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Title: Structures of Light: Exploring Daylight Openings in a Nordic Bathhouse

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Abstract:
The thesis explores daylight's spatial and atmospheric role in architectural design through the development of a bathhouse in Copenhagen. Structures of Light: Exploring Daylight Openings in a Nordic Bathhouse investigates how natural light - direct, diffused, and reflected - acts as a primary design driver that shapes experience, orientation, and mood. Focusing on the unique qualities of Nordic light, the research argues that daylight is essential to defining spatial character, enhancing comfort, and supporting ritual transitions within architecture. It operates on the hypothesis that the type of daylight, the orientation of programmatic elements, and the form and distribution of apertures influence performance and user experience. Central to the thesis are light structures, which are architectural interventions that control and shape daylight through openings. These become performative spatial tools that redirect, reflect, or diffuse light based on environmental and experiential needs. An iterative methodology combining conceptual diagrams, digital simulation, and physical prototyping informs the design process. Six program-specific rooms are developed, each engaging with daylight to support different bathing rituals. The final proposal is a hybrid pavilion extending from land into water, organized along a gradient from bright and open to dim and enclosed. The architecture is structured through the careful modulation of daylight, creating a spatial narrative shaped by light. This approach forms an immersive sequence of retreat and reflection, positioning daylight as an active and expressive driver within the architectural experience.

Keywords: Daylight, Nordic Light, Light Structures, Daylight Openings, Spatial Atmosphere, Bathhouse

Table of Contents

1. Introduction

1.1. Personal Background and Vision

Daylight has always been a fundamental architectural element, influencing perception, mood, and how we navigate space. *Structures of Light: Exploring Daylight Openings in a Nordic Bathhouse* examines how architectural openings can be purposefully designed to sculpt daylight and generate immersive, sensory-rich environments through integrated light structures. The thesis investigates how these openings, defined by the daylight type (direct, diffused, reflected), programmatic needs, and the light structure's form, scale, and distribution, can guide movement, shape experience, and evoke emotional response.

Drawing from a background in interior architecture, civil engineering, and lighting design, this research proposes a methodology that elevates daylight to the status of an architectural force. Through digital and physical prototypes, it investigates strategies for creating spaces that integrate functional performance with an expressive atmosphere. Although the study is situated within the typology of a bathhouse, the design principles are transferable across architectural programs that engage with form and the poetics of light.

The following vision forms the foundation of the project, positioning daylight as the primary medium through which architecture expresses intention, sequence, and emotion:

What if daylight could become a primary architectural driver that informs shape, guides movement, and choreographs atmospheres?

1.2. Daylight as a Primary Architectural Driver

Figure 1: Poetic Daylight Pavilion, Denmark, Figure 2: Nordic Pavilion, Italy, Figure 3: Saint Benedict Chapel, Switzerland

When architects treat daylight as an active architectural driver, geography becomes essential. Latitude, in particular, influences the angle, intensity, and duration of sunlight throughout the year, shaping how architecture responds to natural light. A building's position

on earth affects its environmental performance and the emotional and spatial qualities that daylight brings to architecture.

Figures 1, 2, and 3 present three architectural examples: the Poetic Daylight Pavilion in Denmark, the Nordic Pavilion in Venice, and the Saint Benedict Chapel in Switzerland. Each project responds to its specific latitude, demonstrating how regional daylight conditions guide architectural decisions and contribute to the atmosphere and experience of the space.

Figure 4: Latitude and Longitude map of the European continent showing islands and country boundaries.

At higher latitudes, such as Denmark (around 56°N)(Figure 4), daylight is often oblique, cool, and fleeting, especially in winter. The Poetic Daylight Pavilion responds by allowing light to enter in narrow, concentrated shafts. These openings exaggerate the rare presence of direct sunlight, turning daylight into a poetic event that reveals texture and silence.

Moving south to Italy, specifically Venice (45°N), the Nordic Pavilion by Sverre Fehn demonstrates how a slightly lower latitude offers stronger, more consistent daylight. The structure uses horizontal and vertical concrete fins to filter and modulate this daylight, creating dynamic patterns and rhythms throughout the day. The pavilion becomes a public gathering space where daylight defines openness, flow, and collective experience.

Switzerland is further inland and slightly lower in latitude, where the Saint Benedict Chapel (47°N) is nestled in the alpine landscape. Here, the chapel engages with diffuse light softened by mountain conditions. The architecture captures this softness with curved wooden interiors and carefully placed openings, drawing in light that aligns with the sun's movement while maintaining a sacred and warm interior character. The building resonates with the seasonal cycle, using daylight to reinforce a sense of ritual and reflection.

