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Abstract:

Within the context of museums light is often considered as a quantitative measure used only to illuminate.
However, a considerable part of the public identify museums as being uninspiring and non-engaging, and the experience of the visitors therefore has to be set in focus.
The purpose of this thesis is therefore to investigate how the concept of Narrative Spaces can be used to enhance the experience of museums.
With a qualitative visitor-centred approach to holistic lighting design, the thesis seeks to include the visitors and their need to be engaged through body and mind.
By examining research regarding Museum Development, Narrative Spaces, Atmosphere and Experience of Light, different design considerations are defined.
As part of the Design Approach these are formulated into a Conceptual Design Framework consisting of three stages (Projection, Space and Visitor).
To evaluate the applicability of the framework and its ability to accentuate a narrative, it is assessed through a quasi-theoretical Case Study. Through an evaluation of the final design, it is concluded that the framework is applicable (with some iterations) and has potential to accentuate the narrative and enhance the museum experience.

Aalborg University Copenhagen

FACULTY OF ENGINEERING AND SCIENCE

Department of Architecture, Design, and Media Technology
Master of Science

Lighting Design
Master Thesis

Enhancing the Museum Experience

The Development of a Conceptual Design Framework for Narrative Spaces

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Abstract

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Acknowledgements

Since 2014 I have been employed as a developer and designer at No Parking Production.
No Parking is a content provider that specialises in museum exhibitions, where we use storytelling in
combination with interactivity, to achieve a strong visitor experience.
Through my job at No Parking I have worked on several critically acclaimed exhibitions in Denmark -
for example Ragnarock (Museum for pop, rock and youth culture), the newly opened Wadden Sea
Centre and Den Gamle By in Aarhus. Amongst other lighting projects, I last year designed lighting for
four different locations during the Copenhagen Culture Night.

Recently, I have through No Parking been involved in the Strandingsmuseum St. George, which the
quasi-theoretical case study of this thesis revolves around.

Contents

1   Introduction

Lighting has always been used as a natural part of museums, yet there is a fundamental need for change in the way we think of light in the context of the museum.

Most often the use of artificial light is solely implemented to meet the practical and functional needs of the exhibit: to create visibility and illumination of artefacts. Light is seen as an quantitative measure, dominated by photo-metrics and light exposure levels. The preservation of artefacts seem to out rule the experience of the visitors.

By reevaluating how museums could make use of modern lighting technologies and design, it is possible to support the demands of preservation, while improving the museum experience of visitors. Making a shift from the quantitative to the qualitative aspects of the museum design is challenging, as assessing the success of a museum exhibition qualitatively is a more nuanced and complex process, than sole quantitative data in form of numbers and scales (Shettel [1]).

The need for change is important as a considerable part[1] of the public see museums as being dull and un-engaging (Kobbernagel and Drotner [2]). To alter this belief, it is necessary to place the experience of the visitor in focus, by changing the centre of attention from object to subject. With a visitor-centred approach, lighting will become a greater part of the experience of a visit.

The need for change is becoming progressively more important, as visitors to a greater degree than before are not only more experienced, but also more educated, and therefore have higher expectations and requirements to the museum visit. Visitors need to feel included and engaged, through their body and their mind, and not only act as passive recipients of academia. Experiences in the museum, as an to informal learning setting, has to match or even exceed alternative leisure activities available (Black [3]).

It could be possible to use the potentials of lighting to accentuate the narrative elements in a museum experience, where visitors do not solely see an exhibition as passive spectators, but rather are included within the narrative space, through the atmospheric qualities of lighting. A conceptual design framework to guide the process of design could aid in designing such experiences.

This recent tendency of accentuating the narrative through spatial experiences can be seen in many newer museums and museum renovations (especially in Denmark).

Another issue is that modern technologies (specifically video projections) to a greater extent are being implemented into the museum space, but often not integrated into the space, but rather act as two dimensional incongruous elements that focus on function, rather than on creating an engaging atmosphere. An example of this is using video projections are used to explicitly inform of facts, rather than telling a narrative and creating a mood in the space.

Medias have to melt together, from the screen to the space - bringing the two worlds together as one entity, a Narrative Space. Here it is crucial for the exhibition design that visitors of the narrative space become an integrated part of the museum experience.

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[1]26% of the Danish Youth (Kobbernagel and Drotner [2])

1.1   Thesis Structure
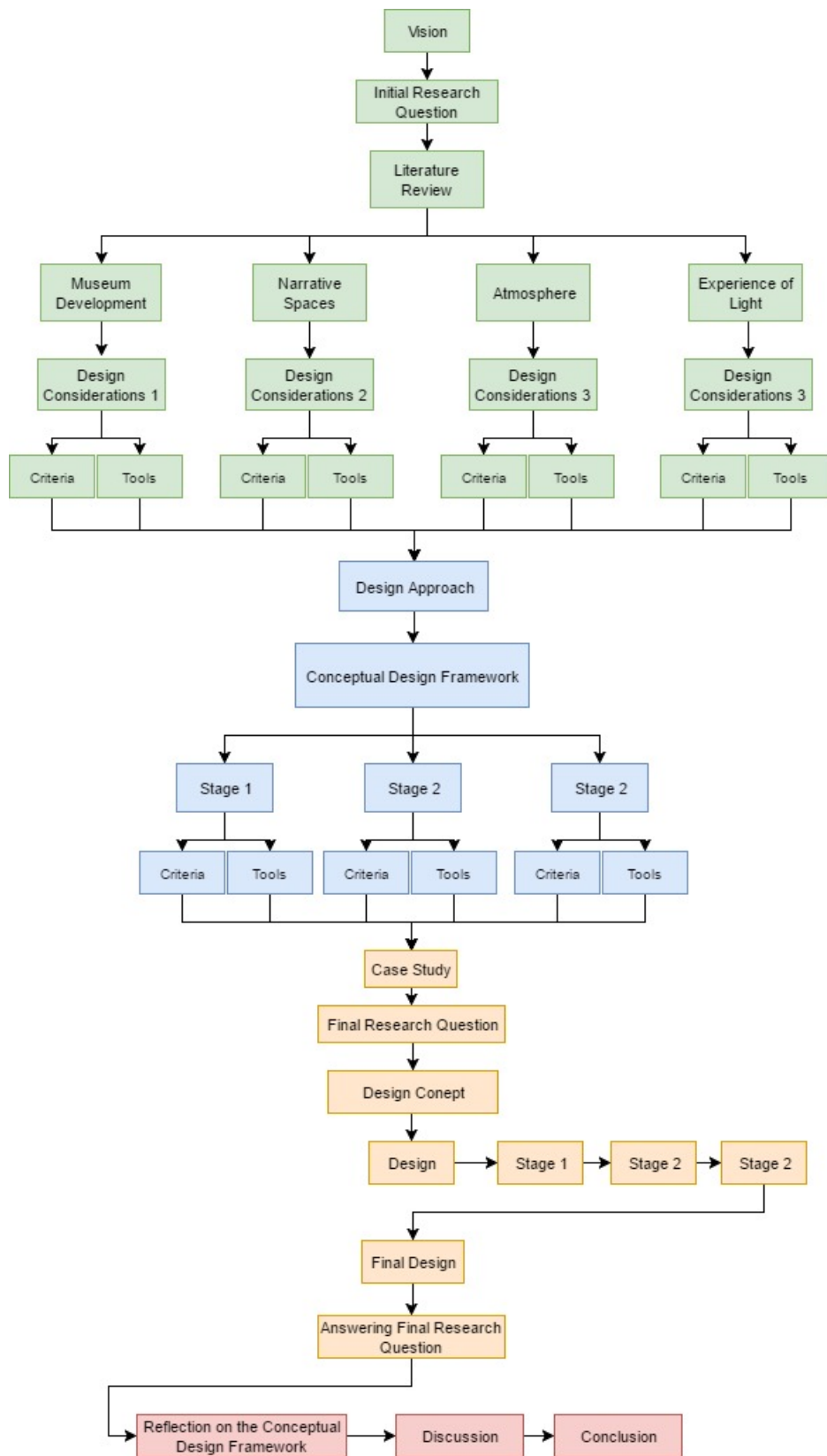
Figure 1: The structure of the thesis described by a flowchart.

2 Vision

Imagine if it was possible to extend a museum narrative beyond the physical space through design of light to form unique and memorable total experiences for the visitor

The Vision consist of three key components, as the target I wish (*To extend a museum narrative beyond the physical space*), with the method (*through the design of light*) and the final ambition being (*to form unique and memorable total experiences for the visitor*).

The target of this thesis is to extend the museum narrative beyond the physical space through the method of lighting design; to create a space out of the ordinary where light and space in combination accentuate the exhibition narrative as a holistic experience. Through this, I ambition to form unique and memorable total experiences for the visitor, where visitors become an included part of the narrative in one total experience.

To help achieve this Vision, an Initial Research Question will be asked. As a fundamental starting point of this thesis, this is done to focus the work and provide direction for the later stages.

2.1 Initial Research Question

The Initial Research Question sets the topic of interest related to this thesis and the presented Vision [2], with the aim of making it possible for new theories to emerge. The Initial Research Question is asked out of both academic and personal interest within the field of museum design, and arises from the practice of my professional work[2]. The desire is to help fill the gap in knowledge within this field, by testing theories and methods in preparation for the forthcoming Case Study.

The Initial Research Question is as follows:

How can Narrative Spaces be created through a visitor-centred approach to lighting design in order to enhance the museum experience?

Equivalent to the Vision, the Initial Research Question too consists of the three key components; Ambition (*enhance the museum experiences*), method (*a visitor-centred approach to lighting design*) and target (*creation of Narrative Spaces*).

The intention is to gain an understanding of how museums can make use of Narrative Spaces, to accentuate the exhibition narrative being mediated. This is with the assumption that Narrative Spaces do in fact enhance the museum experience. As a method for achieving this, this thesis will focus on how qualitative lighting design can be used as a visitor-centred approach, to create narrative spaces that enhance museum experiences as an end target.

Within the scope of this thesis, the following Literature will now be presented. This Literature Review will present the theories and key concepts of other researchers to set my work in perspective to what others have found, and possibly provide evidence that may be used to support the findings of this thesis.

3 Literature Review

The Literature Review will deliberate published material in the particular topics of this thesis, with the intention of establishing a foundation of knowledge to help create insight that can contribute to answer the Initial Research Question [sec. 2.1]

As previously stated in section [2.1], the presented Initial Research Question forms the basis of the Literature Review. As can be seen in the illustration in 2, the Literature Review will begin with presenting the overall context of this thesis (Museums).

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[2]Profession: Lighting designer and developer at the company No Parking Production, which delivers digital storytelling for museums.
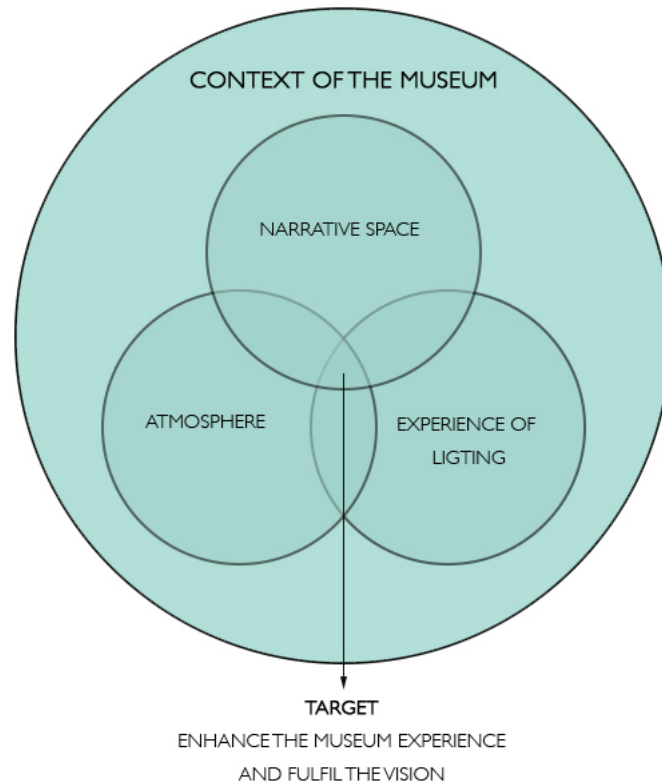
Figure 2: The three main topics of this thesis (Narrative Spaces, Atmosphere and Qualitative Lighting Design) overlap in in the museum context, with the target of enhancing the museum experience and fulfilling the Vision.

The first section is devoted to provide the necessary background understanding of *Museum Development* [3.1]. The purpose is to provide a historical background for how the traditional museums have changed through time, and define some of the problems associated with the traditional approach of museums. This section also includes a theoretical framework on how to reach visitors based on their personal, sociocultural and physical contexts, which can be used to sustain inspiration, learning and enjoyment for the visitor.

To help create successful Narrative Spaces, that accentuate the exhibition narrative being mediated, a section is devoted to *Narrative Space - The art of exhibitioning* [3.2]. This section will account for the possibilities of physical museum spaces, and how spaces can designed to mediate narratives with the visitor experience in focus. Through Narrative Spaces it could be possible to transcend spaces into a place, through organisation and means of storytelling, which potentially could help meet the ambitionq q of the Initial Research Question, to enhance museum experiences.

This section is followed by an introduction to the concept of *Atmosphere* [3.3], which could be used as a visitor-centred approach to re-structure spatial experiences. Atmosphere will in this thesis be based on the theory defined by Böhme, who speaks of the bodily experience that we experience in spaces in which we are present, and how space can be manipulated through generators, such as lighting design.

A final section is afterwards devoted to *The Experience of Light* [3.4], which seeks to provide some design methodologies and guidelines as to how lighting design can be used as a method for answering the Initial Research Question.

Followed by each individual section, a sub-section will be devoted to define the essential design considerations which could be relevant in the later Design Approach [4].

3.1 Museum Development

"People are not hard to reach. Museums are hard to reach"
Dea Birkett, Creative director at Kids in Museums

Through a 50 year period there has been a profound change in the role of the museums and their visitors. Previously, the relationship was one-dimensional, the museum was an authority, that communicated to those who understood how collections were to be understood and interpreted.

However, recent developments in the museum world have made a change in how the public is recognised and many museums are now trying to work to accommodate the diversity of the public. The Museum Association adopted the change around two decades ago (1998), and rewrote their definition of museums; *"Museums enable people to explore collections for inspiration, learning and enjoyment. They are institutions that collect, safeguard and make accessible artefacts and specimens which they hold in trust for society".*[3] (Mus [5])

It is evident that visitors are individuals, with their own experiences, expectations and perceptions, who construct personal meaning that can work against the intentions of the exhibition organisers. Lang et al. [6] elaborate; *"whether or not museums are able to successfully build new audiences and offer high-quality experiences to a wide range of people in the long term depends largely on whether those who run museums believe that they should be exclusive or inclusive"* (Lang et al. [6] p. 38). What Lang et al. state is that it is up to the museum whether or not they manage to be be inclusive in the experiences that they offer for the diversity of the future visitors.

Bennett [7] argues in his article *The birth of the museum: History, theory, politics* that part of the problem with traditional museum thinking is that vision is unarguable seen as paramount over other senses. This conservative way of thinking, is partly caused by the way traditional museums present themselves in their marketing material, which invites visitors to *"see"* and *"look at"* the exhibitions. Hence museums are often seen as a space of observation, rather than a place of experience and engagement. Instead, museums should take on the role of being the storytellers that they could be. By creating a holistic story-line that brings a narrative connection between their artefacts, exhibitions, physical space, atmosphere and visitors, it is possible to help improve the museum experience to be more inclusive.

Christidou and Diamantopoulou [8] suggest that visitors' experiences take basis in physical and performative interactions between the exhibit and other visitors, and therefore must be evaluated according to that.

Christidou and Diamantopoulou [8] argue for the embodied experiences, influenced by the museum and its exhibits, and how these impact multimodality of gesture, gaze, physical movement and conversation through the museum visit. What they state in their article is; *"By drawing upon multimodality, we show how talk, gesture, gaze and elements of the material context blend together and contribute to the production of meaning.",*

Christidou and Diamantopoulou [8] continue; *"although both visitors and curators assume that people come to 'see', they actually do a lot more than that. Visitors act upon the performance by staging their own, one which is prompted by gaze and delivered by movement."* Christidou and Diamantopoulou refer to this as the visitor agentive engagement, that drive visitors by their personal interest and the stimuli given in the specific context. As an example of this, Christidou and Diamantopoulou refer to the relevance of an artwork, that does not come directly from the qualities of the physical artwork, but more from the visitors who stop to engage with it, influenced by their personal interest. Personal interest of visitors can not directly be manipulated, but museums and exhibit design can influence the way the exhibit is presented to encourage particular behaviour and facilitate interest. This is about taking advantage of the highly positive emotional attachment to museums that both visitors and non-visitors have to these cultural institutions (BritainThinks for Museums Association [9]). However, one thing that is evident regarding the museum visit, is that a museum visit should provide visitors with the opportunity for learning something new, to gain understanding and to widen their personal perspectives. To do so, different contextual aspects need to be taken into consideration.

3.1.1 Contextual Model to Understand Visitor Learning

Falk and Storksdieck's [10] *Contextual Model of Learning* is a theoretical framework for learning within a free-choice setting, that has been set in relation to the museum world. The museum experience of the

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[3]The previous definition was *"A museum is an institution that collects, documents, exhibits and interprets material evidence and associated information for the public benefit."*

visitors are therefore influenced by the context in which they are viewed, how the exhibition is understood and presented. Falk and Storksdieck [10] presents three key contexts that have shown to individually influence learning outcomes of museum visitors, through the complex combinations of the three contexts. As seen in fig. 3 the Personal, the Sociocultural and the Physical contexts all overlap in the process of learning, which suggest that all three have to be seen in connection with each other. Figure 3 is a Venn diagram interpretation of the theory of Falk and Storksdieck [10].
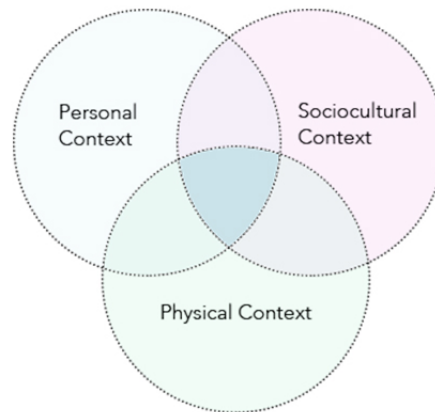
Figure 3: Contextual Model of Learning defined by Falk and Storksdieck. The blue are in the middle is where an experience should lie.

Personal context
Personal interest and agentive engagement drives learning. These are based on prior experience and knowledge which act as the foundation for the new knowledge being constructed. How memories and knowledge are stored are influenced by the emotional value in which they are experienced – the stronger the positive emotional value is, the higher the chances are that the knowledge is to be stored. Learning is especially effective if driven by intrinsic motivation, which acts as self motivated learning, where visitors engage in a behaviour or activity because it is personally rewarding, and not externally rewarding (Falk and Storksdieck [10], Ryan and Deci [11]).

What motivates one to learn in a museum context is, according to Falk and Storksdieck [10], interest and curiosity. An experience of flow can be triggered by an exhibition or exhibit, if it is enjoyable from different perspectives and layers. In a state of flow, a visitor will lose track of time and feel a complete involvement in their experience. (Nakamura and Csikszentmihalyi [12], Csikszentmihalyi [13])

Sociocultural context
Museum experiences are often social experiences. Social interaction connects visitors of the museum and help construct meaning together. Discussion, questioning and the formation of reflection is generated by experiencing the exhibition, and are according to Falk and Storksdieck [10], social factors that are rarely forgotten (Pasupathi [14]). The sociocultural context are not only formed by visiting the museum together with others, but is also formed for singular visitors as indirect social contact with other visitors or museum employees.
The cultural background of the visitors are likewise important, as it influences how visitors engage and feel interest in an experience. What may work in a European museum, may not work in a Saudi Arabian museum.

Physical context
 This context is connected to the physical aspects of the museum and its spaces. This is related to the orientation in the physical space, knowing where to go and in which pace. The design and exposure of the exhibits is likewise connected to the architecture in regards to how they fit into their environment. The physical context is successful if visitors perceive the spatial experience as being meaningful and interesting.

To get a full understanding of how and why the different contexts influence how visitors responds is extraordinarily complicated. This is because visitors are not only reacting the the physicality of the space that they are in, but that they also respond according to their individual personal and sociocul-

tural contexts. It is therefore important to accept that museums and their designers can not determine the response, but that they should strive towards creating visitor engagement that facilitate inspiration, learning and interest.

Black [3] suggests to, *"Place visitors in the 'right frame of mind' on site so that they wish to engage with collections and exhibitions"*. This is done by creating an atmosphere that is welcoming and attractive so that visitors feel compelled to interact with the exhibition.To create inclusive experiences, it is demanded that the experiences being offered are more than passive, ocular-centric presentations of narrative. Nor should the visitor feel that they are being schooled.

To summarise, what can be drawn from this part of the Literature Review, is that there has been a recent development in the museum world which has changed how the diversity of the public is recognised. This demands that the museums are to be inclusive in the experiences that they offer for their visitors.

Museums need to take the role of being the storytellers that they could be. By creating a storyline through their artefacts, exhibits, the physical space and architecture, it is possible to enhance the museum experience.

The Contextual Model for understanding visitor learning can be used as a design framework to take the personal, sociocultural and physical contexts into consideration. For the personal context, we learnt that intrinsic motivation is beneficial for facilitating interest. The more positive experience we provide the visitor with, the higher chances are that visitors will store the new-found knowledge and experience. Social interaction, in both conscious and unconscious form, influence the sociocultural context, which also aids in recollection and retention. Finally the physical context calls for orientation and meaningfulness. (Falk and Storksdieck's [10])

Having now gotten an understanding of Museum Development, it is possible to define some Design Considerations and tools, based on the Museum Development section, which can be used as guides in the later design process of this thesis.

3.1.2 Design Considerations 1 - Development of a Museum Experience

1. Be inclusive in the experiences that the museum offer (Lang et al. [6])

   (a) Accommodate the visitors contexts (Personal, Sociocultural and Physical contexts) (Falk and Storksdieck [10])

      i. Emotional effects (increase the visitors chance of remembering the experience) (Sociocultural context)

         A. internal rewards instead of external (Ryan and Deci [11])

   (b) Set visitors in the right frame of mind (Black [3])

Tools

1. Storytelling and mediation of narrative (Bennett [7])

2. Invoke interest (catch the visitors attention) (Personal context) (Falk and Storksdieck [10])

3. Avoid passive spectatorship (Christidou and Diamantopoulou [8])

4. Provide orientation and visibility (Physical context) (Falk and Storksdieck [10])

   (a) Allow visitors to see their surroundings (Sociocultural) (Falk and Storksdieck [10])

The following section will now provide the understanding of how Narrative Spaces can be used to answer the Initial Research Question [2.1], which seeks to enhance the museum experience and form unique and memorable total experiences for the visitor (Vision [2]). The *Narrative Spaces* section will illustrate how perceptual and sensory means can be made use of to emotionally connect the visitors with the exhibit space. The section will present how a visitor-centred approach to the spatial design in a museum context can include visitors through a high level of narrativity, that transcends a Space to a Place. The section will furthermore present how modern lighting technology can be use as a method to enhance the narrative experience, by integrating video projections into the physical space through sound and lighting.
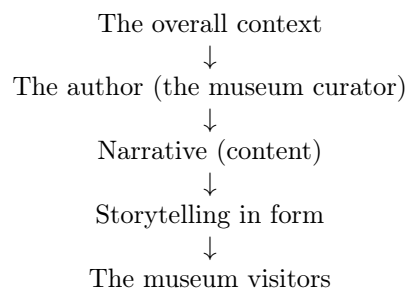
3.2 Narrative spaces - The Art of Exhibiting

"Narrative environments appeal to the visitor's intellect through their body and, vice versa, through their body to their thoughts. In other words, the physical space is designed to tell the story through a variety of sensory means: spatial dimensions and sight-lines, volumes and rhythms, forms, colour, light, materials, sound etc."
Tricia Austin, Course Director, MA Creative Practice for Narrative Environments

Narrative spaces, in the context of this thesis, are defined to be designed physical museum spaces, that mediate and accentuate a form of narrative, which form unique and memorable total experiences for the visitor, that go beyond the physical space. In a narrative space, the narrative of the exhibition is told through a broad range of perceptual and sensory means in different forms, such as lighting, spatial quality, material, rhythm, colour, form etc.

With the use of narrative space and interpretation of its spatial possibilities (space, architecture, place, exhibits, visitors etc.) it is possible to connect with visitors through perception and imagination. This is done by creating experiences that integrate space, the visitor, the exhibits, media and atmosphere, to produce meaningful experiences that are unlikely to be forgotten (Kossmann et al. [15], Macleod et al. [16]).

It is within the human nature that people are natural storytellers and that we can relate to stories told, as it is how we intuitively make sense of the world that surrounds us – by telling stories to ourselves and others as a social and cultural activity. Macleod et al. [16] elaborate, *"These storytelling skills ensure our place within human society and probably mean that information that is not structured narratively is more likely to be forgotten."* In narrative spaces, the process can be broken down to five overall stages, according to Macleod et al. [16].

<div align="center">

The overall context
↓
The author (the museum curator)
↓
Narrative (content)
↓
Storytelling in form
↓
The museum visitors

</div>

The content of the museum experience is traditionally mediated in more direct form, as text or audio speech, or by the use of images in still and moving form. One of the barriers by communicating the content in the form of text is that these most often are drafted by museum curators, whose focus lies in academic reporting, rather than in the narrative of the exhibit. However, recent museums studies support a transition away from the "dominance of language" towards a more sensory approach of engagement, such as in narrative spaces. (Kossmann et al. [15], Dudley [17])

By taking advantage of the narrative of the content it is possible to create an atmosphere that in a greater extend invites visitors to emotionally connect with the exhibit of the museum. By having a bodily approach to the spatial design of the space, it is possible to engage visitors on a much deeper layer than it is with explicit, denotative communication, such as a written banner with information in facts and text. This is because the sensuous perception helps to create meaning (Kossmann et al. [15], Macleod et al. [16]).

