

Daylight as a design element:
an analysis of three different inspiring museums that
design with daylight

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Abstract

This paper analyses the use of natural light as a design element in museums. While the design of natural light is important for all types of buildings, it takes additional layers of complexity in museum buildings and exhibition spaces. Due to the need to preserve the artwork, museums tend to become black boxes, with no interaction with the outside. Even so, there are numerous architects who have designed museum spaces that make use of natural light in incredible ways. This paper wishes to look into different ways in which natural light has been used in museums, what is its role, how it interacts with the exhibition, how was it implemented, etc. To do so, it combines a literature review of architecture books and articles with image analyses of sketches and photographs of three museums chosen as case studies: the Aalborg Art Museum by Alvar Aalto, the Jewish Museum in Berlin by Daniel Libeskind, and the Museum of contemporary art in Herning by Steven Holl Architects.

Key words

Museums, natural light, daylight, design approach, concept, exhibition

Introduction

to its constant presence, tends to be taken for granted and overlooked during the design process. In the past century, discussions have been raised around the influence of natural light on various aspects of our lives as our mental and physical health, the temperature of a building, or the visual comfort in an office. This has resulted in an abundance of books and research into the quantitative aspects of natural light: the optics around light, radiation, and human vision, glare, reflection, relation between natural light and screens, ultraviolet measurements, etc. as well as its effects on the psychology and other aspects of human life. All these research results in numerical indications that are meant to help create a healthy work and living environment.¹

But natural light is so much more than the thermal efficiency of a building or the amount of reflection on our screens. Natural light is a design element in itself, a valued aspect of the art that we create through architecture.² Therefore, this research looks into ways architects have integrated natural light in museums, its role, the atmosphere it creates, and the ways it interacts with the exhibition.

There are a few authors who are tackling this matter as Mary Ann Steane in her book “The Architecture of Light” which “examines how architects handle the relationship between light, material and the occupation of space, looking closely at ways in which these factors affect the perception of and atonement to the visual environment.”³ It considers natural light as a “fundamentally important source of orientation in architecture” that “has prompted imaginative and resonant design approaches for a wide range of building types and contexts”.⁴ It also argues that a sensitive approach to daylight is not just a complex design challenge, but a fundamental and under-appreciated aspect of the “practical-art” of architecture.⁵

From a historical point of view, Steane looks into other sources available for understanding the complexity of designing natural light as texts about buildings in which light has been used as a design element, either written by the architects or about them. Modernist architects have written extensively

¹ L Edwards, P Torcellini, and National Renewable Energy Laboratory, ‘A Literature Review of the Effects of Natural Light on Building Occupants’, 2002.

² Ahmed Mahmoud, ‘The Natural Light as an Important Element in the Interior Spaces Forming’, n.d.

³ Mary Ann Steane, *The Architecture of Light: Recent Approaches to Designing with Natural Light* (London, UNITED KINGDOM: Taylor & Francis Group, 2011), <http://ebookcentral.proquest.com/lib/delft/detail.action?docID=1075089>.

⁴ Steane.

⁵ Steane.

on the matter. Louis Kahn for example said in 1959 that “All spaces need natural light. That is because the moods which are created by the time of day and seasons of the year are constantly helping you in evoking what a space can be if it has natural light and can’t be if it doesn’t. Artificial light is a single tiny static moment in light and can never equal the nuances of mood created by the time of day and the wonder of the season.”⁶ Le Corbusier was also vocal about the necessity of looking at natural light as an essential part of your design. One of his perspectives on light states that light has an impact on the way buildings are encountered sequentially, as a series of visual (and ultimately tactile) experiences. It “suggested that how light is handled is key to the architect’s role as choreographer of events”.⁷

While the design of natural light is important for all types of buildings, it takes additional layers of complexity in museum buildings and exhibition spaces. Natural light in museums is a specifically delicate subject since it can both help and destroy the collections. It is important to design in such a way that light can animate and enhance the space and the objects displayed there without stealing the image, the color or the form.⁸ Light needs to help visualize and enhance the experience without damaging the long process of preservation.⁹

Given the significance of light as a design element in modern architecture, how contemporary architects work with natural light, and how they describe these projects, this thesis is looking into ways in which architects have used light as a design element rather than a quantitative quality of space by bringing together three museums and analyzing them through the lenses of natural light. To do so, the natural light as a design element in the museum will be analyzed in two ways: first, its connection with the overall building: how essential is the natural light for the building, was it part of the initial concept, what were the thoughts behind it, and how did the architect view its role. Secondly, its connection with the museum, how natural light is part of the museum at the design level: what is its role in the story that the museum is saying, what is its connection with the exhibition, with the routing, etc.

Analyzing how architects’ ideas about natural light are being translated into design decisions is possible only by looking at individual projects, and analyzing both the final result and the original drawings together with the texts and interviews written about them. This paper analyses three projects: the Aalborg Art Museum by Alvar Aalto, the Jewish Museum in Berlin by Daniel Libeskind, and the Museum of contemporary art in Herning by Steven Holl Architects.

Methodology

This thesis combines a literature review of architecture books and articles with an image analyses of sketches and photographs of the buildings. As primary sources it looks at original drawings (floorplans, sections, elevations, sketches) published by the architects together with photographs of the buildings (interior and exterior) and interviews with the architects where they discuss the buildings. There is an in-depth image analyses for each of the buildings where through the photographs and drawings the role of the light in the exhibition and in the overall experience of the building is looked into. The light as a concept element is analyzed through original sketches and interviews or notes from the architect.

As secondary sources, it explores a large number of books (written by the architect or about them) to find differences between the their initial wishes and the final result.. Next to it there are also published articles and papers from newspapers and media about the museums.

⁶ Louis Kahn, ‘Louis Kahn’, *Perspecta* 7 (1961): 9–28, <https://doi.org/10.2307/1566863>.

⁷ Steane, *The Architecture of Light*.

⁸ Shkurte Dalipi, ‘Natural Lighting of Museums’, n.d.

⁹ David (David R.) Saunders and Getty Conservation Institute, *Museum Lighting: A Guide for Conservators and Curators* (Los Angeles: The Getty Conservation Institute, 2020).



Figure 1 - Aalborg art museum (Magnus Ekstrøm, 2020)

Aalborg Art Museum – Elissa Aalto, Alvar Aalto and Jean-Jacques Barué

The first museum analyzed is the Aalborg Art Museum by Alvar Aalto, famous for its dramatic way in which light enters the building.¹⁰ For this reason, it is a great example to look into. Throughout his career Alvar Aalto had shown a preference towards museums since they serve a “voluntary, assuredly individual dissemination of culture.”¹¹ One of his ambitions was to make use of architectural ‘inventions’ in order to improve interior lighting which gave exceptionally stimulating challenges in museum planning. He has designed a multitude of museum proposals which unfortunately most of them have not been realized.¹²

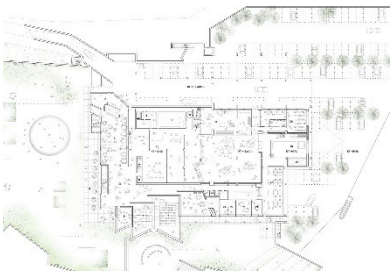


Figure 3 - Ground floorplan of the museum (ARKITEKTEN, 2016)

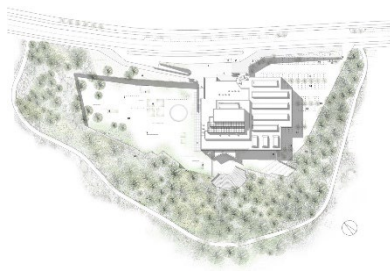


Figure 4 - Roof plan of the museum (ARKITEKTEN, 2016)

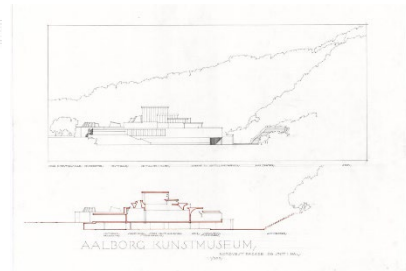


Figure 2 - Section and elevation of the museum (Alvar Aalto foundation)

The design was made during a competition in January 1958 by Alvar and Elissa Aalto and Jean-Jacques Baruel. The construction began in 1966 and was completed in 1972.¹³ The location is a high beech-grown slope above Kong Christians Alle.¹⁴ Jean Jacques Baruel describes the shape of the building as “a stepped pyramid, rising from the bottom of the valley at the only point in Kong Christians Alle from where the whole site is visible. The intention is that the outlines of the pyramid should form a contrast to the wooded slopes of the surrounding country.”¹⁵ Partly embedded into the slope there is a square basement that hosts a parking space, a restaurant two lecture rooms, a restoration workshop, and other administrative rooms. On the ground level, (figure 2) in the original design, there were all the exhibition rooms and a music room with prism-shaped skylights.¹⁶ In 2014 there has been a renovation that added a new exhibition room in the basement.¹⁷ Outside there is an open-air theatre and a sculpture garden.¹⁸

The concept of Gesamtkunstwerk is present throughout Alvar Aalto’s career and it means a complete work in which architecture, design, and art are merged. This is very much evident in the building

¹⁰ ‘Architecture and Light’, accessed 29 March 2024, <https://kunsten.dk/en/content/architecture-and-light-7391>.