This research investigates daylight in the Nordic context, where high-latitude countries such as Denmark, Norway, Sweden, Finland, and Iceland experience dramatic variations in daylight duration and quality throughout the year. The region's characteristically low solar angles, extended twilight, and seasonal fluctuations in light intensity nourish a dynamic and emotionally resonant relationship with natural light. These conditions have defined how Nordic societies perceive and engage with daylight, establishing it as a primary architectural consideration.

1.3. Case Study: The Bathhouse in the Context of Copenhagen

Harbor baths play a significant role in Copenhagen's urban and cultural life, offering a tradition of Nordic bathing along the city's waterfront. The proposed bathhouse is situated between land and water, a position that heightens spatial awareness and intensifies daylight experience. In this setting, daylight becomes highly dynamic, modulated by the harbor's reflective surface, the movement of clouds, atmospheric humidity, and occasional mist. These fluctuating conditions make the site an ideal context for investigating daylight as both a climatic phenomenon and a temporal medium that transforms spatial atmosphere throughout the day and seasons.

The design of each space - entrance, changing rooms, corridor, cold plunge, spa, and sauna - has been developed with specific lighting characteristics, closely tied to its program and desired atmosphere. Architectural openings bring light into the space while guiding movement and defining the rhythm of spatial experience. Daylight is manipulated - captured, blocked, reflected, or redirected - to shape perception and enhance the spatial narrative.

1.4. Research Question

How can the design and integration of different light structures enhance both the functional performance and atmospheric experience within the Nordic context?

2. Methodology and Design Process

This thesis uses a research-through-design methodology, aligning with its broader conceptual framework while responding to Copenhagen's specific environmental and atmospheric conditions. The design of the bathhouse is fundamentally shaped by daylight and solar orientation, placing light at the core of both spatial and sensory experiences. Through an iterative process involving digital simulations, physical models, and spatial testing, the project studies how daylight informs movement, atmosphere, and spatial character of a bathhouse in a Nordic context. The design is structured around three guiding criteria, *Program, Types of Daylight,* and *Light Structures*, which frame the architectural development of distinct light zones: entrance, changing rooms, corridor, cold plunge, spa pool, and sauna.

2.1. Design Criteria

a) Program

A clear understanding of the program, particularly the function and orientation of each space, is essential for supporting the intended atmosphere and spatial experience. Each area requires a distinct interplay of light and shadow. Orientation plays a crucial role in determining the quality and direction of natural light, making it a key factor in aligning daylighting strategies with the bathhouse's functional layout.

b) Types of Daylight

The character of daylight, whether direct, diffused, or reflected, influences how spaces are perceived and experienced. Direct sunlight introduces warmth and sharp contrast, enhancing drama or drawing focus to specific areas. Diffused light provides even illumination, creating a sense of calm and stillness. Reflected light, often entering from above and bouncing off surfaces, produces a gentle glow that enriches interior tones, particularly in compact or enclosed spaces.

c) Light Structures

The configuration of a light structure - its form, scale, and distribution - controls how daylight enters and interacts with the interior space.

- Form: The geometry of an opening, whether rectangular, circular, or irregular, influences the direction and quality of daylight. Rectangular forms produce distinct light patterns and sharp contrasts, reinforcing spatial clarity and architectural order. In contrast, circular or organically shaped forms diffuse light more softly, contributing to a gentler, more contemplative atmosphere. The formal language of an aperture becomes a mediator between structure and sensation, influencing how light is perceived.

- Scale: The scale of an aperture affects both the intensity and distribution of daylight within a space. Larger openings introduce greater luminance and visual openness but require careful modulation to mitigate glare and thermal gain, particularly in

sun-exposed zones. On the other hand, smaller openings cause a more controlled, intimate quality of light, which is ideal for spaces prioritizing enclosure, thermal comfort, and visual privacy.

- Distribution: The overall distribution across façades or within interior sequences defines how daylight animates space over time. Regularly spaced openings can establish a rhythmic progression and guide movement, while asymmetrical or clustered arrangements highlight specific spatial moments. The distribution also involves vertical and horizontal placement: Vertical apertures create dynamic, evolving light patterns, whereas horizontal elements - such as clerestories or skylights - offer steady, diffuse illumination ideal for contemplative or communal areas. Through thoughtful distribution, daylight integrates into the architectural narrative, reinforcing spatial function, orientation, and mood.