Macleod et al. [16] presents a model that can be used to rate the narrative spaces of different museums. In the model (fig. 4) it is possible to judge an exhibition based on a scale from low level of narrativity to a high level of narrativity, and how the content is communicated, ranging from direct denotative communication to evocative connotative communication. Direct denotative communication refers to the explicit literal meaning, as an example: *Scorpions are predatory arachnids*, whereas evocative connotative communication refers the emotions and associations connected to the information, which could for example be *Scorpions are dangerous.*

It is in the green area of high narrativity and evocative connotative communication that narratives have the greatest potentials towards enhancing the museum experience. This Narrativity model can not only be used to judge other museums, but could be used to frame and evaluate one's own design.
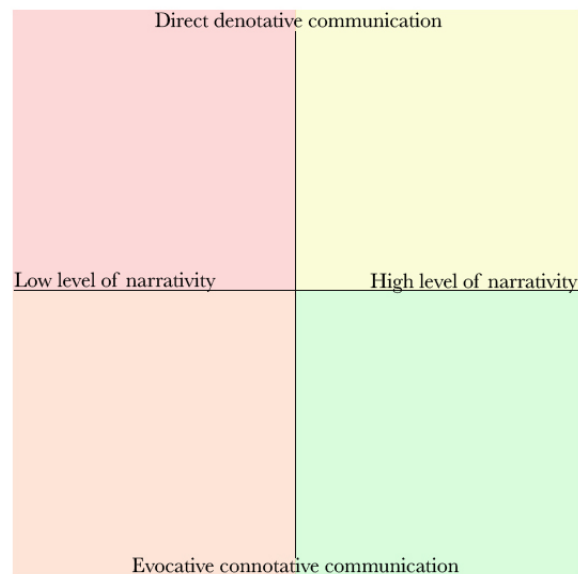
Figure 4: Narrativity model defined by Macleod et al. [16].

By bringing focus to the form and content, a narrative space can be become particularly powerful, as it offers embodied free-flowing temporal experiences in the three-dimensional space.

What is important to note, and much emphasised by Kossmann et al. [15], is that *"it is not just about the design, but about the cohering power of design"*. The form and content is therefore not to be seen as singular elements, but rather in interconnected relationship, held together by the given narrative. Kossmann et al. [15] further argue that it is inevitable that the traditional thinking of curators need to be challenged, from thinking exhibitioning as a two dimensional academic act (denotative mediation from museum to visitor) to considering the denotative spatial experience and atmospheric possibilities (space, lighting, temporal qualities, colour etc), that can help transcend the museum space into a place, that in the end not only strengthens the narrative of the exhibition, but also enhances the museum experience.

3.2.1   From Space to Place

According to Kossmann et al. [15], there is a need to make a distinction between *Space* and *Place*. The character and atmosphere of the space can transform a space into a place. In a place the poetry of the narrative space arises.

If done correctly, museum curators and designers will manage to create a narrative space that transcends the space into place, by bringing it to life, and creating a place where the form and content in unity has extensive engaging capabilities. Kossmann et al. [15] elaborate *"Such spatial arrangement will only unfold when the visitor takes the time to pay attention and starts participating. If not, the narrative remains grounded and will not move."* It is therefore of great importance for museums to create places where atmosphere and spatial experiences invite its visitors to actively take part in their own experience, not only intellectually, but also through their body and their mind.

Making use of the art of stage design and scenography – the physical elements of form, such as the architectural qualities of space, colour and especially lighting – is important, because of what they can contribute with to the place as a whole, and the atmosphere that it holds (Böhme [18]).
The challenge with drawing upon theatrical elements, is that they, according to Macleod et al. [16], suffer under *"a misunderstanding reinforces the prejudice against theatricality which for many still have negative associations with staginess, spectacle, emotionalism and lack of authenticity."* However, a differentiation between the theatrical world and museum experiences has to be made clear, as what should differentiate the two, is that the theatre is about spectatorship, whereas the museum experience should not be. In the theatre you observe the stage, and in the museum you should be part of it, interacting and experiencing a space.

Integrating theatricality, which to a great extend also includes lighting design, into narrative spaces of the museum allows a creation of a place out of the ordinary, where the narrative spreads beyond the physical space. Macleod et al. [16], speaks of the very idea behind this: *"Designers are changing the*

visitors perception and ways of seeing galleries through use of lenses, gazes, filters, mirrors, shadows and illusions. The aim is to exploit the inherent theatricality of the museum architecture; to approach the spaces, circulation and atmosphere scenographically and to create contemporary interpretations using scenic devices.” The use of lighting design can therefore be seen as a key method of creating narrative spaces, which can be used to enhance the museum experience, through sensory and emotional means.

3.2.2 The Experience of a Narrative Space

The experience of a narrative space is not solely formed by the design of the exhibition, but is deeply dependent on its visitors' personal experience. The experiences collected through the place are highly emotive and linked with personal stories or past experiences for the museum visitor. (Kossmann et al. [15], Macleod et al. [16]).

Merleau-Ponty [19] gives a bodily explanation of experience, by stating that every sensation felt, learnt or imagined, takes part of the mental framework and creates a reference for its meaning through the body. Merleau-Ponty and Smith [20] deals with the bodily phenomenology in the book *Phenomenology of Perception*, where he argues that before conscious reflection and thinking have taken place, the body has already sensed and created meaning of the physical spatiotemporal context in which it is present.

It is therefore of great importance that the museum designers and curators need to not only see through the eyes and the mind of their visitors, but also consider the bodily and immediate impression of a space (Macleod et al. [16]).

The optimal narrative space should therefore manage to draw on the visitors personal context to produce engagement and flow, that can transcend the visitor into the narrative space. I

3.2.3 The Organisation of a Narrative Space

Tzortzi [21] argue, that *“the organisation of movement is a concept inherent in museum design”* and therefore has a role in the curated narrative. The museum spaces both set the “stage” and present the “script”, both of which influence the experience of the visitors (Duncan [22]).

Traditionally many museums have strict implicit rules of movement, that involve *“knowing how and where to stand, where and how fast to walk [...] Different modalities of display produces different norms of object-body relations, but knowing where to position your body in a space has always depended on knowing how to read the exhibition 'script'.”* (Leahy, [23]) The movement of the visitors are influenced by a wide variation of aspects, both due to internal and external factors, which can be influenced through methods of visitor-centred lighting design.

What distinguishes a narrative space from other more two dimensional narrative arrangements (such as a book) is the dimensional element of space and time, as the visitor is physically moving (often in a nonlinear manner), and this must therefore be an important aspect when designing narrative spaces.

Visitor behaviour is most often unpredictable and the tempo and focus will vary, based on the interest of the visitor. This movement both brings rhythm and continuity to the experience, but this demands a multidimensional and flexible narrative and exhibition design that is open for the shifting visual focus and interest points of the visitor.

The numerous segments of staging and cueing is therefore of great importance when designing narrative spaces. It is in this context that well considered lighting design becomes essential, as it has the potential to redirect or regenerate the narrative by guiding the attention of the visitor (Macleod et al. [16]).

Aronson [24] further add to the field of selected visibility, that *“What we don't see becomes as important as what we do see.”*

Macleod et al. [16] however argue, that intentionally using un-hierarchical spatial arrangements in narrative spaces, can provide the visitor with greater freedom of choice in the experiences of the museum, exhibits and narrative space. However, with this form of composition, the content of the exhibition are entirely present and apparent. This influences the expressive design that may bring in elements of confusion and uncertainty for the visitor, causing them to lose their willingness to partake in the museum experience. Macleod et al. [16] therefore suggest the use of *Memory boxes*, as isolated zones that are designed for bodily engagement. This controlled, hierarchical composition can help the visitor read the space in both conscious and unconscious manners and thereby modulate the visitors' attention. By working with visual hierarchy it is therefore possible to direct the bodily experience through design, before it

is made into a conscious decision (Merleau-Ponty [20]).

The element of unfamiliar space also help enhance the museum experience, as moving through and around an unfamiliar narrative space means that the space is sensed more. This means that the bodily experience of being present in the given space is in a greater extend formed by our unconscious and conscious involvement and emotion (Macleod et al. [16], (Anderson [25], (Böhme [26]).

To understand the visitors' behaviour, movement and the need for cueing, it is crucial that the designer sets himself or herself in the place of the visitors. As Böhme [26] writes in *"Atmosphere as the Subject Matter of Architecture"*, then *"if it is true that architecture shapes space, then one must move about in these spaces in order to evaluate them. We must be physically present."* The designers must therefore put him or herself in the place of the visitors, by moving around in the space.

The challenges of creating museums spaces that are designed to be more inclusive than the traditional museum spaces, have resulted in a new way of thinking of architectural spaces and spatial form. The space is being integrated in the museum context and history, and is now becoming a crucial part in the making of meaning. The museum topology (architecture) is therefore a concern that has to be kept in mind. One of the clear intentions is that narrative spaces should encourage discovery and learning. Discovery covers the idea of presenting museum objects and and exhibits in visually interesting and intriguing ways. Many traditional museums present their exhibits in an organised and hierarchical manner, which for some visitors quickly can become predictable and uninteresting (Visser [27]). A good example of a Danish museum who has made use of a more innovative design approach to their interior architecture is Dansk Jødisk Museum in Copenhagen (fig. 5). The architect behind it, Daniel Libeskind, has here made use of a very expressive form, structure and light, that gives the museum a secondary layer of experience.
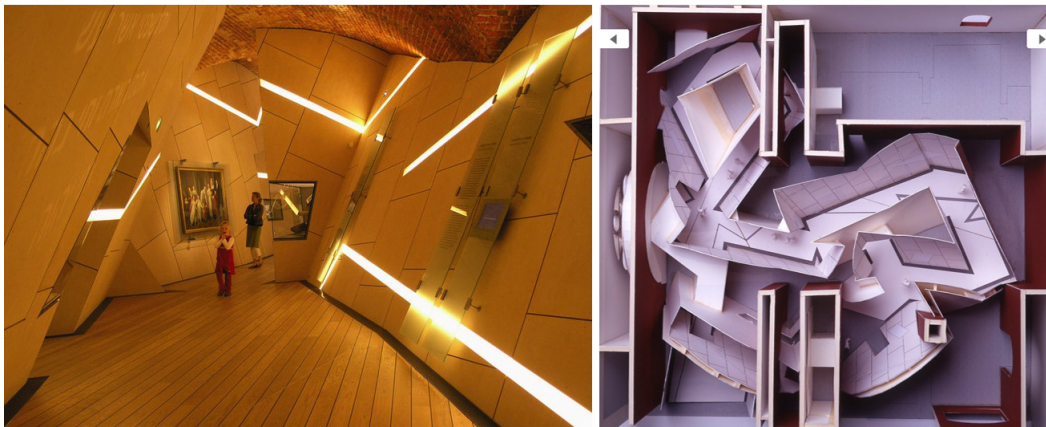
Figure 5: Danish Jewish Museum in Copenhagen, designed by Daniel Libeskind makes use of an expressive design to add a second layer of experience to the space. (Images: Museum [28])

However, it is important to keep some relatability, as a too abstract topology and interior architecture may disconnect other some visitors.

3.2.4 Medium - the Delivery of Narrative

In the wish of creating more inclusive experiences, that can enhance the museum experience and learning outcome, the ambition is to make cultural heritage more present and relatable for the visitors.

The technological development brings innovative possibilities for the way that museums can mediate narratives, which can help bring visitors, narrative spaces and technology closer together to enhance the museum experience. As Othman et al. [29] state; *"The use of these technologies should not be regarded as replacement of the curated tour or more traditional means to disseminate information, but instead as further ways to connect and engage visitors with objects, collections and exhibits."* (Othman et al. [29]). There therefore lies great potential in how modern lighting technologies can be used to mediate narrative and assist in enhancing the museum experience.

Interactive media holds a special quality and potential, as it can provide visitors a new role in their visit, as interactivity can create a direct connection between the visitor and the exhibition.

MMEX [30] describes; *"Good storytelling is delivered in a simple manner, where the solution in it self steps into the background, so you in a greater degree get an experience that make use of your senses, that evoke wonder."* This remark is further backed up by Nick Poole (The Chartered Institute of Library and Information Professionals (Cilip) chief executive), who argues that for the visitors it means less who is the sender of a specific solution or information, as long as the content unfolds in an inspiring manner. Poole further states: *"The users get their own voice in their own experience, where he/she no longer only is a spectator who acknowledge the history, but also get to be a part of it."* (Løssing [30])

Interactivity also works well in creating experience and producing emotional response, if the medium reacts to the visitor, for example though motion detection that causes a specific output based on the motion of the visitor. By doing this, the visitor is involved in the narrative and produces a *magical* dimension, that draws on imagination and surprise, while having strong captive abilities (Kossmann et al. [15]).

Kossmann et al. [15] add, that with most visitors, the use of video is preferred to text. The use of video projections can therefore become especially important when designing narrative spaces. Aronson [24] indicate why this can be powerful. In his book *Looking Into the Abyss*, he states: *"The very idea that one image, the projection, is created by light, and the other, the stage set, is created by objects that are made visible by their ability to reflect light, creates two perceptual orders, two kinds of reality"*. This ability to play with the perception of the visitors, by emotionally transcending them "elsewhere", makes a strong combination between illusion and reality,However, it is important to note that there is not a well established academic studied base of how visitors of museums experience new media, such as video projections.

Implementing video material in museums is not a new thing in the art of exhibitioning. Macleod et al. [16] writes: *"Film, exhibition and staging are related through the nexus of time, space and feeling used to meet their ultimate purpose: creating a rendering of the real or non-real that is not directly visible, regardless of whether that means distant views of unfamiliar places or past events"*. What Macleod et al. state very well corresponds with the work of Aronson [24] that videos can be effective as a transcendental effect, allowing the visitor to experience things that they would never have the chance to experience in reality. This capability furthermore gets enhanced if the material is synchronised with sound and other physical lighting, that allow to expand the perceptual inputs beyond the screen space, and into the three dimensional space. Integrating video projections into the given space allows the physical space to become a temporal storytelling medium – a narrative space.

The movement of the visitors, their change of focus and perceptual inputs, all allow the narrative to be mediated in a more emotional way than the traditional denotative representation that passive spectatorship offers. This allow the video to spread beyond the edge of the frame, encompassing the physical space, creating a place of experience (Macleod et al. [16]). Böhme [26] argues that the use of three dimensional qualities such as integrating a video projection into a space can turn physical objects and architecture into a display surface, which can bring more life into an exhibition. He argues upon this that by means of our gaze *"another aspect of vision comes into play, namely that of focusing on different distances."*

In summary: by creating Narrative Spaces that communicate a form of narrative and telling a story through atmospheric qualities, it is possible to invite visitors to emotionally connect with the exhibit or exhibition of the museum. A bodily, visitor-centred approach to the spatial design of the space, visitors can be engaged on a much deeper layer than it is with explicit, denotative communication. This is due to how our sensory perception has an active role in the creating of meaning. Through perception it is furthermore possible to, to a greater extend, invite to inspiration, learning and enjoyment.

By bringing focus to the form and content, a narrative space can be become particularly powerful, as it offers embodied free-flowing temporal experiences in the three-dimensional space. In this way space can become a place with its engaging capabilities. Making use of the art of stage design and scenography, the physical elements of form, such as the architectural qualities of space, colour and especially lighting, is important, because of what they can contribute with to the place as a whole and the atmosphere that it holds, allows for creation of a place out of the ordinary (Böhme [31]).

Merleau-Ponty's [19] bodily explanation of experience, states that every sensation felt, learnt or imagined, takes part of the mental framework and makes a reference for its meaning through the body. It is therefore demanded that museums designers are able see through the eyes and the mind of their visitors, when composing a narrative space.

The museum both sets the "stage" and presents the "script" through the organisation of the exhibition. Setting the stage and its atmosphere is an important quality of engagement. It is important to note that visitors are physically moving, free flowing, and therefore well considered lighting becomes essential, as it has the potential to redirect or regenerate the narrative by a guiding the path of the vision, and thereby the experience. The use of modern technology and media can help transform the given space into a place. Through video projections and physical lighting, it is possible to emotionally transcend visitors "elsewhere", as it allow to expand the perceptual inputs beyond the screen space, and into the three dimensional space, to spread beyond the edge of the frame, encompassing the physical space as a narrative space.

By designing narrative spaces through a visitor-centred approach to lighting design, it is possible to make use of perceptual and sensory means, that allow the visitor to have an active role in their own museum experience. The narrative space, should become a place out of the ordinary, where visitors feel inspired, engaged and broaden their knowledge base. By taking advantage of modern lighting technologies, such as programmable lighting and video projection, it is possible to enhance museum experiences, and to spread the narrative beyond the physical space.

A set of design considerations can be defined, based on the section of Narrative Spaces. The design considerations and the tools can be used as guides in the later design process of this thesis.

3.2.5   Design Considerations 2 - Narrative Spaces in Museums

1. Encourage visitors to actively participate through their body and their mind (Kossmann et al., Merleau-Ponty [19])

    (a) Bringing strong images, memories, or feelings to the mind of the visitor (Macleod et al. [16])

Tools

1. Set the "stage" and present the "script" (Duncan [22]).

    (a) Communicate a narrative that integrates the space, through perceptual and sensory means (Evocative connotative communication) (Duncan [22]).

    (b) Translate the space to a Place: create a space out of the ordinary through staging, cueing and visual hierarchy (light zones) (Kossmann et al. [15], Böhme [31])

    (c) Flexibility that can accommodate the unpredictability of visitors (Macleod et al. [16])

    (d) Integrate video projection into the space through physical lighting as a transcendal effect (Macleod et al. [16], Böhme [26])

2. Narrativity model defined by Macleod et al. [16] to evaluate the final design

The Initial Research Question [section 2.1] presented the main target of this thesis which is to enhance the museum experience. The aim of this Literature Review is therefore get an understanding of how narrative spaces can be used within the context of the museum, through a visitor-centred approach to lighting. It is therefore important to gain an understanding of how the interaction between the space and its visitors can become unified. To do so, the theory of atmosphere, described by Böhme, could highlight how spatial qualities can affect visitors' experience of a space, on both a conscious and unconscious level. Atmosphere has the ability to re-structure spatial experience, through both material and immaterial qualities, and can therefore be influenced by a broad variety of different means. Especially light has great transcendental and distinctive qualities, that can be made use of to create narrative spaces that can enhance the museum experience. Research in this field is fairly limited, but findings do suggest that atmospheric elements (including lighting, colour, sound, and layout) of a museum experience is of importance, both for the experience of the visitors and their willingness to recommend the museum to others. (Roppola [32]).

3.3 Atmosphere

"Bodies delimit space, space is the extension of bodies, their measure.
Space is where bodies find their place and through which bodies move."
Gernot Böhme [31]

Atmosphere will in this thesis be is considered as a significant mean to re-structure spatial experience, as defined by Gernot Böhme. Atmosphere is seen as crucial part of the creation of Narrative Space, as it holds the possibility to constitute a specific "mood" or a feeling of the space in which visitors are present.

Böhme's [31] notion of atmosphere states that it is the bodily experience of a space that affect us as humans. It holds the power to put us in a certain mood and give us a certain subjective feeling. So, when we speak of atmosphere, it is the relationship formed by the qualities of a physical space and the individual human conditions. Atmosphere has synaesthetic value, which means that sensory stimulation can lead to automatic, unintentional secondary sensory experiences, as a union of the senses. Atmosphere can therefore be produced and influenced by the material and immaterial qualities of colour, lighting, texture, shape, context etc. But it is important to underline, that visual perception on its own does not solely influence the atmosphere of a space. Atmosphere can thus become helpful in forming unique and memorable experiences of the visitor that in the end can help to not only intensify the narrative, but also to enhance the overall museum experience. (Böhme [4])

So, between the space and the subject, who experiences the space, lies atmosphere, as seen in the *Sphere of Presence* figure (fig. 6). Much like the Falk and Storksdieck [10] Contextual Model (fig. 3) there is a connection between the subjects and the physical space. It can therefore be argued, that in the space of atmosphere lies also a learning quality.
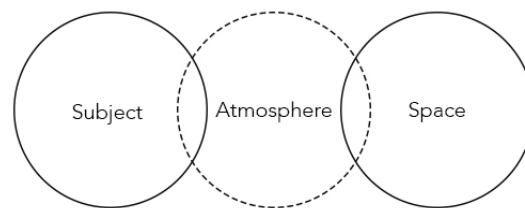

Figure 6: Spheres of Presence as defined by Böhme

Böhme [31] argues that light is a powerful means of transforming spaces and creating atmosphere, as it has the ability to create spaces of their own, and even provide that space with a distinctive quality. Böhme takes his basis in stage design and architecture. Through these he refers to atmosphere by drawing on the sensory qualities that a space can hold, and that to some degree can be manipulated. Through these we perceive the space according to our emotional sensibility. Atmosphere therefore solely exists because it is experienced, and is therefore more than physicality and materiality. Thus one must acknowledge that design does not only take basis in functionality, but also endorses the fundamental conditions that produce the atmosphere of a space, such as lighting, colour and mood, and the mindful physical presence in space.

Böhme [31] argues that our understanding of ourselves is being articulated through the body. He refers to the Swiss art historian Wölfflin's [33] work by stating: *"Heinrich Wölfflin not only perceived the corporeal/sensory impact existing to architecture, but conversely interpreted it as an expression of a corporeal state."*

He therefore argues that architects and designers must change their primary interest away from the functionality and physicality to the emotional atmospheric space that is being created.

Materials such as concrete, plastic, steel etc, allow an abandonment of *"the straight, the plane, the right angle, and show that architecture does not realise given spatial structures"*, and thereby allow architects to work with the human experience in focus. Böhme [31] moreover, argues that the physicality of the space is, so to say, to be breached. Here he refers to the traditional Japanese architecture, which makes use of elegance, through e.g. translucent walls and disguise of structures. This allows focus on the experience of a space, rather than on the physical qualities of the space.

What Böhme [31] states is that sensitivity is what we sense in a given space, its atmosphere, which influences the given mood of the space. The basic mood is something unconscious, but of great importance, as it can have an impact on the interaction of mind and body – how we feel when we are physically and emotionally present in a space.

The "generators" of atmosphere, such as lighting, have to be taken seriously, and therefore it must be well considered based on its effects on atmosphere. This is especially important as studies have shown that the ambience of a museum has an influence on visitors' intention to revisit the museum and their willingness to recommend the museum to potential visitors (Bonn et al. [34]).

To conclude on this section, we can draw multiple important considerations. When designing a space, it is not the material qualities of that objective space that counts. Rather, it is what the generators bring to that space, and the atmosphere and mood that they produce in us a human beings that is of importance. Atmosphere lies between the visitor and the space in which they are present. To gain an understanding on how generators of atmosphere can be used to re-structure spatial experience, and its ability to constitute a "mood" that fills the narrative spaces that visitors inhabit, we must be aware of how the bodily experience affect us as humans. As stated, atmosphere can be produced, and influenced, by the material and immaterial qualities of colour, lighting, texture, shape and so forth. By taking basis in stage design and architecture, as Böhme does, atmosphere can draw on sensory qualities that to some degree be staged to work with the sensitivity of the human experience in focus.

As with the previous sections, we will the define Design Considerations according to the section on Atmosphere. These considerations, and their Tools, will take part of the later design process.

3.3.1 Design Considerations 3: The theory of Atmosphere

1. Produce an atmosphere (set a mood) that fits with the narrative of the space (Böhme [4])

2. Focus on experience rather than on the physical objectives (Böhme [31])

Tools

1. Sensory inputs, in different forms, can add to the experience of a space (Böhme [31])

    (a) "Generators" of atmosphere (Light, colour, material etc) (Böhme [31])

As previously mentioned, working within the context of the museum, the atmosphere of what we experience as visitors in narrative spaces are central to enhancing the museum experience. The atmosphere of a narrative space can be influenced through a broad range of generators, where light has especially strong emotional capabilities. Working with a visitor-centred approach to lighting design, it is therefore relevant to delve into how the experience of light affects our experience of space, and how it can be used as a generator of atmosphere to mediate the museum narrative. A section is therefore devoted to provide us with the necessary understanding of how lighting can be used as a method for achieving the Initial Research Question [2.1]

3.4 The Experience of Light

> *"We know not through our intellect but through our experience."*
> Merleau-Ponty and Smith [20].

With a visitor-centred approach to lighting design, the focus will lie on how things in the space that we are present, appear "for us", more than what they might actually be "in itself". Sensory qualities of lighting, materiality, sound etc can according to Hale [35], who bases his theory upon the work of Maurice Merleau-Ponty, be described as a form of *primordial language*, i.e. as an unconscious act of experiencing.

Merleau-Ponty [20] criticises science, due to its precise accounts of things that surround us, that quantify precise measurements, neglecting the the role of human interference and perception of experience. Science *explains* whereas the phenomenology of a visitor-centred approach aims to *understand* the essence of how light is experienced. The deeper understanding of light is therefore lost if solely focusing on the objective scientific quantitative approach (Mathiasen [36]).

As seen in figure 7, the experience of light can be illustrated though the model of Mathiasen [37]. The experience of light can be seen through the interaction between light, material and man (visitor). Light

is here to be understood as the different qualities of lighting, and material as the spatial organisation and surfaces that interact with light. Man is to be understood as the visual and non visual impact of light that a person interprets when present in their surrounding space.
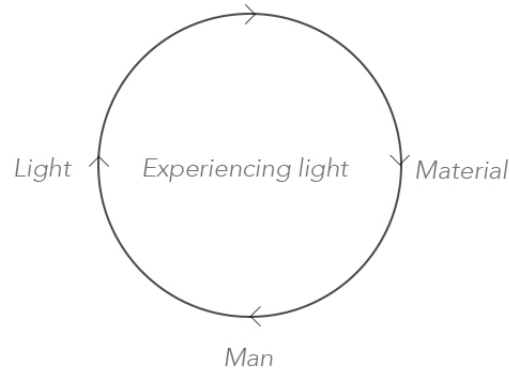

Figure 7: The experience of light consist of Light, material and Man. (Mathiasen [37])

Referring back to what was previously outlined, one of the key elements that stood clear, both from the Museum Development section [3.1] and Böhmes notion of Atmosphere [3.3], was that the visitor-centred approach of placing the experience of a visitor as a central role in the architectural space, where they freely move about, can enhance the experience of narrative space. Dealing with the moving body and its position of sensing is a subject on its own, but working with the notion of Merleau-Ponty, it is possible to divide the moving body into two categories (Merleau-Ponty and Lefort [38]).

