normally expected digital literacy temporarily obsolete to the co-design. This is not necessarily a bad situation. However, key stakeholders are excluded from the co-design. As an example, we have as researchers designed and described design, and reflected on the description of design, which temporarily excluded respectively visitors, suppliers, and organisation. However, they are again included in the project later - often to learn that we had estimated digital literacy of other key stakeholders incorrectly. Another example is when the organisation is less digitally literate than the supplier (of course in the specific organisational context - not in the specific technical solution) and does not involve researchers such as employed PhD. Then supplier must fill out the three top steps of the co-design ladder of reflection; in best case reducing the co-design to two parties - the supplier and the visitor. This might have been tempting from the organisational point of view, because involving researchers and themselves in co-design is expensive and time consuming. However, it involves a big risk for the implementation in the organisation, because employees might simply not take ownership of the design in the exhibition - e.g. as experienced in the AR-app case not providing necessary technical advice and support to the visitors. The risk of not involving researchers is loss of knowledge and learning, including a big risk of repeating unsuccessful design behaviour.

Another illuminating factor of the co-design ladder of reflection is that dynamic gaps in digital literacy are not a bad thing; actually, it is a precondition for a fruitful co-design project. As how the NSO CEO expressed, that a constant gap in digital literacy is a sign of increasing innovation capacity. If there is no digital literacy gap there is no literacy-difference to constitute the ladder, and thus no push towards furthering a state-of-art. The co-design ladder of reflection also stresses the point, that

11

AUTHOR'S NAMES (Vashanth Selvadurai, Peter Vistisen, Claus Andreas Foss Rosenstand)

researcher, organisation, and supplier are obliged to constantly develop their digital literacy not to become obsolete to co-design and ultimately users; in this case visitors.

The four steps in the ladder of reflection can be aligned with four levels of learning termed by Qvortrup (2003) as (1) qualifications, (2) competencies, (3) creativity, and (4) culture on the digital literacy dimension. Visitors expect digital (enriched) experiences that increase their digital literacy. Therefore, suppliers must have digital literacy competencies to describe and implement state of the art digital solutions in exhibitions. To engage successfully in this as a co-design project, the organisation must have creativity to reflect on the state-of-the-art digital solutions in the specific organisational context, which they e.g. get through visiting other digital exhibition solutions. Finally, the researchers must provide new knowledge to all stakeholders to be cultivated to reflect on the relation between visitor qualifications, supplier competences, and organisational creativity.

In figure 6, the time dimension is x-axis and digital literacy dimension is y-axis. In this frame, the ladder of digital co-design is inserted with key stakeholders. In total, the ladder with stakeholders is on a trajectory towards higher digital literacy. As time goes by, digital potential results in a digital strategy, which results in digital changes that then result in new digital experiences. We argue that figure 6 represent a general and healthy situation for a co-design situation with fruitful dynamic gaps in digital literacy. As argued, anomalies appear and there can be practical or uncontrolled reasons for this. However, it results in exclusion of relevant knowledge and learning, which increases risk of wrong assumptions about digital literacy of excluded parties. To this point, we term the area over the ladder in figure 6 as 'over-reflective', and the area under as 'under-reflective'. If the situation is over-reflective, the visitor and supplier are excluded from the co-design, and if the situation is under-reflective the organisation and researcher are excluded from the co-design.
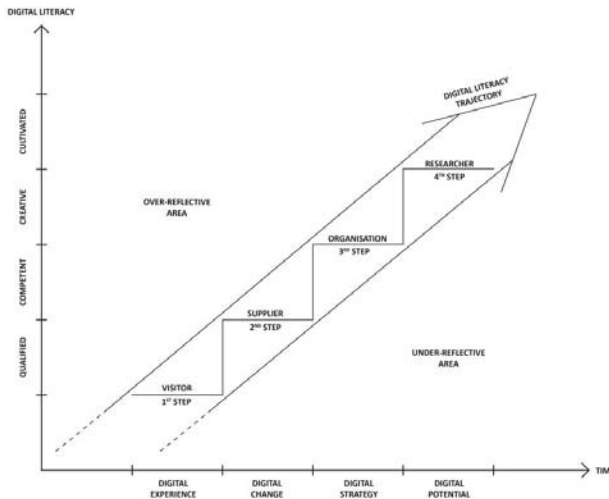

Figure 6. Co-design ladder of reflection

Figure 6 is not considered as a theory describing the actual dynamic reality, and thus we make no general attempts to predict e.g. the time period between each reflective step or how the movement up and down the ladder might look in various edge cases. Rather, the model is outlining a

12

methodology for optimising digital co-design practice, where the main insight from this seven-year study is how the value of persistent collaborative design research effort has been significantly larger than the sum of the individual collaborative design projects, due to the identified co-evolving digital literacies.