¹¹ Göran Schildt, *Alvar Aalto: The Complete Catalogue of Architecture, Design and Art* (London: Academy, 1994).

¹² Schildt.

¹³ Schildt.

¹⁴ Schildt.

¹⁵ Jaime J Ferrer Forés, ‘Alvar Aalto and Jean-Jacques Barué’, *Working Papers*, 2012.

¹⁶ Schildt, *Alvar Aalto*.

¹⁷ ‘The Restoration 2014-2016’, accessed 29 March 2024, <https://kunsten.dk/en/content/the-restoration-2014-2016-2755>.

¹⁸ Schildt, *Alvar Aalto*.

created in Aalborg.¹⁹ He has developed two inventions that determined the originality of his museum plans and that have been derived from most of his museum proposals. The first one is based on the improvement of the accessibility of exhibition areas: Instead of the classic route of positioning halls and sections in a chain which has to be passed in succession, he arranges them in an echelon format that permits visitors to view each section separately or chose any order (figure 2). The second invention relies on a special kind of skylight (also called the 'lock skylight' since it works similarly to the locks in a canal), first used in the Venice pavilion and later in the Aalborg museum and other projects. As seen in the figures below, it distributes throughout the room both natural and artificial light through spot reflectors via parabolic surfaces, preventing in this way direct sunlight from entering the interior. This creates an unequally powerful illumination throughout the exhibition area which is supported by Aalto's opposition to uniform lighting in museums since he believed that different artworks need different amounts of light.²⁰

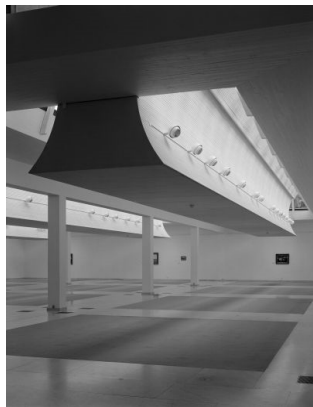


Figure 5 - image capturing the light in the gallery (unknown)

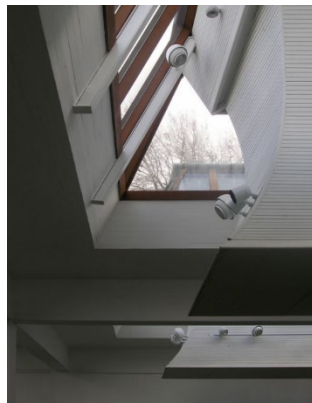


Figure 6 - image capturing the light in the gallery (unknown)

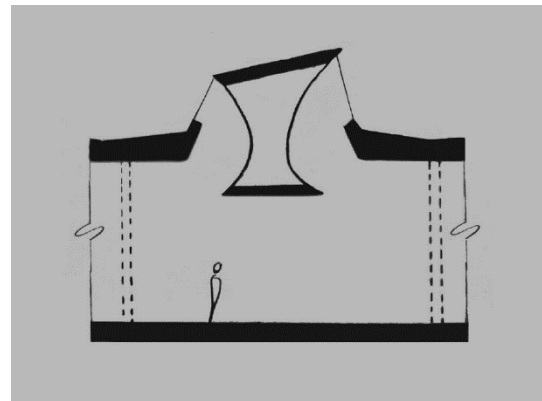


Figure 7 - section with the roof light openings (Storey-Fleming, 2014)

As said above, originally there were 4 galleries above ground (now with an additional one in the basement – the New gallery). The route through the museum was in a circle around the high-ceiling central gallery (the Main Gallery) and continued to the Sky-lit Galleries and the Side-lit Galleries. With the new addition, an even better flow was created through the two floors, connecting even more the café, workshops, and exhibition galleries. In all the galleries, Aalto paid great attention to the way daylight was reflected down onto the artworks through windows and skylights. The daylight was so important for him that he even named most of the galleries after the way the light enters them, which is significantly different from gallery to gallery, varying according to the position of the windows and the season.²¹

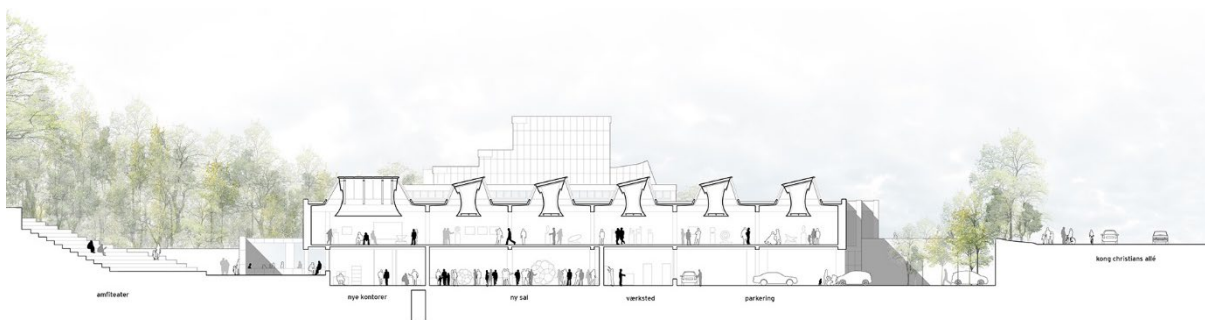


Figure 8 - section of the museum (ARKITEKTEN, 2016)

¹⁹ 'Architecture and Light'.

²⁰ Schildt, Alvar Aalto.

²¹ 'The 5 Galleries', accessed 29 March 2024, <https://kunsten.dk/en/content/the-5-galleries-7401>.

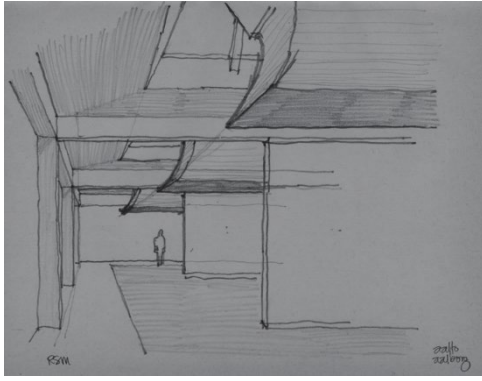


Figure 9 - interior sketch for the light elements (Alvar Aalto)

The lighting system consists of two-sided, elongated skylights that prevent the sunlight from penetrating at an angle up to 56 degrees on the south side while being open up to 90 degrees on the north side. These angles were determined by Aalborg's latitude. The light is then reflected onto the walls without shadow by double parabolic reflecting surfaces suspended from the ceiling to prevent sharp, direct light from hitting the artwork.²² In figure 9 the light elements are sketched by Alvar Aalto and are also visible in the section from figure 8. The result of this unique system of illuminating the space is described by Sonja.

Storey-Fleming describes the natural light from the galleries as “washing across the painting” but not being felt by the visitor. She says that while stepping back from the wall she “can see a subtle but discernible change in the lighting levels of this long low gallery. Long pulsations of light flood in and out from above.” She also remarks that the depth of the light scoops is equal to the height of the gallery below and she describes this as “in terms of sectional hierarchy, the space afforded to human is equal to the space afforded to the sky.”²³

The natural light is supplemented by artificial sources that are located with the greatest precision to make natural light seem more defused when entering the space. Another element meant to underpin the light in the museum is the interior details and materials (figure 12): white marble is predominantly used to reflect the light while the museum laps were also designed by Aalto or Baruel. The laps are very diverse in style but they all emit a gentle, diffuse light.²⁴



Figure 10 - photographs with the light in the gallery (Storey-Fleming, 2014)



Figure 11 - photographs with the light in the gallery (Storey-Fleming, 2014)

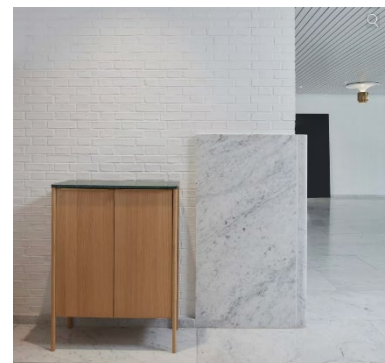


Figure 12 - details of the interior (Magnus Ekstrøm, 2020)



Figure 13 - the Small Gallery (kunsten)

The Small Gallery (figure 13) was originally intended as the Sculpture Gallery and it has all its windows on the North side, with no direct sunlight entering the room. Days with cloudy weather result in colder and bluer light, making the space suitable for sculpture displays. Nowadays the gallery is used for all types of exhibitions and it has a sliding door that can be open

²² Schildt, Alvar Aalto.