- Body Image
  This consists of the representation of one's body in the consciousness (perceptions, attitudes and beliefs concerning one's body)

- Body schema
  The perception and internal experience of the moving body and its parts, and the unconscious acts of movement and posture.

Merleau-Ponty [38] acknowledge in his later work, titled *The Visible and the Invisible*, that there is an important exchange of information between the the body and the object that we perceive, and vice versa. The body and the object both engage equally in the transaction of information through perception, which acts as a bridge from the body to the world (Merleau-Ponty and Lefort [38]). As Merleau-Ponty and Lefort writes: *"... the cane is no longer an object that the blind man would perceive, it has become an instrument with which he perceives"*. The idea is supported by the Gestalt principles which argue that through an intellectual act we synthesise and combine "sense data" (individual qualities) into one entity, a skill developed through previous experience (Koffka [39]). For example, through previous experience we are able to perceive the whole of an object, though parts of it may only be visible. An example of this can be found in figure 8. In this example most people will see a box between the black dots, based on their previous knowledge on how boxes appear. The principles of Gestalt is therefore often used in the art of stage design, which also Böhme takes his inspiration from. It has a vital role of how we understand the world that surrounds us. Through the Gestalt principle it is therefore possible to manipulate the perception of visitors in a narrative space, to allow them to experience a space different than what is actually is, because visitors will focus on how the space appears to them instead of how it actually is.
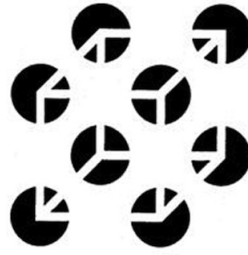
Figure 8: An illustration of the Gestalt principle

In *The Eyes of the Skin* Pallasmaa [40] argues that our understanding of architecture have to examine experience through all senses, and thereby not solely rely on visual prejudice, which corresponds well with both the thinking of Böhme and Merleau-Ponty. Designing a museum experience is a unique opportunity for a lighting design that through sensory design can manipulate space, light and darkness to render the experience of a narrative space in a memorable manner for the visitor. Light bring atmosphere that through built form stretches beyond the tangible, into a mood, in abstract and perceived form, that can be argued to contrast the quantitative rationalist design approach. In other words, light may extend the museum narrative beyond the physical space to form unique and memorable total experiences for the visitor, as the Vision [2] aims to do.

In the book *Thinking Architecture*, Zumthor et al. [41] express it the following way: *"In my job [architect], I contribute to the existing physical framework, to the atmosphere of places and spaces that kindle our emotions... [Arranging] the sequences of rooms to guide us, take us places, but also let us go and seduce us."*.

A sub-section will now be devoted to present some specific design elements of the qualities of lighting, that can be used to influence the atmosphere and the experience of narrative spaces in the context of the museum in the later design process.

3.4.1 Qualities of Lighting

"Lighting is visual, experiential, environmental, and sensual. The phenomenon lies in its affect on the human condition."
Theory of Phenomenology [42]

According to the acclaimed lighting designer Liljefors [43], light can be specified through two main categories: *the experienced light* and *the measurable light*. The experienced light describes the psychological, physiological and visual influences of light, whereas the measurable light takes its basis in quantification and photo-metric measurements. As this thesis works with a visitor-centred approach to qualitative lighting design, and the role of human interference and perception of experience, the scope of this section will focus on the experienced light.

Liljefors [43] separates the experience of light in spaces into seven categories.

1. Level of lightness: How bright or how dark is it?

2. Spatial distribution of brightness: where is it darker or brighter?

3. Shadows: where do they occur and what are their character?

4. Reflections: where do they occur and what are their character?

5. Glare: where does it occurs and how noticeable is it?

6. Colour of light: the colour experience of light.

7. Colours: do they look natural or distorted?

To gain a better understanding of what Liljefors [43] mark within the seven categories, the different items will be explained further.

Level of light

Here we judge how dark or light we perceive a space, estimating it on a scale ranging from dark to light. The level of light does not solely cover the impression of the overall space, but can also be related to certain areas within the space. The way that we as humans experience light is very sensitive to change and our vision is developed to adapt to different light situations. We experience this when we move from one space to another, or when we stay in a space for a longer period of time, our vision will adapt to the light situation - allowing us to perceive the room as being brighter, than when we did initially upon entering (Liljefors [43]).

The brightness of an object likewise manipulates our perception of size and distance, as brighter objects appear not only larger but also nearer than identical objects of lower luminosity (Descottes and Ramos [44]).

An example of how different museums make use of light levels can be found in fig. 9. The newly opened Wadden Sea Centre in Ribe, uses higher, uniform light levels to create a sense of openness, which correspond to the experience of walking on the wadden sea. The museum of Kongens Jelling however make use of relative darkness to produce a more mysterious and intense atmosphere, which goes hand in hand with the narrative they are communicating.
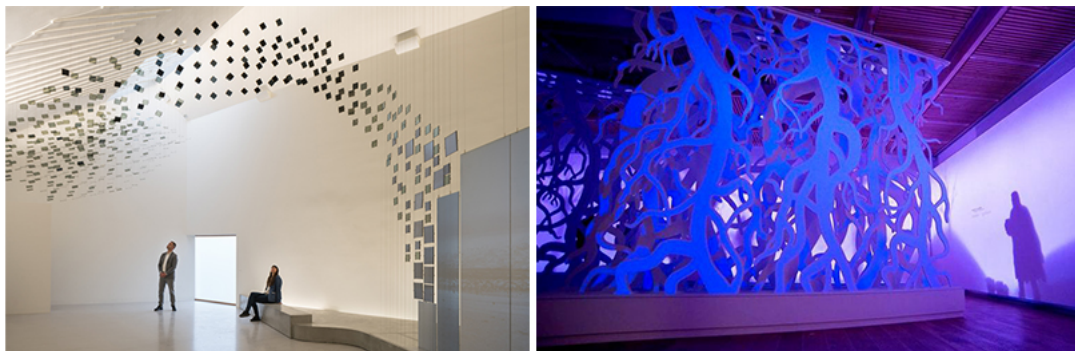

Figure 9: Level of light examples. Bright: Vadehavsmuseet (Left) (Photo: McLaughlin [45]). Kongens Jelling (Darker) (Photo: Jacob Nyborg Andreasen)

Spatial distribution

This item not only deals with distribution of light, but also with the distribution of shadows. When we "read" the space in which we are present, an intuitive part of our brain will immediately interpret from where light and shadows originate, as well as how these are distributed. The spatial distribution of light and shadow gives a space visual variation, while it can also come across as being monotone, if there is very little changes in the variation. Stronger contrasts give a space a more dramatic expression, which is effective as a generator of atmosphere (Liljefors [43]).

Distribution of light expands or restricts our visual perception of the space. Narrow beams of light are often used as highlights of specific areas of interest, such as a special exhibit, whereas wider beams reveal more of the space giving a more even distribution of light.

Especially within the art of stage design, spatial distribution is a control measure of creating obscurity and visibility, which both have strong narrative qualities. It is central when designing places of experiences of illusion and imagination, such as in narrative space, as it allows the lighting designer to design a space, through the composition of hiding and revealing, limitlessness and enclosure, that manipulates the visitors' perception of space and atmosphere. Spatial distribution has strong emotional capabilities that can manipulate responses of fear and comfort of light through the interplay of mind and matter. (Descottes and Ramos [44], Reid [46])

As seen in fig. 10, the art installation *"Forest of Light"* by Sou Fujimoto, 2016, makes use of a controlled distribution between light and shadow as a strong expressional design element.

Figure 10: "Forest of Light" by Sou Fujimoto, 2016, illustrate the use of spatial distribution (Photo: Laurian Ghinitoiu)

The composition of light and shadow likewise brings the quality of visual hierarchy in a space. As explained previously, visual hierarchy is important for the visitors' understanding and orientation of their physical context [section 3.1.1] and act as an essential means in the design of Narrative Spaces, as it can redirect or regenerate the attention of the visitor [section 3.2.3]. When visitors enter a narrative space, their visual attention will naturally be drawn to the light. Focal Glow, is a great tool for creating a point of interest that will make the object in question stand out from its surroundings. With focal glow the designer can actively convey information and mediate narrative as a spatial experience. This however demands that contrast is present in a sufficient manner - too little contrast ratio between the object and its neighbouring area, will make us perceive the object as being less bright. (Descottes and Ramos [44], Kelly [47])

Shadows
Shadows lie where the light can not reach directly. Shadows can articulate and influence structure, material and shape. But also, the way in which the shadows' borders are portrayed hold perceptual information, as these can range from sharp to diffused.

Hard shadows can, if used incorrectly, hide important details, as it renders these details in darkness. Opposite to this, softer, diffused light gives a more subtle expression, but overused it may result in rendering of an object in dullness, giving it a static or unexciting expression, as the information caused by shadowing are lost. With appropriate shadowing, an object or space can be brought to life before the visitor. A playful interaction between light and shadow to create depth and display texture is one of the strongest design features. The power of directionality of light lies in how we manipulate shadows. Altering shadow will result in drastical changes of how we perceive an object or space. (Descottes and Ramos [44]).

An example of how museums can make use of the qualities of shadows to communicate a narrative or manipulate atmosphere, can be found in fig. 11. Both examples are from the same museum in Copenhagen, Glyptoteket. These pictures illustrate just how much expressional difference there is in the sculptural figures. The first example, to the left, show how the daylight brings diffused lighting and soft shadows, that bring a calm and peaceful expression. However, as seen on the right, the sculptural figures appear much more dramatic, due to the hard and high-contrast qualities of the shadows.

Figure 11: The expressional difference between sculptural figures in Glyptoteket based on soft (left) and hard shadows (right) (Photo, left: Kim Nilsson. Photo, rigtht: Glyptoteket [48]).

Reflections

The individual qualities of surfaces dictate how the light is spread from the object to our vision. These reflections can come in different form, which are often characterised into mirror reflections, specular reflections and diffused reflections. Liljefors [43] describe, *"when you move, the reflections change and produce the experience of something almost being alive, giving a positive contribution to the environment."* Reflective qualities of a space can therefore have a great impact on how stimulating we experience a space.

Reflection of light can moreover be used as secondary light sources, that transfer indirect light. This effect is often found in stage design and scenography, as it provides a designer the opportunity to focus not only on primary illumination. As seen in fig. 12, "The Weather Project" (2003) by Olafur Eliasson, the quality of luminance is used as a great means of secondary lighting to mediate a narrative and influence atmosphere. (Descottes and Ramos [44])

Figure 12: "The Weather Project" (2003) by Olafur Eliasson illustrating the use of luminance and reflection as a secondary light source (Photo: di Yourguide [49]).

Glare

Light can overstimulate or blind and it is therefore crucial for the lighting designer to have careful control of illuminance levels. Glare is based on the contrast of brightness in our visual field. A too extreme contrast will either be in the form of discomfort and disability glare. The extend of glare however varies according to our emotional state and context (Descottes and Ramos [44]).

Colour of light

This does not only deal with the obvious colour of light that we perceive. Colour of Light is also about the tint or tone of the light that we experience. Much like our vision is sensitive to changes of brightness or distribution of light, we are perceptive to changes of tint, but also capable of adapting to certain tints. One of the greatest examples of this is they way that we experience daylight, that change throughout the day without us noticing.

Coloured lighting has great transcendental effects, that can transform an otherwise well-known space

to a something new and different, which has a major role in the design of Narrative Spaces. Coloured lighting has a great influence on the atmosphere of a space, how we emotionally perceive the mood of the place in which we are present. Descottes and Ramos [44] argues that, *"Coloured light can leave us with lasting impressions of a place because we are apt to remember our experiences by the colour in which they were rendered."* Colour of light can therefore be used not only to influence the mood of a space; it can also affect how we remember the experience, as part of the recollection process.

What Descottes and Ramos [44] explain is that being present in a space with coloured light allow an intensification of the impression that we have in that space, and even bring psychological responses. A different aspect of coloured light is that it alters our perception of size, where warmer colours tend to forward the distance whereas cooler colours recede (Livingston [50]).

Studies of the psychological effects of coloured lighting is however often vague, as one's subjective psychological response is highly based on past experience and one's personal and sociocultural context (Jalil et al. [51]).

Studies have moreover shown that highly saturated colours are more arousing than hues of lower saturation (Valdez and Mehrabian [52]).

In *Breathing Light* by James Turrell (2015) (fig. 13), the intentions were to manipulate the viewer's perception of space through coloured lighting to experience curious sensations between materiality and spirituality (The Red List [53]).
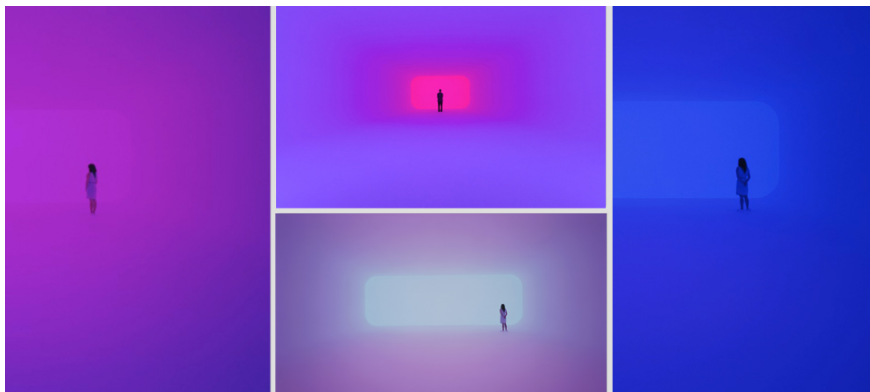
Figure 13: *Breathing Light* by James Turrell (2015) illustrate the use of coloured lighting to create atmosphere (Photo: The Red List [53])

Colour of surface

Fundamental to the art of lighting design is not solely to consider the colour of the emitted light, but to also consider the surrounding environment, and those together bring the capability to render coloured surfaces through the use of light. Rendering surfaces with coloured light can allow an intensification of the surface colour, which can be used as a method to shape the atmosphere of a given space. As seen in fig. 14, the given surface to the right appears brighter than the alternating, due to the red lighting. The surface colour appearance is intensified due to the surfaces quality to either absorb of reflect the given wavelengths of light (Descottes and Ramos [44]). Using surface colour in combination with coloured lighting can therefore be used as a tool to visually underline a narrative statement, through intensification.

Figure 14: Intensification of the red coloured surface, through the use of red lighting (Illustration: Descottes and Ramos [44])

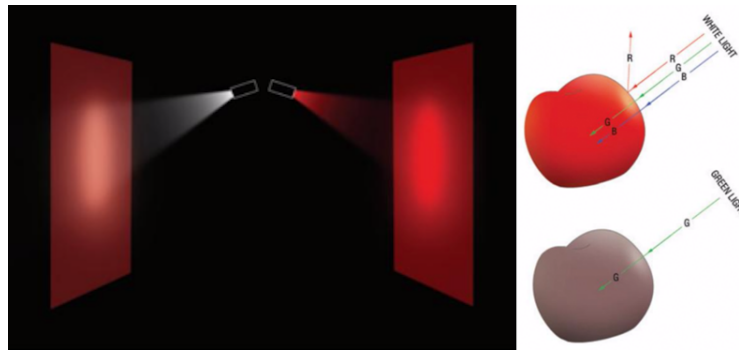Having now gotten an understanding of Liljefors' [43] categories of the experience of light, it could be beneficial to add an additional lighting principle, which could help in the staging of light as a narrative medium.

Density
Density of light and light sources also has atmospheric qualities, and as Descottes and Ramos [44] state: *"A variation of densities can enliven an otherwise mundane space, while changes in density have the power to quicken the tempo and heighten the energy of the space, or, alternatively, slow down the pace or evoke a sense of statis."* How density is used as a design quality influences our perception of that space in which we are present. Density can be divided into three categories: linear (a continuous distribution), organised (geometrical logic that follow a holistic organisation) or random (no geometrical pattern).

Carsten Nicolai's *Unidisplay* illustrate all three types of density. As seen in fig. 15 Nicolai makes use of random density, bringing a more lively expression to the installation.

Figure 15: *Unidisplay* by Carsten Nicolai (2014) illustrate the use of density (Photos: 1: You and Me [54], 2: Designboom, 3: Anders S. Berg)

Density can likewise be used as a *Play of brilliants*, as Kelly [47] point out as an important element of light as information, to draw attention and the creation of meaning; *"Play of brilliants excites the optic nerves, and in turn stimulates the body and spirit, quickens the appetite, awakens curiosity, sharpens the wit."* By using Play of brilliants as a design element allows the designer to give a space that extra element, which can enliven the experience of being present in a space.

What is crucial when working with lighting is that these qualities have to be considered in a context where they are to be made use of according to the contextual appropriateness.

Working with museums is a complex process, as many lighting considerations have to be kept in mind with regards to preservation of exhibits. A section will thus be devoted to some of the quantitative issues which have to be kept in mind when working within the context of a museum.

3.4.2   Museum Preservation

In the museum context, correct illumination of light-sensitive artefacts is of very high priority. It is therefore unavoidable that some quantitative qualities have to be taken into account, when designing with sensitive exhibits.

When illuminating an object, the interaction between light and material will involve risks of irreversible changes which can be classified as damage. The table 1 exemplifies recommended illuminance levels for different exhibit sensitivities. Acceptable levels of light-induced damage should be kept to a minimum and high amounts of ultraviolet radiation should be avoided, as they are the most harmful parts of the spectrum of light. (Feilo Sylvania [55], CIBSE [56])

Table 1: Illuminance Table recommended for preservation (CIBSE [56])

Material/Exhibit	Sensitivity	Recommended Lux Level
Costumes and other textiles, fur and feathers, dyed leather, prints, drawings, watercolours, stamps, manuscripts, coloured, old photographs, miniatures, transparencies, and unprimed thinly coloured paintings on canvas	High	Max 50 lux
Oil and tempera paintings, lacquer ware, plastics, wood, furniture, horn, bone, ivory, undyed leather, minerals and modern black and white photographs	Medium	Max 50-100 lux
Stone Ceramic, Glass and Metal	Low	Max 200-300 lux

Besides having appropriate illumination levels, time as a factor has to be considered. The less exposure time, the better. Designing with light for sensitive materials, such as watercolours, drawings and organic materials, it is beneficial to work with contrast. High contrast allows our perception to perceive objects as brighter, than what they in reality are. An alternative approach is to make use of sensors that allow light to be turned on or off, e.g. motion sensors, to automatically trigger the lighting.

It is recommended that Colour rendering is also taken into account for finding the most appropriate fixture. To evaluate this, one must consider The Colour Rendering Index (Ra), which is a representation of how well a fixture can portray the true colours of what is being illuminated for the exhibit to appear as "natural" as possible . A Ra value of 100 is optimal, while 80 is considered good or acceptable.

As seen in fig. 16 the appearance of the woman in the picture is quite different according to the Ra value of the light source, as an example the woman's skin appear to be greenish with a low Ra Value. (Feilo Sylvania [55]).

CRI +90 Excellent   CRI +80 Good   CRI <65 Reasonable
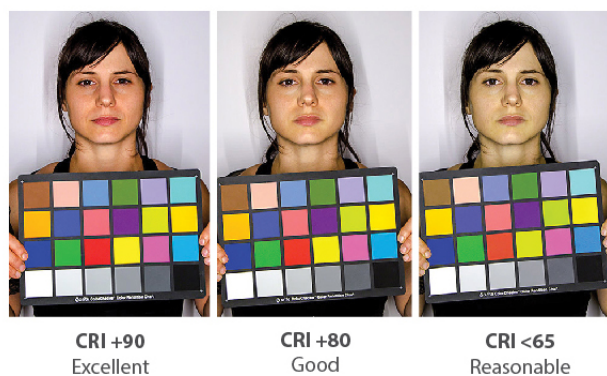
Figure 16: CRI: a measure of how accurately a light source render the true colours of an object. (Illustration: Floroiu [57])

The quantities and qualities of a light source is of great importance when illuminating museum artefacts, as the goal in most cases is to render the objects are truthfully as possible, while also working with respect to preservation of exhibits. Sensitive exhibits therefore set certain limitations when working with light within a museum space, that has to be considered when designing for a narrative space. However, many newer museums are to a greater extent introducing museum spaces meant to more about the concept and the narrative than the material manifestations. This can e.g. be seen in the new *Aarhus*

Fortaeller exhibition of Den Gamle By, which presents the visitors with an exhibition that focuses more on storytelling and scenography than on sole presentations of sensitive exhibits. *Aarhus Fortaeller* makes use of scenography and lighting design to communicate the history of Aarhus from the viking age to now. Fig. 17 show a physical representation of Aarhus cathedral, illuminated with Gobo projectors to symbolise the iconic day light of a church (Historisk Samfund for Århus Stift [58]).

Figure 17: Den Gamle By's new exhibition *Århus Fortæller* makes use of scenography and lighting design to communicate the history of Århus in a 700 year period. Photo: Cecilie Warming

To summarise on this section on The Experience of Light, we learnt that the experience of light is a sensory experience influenced by our perception. The focus therefore should lie on how things appear for us, rather than what they actually are. The experience of light is influenced by the light, the material and the perceiver, and therefore has to be understood according to this (Mathiasen [37]). Merleau-Ponty and Lefort [38] define the moving body into two categories: the body image (the representation of one's body in the consciousness) and the body schema as the unconscious acts of movement. Furthermore, is our experience of light and space influenced by the Gestalt principle that subconsciously collects sensed data into distinct wholes.

Through Liljefors [43], the thesis justified the focus on the experienced light as a qualitative visitor-centred approach. Eight different categories of light that influence our experience of space furthermore defined their individual qualities in how they can be used as design elements.

The different Design Considerations, will now outline some of the qualities, that can be made use of in the later design process.

3.4.3 Design Considerations 4: The Experience of Light

1. Lighting to enhance the bodily experience of a narrative space (Merleau-Ponty and Lefort [19])

2. Gestalt principle (We collect sense data received into one unified understanding of object and space) (Koffka [39])

3. Museum Preservation: Light exposure of sensitive artefacts should be kept down (Light level and time) (CIBSE [56])

Tools

1. Use generators of atmosphere (Böhme [4])

   (a) Liljefors [43] characteristics of light

      i. Level of Lightness (Orientation)
      ii. Spatial Distribution of Brightness (visual variation, produce hierarchy and guide the visual attention)
      iii. Shadows (Portray the perceptual information of form, shape and material)
      iv. Reflectively (Secondary Light source)
      v. Glare (avoid)

      vi. Colour of light (Transcendental effects: Highly saturated colours are more arousing)

      vii. Colour of Surface

  (b) Density to modulate tempo (Descottes and Ramos [44])

  (c) Play of Brilliants to bring attention to detail (Kelly [47])

3.5   Summary on Literature Review

As a final summary of what can be drawn from the Literature Review, we learnt that museums need to be inclusive in the experiences that they offer their visitors. Creating engaging and inclusive museum experiences can be done through storytelling which can invite visitors to take part of the experience, while providing great learning opportunities. This however demands that museums take the different contexts of learning (Personal, Sociocultural and Physical) into account. Visitors need to be placed in the right frame of mind to be motivated to engage in their own museum experience.

Narrative Spaces are within this thesis to be seen as a concept that I aim to create, as in the context of museums these can become a powerful aid in enhancing the museums experience. To connect with visitors it is demanded that the museums are aware of what they wish to communicate, and mediate the narrative in a meaningful manner, that includes the visitor in a holistic total experience. Doing so, it is important to move away from the dominance of language by creating narrative spaces that are relating to the visitors mind and emotions, rather than just through their intellect. With a high level of narrativity and narrative mediation (evocative connotative communication) it is possible to transcend the museum space into a place out of the ordinary. The narrative space therefore also needs to include sensory and bodily stimuli. The experience of the visitors can however not be controlled completely, as each visitor has a personal context, which is influenced by one's intellect, memory, and especially, expectations. Visitor behaviour is therefore also highly unpredictable and a flexible exhibition design is therefore demanded.

As a method, the visitor-centred approach is used meet the thesis target of enhancing the museum experience. With this approach I wish to put the visitor experience in focus, for visitors to take ownership of their own experience. Through organisation of a curated storyline it is possible to set the "stage" and present the "script" (mediate the narrative). Through staging, cueing and visual hierarchy it is possible to guide the visitor thereby making the experience more understandable. Presenting unfamiliar spaces can moreover help enhance the museum experience. By creating narrative spaces, inspired from stage design, it is possible to create enriching experiences, that not only allow visitors to learn, but also to invoke new interests and broaden their knowledge base and perspectives. It should also form unique and memorable total experiences that are not likely to be forgotten.

Making use of modern lighting technologies in museum spaces, such as video projection mapping, is proven to be more effective in terms of learning outcome and engagement than the use of text, and can therefore be used as a tool to answer my initial research question [2.1] Through video projections it is possible to create illusions and transcendental effects, especially if synchronised with sound and other physical lighting, in the space, that can help extend the narrative beyond the physical space. Integrating video projections into the given space through lighting has great possibilities and potentials to enhancing the museum experience. Giving the use of video a three dimensional quality provides depth which has powerful spatial influence on how visitors would experience the the narrative space.

With the concept of atmosphere, as defined by Gernot Böhme, it is possible to re-structure spatial experiences through the "mood" that the narrative space may convey. Atmosphere is therefore used as a method to not only create narrative spaces, but also as a method which could meet the overall aim of the Vision [2] to extend the museum narrative beyond the physical space to form unique and memorable total experiences for the visitor. With the theory of atmosphere it may be possible to provide the visitor with a personal feeling that is related to the specific narrative. This allows museums to communicate a narrative in a much deeper level, as the atmosphere becomes the bridge between the visitor and the narrative space. There are many forms of "generators" of atmosphere that can be helpful, but lighting hold a great potential, especially if set in connection with other non-visual influences.

With a visitor-centred approach to lighting design, it is important to be aware of the conscious and unconscious influences that the experience of light has on us. Light, space and man are all connected together as a form of primordial language in the experience of being bodily present in a space (as body image and body schema). The body and the space engage equally in the transaction of information through perception, which acts as a bridge from the body (and mind) to the world. This is also influenced by the Gestalt principle, that we collect the different sensuous inputs into one entity. What is meant by

this is that visitor perceives the different sensory inputs of a narrative space as one collected experience. A holistic design is therefore crucial to be successful in creating a narrative space that can enhance the museum experience.