Conclusions and Further Perspectives

From treatment of reflections-on-practice from the seven-year involvement with NSO, we unfold the issues regarding how collaborative design research projects establish digital literacy among stakeholders. From the analysis of workshops, we argue how development of project specific literacy is an important dimension for collaborative design in general, but also how it is important to accept how stakeholders will rarely reach equal literacy – gaps will constantly emerge from exploring new aspects of digital technologies. We argue these dynamic gaps are not a fault of collaborative design, but rather an indicator of a gradual increase of innovation potential. Furthermore, gaps foster a culture of being ready to step outside the comfort zone of one's current literacy to further the state-of-art of practice. Seen through this lens, the need to acknowledge how gradual catch-up between e.g. design researchers and a participating organisation is not a process of uncertainty, but a process of gradual increase in organisational innovation capacity, which might first reveal itself a significant amount of time after the design intervention. As argued, this is a beneficial situation for co-design – even though from a non-dynamic perspective it might be interpreted as the direct opposite; especially in early phases of a collaborative design research. The gaps are thus not to be avoided through e.g. enforcing doctrines or strategies to equalise digital literacy between stakeholders. Instead, it is a precondition to a mutual long-term cultivation and growth of digital literacy. Of course, too big digital literacy differences are a threat to coherence of digital co-creation practice.

The co-design ladder of reflection is our synthesised outline of a methodology for optimising digital co-design practice, by providing an argument for why dynamic gaps in digital literacy, which may initially be seen as an inhibitor, might actually evolve to become one of the strongest value propositions of co-design concerning digital technology.

References

Bang, A. ., Krogh, P. G., Ludvigsen, M., & Markussen, T. (2012). The Role of Hypothesis in Constructive Design Research. In *Designskolen Kolding* (p. 11). Retrieved from https://www.designskolenkolding.dk/pure/publication/9557cf57-d3bc-44b5-ae08-ba7daae30704

Binder, T., & Redström, J. (2006). Exemplary Design Research. In *Proceedings of Wonderground*.

Brynjolfsson, E., & McAfee, A. (2012). *Race Against the Machine: How the Digital Revolution is Accelerating Innovation, Driving Productivity, and Irreversibly Transforming Employment and the Economy*. Brynjolfsson and McAfee.

Buchanan, R. (1992). Wicked Problems in Design Thinking. *Design Issues*, *8*(2), 5–21. https://doi.org/10.2307/1511637

Cross, N. (1999). Design Research: A Disciplined Conversation. *Design Issues*, *15*(2), 5–10. https://doi.org/10.2307/1511837

Crossick, G., & Kaszynska, P. (2016). *Understanding the value of arts & culture - The AHRC Cultural Value Project*. Arts & Humanities Research Council.

Frayling, C. (1993). Research in Art and Design. *Royal College of Art Research Papers*, *1*(1). Retrieved from http://researchonline.rca.ac.uk/384/

13

AUTHOR'S NAMES (Vashanth Selvadurai, Peter Vistisen, Claus Andreas Foss Rosenstand)

Gaver, W. (2012). What Should We Expect from Research Through Design? In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 937–946). New York, NY, USA: ACM. https://doi.org/10.1145/2207676.2208538

Gilster, P. (1997). *Digital Literacy* (1st Edition).

Jenkins, H. (2009). *Confronting the challenges of participatory culture: media education for the 21st century*. Cambridge, MA: The MIT Press.

Knobel, M. (2008). *Digital Literacies: Concepts, Policies and Practices*. Peter Lang.

Krishnan, M. S., & Prahalad, C. K. (2008). *The New Age of Innovation: Driving Co-created Value Through Global Networks*. McGraw-Hill Education.

Krogh, P. G., Markussen, T., & Bang, A. L. (2015). Ways of Drifting—Five Methods of Experimentation in Research Through Design. In A. Chakrabarti (Ed.), *ICoRD'15 – Research into Design Across Boundaries Volume 1* (pp. 39–50). Springer India. https://doi.org/10.1007/978-81-322-2232-3_4

Laursen, K. H., & Berglund, S. (2017). *Workshop at North Sea Oceanarium with the CEO Karl Henrik Laursen and Marketing Chief Sylvia Berglund - Part 2* [M4a]. North Sea Oceanarium, Denmark. Retrieved from https://www.dropbox.com/sh/ms6ske4vumn23db/AACKfpeWnAenYsKZE_cpolxoa?dl=0

Niehm, L. S., Tyner, K., Shelley, M. C., & Fitzgerald, M. A. (2010). Technology Adoption in Small Family-Owned Businesses: Accessibility, Perceived Advantage, and Information Technology Literacy. *Journal of Family and Economic Issues*, *31*(4), 498–515. https://doi.org/10.1007/s10834-010-9197-0

Nylén, D., Holmström, J., & Lyytinen, K. (2014). Oscillating Between Four Orders of Design: The Case of Digital Magazines. *Design Issues*, *30*(3), 53–68. https://doi.org/10.1162/DESI_a_00278

Perez, C. (2002). *Technological revolutions and financial capital: The dynamics of bubbles and golden ages*. Edward Elgar Publishing.

Qvortrup, L. (2003). *The Hypercomplex Society*.