²³ Sonja Storey-Fleming, 'Immensity' (Master Thesis, University of Waterloo, 2014), <https://uwspace.uwaterloo.ca/handle/10012/8152>.

²⁴ 'Architecture and Light'.

to connect with the Main Gallery. Most interior walls are flexible in order to allow options in the exhibition layouts.²⁵

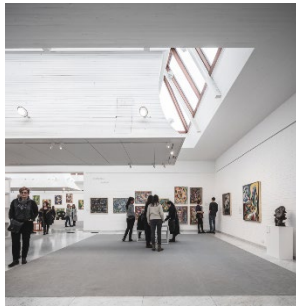


Figure 14 - the Sky-lit Galleries (kunsten)



Figure 15 - the Sky-lit Galleries (kunsten)

The Sky-lit Galleries are a single large open space where the light enters exclusively from above. They are a typical example of Modernism architecture, with pillars and surfaces in shades of white that generate a sense of floating. They provide a flexible exhibition area with the possibility of removable walls that create a maze of artwork. Generally, it is used for the permanent exhibition.²⁶ The double concave light scoops in the ceiling provide the space with primarily northeast and southwest light. They create a different type of connection between the

inside and outside (not through windows and views towards the landscape as in other buildings) but through the light that flows inside, whose consistency is altered by the movement of clouds and the sun projected on the walls. As a visitor, the sky is not visible more than a small occasional silver between the light scoops and the flat ceiling, but its presence is visible through the changes in the light in the room. Storey-Fleming remarks that she did not notice the changes in clouds outside, but inside the space, due to the geometry of the room, the changes in daylight are immediately visible: “This building is an architectural device built within the space of the sky. I stand within an art gallery and within the infinite volume of the sky”²⁷

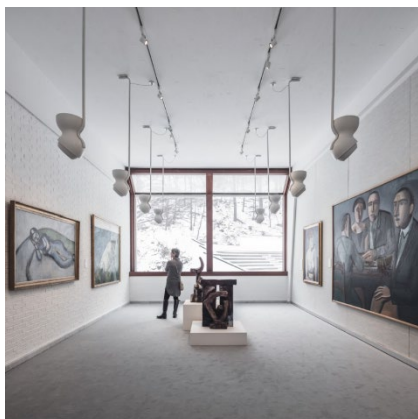


Figure 16 - the Side-lit Galleries (kunsten)

The Side-lit Galleries are made out of seven more intimate galleries, with light entering from the side through windows that allow a view of the woods and the amphitheater. These galleries work with one of the main concepts of the entire building: to create a dialog and interaction between architecture and nature.²⁸

The routing throughout the whole museum is meant for the visitors to head to the Main Gallery, known before as the Central Gallery. When first entering the museum, the rooms are quite dark.²⁹ The main hall is flanked on two sides by a lobby and on the third side by an exhibition room, leaving a few spaces for natural light to enter.³⁰ As visitors progress through the spaces, the light plays an increasing role in their experience from the foyer through the Side-lit Galleries, the Sky-lit Galleries, and finally to the Main Gallery. Here, a high ceiling and a great openness allow a flow of natural light to penetrate the space, becoming the culmination of Aalto’s work with light.³¹

²⁵ ‘Small Gallery’, accessed 29 March 2024, <https://kunsten.dk/en/content/small-gallery-7406>.

²⁶ ‘The Sky-Lit Galleries’, accessed 29 March 2024, <https://kunsten.dk/en/content/the-sky-lit-galleries-7421>.

²⁷ Storey-Fleming, ‘Immensity’.

²⁸ ‘The Side-Lit Galleries’, accessed 29 March 2024, <https://kunsten.dk/en/content/the-side-lit-galleries-7416>.

²⁹ ‘Main Gallery’, accessed 29 March 2024, <https://kunsten.dk/en/content/main-gallery-7411>.

³⁰ Schildt, *Alvar Aalto*.

³¹ ‘Main Gallery’.

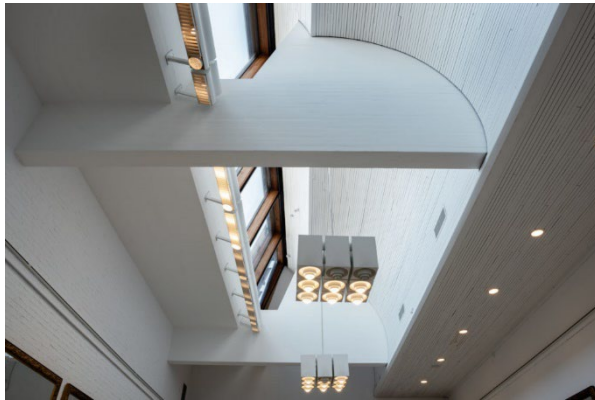


Figure 17 - skylights from the exhibition space (Maija Holma)



Figure 19 - exhibition spaces with the entrance in the background (Maija Holma)

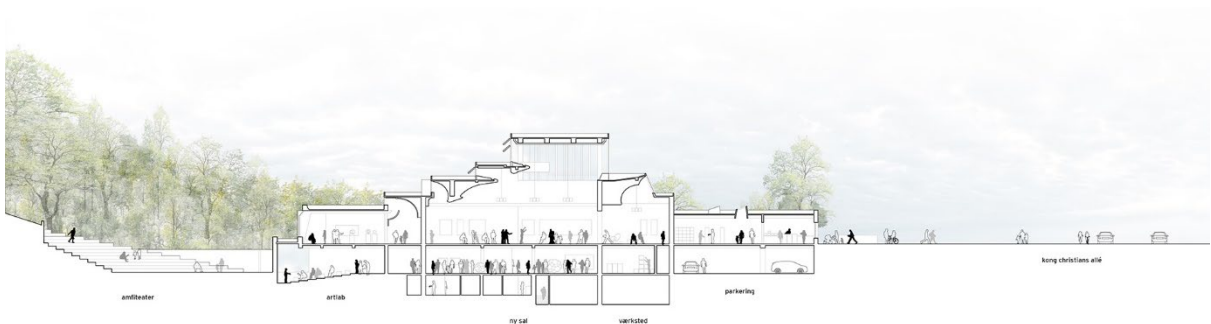


Figure 18 - section of the museum (ARKITEKTEN, 2016)

Aalto wrote about the museum: "Lighting is as important for an art museum as acoustics for a concert hall. That is why I used asymmetrical illumination, with rounded reflectors under the roof openings. Sunlight from the west and south is also utilized using reflecting roof surfaces, which are clad in places with aluminum or enamel tiles. The surrounding tall beech trees form a filter which - together with the seasonal changes of color - give the lighting a life of its own"³². Through his design, the interior is characterized by the dynamic conditions of the expansive sky above. His architecture made tangible the natural movements that, even if always present, otherwise go unnoticed. Sonja describes it as "Standing where a moment before I considered artwork, I suddenly saw, felt, and contemplated the magnitude of the sky above and that light of Northern Denmark. The sky challenged the modest scale of the building and myself as I stood within it. Interior and exterior intertwined."³³

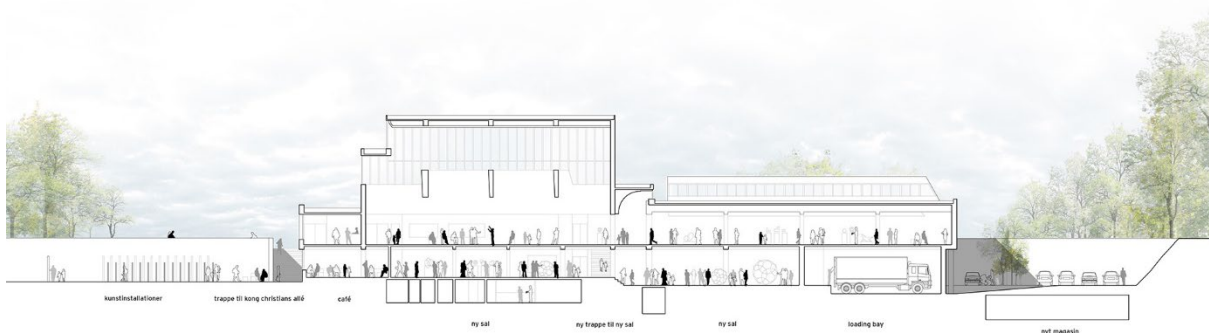


Figure 20 - section of the museum (ARKITEKTEN, 2016)

³² Schildt, Alvar Aalto.