To gain an understanding of how light influences people and the experience of space, a section was devoted to the characteristics of lighting seen from a qualitative and phenomenological perspective. The presented characteristics are furthermore often used as scenographic methods to convey narrative. The level of light that we experience in a space is a great influence of atmosphere, and can further be used to influence the perception of size and distance. Spatial composition of light and shadow is moreover crucial for control of obscurity and visibility, that all aid in visual storytelling. Visual hierarchy and the use of focal glow moreover help cue and guide the attention of the visitor. The use of shadow influences our perception of structure, material and shape, which acts as a fundamental part of how we read our surroundings.

Reflections of light also have qualities that can be used to bring life into a space, and can further be used as a secondary light source.

With regards to atmosphere, colour of light has great transcendental capabilities that can leave us with a lasting impression of a space. It can also be used to intensify colour of materials. Density and Play of Brilliants likewise have atmospheric qualities that can be used to modulate behaviour and excitement of visitors.

As a final consideration of designing with light, it was explained that when dealing with light sensitive artefacts, the exposure of light has to be kept to a minimum.

4   Design Approach

Based on the Vision [2] of this thesis, the Initial Research Question [2.1] set out to answer the question: *"How can Narrative Spaces be created through a visitor-centred approach to lighting design to enhance the museum experience?"*

To answer this Initial Research Question, four main topics[4] were defined as a fundamental starting point of the Literature Review [3] to present relevant theories and concepts of other researchers. Each topic sought to explore new possibilities and to help narrow the focus of this thesis.

The four main topics presented in the model [2] illustrate the connection between these topics in order to achieve the end target of enhancing the museum experience.

The first section of Literature Review, *Museum Development* [3.1], was presented to provide a necessary background understanding of museum development through time and to provide an contextual understanding of how a more inclusive approach to museum development could be made use of.

The section of *Narrative Spaces* [3.2] then followed, to clarify how it is possible to accentuate the exhibition narrative as a spatial experience through the concept of Narrative Spaces (which acts as the target of the Initial Research Question).

A section was thereafter devoted to Böhme's concept of *Atmosphere* [3.3], which could be used as a visitor-centred approach to lighting design within Narrative Spaces, as it evolves around how it is possible to restructure visitors' atmospheric experience of space through generators of atmosphere.

Generators of atmosphere are within this thesis related to light, and a section was conclusively devoted to the *Experience of Light* [3.4], and how characteristics of light can be used as design tools to produce a Narrative Space and mediate narrative as a spatial experience, in both emotional and bodily form.

Individually, for the four main topics of the Literature Review, specific Design Considerations [3.1.2] [3.2.5] [3.3.1] [3.4.3], including tools, were presented based on the key elements from the specific topic. The Design Considerations, as previously described, take part of the design process.
By synthesising the knowledge gained throughout the Literature Review it is now possible to redefine the target of Narrative Spaces according to the scope of this thesis.

4.1   Narrative Spaces

To clarify what is being considered a Narrative Space within this thesis, a *Narrative Space* model will be presented in the figure 18. The model is an iterated version of Böhme's [31] *Sphere of Presence* model (fig. 6) designed to fit the target of this thesis.

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[4]Museum Development, Narrative Spaces, Atmosphere and Experience of Light
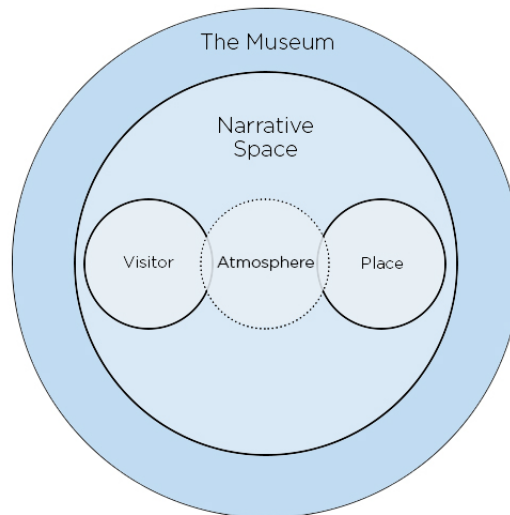
Figure 18: The Narrative Space model

As seen in the model (fig. 18) a Narrative Space consists only through the interplay between the visitor and the place[5], and the atmosphere that exists between these.

A Narrative Space is therefore to be considered more than just a physical space, and it is therefore important to underline that the poetry of the narrative space arises in the creation of place.

Thus, a narrative space is highly dependent on its visitors' participation for the narrative to not stay grounded, and must therefore provide an atmosphere and spatial experience, that invites its visitors to take part of their own experience, not only intellectually, also but through their body and their mind. This can be done through the method of lighting design, where the space is staged to become a place out of the ordinary. (Kossmann et al. [15]).

A Narrative Space does however not only exist due to its immaterial qualities and it is therefore also important to underline the physical constellation.

As can be seen in fig. 19 the scope of this thesis will revolve around the interrelationship between video Projection[6], the Space and the Visitor, bound together through the use of modern lighting technology. This is based on the idea that medias to a greater extend have to melt together in context of museums. The narrative of a projection must transcend from the screen to the space – bringing the two realities together as one entity that as a Narrative Space includes the role of the visitor.
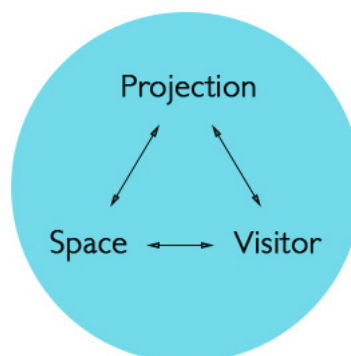

Figure 19: The physical constellation of a Narrative Space: an interrelationship between space, visitor and projection

With the reiterated definition of Narrative Spaces and the Design Considerations presented in the

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[5]The physical character and atmosphere of the space transforms a space into a place, as defined by Kossmann et al. [15]
[6]referred to just as a projection

Literature Review [3.1.2] [3.2.5] [3.3.1] [3.4.3], it is possible to create a conceptual lighting design framework that (I hypothesise) can be used to create Narrative Spaces, which does not only meet the ambition of the Initial Research Question, with the assumption that narrative spaces can enhance the museum experience, and therefore aid in reaching the Vision [2]; *Imagine if it was possible to extend a museum narrative beyond the physical space through design of light to form unique and memorable total experiences for the visitor.*

The Conceptual Design Framework will now be presented.

4.2 Conceptual Design Framework

The Design Framework is based on the three physical elements presented in fig. 19: Projection, Space and Visitor. Each of the three elements act as a stage that needs to be fulfilled in order to, based on the individual criteria, for the framework to be evaluated as successful.

The stages are defined as follows;

1. Projection: *Break the physical boundaries of a video projection*

2. Space: *Integrate the projection into the space through lighting*

3. Visitor Centrism: *Include the role of the visitor*

The criteria of each stage can be used to evaluate a design against, but can also be used to guide and structure the design process.

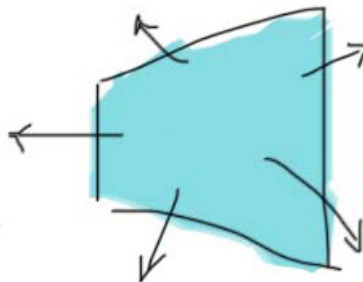### 4.2.1 Stage 1: Projection: *Break the physical boundaries of the projection*

Figure 20: Criteria 1: Rethink the physical format of a video projection

One of the key elements of the Narrative Space is to introduce projections as part of the exhibition space. The reasoning behind this is based on the work of Kossmann et al. [15], who state that with most visitors, the use of video is preferred to text [sec. 3.2.4]. This is further encouraged by avoiding the dominance of language and instead appealing to visitors through the use of a high level of narrativity as a form of evocative connotative communication, which speaks not only to visitors intellect but to their mind through suggestive of associative thoughts, memories, or feelings. (Kossmann et al. [15], Macleod et al. [16], Falk and Storksdieck [10]).

As what has been previously clarified, the use of video in museums is not uncommon, and the recent technological development has therefore also meant that museums make use of video projection within the exhibitions to a greater extent. The great advantage of making use of video is that it allow the visitor to have a view of unfamiliar places or past events, that would not have been realisable to show otherwise. However, it is important to note that there is not a well established academic base for how visitors of museums experience the use of video, such as video projections.

An observation I have done through the line of my work with museum developments, is that museums often do not take advantage of the potentials of video projection as a transcendental medium or scenographic element to mediate a given narrative. Video projections often seem to be used as an alternative to having a big screen, that do not add any particular additional value to the museum experience. Two examples of this can be found in fig. 21.

Figure 21: Examples of use of the traditional 16:9 resolution for projection. Left: Grenaa Museum (2017). Right: Naturama (Svendborg 2017) (Photos: Cecilie Warming)

It is therefore the intention with this stage to break the physical boundaries of the video projection, to use it as method to accentuate the narrative being mediated in the exhibition, which to a greater extent adds positive value to the museum experience.

To framework for the process of fulfilling Stage 1, a series of criteria and tools will be presented. These are based upon the Design Considerations presented after each of the four Literature Review sections.

Criteria

1. Mediate a visual narrative

    (a) Evocative connotative communication and high narrativity

2. Rethink the physical format

    (a) Avoid the visual reference to screens (16:9 format)
    (b) Exploit the Gestalt Principle
    (c) Innovative Projection Materials

3. Flexibility

    (a) Wide viewing angle projection surface

4.2.2   Stage 2: Space: *Integrate the projection into the space*
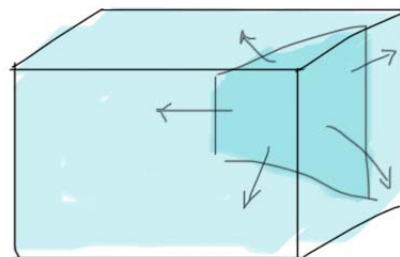
Figure 22: Criteria 2: Integrate the projection into the space

Integrating the projection in to the space with sound and lighting allows the narrative of the projection to spread beyond the physical limitations of the projection canvas. This will expand the perceptual inputs into the three dimensional space and allow the physical space to become a temporal storytelling medium. This will create a narrative space, that accentuate the narrative as a form of primordial language of the

perception of bodily presence. (Böhme [31], Merleau-Ponty [19]).

Based on the Design Considerations presented in the Literature Review, the criteria and tools are now going to be defined. These should be met for the Stage 2 to be evaluated as successful.

Criteria

1. Expand the narrative into the spatial experience

   (a) Reflective surfaces
   (b) Ambient lighting
      i. Level of Lightness
      ii. Colour of light

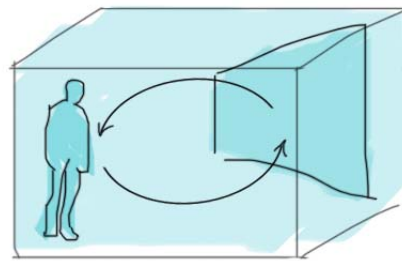### 4.2.3   Stage 3: Visitor: *Include the role of the visitor through the experience of light*

Figure 23: Criteria 3: Inclusion of the visitor through the experience of light. Interaction between the visitor, the space and the projection

To include the role of the visitor it is important for the narrative space not to stay grounded. A narrative space, as illustrated in the fig. 18 and 19, consists of the interplay between projection, space and visitor. This is based in the notion of Lang et al. [6], that museums need to be inclusive in the experiences that they offer. This is done by accommodating the personal, sociocultural and physical contexts of the visitors, which will increase the chance of forming unique and memorable total experiences that are unlikely to be forgotten (Falk and Storksdieck [10]). The experience of a narrative space should act as an internal reward that motivate visitors to participate in their own experience (Ryan and Deci [11]). A Narrative Space should encourage visitors to actively participate through the body and their mind, which mean that the experience needs to invoke and draw on past experiences or feelings of the visitor, through perceptual and sensory qualities of the physical context (Kossmann et al. [15], Merleau-Ponty [19]). The narrative space needs to facilitate an atmosphere (set a mood) that not only accommodate to the narrative of the exhibition, but an atmosphere that is belonging and welcoming through a visitor-centred approach to lighting Design, in order to create a place out of the ordinary.
The criteria that need to be fulfilled for the final, third stage to be successful are as follows.

Criteria

1. Integrate the presence of visitor into the space

   (a) Shadows
   (b) Ambient light

2. Bring attention to the important details of the narrative

   (a) "Play of brilliants"

3. Present the script: Cue the visitor

(a) Visual hierarchy and light zones

The framework presented above should help guide the design of Narrative Spaces for museums. While the framework is based in literature and professional experience, it remains to be seen if it can in fact be used to guide the design of a specific case. Developing a framework is hard, as it must be general enough to applicable in range of cases, yet specific enough to actually provide a set of useful guidelines and methods for design. Thus, the Conceptual Design Framework will now be used to guide the design of a quasi-theoretical Case Study, in order to test its applicability on a concrete real-life exhibition. The case study should hopefully help in pointing out how the framework could be improved in future iterations.

5   Case Study: Strandingsmuseum St. George

"Every exhibition harbours an idea, it is worth showing"
Kossmann et al. [15]

The Conceptual Design Framework will take basis in a real life context, as a quasi-theoretical case study. The reason for this is to provide a probable basis for demonstrating the use of the framework. Thus, it can act as an authentic example of the possibilities and diverse circumstances that would be likely to challenge my design.

The case study is quasi-theoretical because as the design will only partly be implemented into the final exhibition. The part that is being implemented into the Strandingsmuseum St. George evolves around the projection (Stage 1). The projection is part of a delivery that we at No Parking Production are responsible for (amongst other installations). Through my job at No Parking it has been my responsibility to design the physical elements (canvas, setup and selection of surface material) of the projection, while I have also participated in the visual production of Night of the Wreck[7].

The second and third stage of the design – the space and the inclusion of the visitor – will be in a purely theoretical form, motivated by the actual case.
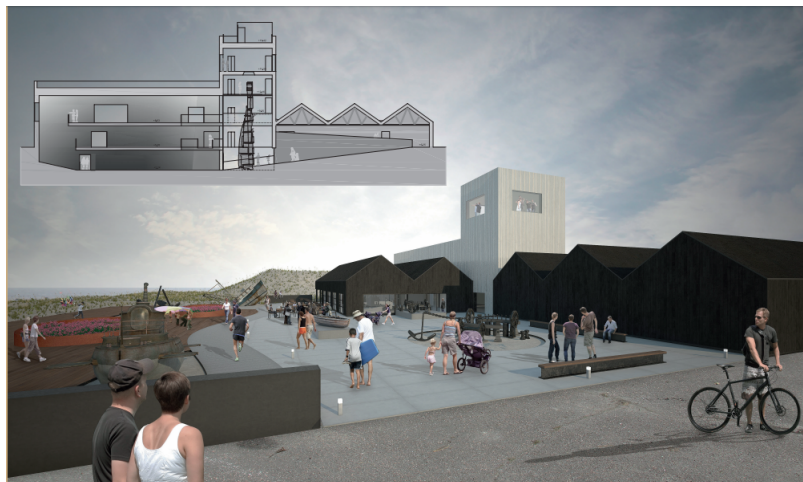

Figure 24: Strandingsmuseet official poster(Illustration: Event [59])

5.1   About

Strandingsmuseum St. George is a new museum exhibition which opened on the 19th of May 2017. The museum tells the narratives of famous ship strandings, specifically the standing of HMS St. George in the west coast of Jutland in 1811.

The stranding of HMS St. George is important to mediate because it is considered one of the world's worst strandings, as only 17 out of 1408 men survived the stranding.
The stranding of HMS St. George is part of the cultural heritage, and has therefore been passed down through many generations to today, where it is our generation's responsibility to pass it on to future

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[7]3D modelling and texturing along with green screen recording of actors. See appendix [A.1.2] and [A.2].

generations. This is important as cultural heritage has a significant role in every human society, in our understanding of self and the world, which allow us to learn from past generations.

The challenge is therefore to make visitors care. This requires that visitors feel compelled and included in the experiences that the museum is offering. Visitors do not wish to feel schooled and they can therefore not just take on the role of being passive recipients of academia, which is also what makes this thesis relevant, and became the foundation of the Vision [sec. 2] (Lang et al. [6]).

Essential for cultural heritage of the stranding of HMS St. George's narrative is to make visitors understand and care for it, which is explicitly the key objective behind the exhibition and why the museum went under an immense renovation. To convey and mediate the narrative of HMS St George as *"a learning experience for all the senses."* (Strandingsmuseet [60])

According to the Exhibition Concept manual [61] the need is that the new museum will offer experiences that are as follows;

- Social experiences

- Easy to understand with strong stories

- Dramatic and sensory

- Involving, emotional and physical

The narrative being told has to underline the powerful forces and dramas on the ocean and the stranding's influence on the people of the coast. It is therefore crucial that the final design meets the expected visitor experiences.

The exhibition space is built on a logical movement pattern through content and architecture – one storyline, known from the filmmakers' playbook. The exhibition consists of six permanent galleries, that together create one continuous story by making use of the possibilities in the new building (See fig. 25).
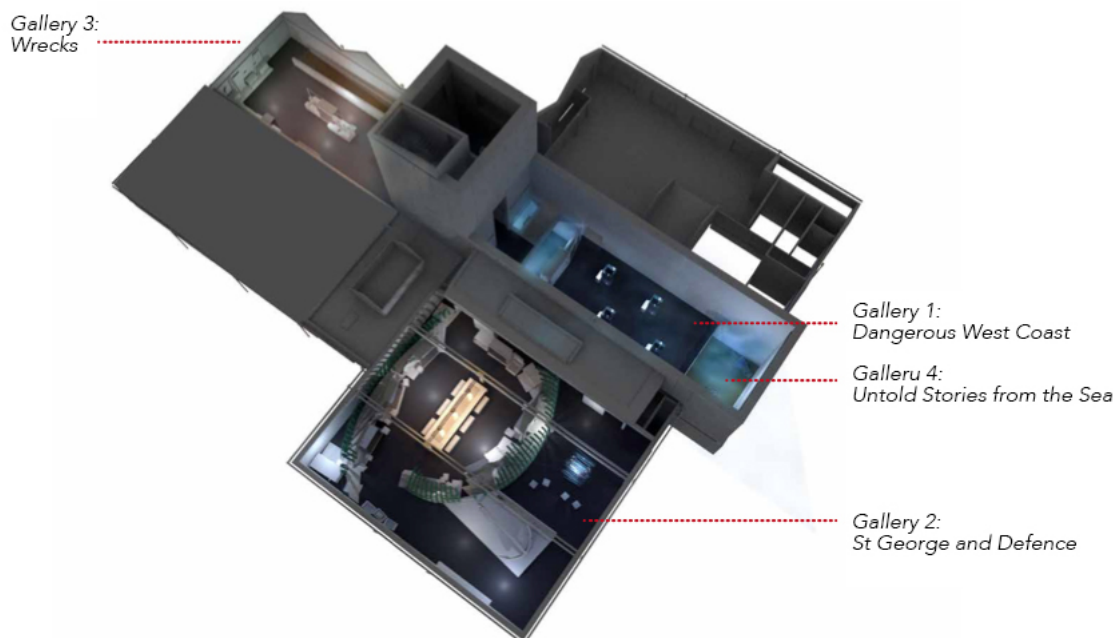

Figure 25: *Exhibition Concept* model illustrating the six galleries (Illustration: Event [59])

5.2 Gallery 2: HMS St. George

The focus in this thesis will be on the second gallery, specifically on the part of the exhibition that evolves around the story of the stranding of HMS St. George. The visitors have to be drawn into the dramatic

story about the ship's last voyage and final hours, parallel with visitors gaining an understanding of how life was on board two of the English fleet line ships in the early 19th hundred.
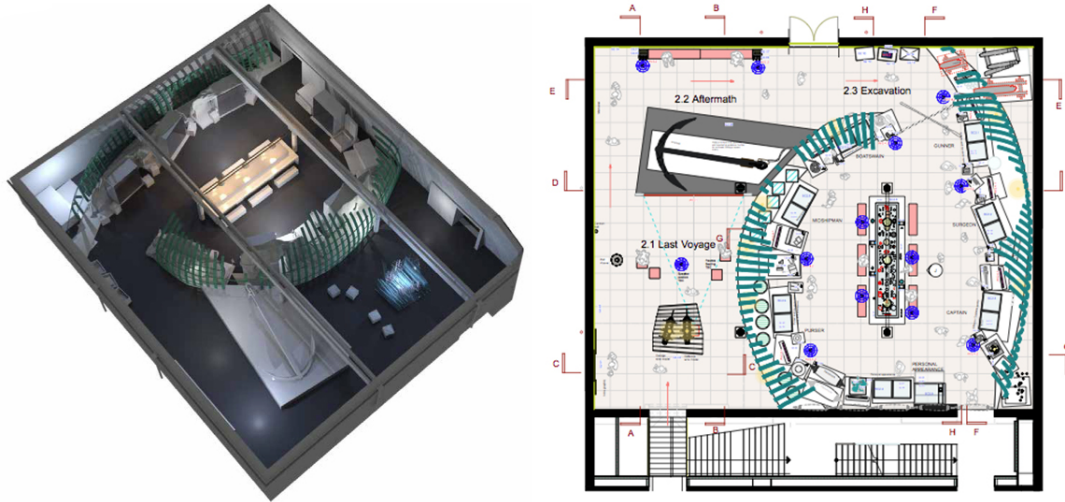
5.2.1   Exhibition Structure

Figure 26: *Exhibition Concept* model illustrating gallery 2 (Illustration: Event [59])

As seen in fig. 26, Gallery 2 is divided into three different sections, that follow a chronological organisation. The first part (2.1) is referred to as *The Last Voyage*, which includesthe projection *Night of the Wreck*, which is the focus of the design[8]. The second part of the exhibition (2.2) revolves around the aftermath of the stranding of St. George, where a giant anchor will be positioned behind the *Night of the Wreck* installation. Along the west end-wall, the names of those 1408 who lost their life during the stranding will be graphically displayed, while the end-wall behind the anchor in (2.2) will present the names of those 17 who survived.

5.2.2   The Narrative of "Night of the Wreck"

The projection, also being referred to as the *Night of the Wreck* installation, will take the visitors on the final voyage of the fleet line ship on its way home to England from Baltic Sea on the fated Christmas morning 1811.

To get a better understanding of the narrative that forms the basis of my design, the most essential parts of the event will be described.

Figure 27: The stranding of HMS St. George (Illustration: Visit Hobro: Strandingsmuseum St. George)

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[8]This part of the design is being implemented as a actual part of the exhibition based on the design presented in this thesis

23. December 1811: A hurricane and awful weather meant that the ships (HMS St. George and Defence) was driven off their course.

24. December 1811: A few kilometres away from the coast of Thorsminde, the stately rudder of HMS St. George is lost by Rødsand Flak, and the ship stranded. Only 500 metres from the coast, the anchor is dropped into the ocean, but its chain breaks on the way down, and the ship now gets seriously heeled. All the smaller boats on board (note: these were not lifeboats) flushes off board.
To lighten the ship the masts were cut down, but while cutting down the mesan mast (only with knives, as all axes had been lost), the wind caught the mast and hauled everything around it into the ocean.
During the night, many had long ago lost their lives to the cold and exhaustion, but around 10 o'clock a great wave washed over the ship, taking hundreds of men with it. In the evening only around a hundred men were seen alive on board HMS St. George.

25. December 1811: A few survivors drift to the shore, more dead than alive.

26. December 1811: There is no longer any signs of life.

The installation is a eyewitness depiction from the survivors, from the locals on the west coast, that saw the ships pass by as they were convoying through the danish belts.

1408 men lost their lives during the wreckage, only 17 survived. Not before, and not after, have so many people lost their life in one stranding on the west coast. (Strandingsmuseet [60]).

Based on what has been presented in the section About the Case study of the Strandingsmuseum St. George and the narrative of Gallery 2, it is now possible to define a more focused Final Research Question.

5.3 Final Research Question

The final research question is used to narrow the scope of the research and through the constitution of the presented conceptual design framework [4.2], it should be plausible to answer to the Final Research Question based on the Case Study.

How can the Conceptual Design Framework [4.2] be used as a method to guide the design of a Narrative Space for the "Night of the Wreck" exhibition to accentuate the dramatic narrative of the stranding of HMS St. George?

With the Final Research Question defined, the Design Concept will now be delineated.

5.4 Design Concept

This section will present the design concept for the final design. The design concept acts as a method for giving the design directions to help provide an answer to the Final Research Question [sec. 5.3].

The design concept will consist of the two sections that will present the spatial constraint of the Narrative Space and its spatial Atmosphere, set in relation to the quasi-theoretical Case Study of the Standingsmuseum St. George.

5.4.1 Narrative Space

To focus the design, the centre of attention will lie on the *Night of the Wreck* installation and the space around it to fulfil the three presented stages of the conceptual design frame work[9] [4.2]. The illustration in fig. 28 illustrates the area of focus highlighted in blue. This area will from this point on be considered as the Narrative Space. This Narrative Space is chosen as it deals with the specific narrative of the stranding of HMS St. George, which is the pre-eminent narrative of the Strandingsmuseum.