2.2. Hypotheses

This section introduces three hypotheses, each aligned with the core design criteria, that guide the bathhouse's daylighting strategy. Each hypothesis addresses a specific relationship between daylight and spatial experience, forming the conceptual framework for simulation, prototyping, and iterative analysis throughout the design process.

Hypothesis 1 (*Program*): The characteristics and orientation of each program directly inform and shape its corresponding daylighting strategy.

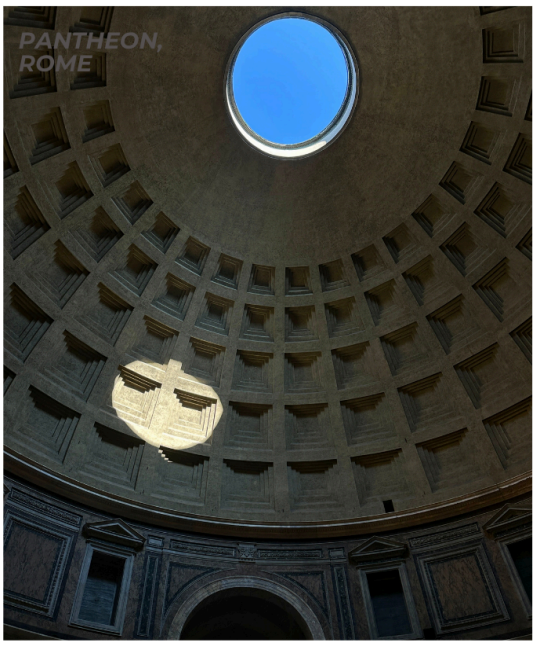
Hypothesis 2 *(Types of Daylight):* Different types of daylight - direct, diffused, and reflected - create distinct spatial conditions that enhance sensory and emotional responses.

Hypothesis 3 (*Light Structures*): The form, scale, and distribution of light structures directly impact daylight performance and spatial perception.

2.3. Literature Review & Case Studies

While researchers have extensively studied daylighting and human-centric lighting, they have overlooked how to apply these principles to spaces that demand more than performance - spaces that aim to move, slow, and immerse. This thesis confronts that gap between the measurable and the experiential. It explores how architecture, within the contemplative typology of the bathhouse, can choreograph daylight to illuminate and articulate mood, rhythm, and spatial atmosphere.

The project investigates how daylight can be intentionally shaped through strategic openings to guide users through atmospheric environments. Drawing from architecture, science, and art, this research treats light as a transformative medium that reveals, animates, and composes space.



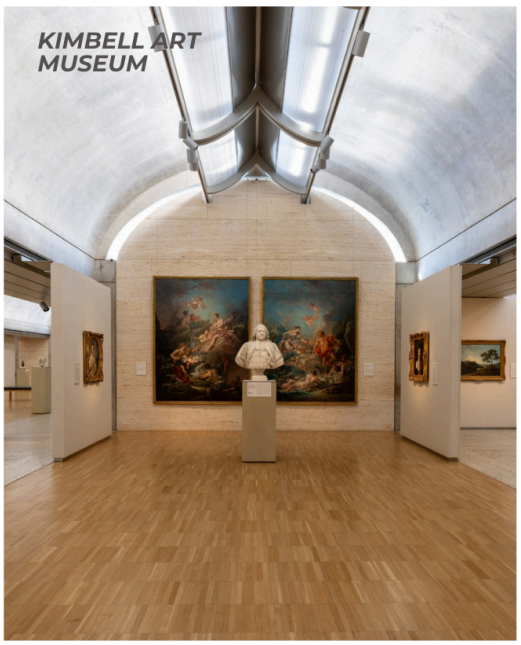


Figure 5: Pantheon, Rome, Figure 6: Kimbell Art Museum, Texas, Louis Kahn

Throughout history, architects have regarded light as architecture's "fourth dimension" (Zumthor, 2006), a dynamic element that transcends physical form to shape presence and atmosphere within space. Daylight has been used both as narrative and structure, from aligning the Pantheon's oculus with the cosmos (Figure 5) to composing the sacred geometries of Kahn's openings (Figure 6) (Unwin, 2014). This thesis draws inspiration from these precedents and uses the Nordic bathhouse as a contemporary setting for exploration, a place to investigate how programs, types of daylight, and light structures can shape the lived experience of daylight.