³³ Storey-Fleming, 'Immensity'.

Jewish Museum Berlin - Daniel Libeskind

Daniel Libeskind provides multiple examples of uses of natural light as a special and crucial element in his designs. His passion for light is clear from both his autobiography (where he dedicates a whole chapter to light) and from Helene Binet's comments (the architectural photographer who has documented a series of his projects). He is constantly thinking about literal, symbolic, and metaphysical light.³⁴ Through his constant and deliberate transgressions of what we know as "conventions of building" he shows his concerns with the "premeditated subversion of assumptions of how light should be thought in architectural terms."³⁵



Figure 21 - aerial view of the museum (The Libeskind Building)



Figure 22 - image of the museum (Helene Binet)



Figure 23 - image of the museum (Denis Esakov)

Besides that, his design for the Jewish Museum in Berlin has a uniquely approach towards natural light compared to conventional museum typologies which made it an excellent choice for the research of this paper.

The Jewish Museum in Berlin is anything but a conventional museum, from its lightning-bolt shape like, to the lack of any visible entrance or connection to the main museum, to the slices in the facades that serve as windows, or the interior layout that doesn't follow any clear special hierarchy or conventional museum circulation, Daniel Libeskind's design is a monument of pain and rage, a depiction of the scarcely imaginable trauma of the Holocaust. The goal of his design was to create an architectural integration of Jewish history into Berlin's rich, multi-textured history, and through the use of natural light in his design he enabled, even encouraged the visitors to "feel what had happened."³⁶

By Steane's description, traditionally light symbolism can be divided into two: matter and shadow. Matter, as in the structure of reality and shadow is the understanding of morality. In relation to this premise, the approach towards light in the design of the Jewish Museum challenges this inherited set of beliefs about light as a symbol. There are two reasons for Libeskind's choice: first is his belief that "the all-too-human inhumanity of the Holocaust has thrown doubt on the traditional sources of architectural order and on the reassurance it provides" which leads to a proposal of the idea of a light that negates the idea of a centered orderable world. Secondly, he believes that the ease with which light is now turned on and off in any space encourages us to become passive observant and choose to show only the "goodness" and to ignore fundamental human conditions like the world that is disorder in the same time that is order and harmony. He seeks to mirror exactly this abandoning the search for meaning through his attitude toward light.³⁷

³⁴ Daniel Libeskind on Architecture, Sustainability and Light, 2009, <https://www.youtube.com/watch?v=VsGkCrIX0e8>.

³⁵ Steane, *The Architecture of Light*.

³⁶ Bernhard Schneider and Daniel Libeskind, *Daniel Libeskind: Jewish Museum Berlin : Between the Lines* (Munich: Prestel, 1999).

³⁷ Steane, *The Architecture of Light*.

The museum is inspired by the sculpture “Line of Fire” made for an exhibition in Geneva in 1988 through the zig-zag shape that refers to the triangular bastions of Palma Nuovas. In figures 24 and 25 we can see clearly how the shape resembles lightning which is commonly a memory metaphor: since is a symbol of catastrophe, it refers to forgetting, to the difference between past and present, memory and renewal. Therefore, through Libeskind’s design, the shape of the museums symbolizes simultaneously catastrophe and memory, blurring the line between monument and building.³⁸

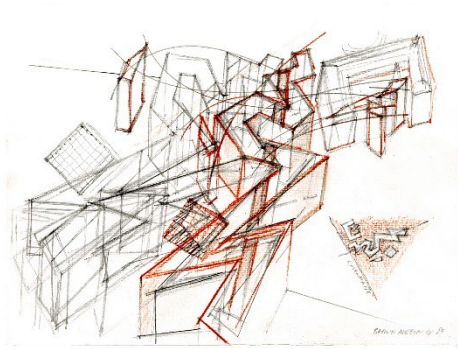


Figure 24 - sketch for the shape of the museum (Daniel Libeskind, 1989)

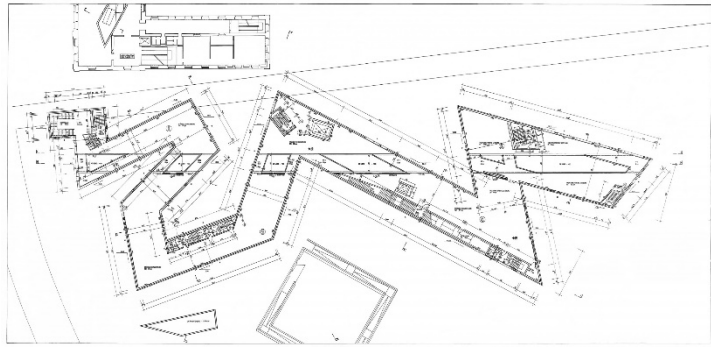


Figure 25 - floorplan (Daniel Libeskind)

The memory as the essence of the building goes from the biggest scale (the shape) to the smallest detail. Following the same concept, the memory element is integrated into the façade where the cuts and openings represent reference lines to places in Berlin where various personalities that represent German culture and German-Jewish symbiosis lived.³⁹

His explanation of the museum's concept has been widely published: "The official name of the project is the "Extension of the Berlin Museum with the Jewish Museum Department" but I have called it "Between the lines". I call it this because it is a project about two lines of thinking, organization and relationship. One is a straight line, but broken into many fragments; the other is a tortuous line, but continuing infinitely. These two lines develop architecturally and programmatically through a limited but definite dialogue. They also fall apart, become disengaged, and are seen as separated. In this way, they expose a void that runs through this museum and through Architecture - a discontinuous void."⁴⁰

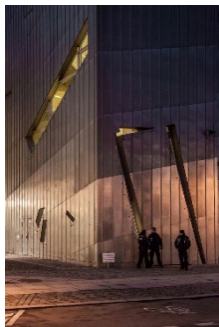


Figure 26 - facade in the night (archdaily, 2022)

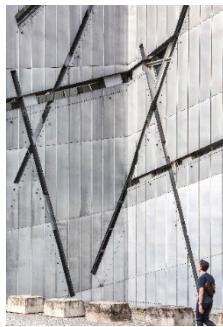


Figure 29 – facade (unknown)



Figure 28 - facade (Bitter Bredt)



Figure 27 – facade (archdaily, 2022)

³⁸ Elke Dörner, *Daniel Libeskind: Jüdisches Museum Berlin* (Berlin: Gebr. Mann, 1999).

³⁹ Dörner.

⁴⁰ Victoria Newhouse, *Towards a New Museum*, Expanded ed (New York, N.Y.: Monacelli Press, 2006), <http://catdir.loc.gov/catdir/toc/ecip0617/2006023622.html>.

For the Jewish Museum, the natural light is not just part of the exhibition, but it seems to be the essence of the museum (as an exhibition and as a building). The pattern of the façade, the windows especially, are influenced by the Jewish connection that Liebskind wants to make through his design. Figures 26, 27, 28, and 29 show how these windows create the patterns on the facades of the museum. He states in the book *Jewish Museum Berlin* that "In the structure of the building I sought to embody the matrix of connections which might seem irrational today but are, nevertheless, visible and rationalized by relationships between people" and wanted "to represent the names and numbers associated with the Jewish Berliners, with the 200,000 Jews who are no longer here to constitute the fabric of Berlin". Figures 30, 31, and 32 show images from the interior of the museum to visualize how these connections are symbolized through the windows and slits in the facades that allow natural light to enter the building while also fragmented views of the city and sky to be visible during the exhibition.⁴¹

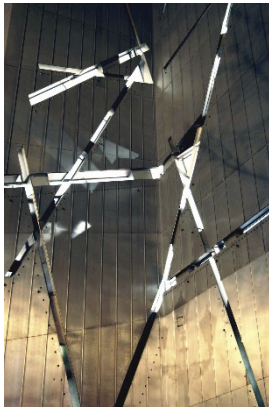


Figure 30 - the windows viewed from the interior (Michele Nastasi)



Figure 31 - the windows viewed from the interior (unknown)



Figure 32 - the windows viewed from inside (Michele Nastasi)

Libeskind is constantly questioning the role of windows in his design, the balance of light and shadow that they generate, and the concepts and narrative that result from this balance. He doesn't bend to the conventional role of windows bringing light into the interior, providing a visual connection towards the outside, reinforcing an orthogonal spatial order, etc) but in the Jewish Museum, he subverts and reworks expectations about the windows' purpose. They rewrite what light can do and say.⁴²



Figure 34 - facades of the old and the new museum (dezeen)



Figure 33 - the stairs to the basement for entering the exhibition (Steane)

⁴¹ Steane, *The Architecture of Light*.