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[9]
- Criteria 1: Break the physical boundaries of the projection.
- Criteria 2: Integrate the projection into the space.
- Criteria 3: Include the role of the visitor through the experience of light
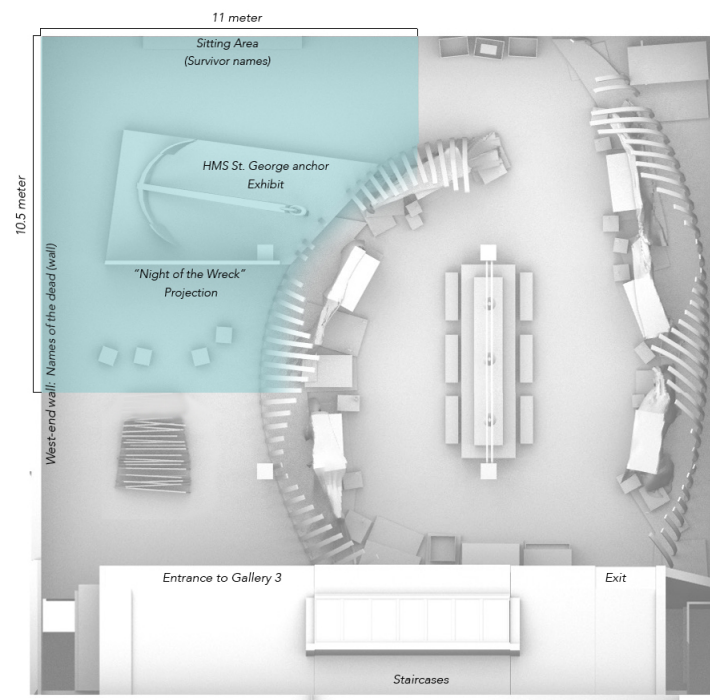
Figure 28: Gallery 2, where the area of focus for this thesis is highlighted in blue

As seen in fig. 28 the narrative space is organised so the projection of *Night of the Wreck* is visible from the entrance to the gallery. In front of the projection is a space dedicated to a seating area. The projection canvas acts as an intimation of movement, that will restrict the movement of the visitors to only be able to pass the installation from the left side. Entering the area, behind the installation, the visitor will meet the only exhibit artefact present in the narrative space, the anchor of St. George.

| Full Narrative Space | Sub-Narrative Space A | Sub-Narrative Space B |
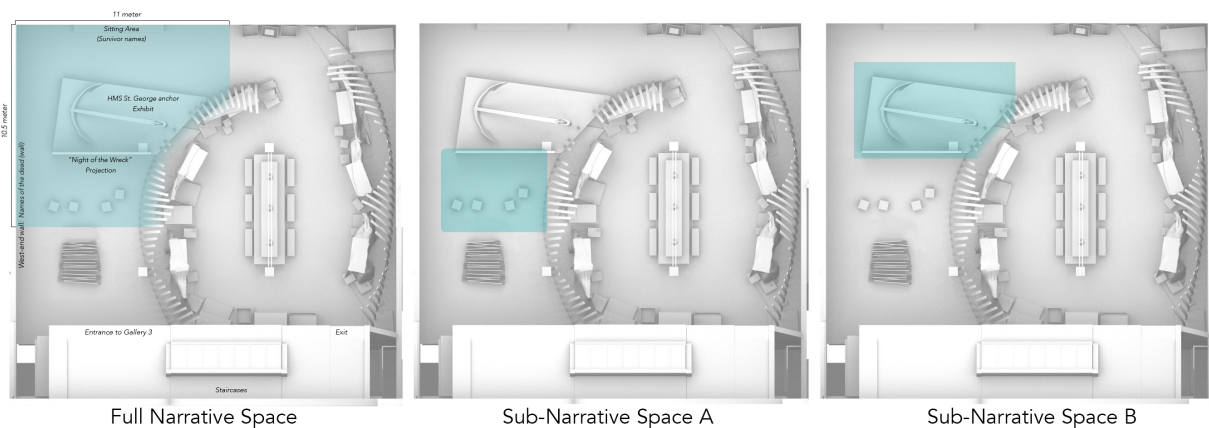
Figure 29: One narrative space, consisting of two sub-narrative spaces

The overall narrative space consists of two sub-narrative spaces, separated from each other by the *Night of the Wreck* installation. It would therefore be relevant to connect or unify these sub-narrative spaces together as on holistic, meaningful and coherent spatial experience.

Having now clarified the physical area that form the basis of the narrative space, it is now time to explain what atmosphere I aim to create in the narrative space.

5.4.2 Atmosphere

As seen section [4.1], fig. 18, then a Narrative Space is, within this thesis, defined as the interplay between the visitor, the place and the atmosphere that exists between these. As has been described in the section [3.3], then atmosphere is defined according to the work of Böhme [4], as the mood or feeling we sense when we are present within a space. The atmosphere of this given Narrative Space is there a primary interest, and it is therefore important to clearly define the atmosphere I wish to develop for the visitors.

Based on the Strandingsmusum St. George's concept manual [61], the museum wishes to create an experience that is dramatic, involving and emotional (section [5.1]), which corresponds well to the narrative of the stranding, which is being projected in the *Night of the Wreck* installation.

Two atmospheric keywords can therefore be defined on the basis of the narrative being portrayed and the museum's concept manual.

- **Coldness**
  The stranding took place during a hurricane on a December winter night (24/12-1811), and it must therefore have been unbearably cold, which also became the death of many of the crew members. To involve the visitors with perceptual feeling of coldness, it could therefore help to intensify the experience of the narrative.

- **Empty void**
  Surrounded by the empty void of the night or the cold, deep and enclosing water. The melancholic narrative of the stranding's loss of life during the tragic events in 1811 is something I wish to make an emotional impact on the visitors with.

To expressly show the atmosphere of the intended design, I have sketched an illustration with the purpose of showing how the keywords can be combined into one unified visual atmosphere, that depicts the melancholic feeling of the empty void during a cold winter night.
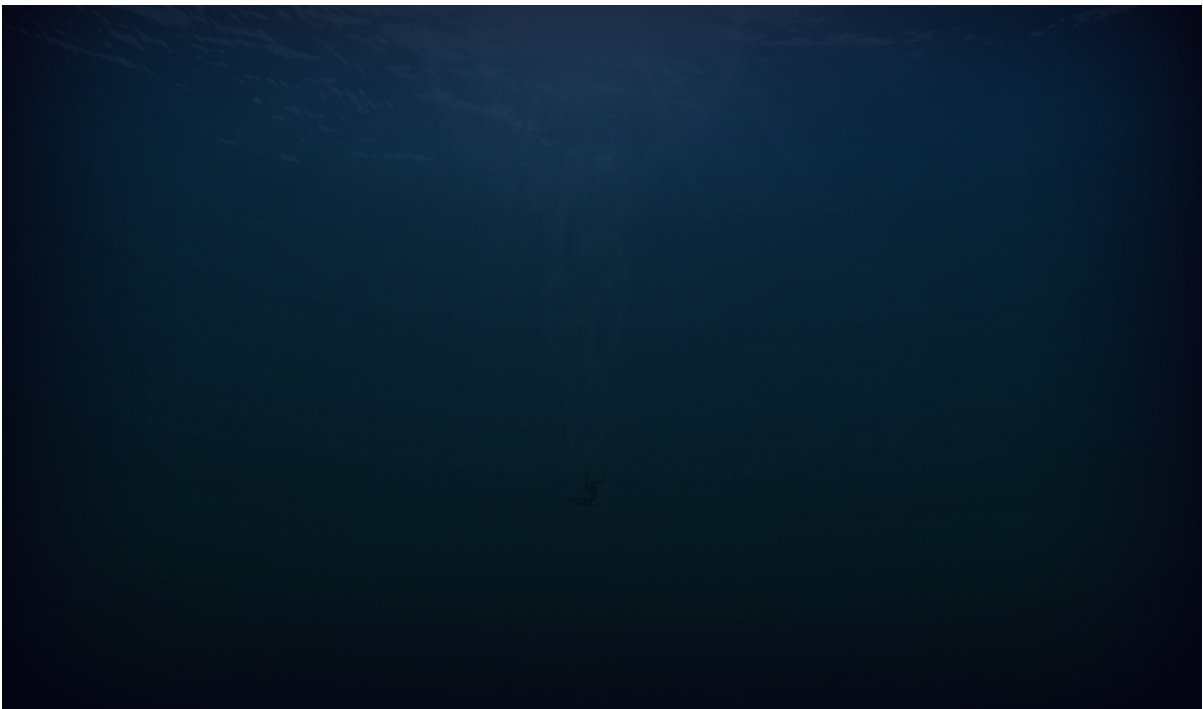

Figure 30: Visual atmosphere intended for the Narrative Space of *coldness* and *empty void*. (Illustration: Cecilie Warming 2017)

By having defined both the Narrative Space and the Atmosphere of this space, it is now time to move on to the Design phase, where the Conceptual Design Framework [4.2] and its three stages will be implemented to answer the Final Research Question [5.3].

6 Design

To answer the Final Research Question [5.3] the design phase will be divided into the three stages of the Conceptual Design Framework, that each seek to fulfil the criteria presented in the sections [4.2.1] [4.2.2] and [4.2.3] though the individual tools. This is done to make sure, that all the necessary criteria are met, in order to be able evaluate the Conceptual Design Framework to be successful. The three stages are as follows:

- **Stage 1: Projection** Break the physical boundaries of the video projection

- **Stage 2: Space** Integrate the projection into the space

- **Stage 3: Visitor** Include the visitor through the experience of light

6.1 Stage 1: Projection: Break the physical boundaries of the projection

One of the things that could be drawn from the Literature Review [3], was that the use of video projections can be effective as a transcendental effect in a museum context, as it allows the visitor to have experiences that would otherwise not have been realisable, which is very profitable when designing for narrative spaces. (Aronson [24]).

Mediation of narrative through projection can both communicate the content and provide a broad variation of innovative design possibilities in a wide alternation of form. Thinking creatively in the design process can help support the transition away from the dominance of language towards a more sensory and bodily approach, which may be more engaging and interesting for the visitor than the traditional form of museum experiences (Kossmann et al. [15], Dudley [17], Visser [27]).

The use of technology within the context of the museum can be seen as an unavoidable development. However, it is important to note what Othman et al. [29] states that technology like this should not be be considered a replacement of the traditional means to disseminate information, but rather be used as tool that can connect and engage visitors, along with with physical artefacts, collections and exhibit space. This however demands that the narrative is communicated in a meaningful manner for the experience to be fruitful. This also means that the projection has be integrated into the architecture of the museum space in a purposeful manner.

The following subsections will therefore delve into how it could be possible to find innovative solutions for the design of the *Night of the Wreck* projection, that can help accentuate the dramatic narrative of the stranding, as the Final Research Question [5.3] sets out to do. This process take basis in breaking the physical boundaries of the projection and the criteria presented in section [4.2.1].

Note that this stage is the part the No Parking delivery to be implemented at the Strandingsmuseum. In collaboration with the Standingsmuseum, who provided the historical material, and No Parking Production, who stood for the design and production of the installation.

6.1.1 Criteria 1.A: Mediate a visual narrative

The purpose of the narrative of *Night of the Wreck* is to create an emotive installation that recounts the events of the stranding of St. George of the coast of Thorsminde.

The visuals draw inspiration from the drawings and painting relating to the Royal Navy of England in the 18th and 19th century (see the appendix [A.1.1] for reference).

The narrative is portrayed and mediated through the use of 3D animation and soundscapes, and therefor does not hold any text or speech, which therefore follow the ways of evocative connotative communication and high narrativity, as defined by Macleod et al. [16] in the Narrativity model (fig. 4).

The fig. 31 illustrates the final visual style used for the Night of the Wreck installation.

Figure 31: Frame from the NOTW illustrating the visual style (Graphics and animation: Søren Klok. 3D Modelled and texturing by Cecilie Warming)

More frames portrayed in the *Night of the Wreck* can be found in fig. 64 of the appendix [A.1.1].

6.1.2   Criteria 2: Rethinking the physical format

As seen in the design illustration on fig. 32, the original intention, from *Event*, was that the projection was in the classic aspect ratio with a width of 16 units and height of 9 (16:9).
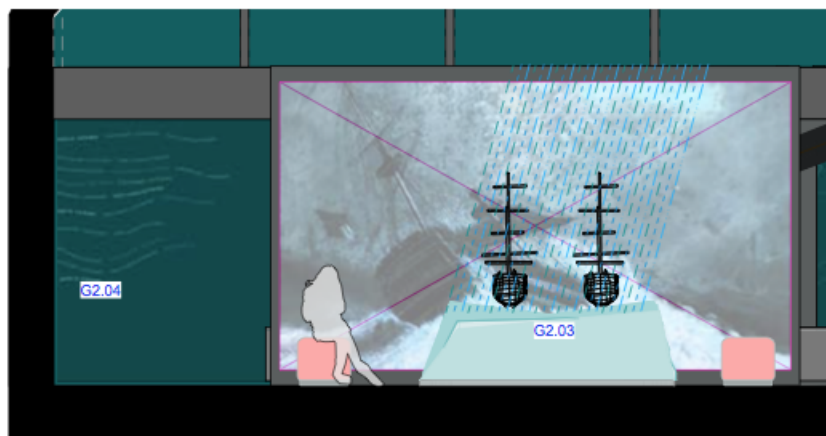
Elevation AV2.1 The Night of the Wreck

Figure 32: Initial Design suggestion from *Event* illustrating the projection as a 16:9 format. Illustration: *Event*

C2.A.   Avoid the 16:9 format

In the early start of the design process, we (at No Parking Production) knew that we wanted to challenge this idea of a traditional canvas design, as an abandonment of *"the straight, the plane, the right angle"* that Böhme [31] denounce. The reasoning behind this is to avoid the visual reference to screens (16:9), that surrounds us in our everyday life (televisions, mobile phones etc) and the idea was therefore to present *Night of the Wreck* as a "screenless" experience, which had to become an integrated part of the spatial experience for the visitor rather than an add-on to the space.

The concept of our solution was to make use of groupings or fragmentation of physical geometric structures as scenographic elements, which could add to accentuate the dramatic narrative experience (FRQ [5.3]).

The idea of using alternative constellations and materials for projection surfaces, can be seen in other (often newer) museums, where they often bring a very interesting expression to the museum space. An example of this can be found in the M/S Maritime Museum of Denmark (fig. 33), which makes use of fragmented rusted metal plates as projection canvases, installed above the walking area, which adds positively to the narrative of the exhibition.

Figure 33: M/S Maritime Museum of Denmark, war exhibition, using fragmented projection surfaces

C2.B.   Gestalt Principle

The fragmented design was inspired from the Gestalt principle, which states that we, as humans, perceive objects as distinct wholes (Koffka [39]). Having this in mind, it would be possible to create a projection which does not solely consist of the surface projected on, but a projection which would take advantage of how we as human perceive the world that surrounds us, allowing us to "fill in" the missing gaps. This could help stimulate the visitors' imagination and visual senses, and thereby make the experience of *Night of the Wreck* more stimulating and exciting for the conscious and unconscious part of the visitors perceptive process.

Designing the canvases as fragments, with physical distances of void and vacuum, further allows for visibility and orientation to the surrounding space. This allows the visitor not only to see the projected canvases, but rather, see the projected canvases integrated into the physical context of the narrative space (and its visitors). With a fragmented design, one is able to see the space and the surroundings behind and around the projection, which may help create an interrelationship between the visitor, the space and the projection.
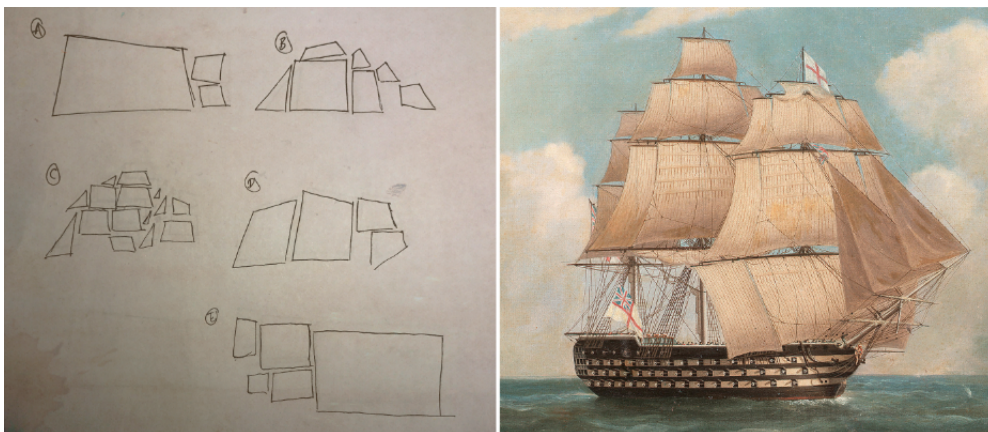

Figure 34: Early sketches for canvas layout

The figure 34 illustrates some of the initial ideas that I sketched during the brainstorming process. The sketches arose from the inspiration of sails. The graphic representation of sails would furthermore make a direct visual reference to sails, that could help the visual relatability and strengthen the connection to the narrative. In the process it was decided to go with the design (in a mirrored version), as seen in fig. 35[10].

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[10]The final three suggestions can be found the the appendix [A.1.3] in fig. 66.

Figure 35: Final design of canvases (Rendering: Cecilie Warming. Post-production: Søren Klok)

Additionally, the principle of Gestalt was also used within the graphics. As can be seen in the fig. 36, the visuals make use of both a non-fragmented and fragmented style. The non-fragmented show the graphics in one connected unity, whereas the fragmented visuals divide different visual elements between the canvases to show multiple activities simultaneously.
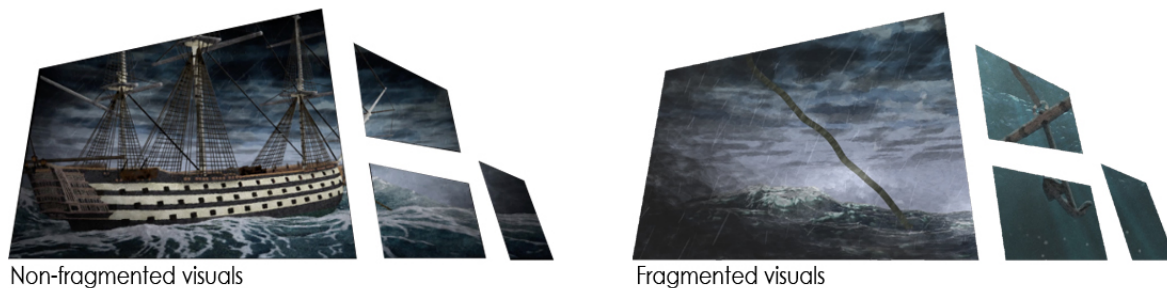

Figure 36: Frames from the NOTW illustrating the non-fragmented and fragmented visuals. (Graphics and animation: Søren Klok. 3D Modelled and texturing by Cecilie Warming)

Criteria 2.C.   Innovative Projection Materials

The aim was here to find a material projection solution with a different quality than what is mostly used within traditional setups (opaque plastic). The inspiration naturally also came from sails, or another kind of fabric which could make a visual reference to sails, to further strengthen the connection between the narrative elements, which may aid in accentuating the dramatic narrative of the stranding of HMS St. George.

The intentions was to create an elegant expression, with a semi translucent fabric or other material, much like what is also used within the Japanese architecture that Böhme [31] refers to. The intention with an elegant, semi translucent material was to bring focus to the canvas more as a scenographic quality, than a practical necessity, and to give the installation a light, almost flying expression.

6.1.3   Criteria 3: Flexibility

As was drawn from the Literature Review (The Organisation of a Narrative Space [3.2.3]), the visitor's bodily behaviour and movement is highly unpredictable, and it can therefore not be expected that they will position themselves perpendicularly towards the projection surface (Macleod et al. [16]).

The viewing angle[11] of the projection surface therefore has to accommodate the unpredictability to provide the best possible visual experience for the visitor, that accommodates the free-flowing movement of visitors.

C3.A.   Wide Viewing Angle Projection Surface

As seen in fig. 37, the examples illustrate how the blue areas are within an acceptable brightness of the projection. Moving outside these areas will result in an decrease of brightness of the image, which may

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[11]The viewing angle of a projection surface indicates the maximum angle at which the projected image is still clearly visible

impact the experience negatively. The commonly accepted standard for image quality for the maximum viewing angle lies where the viewer will perceive 50% or less of the luminous intensity of the projected surface, ideally with a perfect evenness. (Projecta [62]).

Figure 37: Viewing angle examples. Ideal viewing angle of 360, would allow visitors to see the projection from all directions.

The ideal material would not only have wide viewing angle from the front side of the projection, but would also have it from the backside of the projection (360°). This would mean, that visitors from all viewing angles, would be able to get that same experience as those in front, which would accommodate the free-flowing movement of visitors.

To test a variation of materials and their visual performance, a controlled lab experiment was set p, to evaluate the precise nature of the cause and effect relationships between the different materials.

6.1.4 Experiment 1: Projection Materials

The goal of these experiments was to find the material which has the best perceived image quality from a wide viewing angle. The experiment took place at No Parking Production, in a room specifically designed to test projectors and video projections. A Philips projector[12] was mounted on a truss rag suspended from the ceiling. The materials in question were installed, one by one, in the mid centre throw of the image, 4 meters from the projector, as seen in fig. 38, in a 2 meter height. The materials were all evaluated on an qualitative basis with a focus on the perceived best experience.
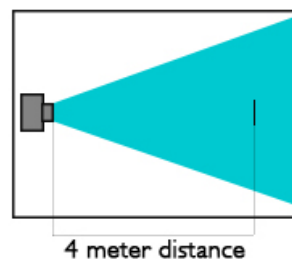

Figure 38: Laboratory experiment setup. Distance between projector and material: 4 m.

A variation of four materials were selected to represent different material qualities.

- Material 1: Diffusing fabric

- Material 2: Paper/fabric with a low saturated yellow hue (resembling sails)

- Material 3: Diffused plastic filter

- Material 4: Acrylic (Pop3: Rear projection material)

Experiment Hypothesis: Material 4, the acrylics (POP3), will provide the best visual experience from a 360°viewing angle, in terms of brightness, colour saturation, and image sharpness

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[12]Note, that this is not a ultra short throw projector

The reason behind this is, that it is a material specifically design and produced for projections (in contrast to the other three). The manufacturer (DAF screen) further promises an even light distribution in almost all viewing-angles (DAF Screens [63]).
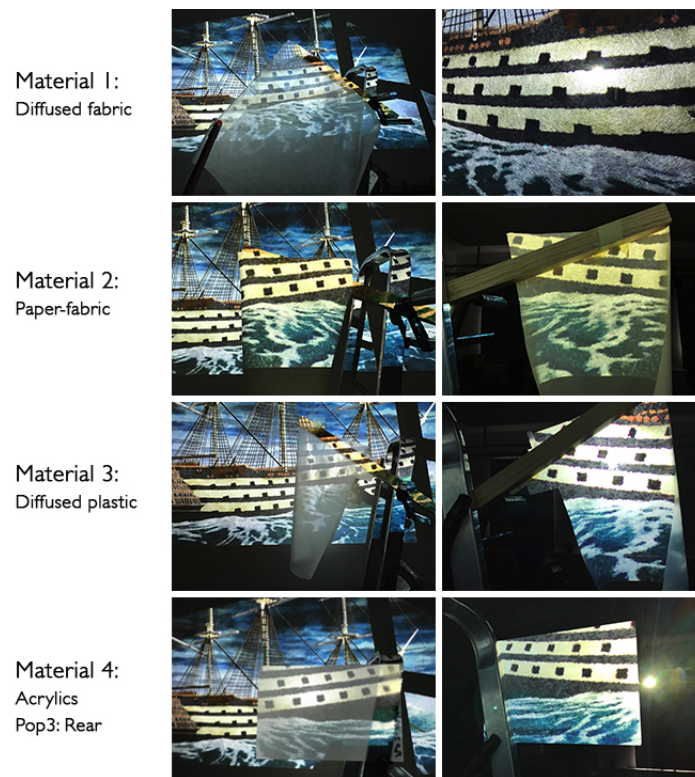

Figure 39:

Results
Material 4, the acrylic POP3 material, did fulfil the presented hypothesis, by having the best visually perceived performance. However, the differentiation between the selected materials, were not as great as expected. An important thing to note is that the POP3 material is designed for a rear projection with an ultra short throw projector, and as this experiment was set up as a front projection, with a normal wide angle projector, the material did not have the optimal circumstances. It should be expected that under the right circumstances the material should perform better.

A surprise was that the wide viewing angle capabilities (brightness, colour saturation, and image sharpness) of the different materials, were acceptable in all of the four materials, on both the front and back side. However, they all had reduced colour saturation, as compared to the control projection screen (opaque plastic). This is however less of a problem, as the majority of new projectors have a high contrast-ratio, which can accommodate for this loss of colour contrast.

The experiment further showed that discomfort glare can be expected from the backside view, when using a material of high transmission, which would mean that the final material used should not be too transmissible.

A table evaluating the performed capabilities, according to colour saturation, sharpness and viewing angle can be found in the appendix [A.1].

Considering the results of this experiment, it would seem most beneficial to make use of a Front POP acrylic material to gain the best wide-angle image for the purpose of the *Night of the Wreck* installation.

6.1.5   Summary on Stage 1

Within Stage 1 the aim was to to break the physical boundaries of a projection by fulfilling its criteria [4.2.1], which in the end can help answering the Final Research Question [5.3], by accentuating the dramatic narrative of the stranding.

Through the *Night of the Wreck* installation the narrative of the stranding of HMS St. George will meet the first criteria to mediate a visual narrative through evocative connotative communication with a high level narrativity (no text or speech). The intention of the second criteria was to create an installation that could become a scenographic experience on its own, which was designed with visual connection to the narrative, as a meaningful total experience. To do so, the physical format had to be reconsidered to move away from the traditional 16:9 format and instead make a fragmentation of canvases, inspired from the Gestalt principle. The fragments were designed to resemble sails, both in structure and in material, as an innovative projection surface. To meet the third criteria, the solution needed to be flexible, to accommodate the unpredictability of visitors, it would demand that the projection material would have an ideal 360°viewing angle. An experiment was therefor conducted to test four different materials' visual performance again each other, in a controlled lab experiment. The results of the experiment did not prove a great difference between the materials, but it was concluded that the POP3 would fit the needs of this design the best.

This first stage of the Conceptual Design Framework proved to work well within this specific narrative space of the Strandingsmuseum, which supports the idea that it could be used as a general design approach for other museums.

6.2 Stage 2: Space: Integrate the projection into the space

In view of the work by Aronson [24] it should be possible to use the physical space as a temporal storytelling medium, facilitating the establishment of a Narrative Space and the accentuating the dramatic stranding (Final Research Question [5.3]).

Through Stage 2 [4.2.2], the integration of the projection into the narrative space would allow the narrative, in this case of the stranding of St. George, to go beyond its physical canvas. This would fulfil the criteria of expanding the narrative into the spatial experience, as it spreads beyond the edge of the canvas, as an interplay between the projection and the space. In a Narrative Space like this, the narrative of the stranding is to be told through a broad range of perceptual and sensory means in different forms, such as lighting, spatial quality, material, colour, form etc. Through means like these it is possible to not only establish a space, but to compose an atmospheric *place* (Kossmann et al. [15]). As previously stated, it is in a place that the poetry of the narrative space arises.