2.3.1. Defining Key Principles

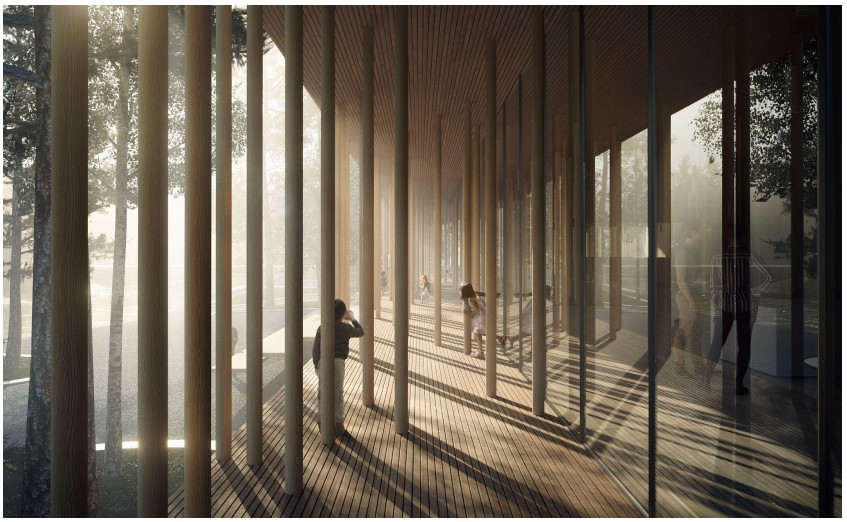


Figure 7: Museum of Forest Finn Culture in Svullrya, Norway

The word *structure* originates from the Latin *structura*, meaning to build or to assemble. While it traditionally refers to physical support and stability systems, its meaning involves the tangible and the notions of order, pattern, and relation (Figure 7) (Markus, 1993). *Light*, derived from the Old English *leoht*, signifies illumination and understanding, a source of literal and metaphorical clarity. This duality establishes the thesis's conceptual foundation, positioning structure as the system that organizes form and daylight as the agent that reveals it. In this context, light operates as a generative spatial structure in its own right.

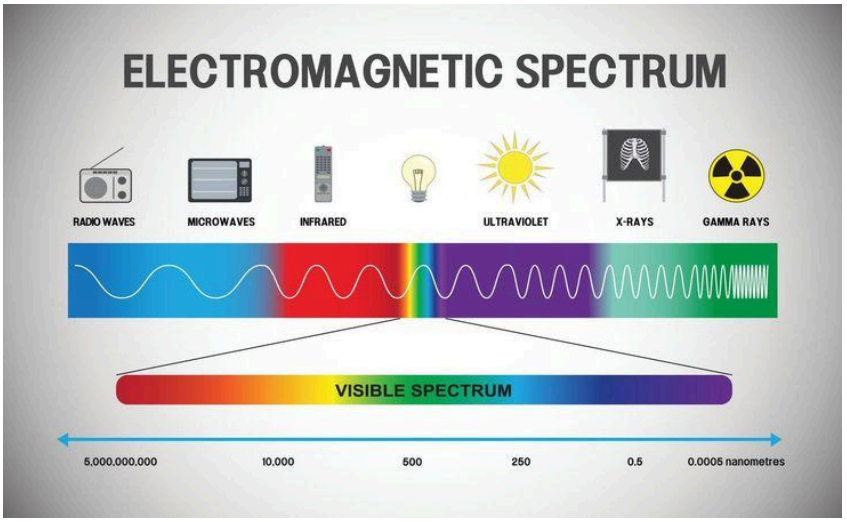


Figure 8: Electromagnetic Spectrum Infographic

In scientific terms, light is a form of electromagnetic radiation that occupies a small portion of the broader electromagnetic spectrum to which the human eye is sensitive. Light behaves in predictable ways - through reflection, refraction, absorption, and transmission - and can be

measured by its wavelength and intensity. This physical understanding allows precise control and simulation, especially in architecture and environmental design.

However, in architecture, light goes beyond its scientific definition. It creates a mood and atmosphere that cannot be fully measured. Light shapes our experience of space and can even make intangible elements like time feel visible. Both historical and contemporary examples illustrate this balance. Light exists where science meets perception, blending precision with poetry. As Dugar (2016) discusses in *The Role of Poetics in Architectural Lighting Design*, architecture harnesses the physical properties of light while using it as a meaningful tool to influence how we see, feel, and remember space.