⁴² Steane.

The uniqueness of the museum in terms of its typology is visible from the way the exhibition is constructed: Libeskind wishes to dissolve the idea of standard exhibition spaces and traditional public spaces and create the routing not as a series of spaces but spaces that act in series, creating a range of possible choices and trajectories. He even states that “there are a lot of ends in the museum” but “no space in the building to get away to”.⁴³

The entrance to the museum happens through the palatial Berlin Museum, where visitors have to descend to the basement to enter the new wing. Figure 33 shows a picture of the staircase to the basement. The connection between the two museums is subterranean due to Libeskind's perspective that the Jewish museum department should be integrated with the Berlin Museum but at the same time keep its independence to symbolize the Jewish tradition and German cultural relations. Libeskind says that “preserving this contradicting autonomy of both on the surface while binding the two together in depth.”. The Berlin Museum is hosting an exhibition about the pre-1871 history of Berlin while the extension is hosting a continuation of Berlin's history from 1871 to the present together with a section dedicated to religious and community history. The extension buildings hosts also the theatrical and graphic design department, a lecture hall, spaces for temporary exhibitions, and service areas. “The museum's program includes works of art related to, and forming a continuum with, the museum's historical presentations”⁴⁴. In figure 34 the dialog between the old façade of the museum and Libeskind's extension is shown.



Figure 35 - the crossroad (Bitter Bredt)



Figure 36 - the underground exhibition (archdaily)

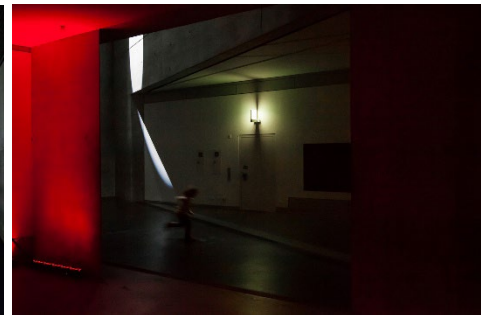


Figure 37 - the underground exhibition (Denis Esakov)

Once reach the basement level, the visitors are confronted with a crossroad (figure 35) where they need to choose between three identical paths, called “Axes” of Continuity, of Exile and Emigration, and of the Holocaust.⁴⁵ This approach presents the museums as a series of catacombs, a labyrinth instead of a simple straightforward exhibition routing. Figures 36 and 37 show the labyrinth feeling of the underground route. The first path goes to the Holocaust Tower, otherwise known as the ‘Voided Void’ which symbolizes the raw darkness of a concrete tomb. It is a dead end where we see the first use of natural light to express the museum's story and exhibition: in the pitch darkness, there is a slide of light high above the ground, a sign of hope and orientation when everything else is unreliable.⁴⁶ This connects to an important element in the museum's design and that's the Void.

⁴³ Steane.

⁴⁴ Newhouse, *Towards a New Museum*.

⁴⁵ Newhouse.

⁴⁶ Mimi Zeiger, *New Museums: Contemporary Museum Architecture around the World* (New York, NY: Universe, 2005), <https://www.loc.gov/catdir/toc/fy0714/2004195260.html>.

In Libeskind's words: " 'Die Leere' is a quality. It is a space you enter in the museum that organizes the museum, and yet it is not part of the museum. It is not heated, it is not air-conditioned, furthermore, it is not really a museum space. [...] it refers to that which can never be exhibited when it comes to the Jewish Berlin history. Humanity reduced to ashes."⁴⁷ He is trying to symbolize this absence of the six million Jews that were murdered by making visible the invisible, to "take the emptiness and materialize it as a building"⁴⁸. The void is formed by a series of discontinuous roof-lit empty spaces that cut through the galleries and are invisible from the outside. Black bridges connect the galleries and make possible the crossing of the void, a contrast from the empty concrete of the voids or the preteen white of the galleries. The only way you can see the voids is by windows through the bridges. The light here is also contrasting the galleries, entering through only small slides in the roof, it is very flat and diffuse. With the bear concrete, this Void that shows a part of Berlin that was obliterated can be considered a true "tomb of light".⁴⁹



Figure 38 - the void (Bitter Bredt)



Figure 39 - the void (Bitter Bredt)

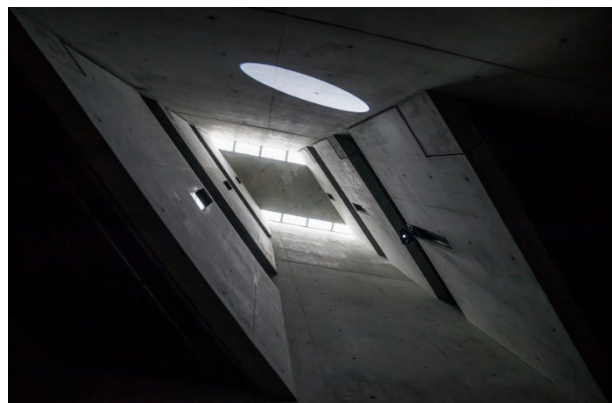


Figure 40 - the void (Bitter Bredt)

The second path leads to the E.T.A. Hoffmann garden, (figures 41 to 43) an enclosed upside-down tilted garden. Here there is a play between the contrast of light, from the darkness of the museum to the daylight, which can lead to temporary blindness.⁵⁰



Figure 41 - the E.T.A. Hoffmann garden (Michele Nastasi)



Figure 42 - the E.T.A. Hoffmann garden (Daniel Libeskind studio)



Figure 43 - the E.T.A. Hoffmann garden (Daniel Libeskind Studio)

The third path, the longest, leads to the main stairs (figure 44) to the upper galleries on the first and second floors. What is interesting about the main stair is that is so predictable for a museum that it become the least-expected element present. Museums usually have primary routes which Libeskind's

⁴⁷ Daniel Libeskind and Hélène Binet, *Jewish Museum, Berlin* (Amsterdam? G + B Arts International, 1999).

⁴⁸ Libeskind and Binet.

⁴⁹ Steane, *The Architecture of Light*.

⁵⁰ Steane.

design specifically doesn't have them except this route upwards that "affirms and denies the normal decorum of the museum stair hall"⁵¹. It rises through a trapezoidal crack and makes the transition from artificially illuminated darkness towards bright daylight which symbolizes a graceful ascent from "the darkness of ignorance towards the promise of light and knowledge". The daylight enters from a series of one-storey-deep roof-lights positioned along one wall and the ceiling together with the building's longest horizontal window (the only window in the museum that offers a more traditional view out from the museum, a panoramic view of Berlin). This daylight doesn't act as a reassurance or a blessing as it does in the previous areas but it inspires confusion and shock, even if it still keeps the meaning of hope. Another unusual choice in this area is at the end of the stairs, one has to turn away from the light in order to continue the route.