The creation of an engaging Narrative Space is important because if museums can manage to invite their visitors to actively take part of their own experience, not only intellectually, but through their body and their mind, they can improve the museum experience, as the Vision [2] set out to do. The spatial qualities of such an experience is especially effective when considering the work of Merleau-Ponty and Smith [20], who argue that before conscious reflection and thinking have taken place, the body schema has already sensed and created meaning of the physical spatio-temporal context in which it is present. (Holl et al. [64]).

This stage focuses on expanding the projection into the space through the use of reflective surfaces as secondary light sources and ambient lighting, in the form of level of light and colour of light.

6.2.1 Criteria 1: Expand the narrative into the spatial experience

This second stage of the Conceptual Design Framework seeks to integrate the projection into the space through the criteria of expanding the narrative into the spatial experience. This is done through two main qualities; reflectivity of a surface and ambient lighting. These two tools each have a specific purpose. Reflection of light, to transfer light from the projection to the space, and ambient lighting, to contribute from the space to the narrative of *Night of the Wreck*.

C1.A: Reflective surfaces

Reflective materials are especially important to take into consideration when designing narrative spaces, as Liljefors [43] argues *"when you move, the reflections change and produce the experience of something almost being alive, giving a positive contribution to the environment."* Reflections therefore provide much more than just being secondary light sources, that transfer indirect lighting. In this context, the reflective qualities of ceiling and floor has the potential to help spread the projection from the canvas into the space. This is not to be understood as mirroring of the graphic content but rather as diffused reflections, designed to transfer the colour dynamics into the surrounding space. By doing so, it is possible to create

a relationship that potentially helps bind the visuals of *Night of the Wreck* to the physical space, as a spatial experience.

In the fig. 40, there is an illustrations of the visual effects of reflections within the Narrative Space, from two different perspectives, in front of and behind the *Night of the Wreck installation*. As seen in these two illustrations, the reflectivity of the floor allows the colour dynamics to travel beyond the canvas and into the actual space in front of and around the projection.
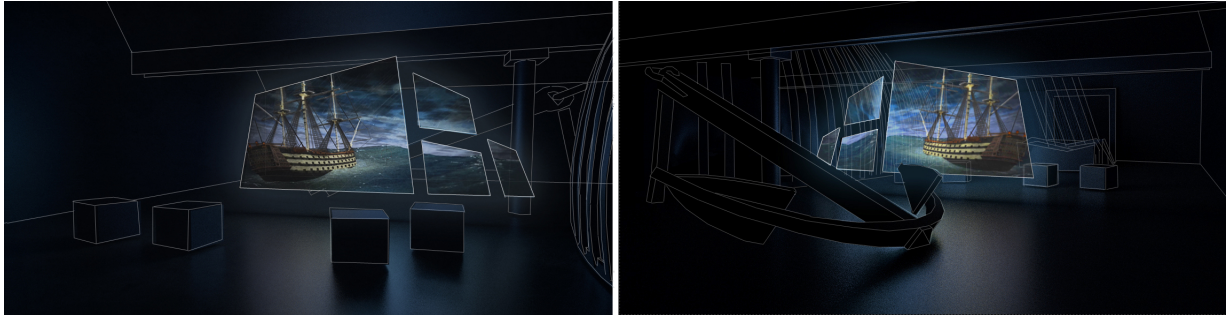

Figure 40: Reflections effect on the Narrative Space, seen from front and back position.

C1.B: Ambient lighting

The use of ambient lighting is implemented to create a background that serves to help visitors perceive the space by providing general illumination to the space. Ambient lighting is important as it allows not only general visibility but also provides orientation, which is crucial for the museum visitors, especially as it allows the visual circumstances necessary for free-flowing temporal movement behaviour in a space, such as this. The ambient light acts as the base layer, where the functional lighting is built upon.

In context of this specific narrative space, the reflective materials of floor, walls and ceilings are of great importance, as these spread the ambient light, and thereby become secondary light sources on their own. Using ambient lighting to create luminous surfaces can further bring a magical quality to space, especially if they embody the light reflected from a disguised source (Descottes and Ramos [44]).

In this narrative space, the ambient lighting is provided by LED strips implemented into the floor molding and in the area where ceiling and walls meet, as seen in fig. 41. As a suggestion, a 90°corner aluminium Profile, with diffuser for LED Strips could be used, as seen in fig. 42 in combination with a PROLED Flex Strip RGBW led strip[13].
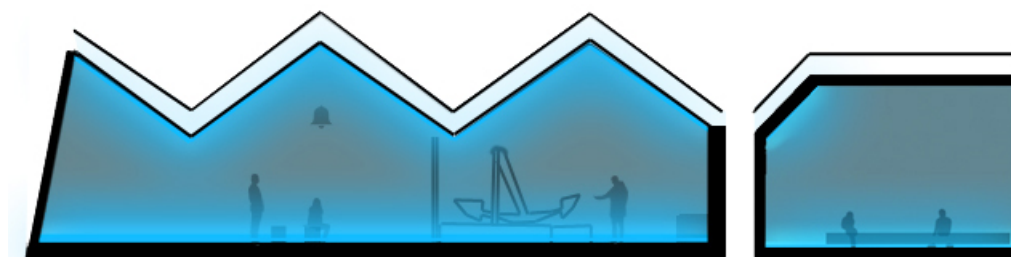

Figure 41: Ambient lighting in the narrative space provided by the LED strips integrated into the floor and ceiling moldings.

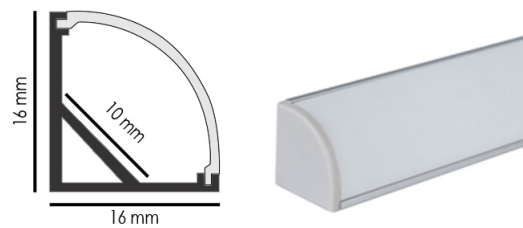[13]Further specification can be found in the appendix [A.2.2]

Figure 42: Suggested 90°corner aluminium Profile LED Strip be used. Manufacturer: Havit Lighting

Implementing LED strips in the floor and ceiling will not only provide the ambient light, it will also further cause higher luminance levels at the walls and ceiling which can help create perceptual depth and alter how visitors perceive the spatial size and distance, to make the space seem bigger (Descottes and Ramos [44]). This is beneficial to accentuate the narrative of the stranding of St. George, which takes place at the open sea. Furthermore, it will add to the atmospheric quality of *Empty Void* (Atmopheric keyword presented in section [5.4.2])

Furthermore, the led strips will provide the space with a linear density, as a continuous distribution of light, that will contribute to the visitors orientation of the space, as it indicates directionality.

C1.B.i: Level of Lightness

Level of lightness has a great influence on how visitors will experience the narrative space and can therefore be used as a scenic tool to accentuate the narrative of the stranding as a bodily and emotional experience, which can help answer the Final Research Question [5.3].

As described in the section [5.2.2] (The Narrative of "Night of the Wreck"), the dramatic events of the stranding took place during a cold December night, so to emphasise this fact it would make sense to leave the space in relative darkness, while still providing visibility and orientation. Entering the gallery and the narrative space in a dim level of light would mean that the full extend of the narrative space would not be immediately visible, but rather revealed in the time required for the eye to adjust to the lower light levels (Descottes and Ramos [44]). The level of lightness would therefore resemble what can be found at the museum of Kongens Jelling (fig. 9).

Being present in dim spaces can become quite powerful, as darkness has strong emotional capabilities that draw upon the interplay of mind and matter that are active when we are in places of darkness and obscurity.
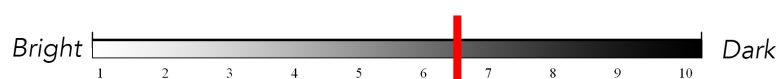

Figure 43: Level of Lightness from a scale from 1 to 10. Red line indicating the estimated dim experience of brightness of the space

Another consideration that has to be kept in mind towards lighting levels is the fact that dimmer lighting favours the preservation of light-sensitive artefact. This is important for the original anchor of HMS St. George, that is placed in the sub-narrative space B. The anchor consists of metal and is therefore classified with a low sensitivity on the table 1 presented in section [3.4.2]. The light level on the anchor should therefore be kept below 100-200 lux.

High contrast allow us to perceive brighter objects as being brighter than what they in reality are. It is therefore beneficial to work with a relative high contrast level between the spatial distributions of brightness, to allow the anchor to seem as illuminated brighter, than what it actually is.

C1.B.ii: Colour of light

According to Livingston [50] cooler colours will recede the perceptual distance and create depth, so it would be natural to make use of such to accentuate the narrative and extend the narrative of *Night of the Wreck* from the canvas into the space, which could help in integrating the projection into the space (Stage 2).

Using a cooler hue furthermore supports the atmospheric keyword of *coldness* [5.4.2], as our perceived thermoception is affected by the colours that surround us – warmer colours make us feel warm, whereas cooler colours make us perceive temperatures to be lower.

The greatest benefit with making use of coloured lighting is that it can have transcendental powers, to transform an otherwise well-known space to something new and different, which increases the chances for the visitors to have an unique and memorable total experience within the narrative space (Vision [2]). Coloured lighting highly influences the atmosphere of a space, how visitors will perceive the mood of the place (Böhme [31], Descottes and Ramos [44]).

However, making use of coloured light is not just about selecting a colour. The selection of colour (or tint), has to be considered in the context in which they are being made use of, in this context according to the Narrative Space of this thesis. To select the hue and saturation, an experiment has to be carried out to find the specific colour of lighting that the best accentuate the narrative behind the *Night of the Wreck*

6.2.2   Experiment 2: Colour of ambient light

This experiment sets out to test how different variations of hue and saturation affect the perceived atmosphere of a space in combination with the projection of *Night of the Wreck*. The intention is to get an understanding of what atmospheric qualities of the coloured ambient lighting that best accentuate the narrative of the stranding of the St. George, in order to answer the Final Research Question [5.3].

The experiment took place under the same conditions as the first experiment [section 6.1.4], as a controlled laboratory experiment at No Parking Production. The experiment room consists of matte white walls and a high reflectivity white floor.

A still image from *Night of the Wreck* was projected on the pre-installed projection surfaces suspended on the end wall, around 5 meters from the projector. Below the projection, one triangle[14] was suspended. The triangle consists of three 80 cm RGB Led strip (DMX controllable) in aluminium profiles, with a curved diffuser.

Through a DMX controller, five different variations of colour were selected, as seen in fig. 44. A full white, a green-blue, a light blue, a full blue and a red (all were in full intensity[15]). The red hue was chosen as control to see if highly different hue, which stood in great contrast to the colder hues of the projection, would accentuate the atmosphere of the narrative.
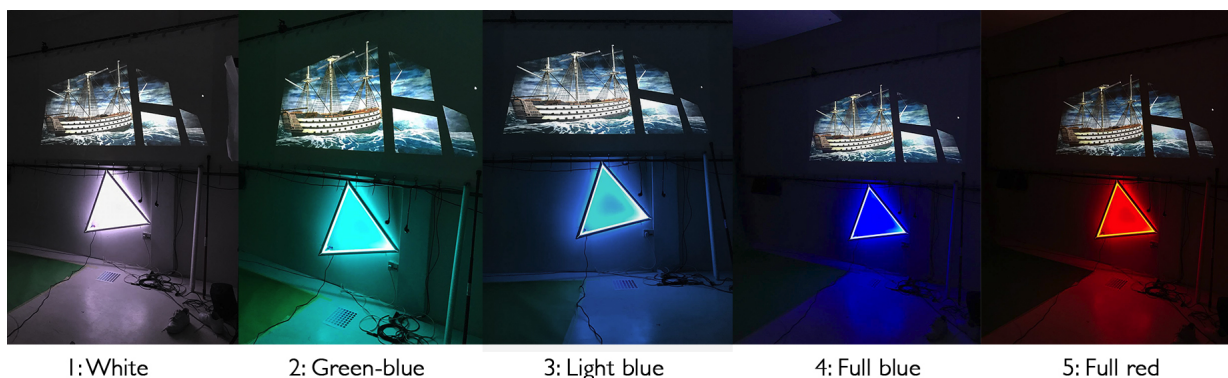

| 1: White | 2: Green-blue | 3: Light blue | 4: Full blue | 5: Full red |

Figure 44: Five lighting scenarios used for the second experiment

The Hypothesis *Coloured ambient lighting of low saturation and cooler hues will be preferable to accentuating the narrative Night of the Wreck.*

To evaluate the selected colours, I made use of my personal judgement as a lighting designer, but did a re-evaluation of the lighting scenarios, with two test subjects. The two test subjects was selected from No Parking Production, based on their understanding of the narrative of St. George and the installation. The two test subjects[16], were individually introduced to the five different lighting scenarios and asked to

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[14]Originally designed by No Parking for the Culture Night 2016
[15]Blue: 80 Lumen per meter. R+G+B (white): 550 Lumen per meter
[16]A visual artist and a sound designer

express their initial impression of the given colour and the atmosphere that it helped create.

Having seen the five different scenarios, the subjects were asked (in-dependently) to chose the colour that they found to the able to accentuate the atmosphere of the *Night of the Wreck* the best.

Results
All three evaluations had unquestionably the same result.

Where the hypothesis assumed that the ambient lighting of low saturation and cooler hues would be preferable to accentuating the atmosphere of the narrative, the results of the experiment showed to reject the hypothesis.

The results evidently showed that high intensity saturation of blue makes a much stronger atmospheric statement than cooler hues of lower saturation. Though the full blue may not perfectly visually support the visual colour scheme of the projection, it clearly accentuated and emotionally supported the dramatic narrative and atmosphere of the *Night of the Wreck*. An illustration of the relationship between the visual support and the emotional support can be found in fig. 45.

The full red was rejected as it stood as an unnatural contrast to the narrative.

Figure 45: Scale illustrating the focus on emotionally supporting

What seemed to work well with the full blue scenario, was according to test subject 1, the *"dramatic, drowning feeling"* that he felt. Test subject 2 further explained that it gave *"more atmosphere, drama and feeling"*, where the cooler hues of lower saturation seemed to *"resemble daylight too much."* This relationship can be illustrated when comparing the white scenario against the full blue, in fig. 46.
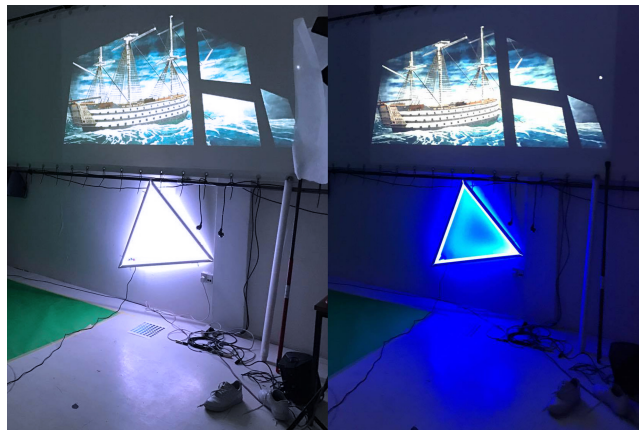

Figure 46: An comparison between white and blue ambient lighting, illustrating how the blue has a more dramatic expression

The results of the experiment therefore also corresponded to the results of the studies by Valdez and Mehrabian [52], which showed that highly saturated colours are more arousing than hues of lower saturation.

To not solely consider the colour of the emitted light, it is important to consider the surface colours of the surrounding environment. As explained in section [3.4.1] (fig. 14), illuminating coloured surfaces with coloured light of the same hue allows for an intensification of the narrative space. To test different surface colours, a small sub-experiment was carried out with the purpose of testing a range of different blue hues and their brightness illuminated with the blue lighting. As can be seen in fig. 47, the brighter

hues disappear, while the darker hues gets more intensified. It can therefore be concluded that the surrounding walls of the narrative space could benefit from medium dark hues of blue (medium, from light blue to very dark blue).
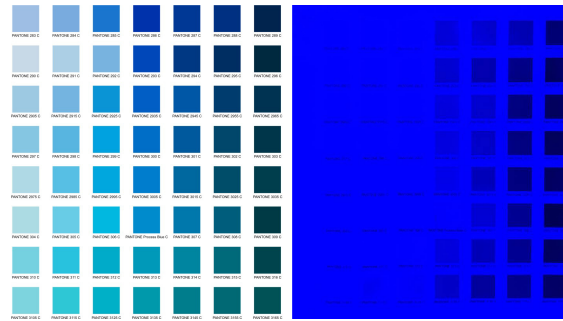

Figure 47: Surface colours being rendered by blue lighting. Light colours disappear, and darker look almost black. Medium brightness is preferred.

The results of this experiment therefore determine that this specific narrative space could benefit from coloured lighting of higher saturation of blue in combination with a blue hue of medium brightness.

Illustrations of how the implementation of a high saturated blue hue and medium bright blue walls and ceiling, in combination with the reflectivity of the space, would add to the narrative space, can be found in the figures 48 and 49.
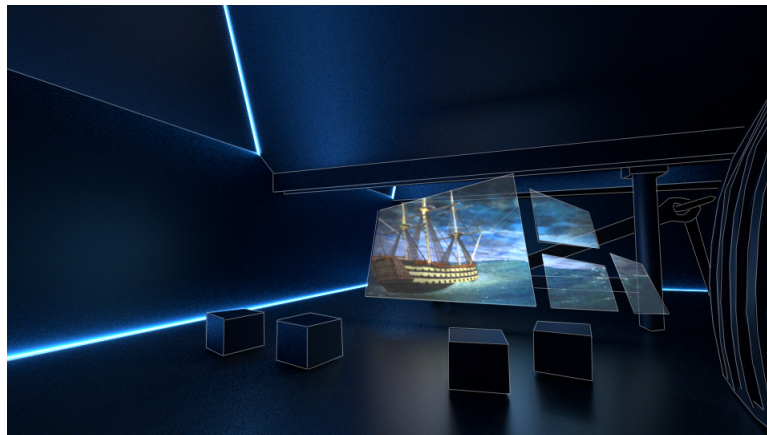

Figure 48: Ambient light in the colour of blue with medium bright blue surfaces effect on the narrative space (front view).

Figure 49: Ambient light in the colour of blue with medium bright blue surfaces effect on the narrative space (back view)

6.2.3   Summary on Stage 2

As a summary on what can be drawn from Stage 2 of the Conceptual Design Framework [4.2.2], the aim was to integrate the projection into the space. To be successful in fulfilling this stage would demand that the criteria of expanding the narrative of the *Night of the Wreck* installation into the narrative space, as a spatial experience, was met. This way the space could become a temporal storytelling medium that could aid in accentuating the narrative of the dramatic stranding (Final Research Question [5.3]), as an interplay between the projection and space. This is done to compose an atmospheric place out of the ordinary through spatial qualities of lighting.

The specific tools being used in this stage was reflectivity of surfaces and ambient lighting. Not only would the reflectivity act as secondary light sources, it would also transfer the colour dynamics from the projection into the space, specifically as diffused reflections on the floor. The intention behind this was to help bind the visuals of projection to the physical space, as part of the experience of space.

The ambient lighting provide orientation and visibility for the visitors, which are necessary for free-flowing temporal movement behaviour. The ambient lighting is designed to transform the walls and ceiling into luminous surfaces which could bring a magical quality to space. By employing higher luminance levels at the walls and ceiling would further create perceptual depth and alter how visitors perceive the spatial size and distance, to make the space seem bigger, which could resemble the feeling of being on open sea. To further accentuate this narrative, the level of lightness should be dim, as the narrative of the stranding takes place during the night.

With the atmospheric keyword of *coldness*, cooler colours of hue in the lighting would maybe bring transcendental capabilities, which would accentuate the mood and the feeling of place. To decide on the suggested colour of light, a controlled lab experiment was set up to find the most suitable colour of ambient lighting in combination with blue colours of surfaces and hues. The results of this experiment determined that in this specific narrative space it would be more accentuating for the narrative to make use of higher saturation of blue, in combination with a medium dark blue surface, as these showed to have the most atmospheric potential.

6.3   Stage 3: Include the visitor through the experience of light

> *"Lighting design in museums is not about numbers, it about people and their experience"*
> Mark Sutton Vane, Museums and Heritage conference 2017

As has been made clear, the ambition of the Final Research Question [5.3] is to create a narrative space, that not only connects with visitors on an intellectual level, but connects with them through both their body and their mind. This Stage 3 of the Conceptual Design Framework [4.2.3], therefore aims to include the role of the visitor through the experience of light.

Through the narrative space, it is possible to tell a the narrative of the stranding as a bodily experience of being present in the space and the experience of this place, through the atmospheric qualities of lighting. This allow the visitors to become part of the narrative, because the experience offered is designed to be

inclusive to a wide diversity of visitors (Lang et al. [6]). As Christidou and Diamantopoulou [8] argue, museums need to move away from the traditional forms of spectatorship.

Designing a narrative space, that includes the visitor is a complex process, as each visitor has their own personal experiences, expectations and meaning. The museum experience is therefore, according to Falk and Storksdieck [10], influenced by the personal, sociocultural and physical context in which the exhibition is experienced (Falk and Storksdieck [10]). Where the physical context holds the main potential for the designer.

However, it is important to make clear that this thesis does not claim to be able to dictate a specific experience, but rather to create the best conditions for the visitors to have their own engaging experience and invoked or new found interest.

Interest and engagement, as part of the personal context, is what drives learning, which essentially is the key purpose of what a museum should provide. The stronger the positive emotional value is with the visit, the higher chances are that the knowledge is to be stored into the explicit episodic memory[17]. To include visitors, is in the scope of this thesis, a manner of appealing to the visitors' intrinsic motivation, so visitors engage because it is internally and personally rewarding (Ryan and Deci [11]). As Black [3] states *"Provide the motivation and support to engage directly with the site"* by placing the visitors in the *"right frame of mind."*

The atmosphere of the narrative space therefore also has to be welcoming and belonging so visitors feel compelled to engage in their experience.

Lighting has to be seen as a positive and influential contributor to the atmosphere of the narrative space, which can affect how visitors experience the mood of the space and help fulfil the criteria 1 to integrate the presence of the visitor. The synthetic property of light (lighting in connection with rhythms, forms, colour, light, materials, sound etc.) and its different characteristics can thus be endorsed as a "generator of atmosphere" (as stated by Böhme [31]), which may help accentuate the narrative of the stranding to the visitor. To do so, this stage will set out to fulfil the three criteria by making use of shadow in combination with ambient light to integrate the presence of the visitor (body image) into the space. Furthermore, there has to be given attention to important details through "Play of brilliants". Finally, the lighting of the space will present the "script" for the visitors, as cues for the visitor, through visual hierarchy and distribution of light.

6.3.1 Criteria 1. Integrate the presence of the visitor into the space

The purpose of this criteria is to set the visitor in visual contact with their own body in the space (body image), to strengthen the interplay between the visitor and the narrative space. This is done through the ambient light and the projection of bodily shadows. Integrating the visitor through these two methods would mean that the visitors own presence, as body and mind, become an active part of the narrative space.

To integrate the presence of the visitor into the narrative space there will be made use of two tools: the ambient light and shadows.

1.A: Ambient light

Through the ambient lighting, presented in section [6.2.1], the intention is to render the visitor in the same qualities as the ambient lighting provides. Rendering the visitors in colder hues would allow the visitor to not only see themselves in the same hue as the space, but also to see the surrounding other visitors in a similar manner. An illustration of this can be found in fig. 51.

The reason behind this idea is based on the sociocultural context in which the visitor finds themselves. Seeing oneself and your surrounding others in a unfamiliar manner, could allow for both direct and indirect, conscious and unconscious social interaction which could aid in connecting visitors together and help construct meaning. Being visually integrated into the space could mean that the visitor may also be emotionally integrated into the atmosphere of the narrative space.

1.B: Shadows

The second tool to integrate one's feeling of presence, it to make use of shadowing to project the visitor's shadow onto the floor, from the body and towards the projection (see fig. 50). This would allow a spatial translation of ones own body as a three dimensional circumstance to a two dimensional quality, going from 3D (body) to 2D (shadow). The reflective quality of the floor, that carry the projection towards the

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[17]Long term memory that stores specific personal experiences.

floor would moreover mean that a sub-space is created, where the presence of the visitor (in the form of shadow) and the reflections from the projection of *Night of the Wreck*, would meet on common ground as a visual interaction. A rendering of this interaction can be found in fig. 51.
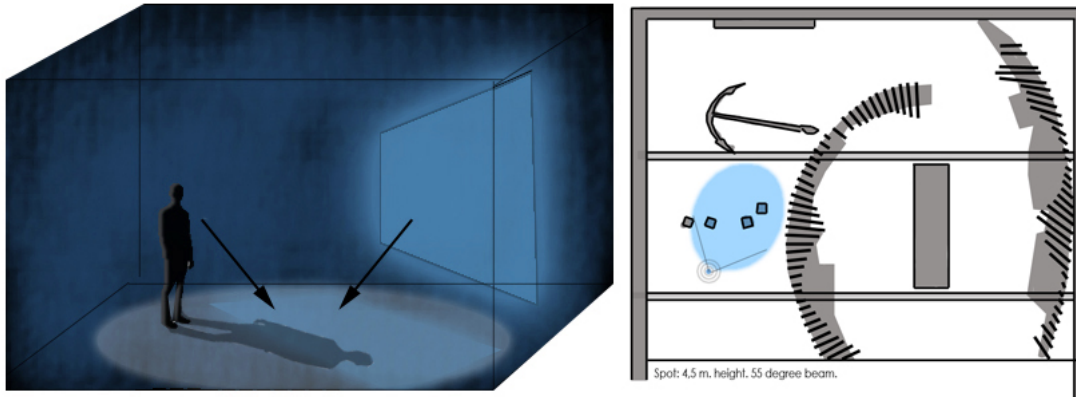

Figure 50: Left: Illustration of the interaction between the visitor's shadow and the projection's light. Right: positioning of fixture.