2.3.2. Reframing the Relationship between Structure and Light

In architecture, structure is often understood as physical elements - beams, columns, walls - but it also includes less tangible aspects that influence how space is experienced. These include movement, rhythm, thresholds, and most importantly, light. Openings help define and organize space. Daylight becomes a tool for spatial orientation, guiding attention, marking boundaries, and influencing the pace at which a space is perceived.

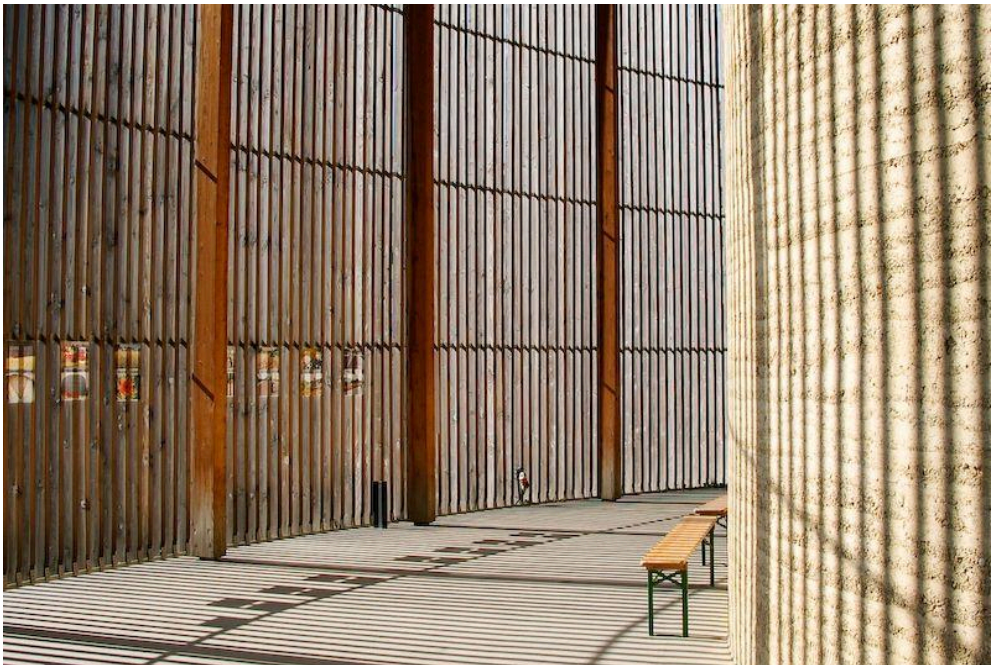


Figure 9: Chapel of Reconciliation, Berlin

In this context, structure includes an entrance angled to catch morning light, a roof opening that frames the sky, or a narrow slit that filters sunlight into a quiet interior. These elements, grounded in rhythm and illumination, make architecture more legible, layered, and emotionally engaging (Figure 9). Elements such as light, shadow, and movement form a parallel, ephemeral yet deeply impactful architecture.

Light carries different definitions across disciplines. It is a measurable phenomenon in science, split by prisms (Figure 10) and charted in the solar spectrum. In art, light becomes a medium of perception and emotion: Yayoi Kusama's Infinity Rooms (Figure 11) invoke infinite space, while James Turrell's installations give light a tangible volume and depth. Architecture unites these approaches, treating light as a precise element and an expressive force. Tadao Ando's Church of the Light (Figure 12) demonstrates this synthesis: a cross-shaped cut in a concrete wall captures and guides daylight, transforming an ordinary wall into an evocative spiritual setting.