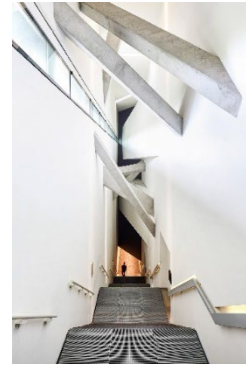


Figure 44 – the main stairs (dezzen)



Figure 45 - interior view of the windows (Elke Dorner)

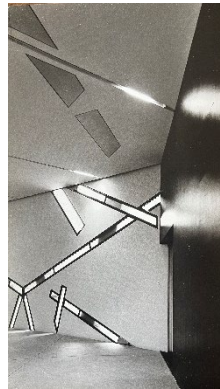


Figure 46 - the windows (Elke Dorner)

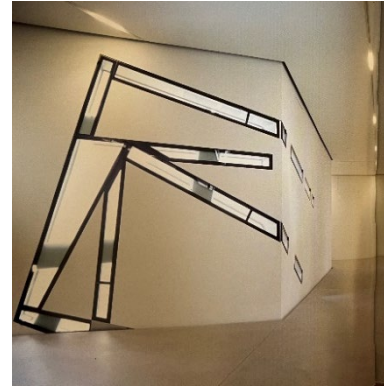


Figure 47 - the windows (Elke Dorner)

The galleries at the upper floors present no clear route to follow, a decision described by Libeskind as "active paths". These spaces lead us to the discussion of the peculiar windows that are sliced or punctured on the facades and let light enter the galleries in this way. The windows are part of the complex matrix meant to commemorate the Jewish culture: they are actual topographic lines meant to indicate addresses where Germans and Jews lived around the site. "In the structure of the building I sought to embody the matrix of connections which might seem irrational today but are, nevertheless, visible and rationalized by relationships between people" explains Libeskind in the book *Jewish Museum Berlin*. "I attempted to represent the names and numbers associated with the Jewish Berliners, with the 200,000 Jews who are no longer here to constitute the fabric of Berlin which was so successful in business and the arts, intellectual, professional, and cultural fields."⁵² These windows were never meant to be a traditional opening in the façade to allow light in and a view towards outside. They come from a different notion of "openness" that creates accidental glimpses of the outside world.⁵³ They also are perceived in two different ways, from the outside they are crosses, slashes, bands, irregular shapes, lines that wander and intersect engraved in the zinc façade⁵⁴ while from the inside they are "oblique lines of light that slice apart and generate alternative three-dimensional spaces".⁵⁵ Their haphazard intersections with the floors and ceilings create bright paces of light and animate the flat white box-like galleries. Through this method, the wall, floor, and ceiling surfaces become equivalent and the projections force the gaze in unexpected directions. As Mary Ann Steane says "Light wanders,

⁵¹ Steane.

⁵² Zeiger, *New Museums*.

⁵³ Libeskind and Binet, *Jewish Museum, Berlin*.

⁵⁴ Daniel Libeskind, *Daniel Libeskind: Countersign* (London: Academy Editions, London, 1991).

⁵⁵ Steane, *The Architecture of Light*.

the route wanders, space seems to continually unfold as one is led ever onwards by the meandering lines of light".⁵⁶

Libeskind has two approaches to light through which he wants to "create conditions within which contemporary cultural and philosophical dilemmas become apparent, conditions which mean that visitors are no longer able to take the current world for granted." He has four different lines of thinking about light, two vertical (the stair and the void) and two horizontal passages (the gallery spaces and the basement roads).⁵⁷

Through the vertical ones, he is questioning whether he can structure through light a world that makes sense. The main stairs refer to the earth-sky theme, looking up you can see an explosion of light while looking down only darkness. In contrast, with the Void he is structuring a negative differentiation of light. Through it, Libeskind foregrounds shadow and creates a light that cannot be seen, denies orientation, and resembles getting lost in a tomb.⁵⁸

On the other hand, the horizontal passages are an example of the relation between light and movement, while also referring again to light and orientation, or better said disorientation since both passages are to a degree disorienting. They both provide the visitor with unexpected insights into the site, the building, and the world. There is a haphazard spatial rhythm within the galleries meant to disorient through light while the basement creates a discussion around the role of light as a vehicle of mediation (the sudden exposure of light or darkness is always destabilizing).⁵⁹

⁵⁶ Steane.

⁵⁷ Steane.

⁵⁸ Steane.

⁵⁹ Steane.

Museum of Contemporary Art in Herning – Steven Holl Architects

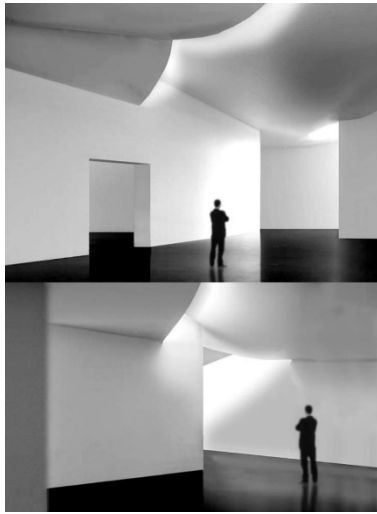


Figure 48 - the light in the galleries
(Steven Holl Architects)

Steven Holl has talked about natural light in a great number of instances through interviews, books, articles, etc. Through his buildings, he is using natural light as an architectural object and material.⁶⁰ In one of his books, he explains that “we must consider space, light, color, geometry, detail, and material in an intertwining continuum.” He believes that the human perception of the building is made through the synthesis of all these elements.⁶¹

For him, all elements of architecture (physical, psychological, and temporal) are interconnected and interdependent. He believes that natural light, along with the phenomena it conveys, grants architecture its soul and its value, that light is what defines the elements and can grant them life: “Natural light with its ethical variety of change, fundamentally orchestrates the intensities of architecture.”⁶²

Through this lenses, we can analyze one of his many museum designs, the Museum of Contemporary Art in Herning, Denmark. The site of the museum lies in Herning, in the middle of Denmark’s Jutland peninsula. In his notes, Steven Holl describes it as being “charged with the mysterious energy of 1960s Arte Povera, Gruppo Zero, and the monochromatic desert ground of Malevich.” The initial design was proposed at a competition where 7 companies were invited. The site was also close to the museum-occupied original shirt factory. The plan of the factory was in the shape of a shirt collar, which made Herning, in Holl’s opinion, “an interesting, idiosyncratic place”.⁶³ It is important to mention here that the relationship between the site and the building is an important element in Steven Holl’s work. In an interview, he states “I was reading Rudolf Steiner, who wrote that the history of the physical site has a presence and a meaning. You can choose to acknowledge it or you can choose to ignore it but it exists nevertheless. That became one extreme of my work”⁶⁴



Figure 49 - the model of the museum (Steven Holl Architects)

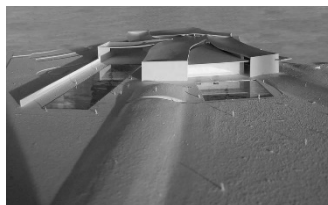


Figure 50 - the model of the museum (Steven Holl Architects)



Figure 51 - the model of the museum (Steven Holl Architects)



Figure 52 - aerial view of the museum (Steven Holl Architects)

⁶⁰ Dilara Ertaş and Ayşe Sirel, ‘The Importance of Light in Steven Holl’s Perception of Form: The Importance of Light in Steven Holl’s Perception of Form’, *Proceedings of the International Conference of Contemporary Affairs in Architecture and Urbanism-ICCAUA* 5, no. 1 (15 May 2022): 49–61, <https://doi.org/10.38027/ICCAUA2022EN0056>.

⁶¹ Yukio Futagawa and Shlomi Almagor, *Steven Holl and Chris McVoy Vol. 2, 1999-2012* (Tokyo: ADA Edita, 2012).

⁶² Futagawa and Almagor.

⁶³ edited by Yukio Futagawa ; introduction by Toyo Ito = 企画. 編集 二川幸夫 ; 序文 伊東豊雄. et al., *Steven Holl*, GA Architect 11 (Tokyo: A.D.A. Edita, 1993).

⁶⁴ Futagawa and Almagor, *Steven Holl and Chris McVoy Vol. 2, 1999-2012*.

In the images below, we can see the mass of the museum, the first three being pictures taken of the model and the fourth one an aerial photograph of the finalized building. The impression of a crumpled textile shirt that the mass gives is well visible here.

Steven Holl provides a detailed description of the design in the book “Steven Holl Volume 2 1999 – 2012”. One of the inspirations for the competition was an extensive study of Piero Manzoni’s work done by Steven Holl, which included the “Soclu de Monde” which had been made at Herning, the canned series “The Artist’s Shit” produced at the Herning factory, as many other fabric explorations in the “Achrome” series. The connection between all of these and the design was made through the white tilt-up concrete with forms lined to capture a fabric wrinkle texture.⁶⁵

In Steven Holl’s buildings, light influences the experience of the visitors at a profound level. This comes from his belief that “The real test of architecture is the phenomena of the body moving through spaces, which can be sensed and felt regardless of understanding the architect’s concept and philosophy”.⁶⁶ He is convinced that to truly understand your building, you have to experience it yourself, wander through it, and perceive it with all your senses. “The phenomenological properties of a space, its light and acoustics, the overlapping perspectives and the details – they form the true experience of architecture. This is not something you can reproduce in a magazine”.⁶⁷

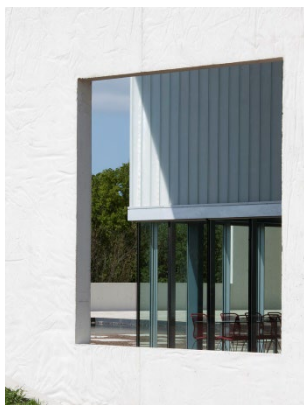


Figure 53 – light through the outside space (Steen Gyldendal)



Figure 54 - the water pond from outside (Steen Gyldendal)



Figure 55 - the continuation of the curved roof outside (Steen Gyldendal)

In the Herning Museum, this concept is also visible both in the interior and in the exterior of the building. As you move around the museum you experience very different spaces, none of which add up into one (Figures 53, 54, and 55), but when you enter there is a sense of surprise, especially around 5:30 when the low angle of the sun enters through the two low slung curves. While you move through the space, it feels like they glides into one another through the splayed rectilinear walls constraining the galleries.⁶⁸

⁶⁵ Futagawa and Almagor.