To create the shadow effect demands that a spot is implemented behind the visitor, on the ceiling. A potential product could be the Altman 30-55 degree PHX LED RGBW Zoom Spot (Specifications can be found on this product in the appendix [A.2.3])

Figure 51: Rendering of the ambient light and the use of shadow contributes to integrating the visitor into the narrative space

6.3.2   Criteria 2. Bring attention to the important details

In the design manual it is written that *"The western wall of the gallery is treated as a graphic surface [...] A large-scale graphic list of names drawn from the muster rolls forms waves along the wall, leading visitors through into the next area, 'Aftermath' (2.2)."* An illustration by Event explaining this, can be found in fig. 52. (Strandingsmuseum [59])

It is therefore relevant for the visitors to give special attention to these details and they make up an important part of accentuating the narrative. As was explained in section [5.2.2], 1408 lives were lost, with only 17 survivors of HMS St. George, which made it one of the world's worst strandings, and underline just how tragic the event was.
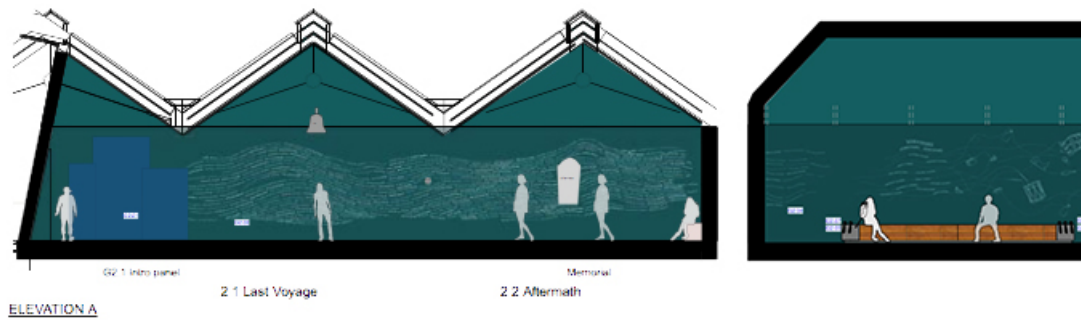
Figure 52: Gallery 2: Names of the Dead displayed on the west-end wall. Name of survivors on the end wall. (Illustration: Event [59])

C2.A: Play of Brilliants

To highlight the names of those who lost their life during the stranding as an important detail to the narrative, the graphic list of names will occur on the west-end wall as a play of brilliants (as explained in the section of Density [3.4.1]). As was stated in the Literature Review, Kelly [47]'s notion of *Play of brilliants* can be used as a scenic element of using light as a tool to mediate information. The concept is favourable as it, according to Kelly [47], not only excites the optic nerves, it also *"stimulates the body and spirit, quickens the appetite, awakens curiosity, sharpens the wit."*

The design manual explains that the names should be a graphic representation that illustrates the form of a wave, as an organised distribution of names as a density (Strandingsmuseum [59]). To meet this design criteria through the use of light, it would make sense to make use of Gobo projections, as explained in section [3.4.1].

Gobo projections can be used as a scenographic tool to bring a dramatic expression, through its concentrated sharp-edged lighting. This makes the names "pop out" more due to the vividness of illumination. Using Gobo projection would further allow dynamics of lighting to be programmed according to the portraying of *Night of the Wreck*. This could be used as a tool to accentuate the narrative of the stranding, which the Final Research Question [5.3] seeks to answer. An illustration of the design can be found in fig. 53. The names have in the illustration been projected in a warm white (around 2700 kelvin) to create a visual contrast to the colder hues in the space.

A suggested Gobo projector[18] can be found in the appendix [A.2.4].

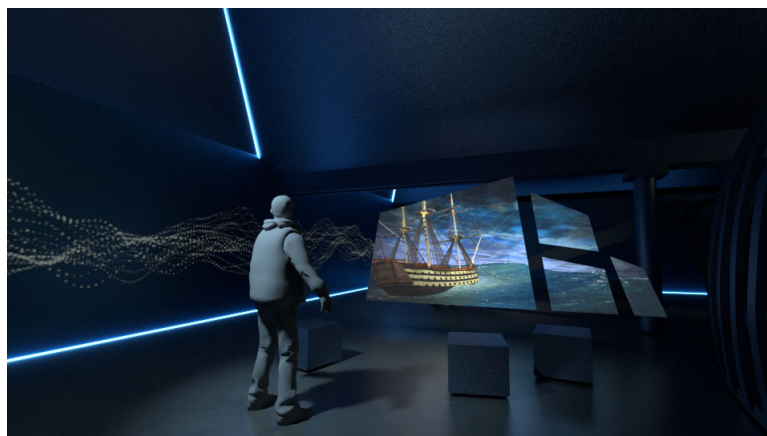Figure 53: Gallery 2: Names of the Dead displayed on the west-end wall, with Gobo projectors.

6.3.3   Criteria 3: Present the script – Cue the visitor

Taking in the movement and gaze as elements of visitor engagement in a museum context, is part of recent developments and tendencies, which acknowledge that visitors' interaction with the exhibition space is

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[18]Note: multiple Gobo projectors would be required

part of the production of meaning, as movement, flow and gaze influence both visibility, attention and engagement (Christidou and Diamantopoulou [8]).

As stated in section [5.1], this exhibition is built upon a logical movement pattern that follow a holistic storyline, and it is therefore important to take movement of visitors into consideration when designing, as Tzortzi [21] argues, *"the organisation of movement is a concept inherent in museum design"* and therefore, has a role in the curated storyline and the experience of that narrative space, which both set' the "stage" and present the "script" (Duncan [22]). This is, according to the work of Merleau-Ponty and Lefort [38], crucial as there is an exchanges of information, between the the body and the space that is perceived through the visitors' body image and body schema. Perception is the body's bridge to the world that surround us.

Visitors are driven by their agentive engagement, both in terms of personal interest and the stimuli perceived in the physical context, so the path of movement can therefore not be fully predicted (Christidou and Diamantopoulou [8]).

Movement brings rhythm and continuity to the experience of the narrative space, but demands a multidimensional and flexible narrative exhibition design, open for the shifting visual focus and interest points of the visitor.

Is is therefor important to visually cue the visitor through the design of light to bring structure and continuity to the experience of the narrative space, in order to truly accentuate the narrative of the exhibition (Macleod et al. [16]). In the physical context, cueing can be essential for orientation, as it can guide visitors to where to go and in which pace to follow the spatial narrative. Furthermore, the implementation of light zones provides the visitors with zones of intimacy.

To present the script through visual cueing can be done through visual hierarchy and the use of light zones.

C3.A: Visual hierarchy and light zones
As Macleod et al. [16] suggest, *memory boxes*, as isolated zones of higher brightness, can be used as a tool to bring visual hierarchy to a museum space. By making use of this, it is possible through a hierarchical composition of the spatial distribution of brightness, to help the visitor read the space both consciously and unconsciously, which will aid in modulating the visitor's attention, movement and spatial experience. In context of this thesis, this will be implemented, and referred to, as "Light zones", implemented as a tool to provide visual hierarchy to help accentuate the curated narrative of the space.
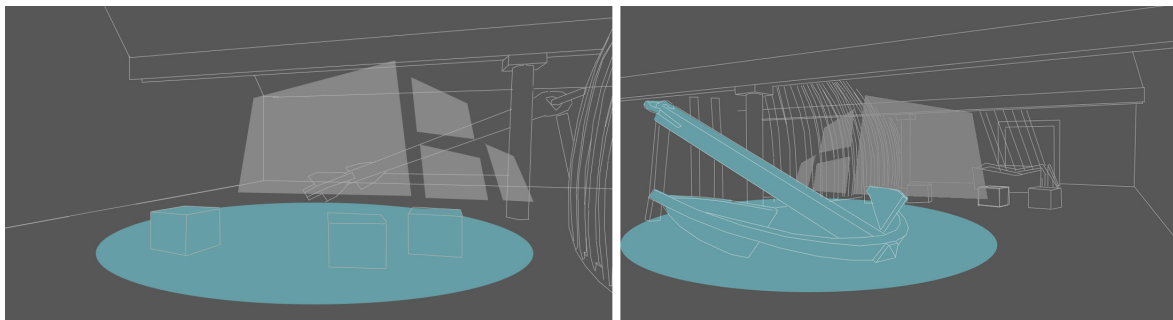

Figure 54: Distribution of Brightness, Light zones in front and back

As can be seen in fig. 54, the spatial distribution of brightness will consist of two light zones based on the sub-narrative spaces (presented in section [5.4.1]). The first light zone takes its basis in the integration of the visitor through shadowing as previously explained in stage 3.A.i (section [6.3.1]). This light zone will be the first one the visitor enters in the gallery. The light zones act as as a tool to cue the visitors to place themselves in the area in front of the projection, with the intention of getting visitors to watch the projection of the *Night of the Wreck* being displayed.

The second light zone focuses on the anchor of St. George, behind the projection. The purpose of this light zone is to illuminate the anchor so visitors will be invited to go observe it. This will bring both a visual and emotional connection between the narrative being portrayed and the actual anchor. This design is intended to be implemented with two 45°Neo Fresnel spots from Ljusdesign [65] (futher
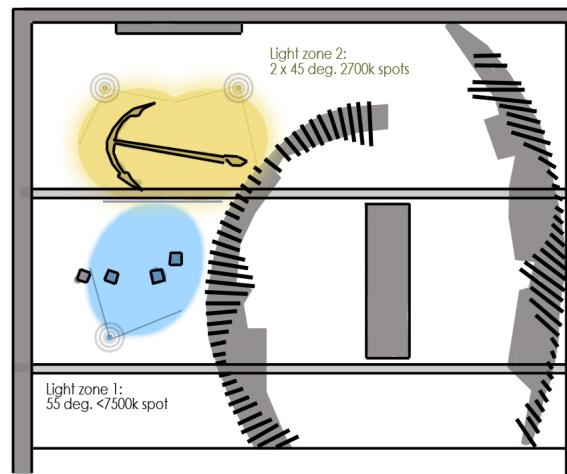
information in appendix [A.2.5]).

Figure 55: Light zones, top view

The use of light zones will moreover provide a contrast to the surrounding space, which can give the narrative a more dramatic expression, which would meet the museum's ambition to offer experiences that are dramatic and sensory (Strandingsmuseet [60] [5.1])

To provide a dramatic expression the use of hard shadowing can be very beneficial. The hard edged shadows will act as a visual contrast to the general ambient lighting and its soft shadows. To get hard shadows, it is demanded that the lighting used to establish the light zones come from a fixture with a relatively narrow spot light. Narrow beams of light are, especially within the scenic and scenographic world, used as focal glow to highlight specific areas of interest in order to cue the visual attention of the visitor (Descottes and Ramos [44], Kelly [47]). In this case, the narrowness can however not be too to exaggerated, as light need to reveal a relative big part of the space.

Due to the tragic events of the stranding, the second light zones should illuminate the anchor of St. George as naturally and clearly as possible. By illuminating the anchor with a light source of high Colour Rendering Index (Optimally with a RA value of 100), it is possible to show the anchor as truthfully as possible. Illuminating the anchor with a warmer colour temperature (e.g. 2700 kelvin), would furthermore create a visual contrast to the surrounding space, which may help the anchor to stand out more.

6.3.4 Summary on Stage 3

To answer the Final Research Question [5.3], it is necessary to be successful in Stage 3: to include the visitor through the experience of light. This is important, as the ambition is to create a narrative space, that not only connects with visitors on an intellectual level, but connects with the body and their mind of the visitor as well. The Conceptual Design Framework of this case study seeks to accentuate the narrative of the stranding exhibition through the atmospheric qualities of lighting to be inclusive in the experience that is offered. To include the visitor is a complex process, but producing a positive emotional value to the experience of the narrative space will heighten the chances of storing the museum visit in the long term memory.

To include the visitor in the narrative space demands that the intrinsic motivation is present, this is done by placing the visitors in the "right frame of mind", with an atmosphere that is welcoming and safe. Qualities of lighting (generators of atmosphere) has in this process to be seen as a positive and influential contributor to the atmosphere of the narrative space, which accentuates the narrative of the stranding to the visitor.

This third stage consisted of three criteria which had to be met for the stage to be considered successfully. The first criteria was to integrate the presence of the visitor (body image) into the space, as a physical representation of presence, through the tools of ambient light and shadow, which in combination resulted in visual interaction. The second criteria was to bring attention to important details through "Play of brilliants". To treat the western wall of the gallery as a graphic surface, the concept of play of

brilliants was used as a scenic element to mediate information, by the use of Gobo projections to have the names of the stranded be illuminated on the western wall. This was done so the visitor could get an understanding of the men behind the number of the dead, to accentuate the narrative as an event that actually took place. Finally, the "script" designed as cues for the visitor, through visual hierarchy and distribution of light, as a final third criteria. Visitors need to be cued in the movement to bring rhythm and continuity to the experience of the narrative space. Light zones were therefore used as a tool to guide the visitor. The narrative space therefore consists of two light zones. The first will be met upon entry of the gallery as an invitation to enter the sub-narrative space A, to watch the *Night of the Wreck*. The second light zone is based in the sub-narrative of the anchor of St. George, which is intended to make a visual and emotional connection between the narrative being portrayed and the actual anchor as an original artefact of the stranding.

By now having fulfilled the three stages of the Conceptual Design Framework it is now possible to present the Final Design for the narrative space of the case study.

7 Final Design

Based on the three stages of the Conceptual Design Framework presented in section [4.2] the final design can now be presented, as a "walk through" presentation of what can be experienced in the narrative space.

7.1 1. Entry of Gallery 2

The visitor enters the Gallery. When entering the space, the visitor will notice the canvases of the *Night of the Wreck* installation. The canvases are being projected on with a sail texture, with light movement.

Ambient: On
Light Zone A: On
Light Zone B: Dimmed to 20%
Gobo: Off
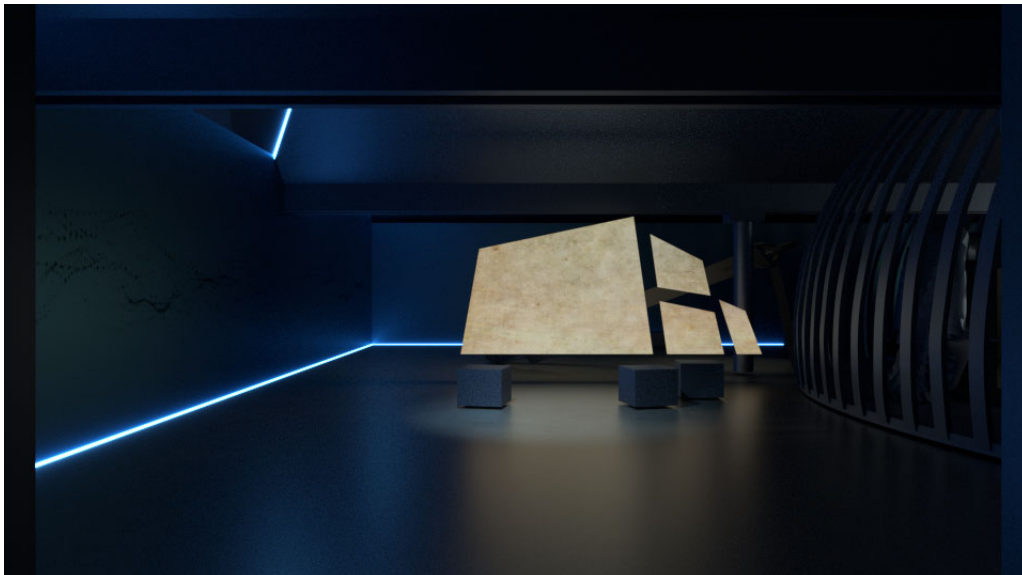**Projection Graphics:** Sail texture, slowly animated.

Figure 56: Narrative Space upon entry of Gallery 2.

7.2 2. Entry of Narrative Space

The visitor now enters the Narrative Space. From the Narrative space, the visitor now notices Light Zone A, placed in front of the projection. This acts as a cue, for the visitor to enter the light space.

Ambient: On
Light Zone A: On
Light Zone B: Dimmed to 20%
Gobo: Off
Projection Graphics: Sail texture, slowly animated.

Figure 57: Being present in the Narrative Space

7.3   3. Entry of Sub-Narrative Space A

The visitor now enters the Sub-Narrative A (light zone), and without noticing, triggers the motion detection. The motion detector sends a cue to the light, that now slowly fades downto around 70%. The graphics of the projection now transforms from sails into the *Night of the Wreck* being portrayed.

The *Night of the Wreck* ends after 3 minutes, and the canvases now transform back to sails. Light zone A fades up to 100% again, as a cue for the visitor that this part of the exhibition has been experienced.

Activation of motion detector
Ambient: On
Gobo: Off
Light zone A: fades down to 70%
Light Zone B: Dimmed to 20%
Projection Graphics: Transformation (sails to *Night of the Wreck*)
Night of the Wreck starts playing
Night of the Wreck ends after 3 min.
Projection Graphics: Transformation (from *Night of the Wreck* to sails)
Light Zone A: fades up to default (100%)

Figure 58: Entry of Sub-narrative Space A (light zone A)

7.4   4. Exit of Sub-Narrative Space A

The visitor now exits Light Zone A, and notices how the names displayed by the Gobo projections, slowly appear on the west end-wall, fading up from left to right, towards the next area (sub-narrative space B). This acts as a cue that the visitor is to follow the rhythm and direction as the names appear.

Ambient: On
Light Zone A: On
Light Zone B: Dimmed to 20%
Gobo: Names (wave) fades slowly up (subtle dynamics, appearing on west end-wall, from left towards right)
Projection Graphics: Sail texture, slowly animated.
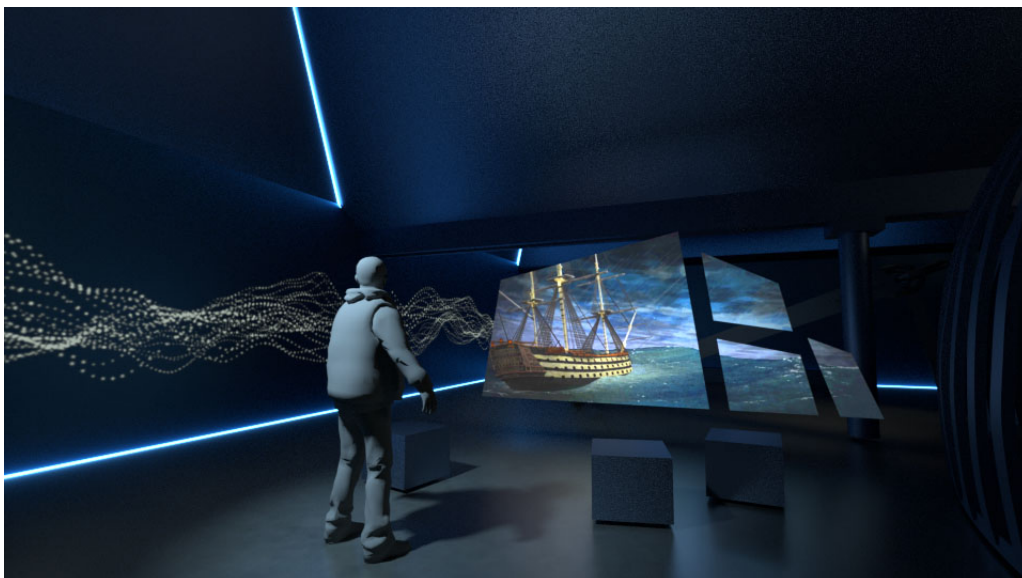

Figure 59: Exit of Sub-narrative Space A

7.5   5. Entry of Sub-Narrative Space B

The visitor now enters the last light zone B. A motion detector triggers the lighting of this zone to slowly fade up and illuminate the anchor.

Activation of motion detector
Ambient: On
Light Zone A: On
Light Zone B: fades up to full from default (20% to 100%)
Gobo: Names on (subtle dynamics)
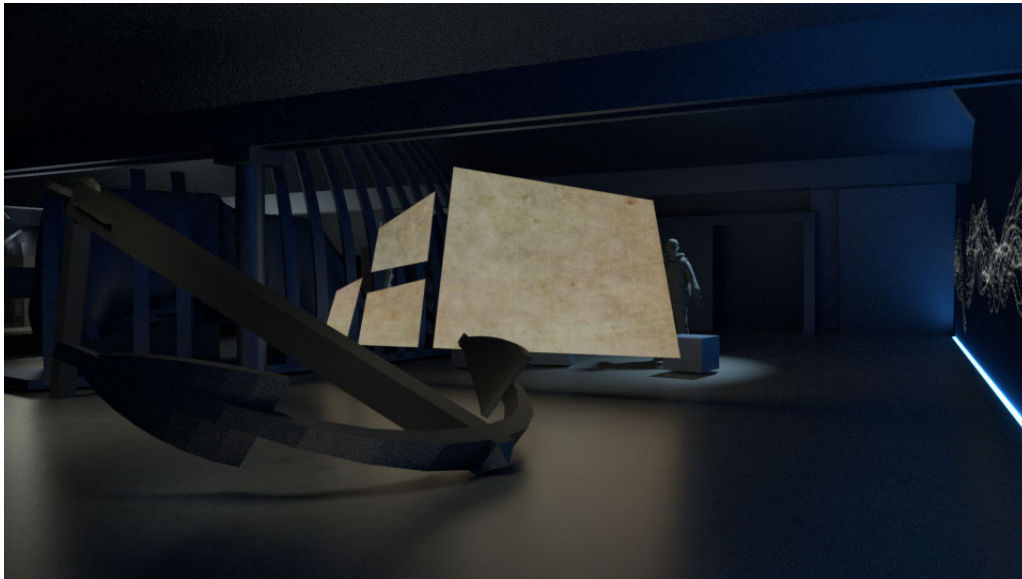**Projection Graphics:** Sail texture, slowly animated.

Figure 60: Entry of Sub-Narrative Space B

7.6   6. Exit of Narrative Space

The visitor now exits the Narrative Space, and after a while (when the timer ends) the lighting goes back to default (Light zone B: 20%).

Ambient: On
Light Zone A: On
Light Zone B: Dimmed to 20%
Gobo: Off
Projection Graphics: Sail texture, slowly animated.

7.7   Summary of the Design Process

The definition of a Narrative Space was through the Design Approach [4] reiterated to fit the scope of this thesis. As seen in the model on fig. 18 [4.1], a Narrative Space only consists through the interplay between the visitor, the place, and the atmosphere that exists between these. A narrative space is therefore dependent on its visitors to be engaged in their museum experience, not only intellectually, but through body and mind. With the definition of the Conceptual Design Framework [4.2], based on the Design Considerations from the Literature Review, I have used lighting design as a visitor-centred method to create a narrative space, as a place out of the ordinary that is inviting and welcoming for its visitors.

   The Narrative Space needed to melt medias together in the context of museums, with the target of transcending the narrative of a projection from the screen to space, bringing the two realities together as one entity that as a Narrative Space includes the role of the visitor.
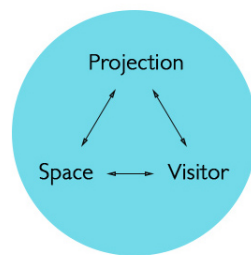
Figure 61: Narrative Space: an interrelationship between space, visitor and projection

The three stages of the Conceptual Design Framework was therefore based on the physical constellation of a Narrative Space, as the interrelationship between space, visitor and projection bound together through the use of modern lighting technology (see fig. 61). The three stages were therefore divided into: The Projection, the Space and the Visitor.

To summarise how the Conceptual Design Framework was used to structure the design for the case study of the Strandingsmuseum, a brief overview of the final design expressed through the stages of the conceptual design follows:

7.7.1   Stage 1: Break the physical boundaries of the projection

Criteria 1: Mediate a visual narrative
The *Night of the Wreck* animation uses sound and visuals to mediate the narrative as a form of evocative connotative communication[19] with a high level of narrativity. Thus, it attempts to emphatically speak to the mind of the visitors. Avoiding the dominance of language, in form of text and speech, further makes the experience inclusive for all demographics.

Criteria 2: Rethinking of the physical format
The design avoids traditional formats for the projection; instead the projection is displayed on several fragments suspended in midair. The fragments are arranged to resemble the sails on a ship. The fragmented design further allows visibility and connection to the surrounding space, which additionally helps integrate the projection into the space.

Criteria 3: Flexibility
Flexibility is achieved by using a projection material with a wide-viewing angle quality, to allow the projection to be experienced from a wide variety of locations. Motion detection sensors further expand the ways in which the visitors can experience the exhibition.

7.7.2   Stage 2: Integrate the projection into the space

Criteria 1: Expand the narrative into the spatial experience
The projection of *Night of the Wreck* is integrated into the narrative space through reflective surfaces and ambient lighting. The ambient lighting primarily consists of saturated blue hues, while the reflective qualities of the floor assists in transcending the dynamics of the visuals of the projection into the space.

7.7.3   Stage 3: Include the role of the visitor through the experience of light

Criteria 1: Integrate the presence of the visitor into the space
A spotlight aiming from the ceiling towards the projection integrates the physical presence of the visitor into the space, by visibly throwing the visitor's shadow onto the floor in front of the projection. The shadow interacts visually with the reflected light from the projection (as seen in fig 50). The ambient lighting also serves to include the visitors into the space, as the visitors are rendered in an abnormal manner, which aims to allow them to share a socio-cultural experience.

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[19]through suggestive associative thoughts, memories, or feelings

Criteria 2: Bring attention to the important details of the narrative
A play of brilliants highlights the names after the ending of *Night of the Wreck*, thus bringing attention to the important detail of the names of the men who died during the stranding. This also works to emphasise that the events depicted are real, and not fictitious, adding weight and a solemn quality to the narrative space. The wavy motion of the names also serve to guide the visitor towards the anchor (sub-narrative space B).

Criteria 3: Present the script – Cue the visitor
Through distribution of light and shadows, the design attempts to compose a narrative space with a visual hierarchy created through dynamic light zones, that the visitors can "read" to understand the "script" of the narrative space. Motion detection serves to loosen the "script" and give the user some control over it, additionally adding a *magical element* to the experience.

The Macleod et al. [16] Narrativity model presented in the section [3.2] can now be used to evaluate the level of narrativity within the final design. As seen in fig. 62, the narrative space is indicated with a red mark, illustrating its high level of narrativity and evocative connotative communication, as its emotional capability. It is in the green area that narratives have the greatest potentials towards enhancing the museum experience.
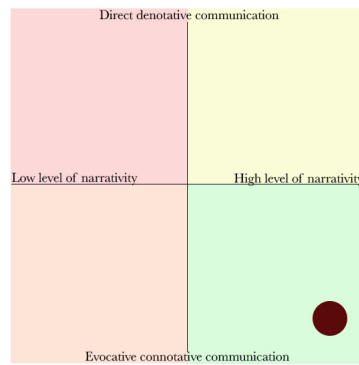

Figure 62: Narrativity model defined by Macleod et al.. Red mark indicates the narrative space of the final design.

We have now outlined how the Conceptual Design Framework has been used to guide and motivate the concrete design decisions for the quasi theoretical case study of the Strandingsmuseum.