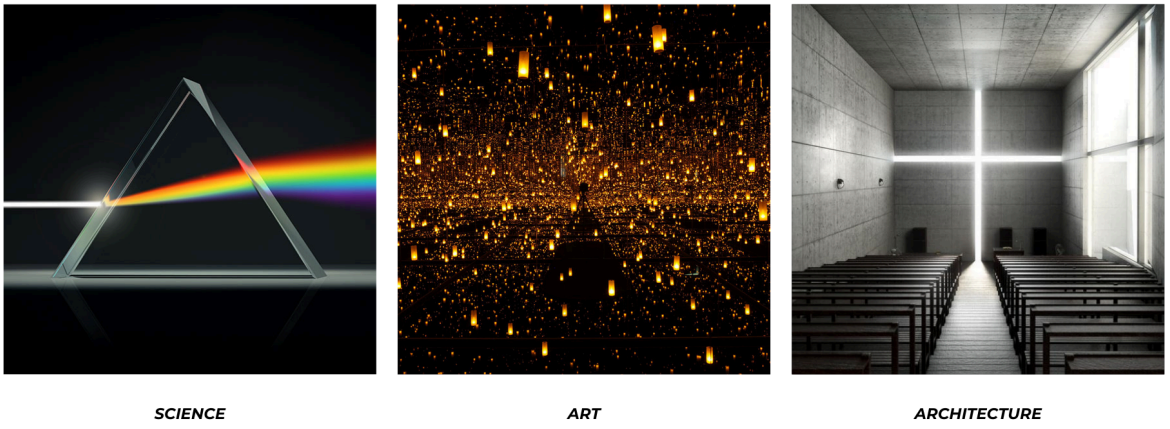


Figure 10: Light Prism, Figure 11: Infinity Mirror & Light Room by Yayoi Kusama, Figure 12: Church of Light, Tadao Ando

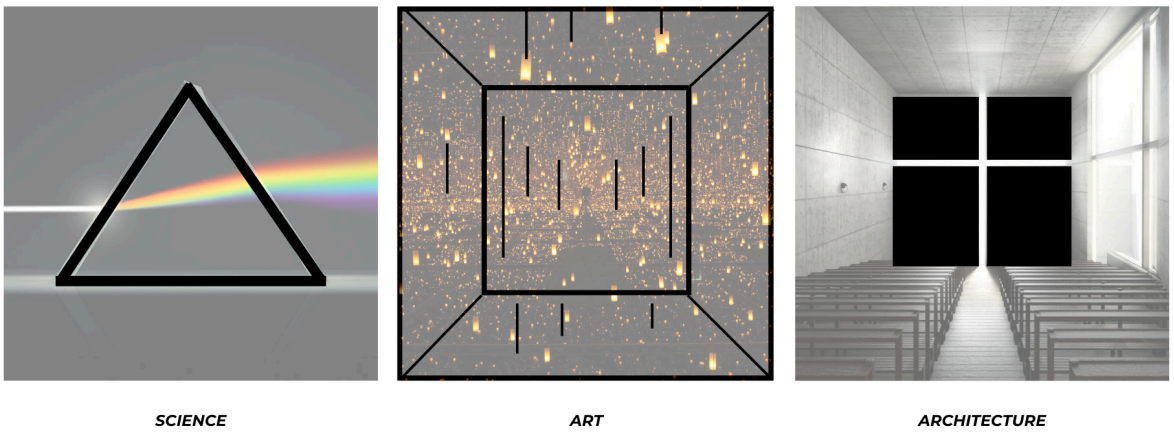


Figure 13: Invisible Structures - Author's Illustration

The Figures above illustrate the connection between perception and design strategy. The top row (Figures 10, 11, 12) captures the immediate sensory impact of light, while the diagrams in the bottom row (Figure 13) reveal the architectural elements that shape it. Together, these images emphasize that the dynamic interplay of light and structure shapes our experience of space. Such interventions are defined as light structures - architectural components ranging

from façades and wall planes to ceiling openings and entire rooms - designed to capture, filter, or frame light.

2.3.3. Daylight in Architecture: Perception and Atmosphere

Figure 14,15,16,17: Poetic Daylight Pavilion, Copenhagen

In the design of spaces where time slows and the body becomes attuned to its surroundings, daylight becomes a carrier of atmosphere, a subtle yet powerful force. The presence of daylight - its movement, intensity, softness, or stillness - can affect emotional and sensory perception. The idea of atmosphere in architecture refers to the intangible qualities that make a space feel certain. As Peter Zumthor (2006) explains, atmosphere comes from a combination of different design elements, with daylight being one of the most important. Juhani Pallasmaa (2005) likewise insists that architecture must engage all senses and that daylight, particularly, affects us through vision, rhythm, and bodily perception.

In this context, daylight moves, fades, intensifies, and interacts with geometry in ways that activate the perception of space. These qualities can reinforce the feeling of retreat, introspection, and presence, especially in ritualistic environments like a bathhouse.

The Nordic tradition of valuing daylight - its scarcity in winter and abundance in summer - elevates its perceptual importance. In Nordic culture, light is cherished for its subtle gradations and quiet presence. This sensibility shapes the bathhouse concept: a space that reveals itself through the movement of daylight.