⁶⁶ ‘Thought, Matter and Experience. Steven Holl in a Conversation with Juhani Pallasmaa.’ (El Croquis 108/2002, n.d.).

⁶⁷ ‘Designed for All Senses: The Architecture of Steven Holl’, The Daylight Site | Daylighting research, architecture, practice and education, 4 October 2017, <http://thedaylightsite.com/designed-senses-architecture-steven-holl/>.

⁶⁸ edited by Yukio Futagawa ; introduction by Toyo Ito = 企画. 編集 二川幸夫 ; 序文 伊東豊雄. et al., *Steven Holl*.



Figure 56 - the ceiling in the corridors (Steen Gyldendal)

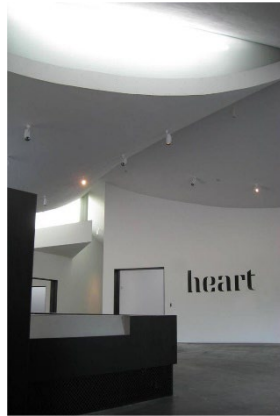


Figure 57 - the light in the corridors (Steen Gyldendal)

The galleries were thought of as two “treasure boxes”, designed as rectangles in the center of the plan and that would display loosely curvilinear light gathering roof elements. The galleries where walls and floors intersect at right angles are shaped to orient the focus on the art, while at the edges of the building, the spaces are more fuzzy, allowing an interaction between the landscape and the design. The landscape was shaped in the reverse curve of the geometry of the roof. Steven Holl describes the mass of the design as shirt sleeves thrown onto boxes. The design is clearly anchored to the site presenting a strong concept. The roof elements provide a gradual curved light that brings the space to life.⁶⁹

In the administrative areas, the curved planner roofs energize the areas in an upswing curve towards the landscape outside. Holl declares that these design elements are meant to enliven the day-to-day activities within through the planner and light-catching geometry of the architecture. The monochromatic architecture of the museum is meant to provide a frame for the daily changes of light to be admired.⁷⁰



Figure 58 - route diagram (Steven Holl Architects)



Figure 59 - floorplan (Steven Holl Architects)

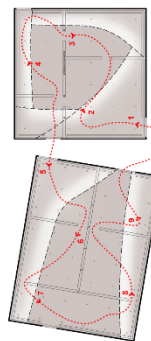


Figure 60 - routing and light in the galleries (Steven Holl Architects)

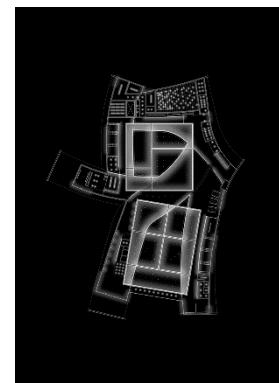


Figure 61 - diagram with the light in the galleries (Steven Holl Architects)

In the image above you can see the floorplan of the museum and the scheme of the exhibition route. The two box-like galleries are clearly visible with all the other functions on the sides. The dotted lines in Figure 58 show the paths of the curved ceilings: we can see how the majority of the area of the curved shapes are on the peripheric functions while the part that allows light in penetrates the galleries, supplying natural light in these spaces would otherwise be black boxes. In Figures 60 and 61 the areas where the ceiling allows natural light are even more clearly shown, highlighting how natural light illuminates the edges of the galleries. Figure 62 shows how this light is visible in the interior.

Steven Holl states that his approach to natural light for this museum was inspired by his experience with designing the contemporary art museum in Helsinki (where his concept was about intertwining northern light with the city fabric and the landscape and paying extra attention to the low angle of Helsinki sunlight) combining with his Scandinavian roots. He describes the “curved planner ‘shirt sleeve’ roofs turn up with strips of skylight to catch the low angle of the sun and allow it to slightly

⁶⁹ Futagawa and Almagor, *Steven Holl and Chris McVoy Vol. 2, 1999-2012*.

⁷⁰ edited by Yukio Futagawa ; introduction by Toyo Ito = 企画. 編集 二川幸夫 ; 序文 伊東豊雄. et al., *Steven Holl*.

grace across the down curving ceiling. The geometry in light-reflecting curves distributes the light so wonderfully in the gallery spaces that they can be used without artificial light. The space is animated and alive when a cloud moves in front of, or away from, the sun – as often happens in the region.”⁷¹



Figure 62 - the light in the galleries (Steven Holl Architects)

The curved light in the galleries is not the only type of impressive natural light in the museum. Areas like the café present a diffuse light achieved by sandblasted channel glass, while the curved landscape around the building creates pockets of spaces where large reflection pools gather and reflect the sunlight onto soffits.⁷²



Figure 63 - the ceiling openings (Steen Gyldendal)

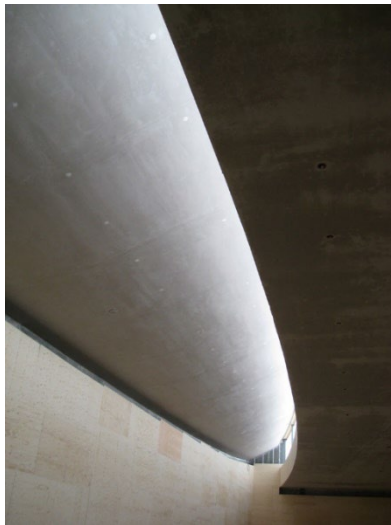


Figure 64 - the ceiling openings (Steen Gyldendal)



Figure 65 - the ceiling openings (Steen Gyldendal)

The competition presentation was made to showcase the importance of light in the design: there were seven boards all black and white, presenting the “amazing quality of light” imagined by Steven Holl within the orthogonal galleries.⁷³ They included drawings, black and white photographs with the light in a model (Figure 66), and watercolor concept drawings. Steven Holl himself is the one who supplies the concept drawings for all his buildings. There are always made in pencil and watercolors, in a notebook, sometimes a bit vague but always capturing the idea of the building.⁷⁴ In the following figures

⁷¹ edited by Yukio Futagawa ; introduction by Toyo Ito = 企画. 編集 二川幸夫 ; 序文 伊東豊雄. et al.

⁷² edited by Yukio Futagawa ; introduction by Toyo Ito = 企画. 編集 二川幸夫 ; 序文 伊東豊雄. et al.

⁷³ Futagawa and Almagor, *Steven Holl and Chris McVoy Vol. 2, 1999-2012*.

⁷⁴ ‘DESIGNED FOR ALL SENSES’.

we see the ones made for the Herning museum. You can see how the light plays from the beginning a crucial role and how well the watercolour helps showing the beam of light entering the gallery.