8 Answering the Final Research Question

Now that the final design has been complete it is possible to answer the Final Research Question, presented in section [5.3] and reproduced below.

How can the Conceptual Design Framework [4.2] be used as a method to guide the design of a Narrative Space for the "Night of the Wreck" exhibition to accentuate the dramatic narrative of the stranding of HMS St. George?

The final design answers the Final Research Question by being a demonstration of a design guided by the Conceptual Design Framework.

The fact that the design for the *Night of the Wreck* exhibition creates a narrative space, is justified by fulfilling all the seven presented criteria from the Conceptual Design Framework, which is based on the physical constellation of a narrative space (Projection, Space and Visitor), as defined in section [4.1].

However, the underlying purpose of answering the Final Research Question was to both demonstrate and test the applicability of the Conceptual Design Framework. Thus the case study can be used to reflect upon the structure of the Conceptual Design Framework.

9   Reflection on the Conceptual Design Framework

Through the completion of the quasi-theoretical case study, the Conceptual Design Framework and its use of guiding a design of a narrative space has now been demonstrated. Based on this, it is now possible to reflect on the applicability of the framework, both in this specific case and in more general terms. This reflection ultimately provides some directions on a future iteration of the framework.

9.1   Stage 1: Break the physical boundaries of the projection

Criteria 1: Mediate a visual narrative
The first criteria of Stage 1 worked well in the case of this study, where the narrative of the exhibition in advance had an emotional quality, and a high level of narrativity that could be accentuated by mediating visually through evocative connotative communication[20]. However this kind of mediation, and its emotional impact, is highly dependent on the personal context of the visitor. Avoiding the use of text and speech can further include a wider variation of demographics. Whether or not this approach is invariably appropriate for all exhibitions can be discussed, and for visitors who seek a deeper factual understanding, supplementary material would be required.

Criteria 2: Rethinking of the physical format
Rethinking the traditional projection format (16:9) proved to be a positive scenographic addition to the design of a Narrative Space, which can give a projection an additional function and prevent the visual reference to screens, that surrounds us in our everyday life. Exploiting the Gestalt principle further allows greater visibility and connection to the surrounding space.

The criteria has great potential for future design of narrative spaces, also in other contexts than in the museum, but it also has to be considered that the economical cost are likely to be raised in contrast to the traditional solutions.

Criteria 3: Flexibility
The Flexibility criteria is satisfied by allowing for a wide viewing angle of the projection. However, in the process of design in the case study, it showed that this criteria is both too general and could benefit from being more specific, to provide sufficiently concrete guidelines for a design. Instead the focus of this criteria should seek to accommodate the free-flowing movement behaviour of the visitors.

Additional Criteria (Iteration)
An element of the physical format of the projection that was missing was however the use of depth. By turning physical objects or elements of architecture into display surfaces, it would be possible to make use of binocular cues and depth perception to create a more stimulating experience.

9.2   Stage 2: Integrate the projection into the spatial experience

Criteria 1: Expand the narrative into the spatial experience
By expanding the narrative into the space, the intention is to create more perceptually stimulating experiences, which allow a space to become a temporal storytelling medium, which could accentuate the narrative of the exhibition through a form of primordial language.

Through the use of ambient lighting, it is potentially possible to enhance and establish an atmospheric basis to "set the stage" for the visitor, which helps in creating a place out of the ordinary. A descriptive contrast ratio table to regulate level of lightness could further benefit the Conceptual Design Framework.

However, it can be discussed whether or not the use of coloured lighting is always appropriate within the context of the museum, and the Conceptual Design Framework should therefore be iterated to help estimate the appropriateness. A rule of thumb could be that the coloured lighting should solely be implemented if it can be advantageous to accentuate the narrative of a exhibition space.

Additional Criteria (Iteration)
Stage 2 is perchance too abstract, having only one criteria. The stage could therefore benefit by having more concrete criteria. Through the case study it showed that light and material should not be seen

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[20]through suggestive associative thoughts, memories, or feelings

as two separated circumstances, and a iteration of the framework should therefore involve the interplay between light and material.

Moreover, the ambient lighting (light level and colour) could further be used to accentuate the narrative of the projection, to follow the colour dynamics of the projection, which could create a more holistic experience.

Furthermore, the second stage of the Conceptual Design Framework could be iterated to contain an Accent layer to highlight points of interest, e.g. through focal glow. This could bring more variation and visual interest in the spatial design.

And finally, this stage could benefit from a criteria representing the qualities of shadows, and how these can be used to accentuate a visual narrative. For example, hard shadows produce a more dramatic expression, whereas softer give a more subtle expression.

9.3   Stage 3: Include the role of the visitor through the experience of light

Criteria 1: Integrate the presence of the visitor into the space

This criteria refers to the physical presence of a visitor (which perhaps should be clarified better). This criteria was met in the case study by projecting the visitors shadow onto the floor, as a direct physical interplay on the floor between the visitors' presence, the space (ambient light) and the reflected light from the projection. Whether or not this is appropriate as a general criteria would need further research to be decided upon. Furthermore, it seems misplaced to have ambient lighting implemented in this stage, as it fits more naturally in the second stage (space).

Criteria: 2 Bring attention to the important details of the narrative

The case study revealed that this criteria should be placed under the Accent layer in Stage 2 instead. A Play of Brilliants is appropriate in this specific case, but is presumably not applicable in the general case. Furthermore, it could be added as "nice to have" and not as a necessity.

Criteria 3: Present the script – Cue the visitors

The case study revealed that this criteria is in fact quite important and cueing of visitor is essential for a good museum experience as to how, where, and when for the visitors to position their body in the space. This criteria should therefore have more of an influence in the Conceptual Design Framework and could benefit from having a wider variation of tools. The use of visual hierarchy is in most cases of design always appropriate and functional, and is undoubtedly an important criteria of the Conceptual Design Framework. However, by cueing visitors it does not necessarily mean that they obey or notice those cues, and the use of motion detection, as implemented in the case study, can therefore become an important tool to accommodate the unpredictability of visitors.

Final remarks

Based on the experience of the Conceptual Design Framework used for the quasi-theoretical case study of the Strandingsmuseum, it showed that the framework is applicable for using modern lighting technology as visitor-centred method to design a narrative space within the context of museums. Yet, it is important to note that the design, and the framework, only can create the best possible circumstances for the visitors to have positive and memorable total experiences during the visit, and can not be seen as a guarantee for an enhanced museum experiences.

As a final remark, it can be discussed whether or not the order of the stages should be reversed to follow a more visitor-centric form, that in a greater extent begins with designing with the experience of the visitor in focus. By iterating the overall Conceptual Design Framework to begin main priority as a Stage 1: Visitor, Stage 2: the space and the final, potentially optional, third stages of the projection.

10   Discussion

> "If it is true that architecture shapes space, then one must move about in these spaces in order to evaluate them. We must be physically present."
> Böhme [26]

The vision of this thesis is to extend the museum narrative beyond the physical space, through the design of light, to form unique and memorable total experiences for the visitor. To realise this vision, I've

reviewed the related literature, and based on this review I've constructed a Conceptual Design Framework [4.2], whose goal is to aid the lighting designer in creating Narrative Spaces for museums. The framework has been used for a quasi-theoretical case study in order to appraise its applicability and to further re-iterate the structure of the framework.

The Conceptual Design Framework's applicability has only been assessed through a single quasi-theoretical case study. This obviously could be improved upon, as the framework should work in general and not only for the Strandingsmuseum. Further case studies would establish a more thorough foundation for the framework. In addition, the case study is quasi-theoretical and therefore only partly implemented at the actual museum. Namely, only Stage 1 of the design is implemented. It goes without saying that a complete implementation and empirical evaluation would greatly increase the confidence of the applicability of the framework. However, this was not possible for several practical reasons.

However, the framework is still based on a thorough theoretical foundation, which adds to its integrity. The case study is neither completely theoretical, and its basis in a real-life exhibition gives it many concrete and specific restrictions that further supports its validity in the context of this thesis.

While the framework is only in its first iteration, I do believe that it has potential and with further iterations can be very useful in practice. The reflection of the framework in section 9 already described some directions that future iterations of the framework could take.

Modern lighting technology considerably expands the possibilities for designing with light in museums. While museum preservation considerations impose unique restrictions on the design, modern technology, along with careful design, offers ways to accommodate these challenges, and incorporate them into a unified solution. The restrictions do not exclude the co-existence of a narrative space. But with great power comes great responsibility, and just because modern technology offers such a vast array of opportunities for novel lighting design, one must be cautious and aware to only create designs that accentuate the narrative of the exhibition and does not needlessly distract and thus detract from it. As Kossmann et al. [15], state *"it is not just about the design, but about the cohering power of design"*.

In the beginning of this thesis I made an assumption that the concept of narrative spaces can be used to enhance the museum experience. An assumption I have throughout my work on this thesis grown more certain of. What the visitor comes with, in form of personal and sociocultural background, I cannot alter. However, through lighting design I have the possibility to facilitate a physical context, that through light provides a spatial experience that is meaningful and interesting enough that it can invoke a new-found interest. However, while the assumption is based on prior research, there is no "hard evidence" that it is true. But such assumptions are necessary to make when working in academic fields like phenomenology, architecture and aesthetics. A more empirical and quantifiable approach might offer more substantial evidence to base research on, however, it fails to accurately capture human experiences and phenomena. Making a shift from the quantitative to the qualitative aspects of the museum design is challenging, as assessing the success of a museum exhibition qualitatively is a more nuanced and complex process, than sole quantitative data in form of numbers and scales (Shettel [1]).

11 Conclusion

There is a need for change when a considerable part[21] of the public sees museums as being dull and un-engaging. A potential way to change this perception is to shift the focus from the object to the subject (the role of the visitors) when designing museum exhibitions and spaces. It is in this process that lighting design has an important role. Visitors should not feel schooled or act as spectators; therefore the experience that a museum should offer needs to be inclusive. Especially because the public is becoming increasingly more educated, and therefore demand much more room for reflection and perspective. Giving visitors a strong emotional experience, such as what the *Night of the Wreck* could offer, also heightens the chances of forming memorable and unique total experiences, that are not soon to be forgotten.

With my job at No Parking Production, working professionally with museum development, I therefore also have some responsibility to design solutions that not only mediate *about* the cultural heritage, but that also make people care. Culture needs to be passed along for the generations to come, as our sociocultural context has an impact on who we are as a society.

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[21]26% of the Danish Youth (Kobbernagel and Drotner [2])

To work towards this vision, this thesis attempts to create a Conceptual Design Framework that lighting designers can use to guide their designs towards establishing narrative spaces in museums. The Conceptual Design Framework is synthesised from a foundation of prior research from multiple academic fields. The framework describes three stages of design – the Projection, the Space and the Visitor. Each stage is accompanied by criteria and tools that can be used to both evaluate and guide the design. Through a quasi-theoretical case study based on an exhibition at the Strandingsmuseum, the framework is demonstrated and evaluated. The results of the case study show that the framework is applicable but could benefit from further iterations and evaluations based on real-life implementations.

In conclusion, the Conceptual Design Framework can be used to guide a design of a narrative space. With the assumption that such a narrative space does in fact expand the museum narrative beyond the physical space, we can say that it is possible to use the framework to accentuate the narrative of an exhibition, from a designer's point of view. We cannot however conclude on the final effect on the visitor, without further research.

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Appendices

A Appendix

A.1 Experiment 1: Results

Material 1

- Front side
  - Colour Representation: Unacceptable
  - Sharpness: Acceptable
  - Wide angle: Acceptable
- Back side
  - Colour Representation: Acceptable
  - Sharpness: Acceptable
  - Wide angle: Acceptable
  - Note: Discomfort glare from projector

Material 2

- Front side
  - Colour Representation: Unacceptable (yellow tint)
  - Sharpness: Acceptable
  - Wide angle: Acceptable
- Back side
  - Colour Representation: Unacceptable (yellow tint)
  - Sharpness: Acceptable
  - Wide angle: Acceptable

Material 3

- Front side
  - Colour Representation: Unacceptable
  - Sharpness: Acceptable
  - Wide angle: Acceptable
- Back side
  - Colour Representation: Acceptable
  - Sharpness: Acceptable
  - Wide angle: Just Acceptable
  - Note: Some discomfort glare from projector

Material 4

- Front side
  - Colour Representation: Acceptable

- Sharpness: Acceptable
- Wide angle: Good

- Back side

  - Colour Representation: Acceptable
  - Sharpness: Good
  - Wide angle: Good

A.1.1 Visual Graphics

Strandingsmuseum [59]) describe in their design manual *The Night of the Wreck* as follows; *"The AV draws inspiration from drawings and documents relating to the Royal Navy, as well as 18th and 19th century drawings and paintings of ships at sea. Line drawings are washed with watercolour, then overlaid with stills or footage to create a montage of the events of the night of the wreck."*

Figure 63: Reference illustration of the visual style for Night of the Wreck

I was personally responsible for the 3D modelling of assets (including St. George) and texturing, while assisting in the visual style.

01: Introduction to HMS ST George
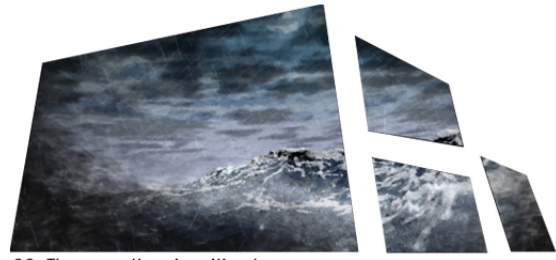
02: The weather is critical

03: Something is wrong

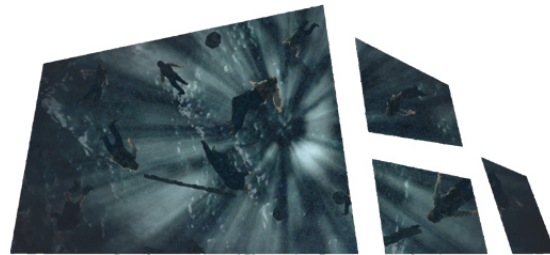04: Sails are breaking

05: Loss of anchor

06: Cuts masts to lighten the ship

07: People of the coast watching the stranding

08: Giant wave hitting the ship

09: Drowned men floting at sea

10: Survivor carried to safety

Figure 64: Graphics and animation: Søren Klok. 3D Modelled and texturing by Cecilie Warming

Tools
3D modelling software: Maya LT (Cecilie Warming)
Texturing: Photoshop and Mudbox (Cecilie Warming).
Animation and rendering: Blender (Søren Klok og Kenneth Berle).
Post-production: AfterEffects (Søren Klok og Morten Ranmar)
Sound production: Phillips Gabriel

A.1.2 Green Screen Recording

To lower render time we decided to make use of green screen recordings to replace any redundant 3D modelling. Filming on green screen with real life models, would also allow us to get more natural physical human behaviour than what would have been possible in 3D.

An evenly light of the green screen backdrop was done through a diffused top light and four wide angled floodlights[22], to give better results for post production, as the editor would be able to key more easily. Even light distribution is important for consistency, and while traditional film lighting would work with e.g. three point lighting and contrast in form of light and shadows, it is important to keep the lighting uniform for this purpose. However, to avoid a too characterless expression of the models and more dramatic look, a key spot light was added, from the right side of the actor. The key light was positioned and adjusted with barn doors so the throw of the light and shadows did not make contact with the green screen backdrop.

Figure 65: Green Screen Recording of model. Image: Private

A.1.3 Projection canvas suggestions

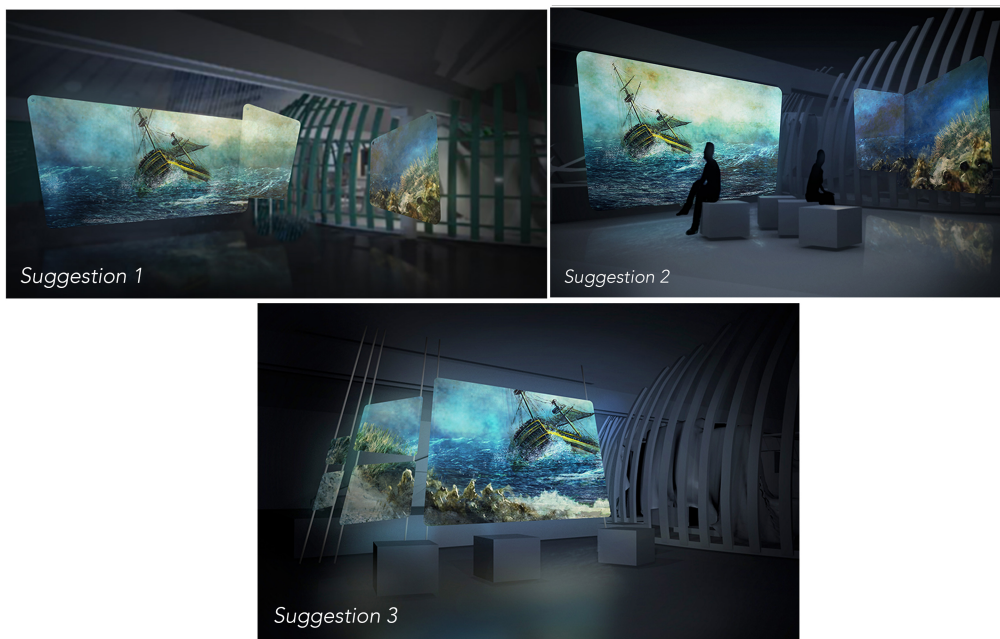Final three suggestions sent to the museum and Event. Suggestion 3, was chosen in a mirrored version.

Figure 66: Canvas design suggestions sent to the museum

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[22]This was already setup by Sventyfourseven Studio upon arrival.
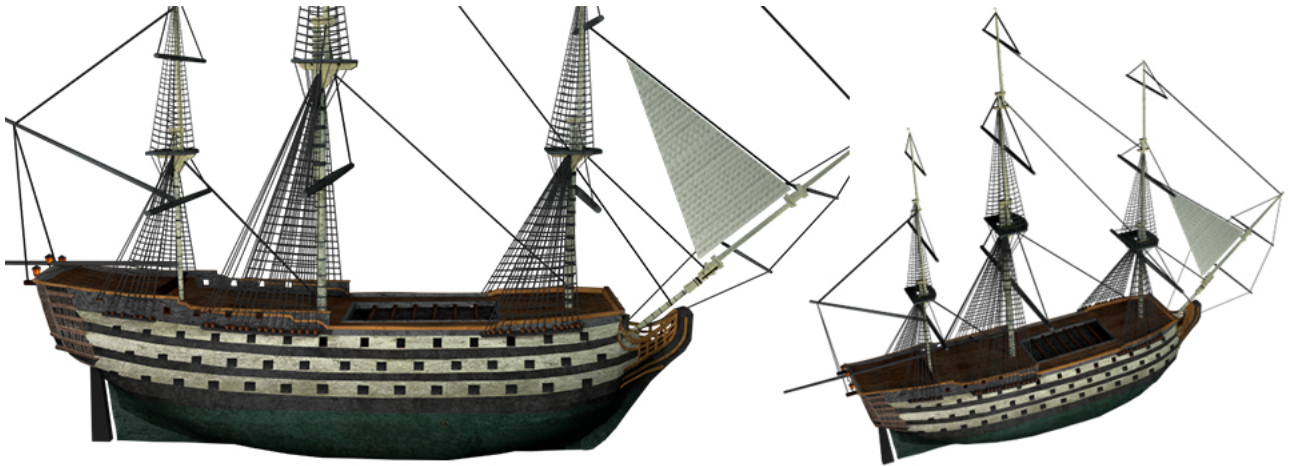
A.2 3D elements: HMS St. George

Figure 67: Rendering of St. George ship model, built after original blueprints. Modelled by Cecilie Warming

A.2.1 Movement patterns

The linear movement pattern, illustrate a visitor who travel in a more or less linear movement pattern, with relative big distance to the presented items and in a immediate tempo. This person will likely only to pay little attention to the spatial conditions and may chose to quickly glance at the Night of the Wreck installation before moving onwards.

The second version, the semi-linear, illustrate a visitor who is a bit more prone with exploration, but who still move relatively conservatively around the space. This visitor may be more likely to become engaged in the narrative space(s) as he or she move around with a lower tempo than the linear. This person may also see Night of the Wreck to an end, before moving onwards.

The final and third version is the non-linear, free-flowing visitor. His or her movement pattern are highly unpredictable and exploratory. This person will likely spend the greatest amount of time in the space, in the lowest tempo and will not leave until all details have been absorbed. This is also the person who has the greatest chance of being engaged in the experience of the narrative space and will certainly watch the full animation, even multiple times from different distances. It also very possible, that this visitor may move both forward and backtrack around the space.
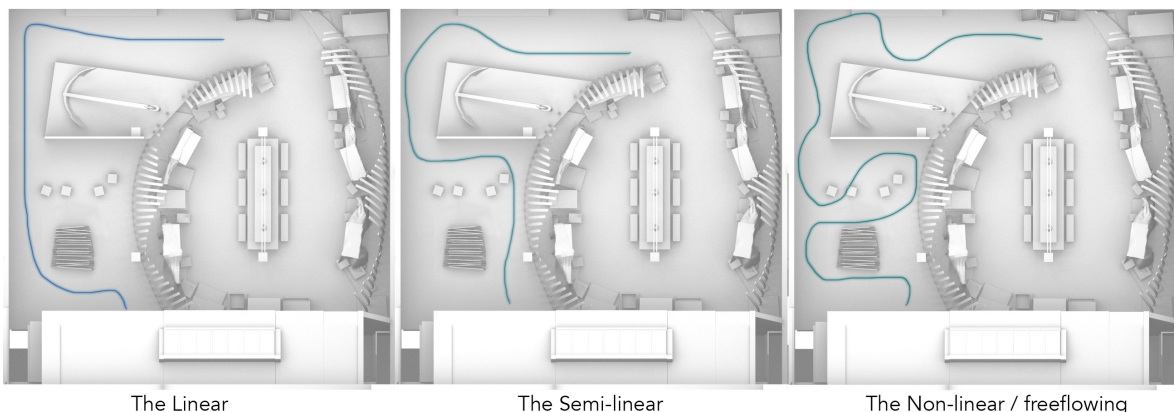

Figure 68: Flow

A.2.2 ProLED speficication

Reference: APS [66]

Roll length: 5 m
IP classification: IP20
Power source: 24 VDC
Power consumption: 76W
Width x height: 12 x 2,5 mm
Luminous flux: Red 90 lm/m
Luminous flux: Green 220 lm/m
Luminous flux: Blue 50 lm/m
Luminous flux: White 710 lm/m
Luminous flux: R+G+B+W 1020 lm/m
CRI (White LED): +80
Beam angle: 120°

A.2.3   ALTMAN 30-55 degree PHX LED RGBW: spefication

Reference: Store [67]

IP classification: IP20
Power source: 100-240VAC
Power consumption: 250-Watt
Width x height: 10.3 x 25 inch
Illuminance (Distance of 3.048 m):
Red: 477.73 lx
Green: 845.4 lx
Blue: 175.6 lx
RGBW: 1,499.86 lx
Beam angle: 30-55°
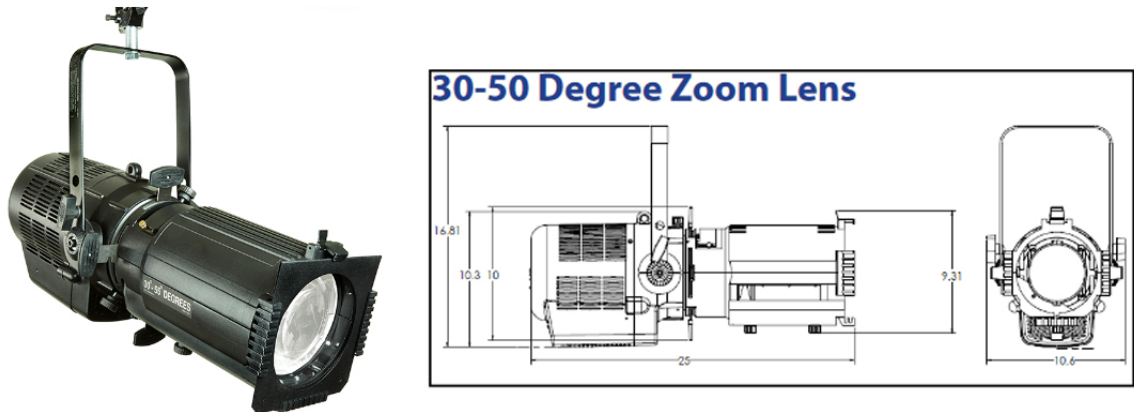Fixture is designed for continuous operation

Figure 69: ALTMAN 30-55 degree PHX LED RGBW (Store [67])

A.2.4   Gobo Zoom USB: spefication

Reference: DJ [68]

IP classification: IP20
Power source: 100 to 240 VAC
Power consumption: 25 W
Width x height: 238 x 124 x 244 mm
Illuminance:
(28°) 1,121 lux @ 2 m
(17°) 3,075 lux @ 2 m
Beam angle: 17 to 28°

Fixture is designed for continuous operation
DMX control
Print your own custom gobos on transparency film

Figure 70: Gobo Zoom USB (DJ [68])

A.2.5   Ljusdesign neo Fresnel: speficication

Reference: Ljusdesign [65]

IP classification: IP20
Power source: 100–240V
Power consumption: 27W
Width x height: 101x217 mm
Illuminance:
Beam angle: 16–64°
Colour rendering CRI 95+
Colour temperature: 2700kelvin
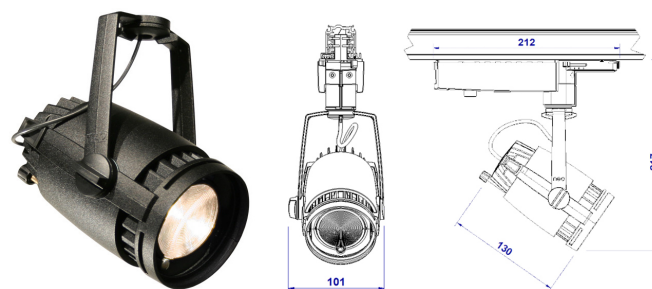Fixture developed for use in museums
DMX: Wireless
Barndoors included

Figure 71: Ljusdesign neo Fresnel (Ljusdesign [65])