The body perceives space through all senses, with vision as just one part of a richer sensory dialogue (Pallasmaa, 2005). Light contributes to this perception by shaping spatial orientation, influencing the sense of time, and triggering physiological responses such as calmness or alertness. In a bathhouse, where warmth, humidity, and quietness already heighten awareness, daylight becomes an essential element in the orchestration of sensory experience.

Soft, diffused illumination can slow down perception, inviting stillness and reflection. Narrow shafts of sunlight or shifting shadows may suggest movement, hint at passage, or mark moments of transition.

Daylight as Temporal Presence

Daylight is a dynamic and physical element, distinct from artificial illumination by its continuously shifting tone, angle, and intensity. Throughout the day, natural light marks the passage of time, transforming architectural space and enriching it with a sense of temporal depth. A space bathed in dawn light conveys a vastly different mood than the same space at midday or dusk, allowing the bathhouse to unfold gradually, inviting return, reflection, and variation with each visit.

This ever-changing quality of daylight resonates with the cyclical nature of bathing rituals, which are slow, intentional, and deeply personal. The rhythms of natural light echo the bodily and sensory transitions of bathing, reinforcing a responsive, evolving architectural experience closely attuned to time and environment.

Functionality, adaptability, and emotional resonance shape Nordic approaches to daylighting. Architects thoughtfully consider building orientation to optimize daylight within interiors. Apertures' scale, shape, and distribution are often intuitively adjusted to maximize exposure to low-angle winter light, ensuring spaces remain luminous even during limited natural illumination.

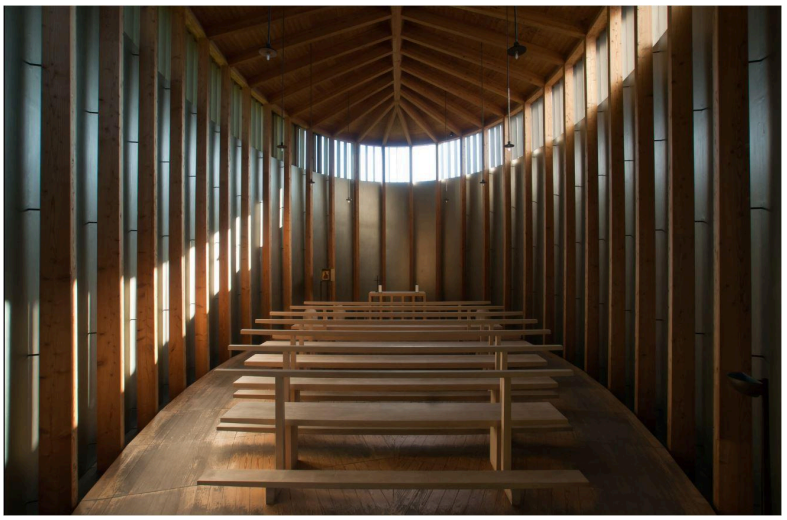


Figure 18: Saint Benedict Chapel, Switzerland

Contemporary architects such as Steven Holl and Peter Zumthor have elevated daylight from a passive background condition to an active force within architecture. For these practitioners, light is integral; it carves, softens, and defines space much like concrete, stone, or timber. Holl (1994) speaks of the "luminous phenomena of architecture," while Zumthor (2006) emphasizes light’s power to evoke atmosphere. By using daylight as a medium, architecture exceeds static form and engages occupants in a dialogue with time, season, and memory. Within the bathhouse, this approach fosters a continuous interplay between the built environment, the body, and the ephemeral qualities of light, enhancing introspection, bodily awareness, and emotional resonance.