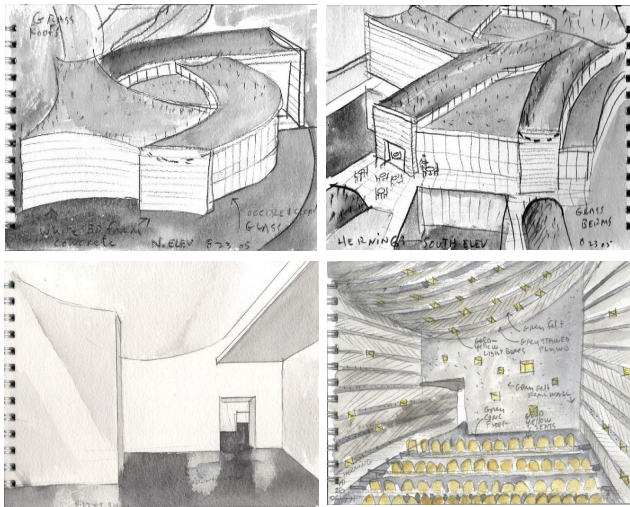


Figure 66 - sketches from Steven Holl's notebook

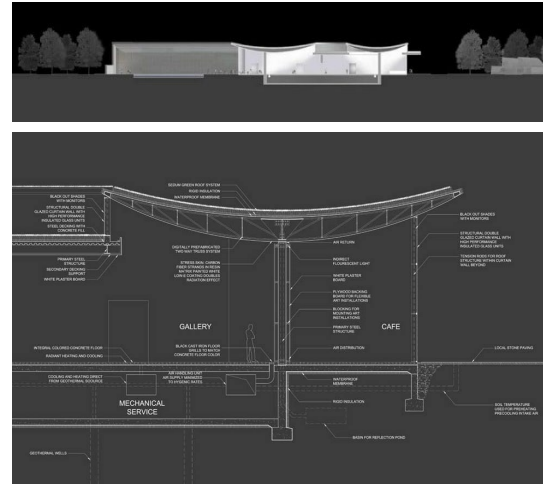


Figure 67 - section (Steven Holl Architects)



Figure 68 - images of the model for the competition to show the light in the design (Steven Holl Architects)



Figure 69 - facade (Steven Holl Architects)



Figure 70 - facade (Steven Holl Architects)



Figure 71 - Sections (Steven Holl Architects)

Conclusion

The purpose of this paper was to analyze the use of natural light as a design element in museums. The intention was to emphasize the important role that natural light can play in a building and to show that even in a museum it can still be present and incorporated in the experience of the users without damaging the art. To accomplish this, I relied on a literature review of architecture books and articles with image analyses of sketches and photographs of the three museums that heavily incorporate natural light in their design: Aalborg Art Museum by Alvar Aalto, the Jewish Museum in Berlin by Daniel Libeskind and the Museum of contemporary art in Herning by Steven Holl Architects.

The thread that relates these three museums together is the importance that their architects put on the natural light as an element from the first stage of the design. Aalto, Libeskind, and Holl have all been vocal about their opinions on the importance of incorporating natural light in the museum, of finding ways to make it part of the visitors' experience without damaging the art, of generating emotions and influencing atmospheres through it.

The differences between them are on one hand the implementation of these ideas (at the type of openings designed: Aalto creates either traditional big windows or through the lock skylights, while Libeskind uses a mix of thin long windows that slice through walls, floors, or ceilings while Steven Holl presents his curved ceilings that allow diffuse light inside the galleries) and on the other hand, the purpose that the architects give to natural light in their projects. Alvar Aalto creates an interior space characterized by the dynamic conditions of the expansive sky above, an example of his belief in the concept of Gesamtkunstwerk (a merge between architecture, design, and art). Libeskind looks at his museum as a monument of grief where light is at the essence of his design. The light here is meant to represent all that was lost due to the Holocaust, the history of what is no more. Steven Holl follows to influence his visitors at a profound level through light as he believes that it is the essence of his architecture.

Looking over all these projects and different approaches in one paper helps in understanding the variety of possibilities available for designers of creating impressive interiors, of influencing the experiences of the users, all by implementing natural light as an active element in the architecture.

To get a more comprehensive view of the use of natural light in museums, future studies could also discuss a higher number of projects, maybe looking into patterns between geographical positions and how the light in different areas generates different approaches to openings and windows. This thesis picked specifically projects with different types of openings for a more general understanding but with a much higher number of reference projects a classification can be made by the types of light allowed in or the types of openings used: for example, diffuse light versus more direct light, ceiling openings, traditional windows, skylights, etc.

To elaborate even more on the subject, this type of research can be reproduced on a variety of buildings with different functions than museums, to find connections between other functions and the use of light, to look into what other needs these buildings might have, and to find parallels between them.

In the end, this research is a small contribution, nonetheless important, to the subject of natural light in architecture and the possibilities of continuing it further are endless. It is important that through this paper there has been some awareness raised around these possibilities and that there are already a significant number of projects that tackle this subject through their designs.

References

'Architecture and Light'. Accessed 29 March 2024. <https://kunsten.dk/en/content/architecture-and-light-7391>.

Dalipi, Shkurte. 'Natural Lighting of Museums', n.d.

Daniel Libeskind on Architecture, Sustainability and Light, 2009.
<https://www.youtube.com/watch?v=VsGkCrIX0e8>.

Dorner, Elke. *Daniel Libeskind: Jüdisches Museum Berlin*. Berlin: Gebr. Mann, 1999.

edited by Yukio Futagawa ; introduction by Toyo Ito = 企画. 編集 二川幸夫 ; 序文 伊東豊雄., Steven Holl, 二川幸夫., and 伊東豊雄. *Steven Holl. GA Architect 11*. Tokyo: A.D.A. Edita, 1993.

Edwards, L, P Torcellini, and National Renewable Energy Laboratory. 'A Literature Review of the Effects of Natural Light on Building Occupants', 2002.

Ertas, Dilara, and Ayşe Sirel. 'The Importance of Light in Steven Holl's Perception of Form: The Importance of Light in Steven Holl's Perception of Form'. *Proceedings of the International Conference of Contemporary Affairs in Architecture and Urbanism-ICCAUA* 5, no. 1 (15 May 2022): 49–61.
<https://doi.org/10.38027/ICCAUA2022EN0056>.

Forés, Jaime J Ferrer. 'Alvar Aalto and Jean-Jacques Barué'. *Working Papers*, 2012.

Futagawa, Yukio, and Shlomi Almagor. *Steven Holl and Chris McVoy Vol. 2, 1999-2012*. Tokyo: ADA Edita, 2012.

Kahn, Louis. 'Louis Kahn'. *Perspecta* 7 (1961): 9–28. <https://doi.org/10.2307/1566863>.

Libeskind, Daniel. *Daniel Libeskind: Countersign*. London: Academy Editions, London, 1991.

Libeskind, Daniel, and Hélène Binet. *Jewish Museum, Berlin*. Amsterdam: G + B Arts International, 1999.

Mahmoud, Ahmed. 'The Natural Light as an Important Element in the Interior Spaces Forming', n.d.
'Main Gallery'. Accessed 29 March 2024. <https://kunsten.dk/en/content/main-gallery-7411>.

Newhouse, Victoria. *Towards a New Museum*. Expanded ed. New York, N.Y.: Monacelli Press, 2006.
<http://catdir.loc.gov/catdir/toc/ecip0617/2006023622.html>.

Saunders, David (David R.) and Getty Conservation Institute. *Museum Lighting: A Guide for Conservators and Curators*. Los Angeles: The Getty Conservation Institute, 2020.

Schildt, Göran. *Alvar Aalto: The Complete Catalogue of Architecture, Design and Art*. London: Academy, 1994.

Schneider, Bernhard, and Daniel Libeskind. *Daniel Libeskind: Jewish Museum Berlin : Between the Lines*. Munich: Prestel, 1999.

'Small Gallery'. Accessed 29 March 2024. <https://kunsten.dk/en/content/small-gallery-7406>.

Steane, Mary Ann. *The Architecture of Light: Recent Approaches to Designing with Natural Light*. London, UNITED KINGDOM: Taylor & Francis Group, 2011.
<http://ebookcentral.proquest.com/lib/delft/detail.action?docID=1075089>.

Storey-Fleming, Sonja. 'Immensity'. Master Thesis, University of Waterloo, 2014.
<https://uwspace.uwaterloo.ca/handle/10012/8152>.

'The 5 Galleries'. Accessed 29 March 2024. <https://kunsten.dk/en/content/the-5-galleries-7401>.

The Daylight Site | Daylighting research, architecture, practice and education. 'Designed for All Senses: The Architecture of Steven Holl', 4 October 2017. <http://thedaylightsite.com/designed-senses-architecture-steven-holl/>.

'The Restoration 2014-2016'. Accessed 29 March 2024. <https://kunsten.dk/en/content/the-restoration-2014-2016-2755>.

'The Side-Lit Galleries'. Accessed 29 March 2024. <https://kunsten.dk/en/content/the-side-lit-galleries-7416>.

'The Sky-Lit Galleries'. Accessed 29 March 2024. <https://kunsten.dk/en/content/the-sky-lit-galleries-7421>.

'Thought, Matter and Experience. Steven Holl in a Conversation with Juhani Pallasmaa.' *El Croquis* 108/2002, n.d.

Zeiger, Mimi. *New Museums: Contemporary Museum Architecture around the World*. New York, NY: Universe, 2005. <https://www.loc.gov/catdir/toc/fy0714/2004195260.html>.