Rogers, E. M. (2003). *Diffusion of innovations*. New York: Free Press. Retrieved from http://books.google.com/books?id=4wW5AAAAIAAJ

Rosenstand, C. A. F. (2001). Managing Narrative Multimedia Production. In L. Qvortrup (Ed.), *Virtual Interaction : Interaction in Virtual Inhabited 3D Worlds* (Qvortrup, Lars (ed.), pp. 422–442). London: IEEE Computer Society Press.

Schön, D. A. (1990). *Educating the Reflective Practitioner: Toward a New Design for Teaching and Learning in the Professions* (1 edition). San Francisco, Calif.: Jossey-Bass.

Selvadurai, V., & Rosenstand, C. A. F. (2017). A Heuristic for Improving Transmedia Exhibition Experience. *The Design Journal*, *20*(sup1), S3669–S3682. https://doi.org/10.1080/14606925.2017.1352873

Simonsen, J., & Robertson, T. (2013). *Routledge International Handbook of Participatory Design*. Routledge.

van Dijk, J. (2005). *The Deepening Divide: Inequality in the Information Society*. SAGE. Retrieved from https://www.amazon.com/Deepening-Divide-Inequality-Information-Society/dp/141290403X

Vink, P., Imada, A. S., & Zink, K. J. (2008). Defining stakeholder involvement in participatory design processes. *Applied Ergonomics*, *39*(4), 519–526. https://doi.org/10.1016/j.apergo.2008.02.009

Vistisen, P. (2016). *Animation-based Sketching: an explorative study of how animation-based sketching can support the concept design of non-idiomatic digital technologies* (PhD-thesis). Aalborg University. Retrieved from http://vbn.aau.dk/ws/files/238026522/PHD_Peter_Vistisen_LOW_E_pdf.pdf

Vistisen, P., Østergaard, C. P., & Krishnasamy, R. K. (2017). Adopting the Unknown through the Known Supporting user interaction of non-idiomatic technologies in exhibitions through known

14

idioms of conventional technologies. *The Design Journal*, *20*(sup1), S3696–S3706. https://doi.org/10.1080/14606925.2017.1352875

Vistisen, P., & Rosenstand, C. A. F. (2016). Facilitating Consensus in Cooperative Design Processes using animation-based sketching. *Aalborg University Press*. Retrieved from http://vbn.aau.dk/en/publications/facilitating-consensus-in-cooperative-design-processes-using-animationbased-sketching(a7951d18-c6af-4721-987d-5254caafb464).html

Vistisen, P., Selvadurai, V., & Krishnasamy, R. (In Press). Applied Gamification in Self-Guided Exhibitions: Lessons Learned from Theory & Praxis. Presented at the GameScope Conference, Denmark.

Wensveen, S., & Matthews, B. (2015). *Prototypes and prototyping in design research*. Routledge. Retrieved from http://espace.library.uq.edu.au/view/UQ:344373

Ydesen, K. (2017). *Workshop at North Sea Oceanarium with the Chief of Exhibition Kristina Ydesen - Part 3* [M4a]. North Sea Oceanarium, Denmark. Retrieved from https://www.dropbox.com/sh/ms6ske4vumn23db/AACKfpeWnAenYsKZE_cpolxoa?dl=0

Zimmerman, J., Forlizzi, J., & Evenson, S. (2007). Research Through Design As a Method for Interaction Design Research in HCI. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 493–502). New York, NY, USA: ACM. https://doi.org/10.1145/1240624.1240704

About the Authors:

Vashanth Selvadurai, Industrial Ph.D. fellow at Aalborg University and North Sea Oceanarium. Selvadurai's research focus on generating theory, methods and techniques for creating and implementing an involving and educative transmedia exhibition, which bridges the pre- and post-experience with the actual visit.

Peter Vistisen, Peter Vistisen, Ph.D., is assistant professor at Aalborg University, with a research interest in the intersection between technology and the liberal arts. Peter's research focuses on developing design approaches for early exploration of the viability, feasibility and desirability of digital technologies.

Claus Andreas Foss Rosenstand, Ph.D. Creating Narrative Multimedia Systems, is associate professor at Aalborg University, with a research interest in innovation and management of people, organisation and system development in digital media projects.

15

SUMMARY

The research was an industrial PhD project partly funded by the Innovation Fund and has been carried out in collaboration with the Danish aqua zoo North Sea Oceanarium in Denmark. The host was Department of Communication & Psychology at Aalborg University, where the project was associated with the research centre Interactive Digital Media (InDiMedia) and Experience Design. This project was further associated with the national research program 'Our Museum', which consisted of 13 research projects in collaboration with five Danish universities and eight museums. Part of the research was conducted during the research stay at Royal Melbourne Institute of Technology (RMIT University) in Melbourne and at Griffith Film School (Griffith University) in Brisbane. The area of interest was transmedia experience in an exhibition context, and the general purpose of the thesis was to investigate this domain. As such, the value sought was to generate new theory, methods, and techniques for designing, implementing, and evaluating an involving and educative transmedia experience in an exhibition context, which bridges the pre- and post-experience with the actual visit. This objective was formulated as the following research question.