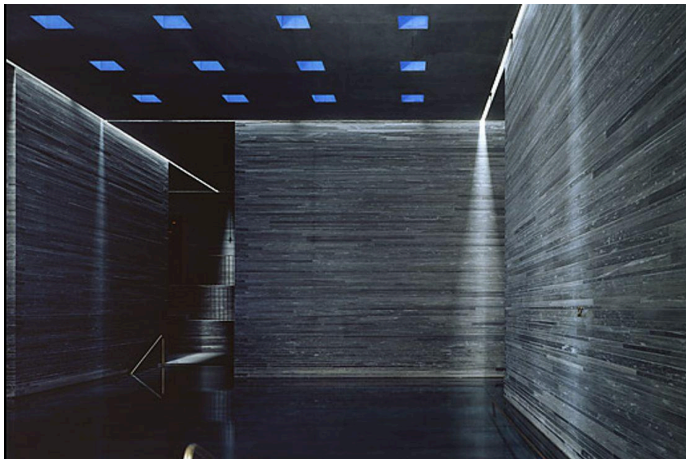
2.3.4. Case Studies

Modern architectural theory highlights the expanded role of light. Le Corbusier famously described architecture as "the masterly, correct, and magnificent play of masses brought together in light," positioning it at the core of spatial perception. Louis Kahn referred to natural light as "the giver of all presences," filling architecture with meaning and presence. Likewise, Peter Zumthor, in *Thinking Architecture* (2006), urges that "light is material," emphasizing its atmospheric and sensual qualities. Juhani Pallasmaa (2005) deepens this view by advocating for a multisensory experience of architecture, where light is felt as much as seen; tactile, immersive, and emotionally resonant.

These theoretical positions resonate with contemporary sustainable design methods, where daylight is leveraged to reduce energy consumption while elevating spatial quality. Strategies involving diffused, reflected, and filtered light are embraced to soften interior environments, modulate glare, and create functionally and emotionally attuned atmospheres.

This chapter builds on these ideas by examining how daylight, understood as a structural and poetic element, can be intentionally manipulated to support space's function, rhythm, and sensorial richness.

Therme Vals – Peter Zumthor (1996, Switzerland)



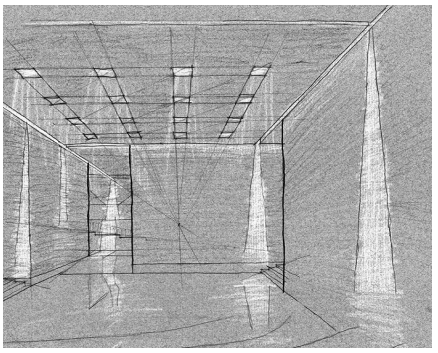


Figure 19: Interior View of Therme Vals, Figure 20: Sketch illustrating the Light

Daylight in Therme Vals (Figure 19) is integral to the building's spatial atmosphere. Zumthor manipulates natural light with precision and restraint. The narrow skylights are designed to introduce daylight in elemental and immersive ways, creating a dynamic interplay between illumination and shadow.

The light filters through the openings and generates ephemeral effects - soft halos, shimmering patterns, and shifting intensities. These luminous qualities contribute to what Böhme might describe as an atmospheric presence, where light carries emotion and spatial meaning. In this sense, daylight becomes a protagonist in the architecture, animating the stone surfaces and guiding the visitor's movement and mood throughout the complex.

Importantly, the daylight in Therme Vals serves to orient the bather through intuitive spaces. It marks thresholds between hot and cold zones and open and enclosed areas, guiding users through a series of thermal rituals with a rhythm that feels both ancient and immediate. This phenomenological treatment of light echoes Zumthor's broader architectural ethos: buildings should be seen and felt, with light acting as a silent yet powerful agent of spatial experience.

Notre Dame du Haut – Le Corbusier (1955, France)

Figure 21: Light Cones shown at Notre Dame du Haut

Le Corbusier's *Notre Dame du Haut* is a masterclass in the affective potential of daylight, where light is sculpted, filtered, fractured, and dispersed to heighten the emotive resonance of space. The apertures scattered across the thick masonry walls are asymmetrical, each tuned to allow light to enter at different intensities and angles throughout the day. Some openings cut straight through the wall, while others pass through at an angle, creating a shifting atmosphere that changes with the sun's movement. This manipulation of light recalls Le Corbusier's assertion that "architecture is the learned game, correct and magnificent, of forms assembled in the light" (*Vers une Architecture*, 1923).

Daylight here activates the curving interior surfaces, reflecting light in a soft, ambient way. As light pours in, it animates the form, casting shadows and glowing gradients that transform the sanctuary into an ethereal environment. Light acts as a ritual presence, reinforcing the spiritual tone of the architecture and inviting contemplative stillness.

This sensibility complements the design of spaces like bathhouses, where ritual, rhythm, and repose are central. Ronchamp demonstrates how daylight can move beyond function to become an active atmosphere, setting the mood, directing attention, and creating spatial thresholds. In sacred and thermal contexts, light serves as a silent guide, orchestrating transitions between the visible and the felt. Though Le Corbusier's luminous composition contrasts with the humid stone of Vals, it shares the same phenomenological ambition: to make space truly experienced.

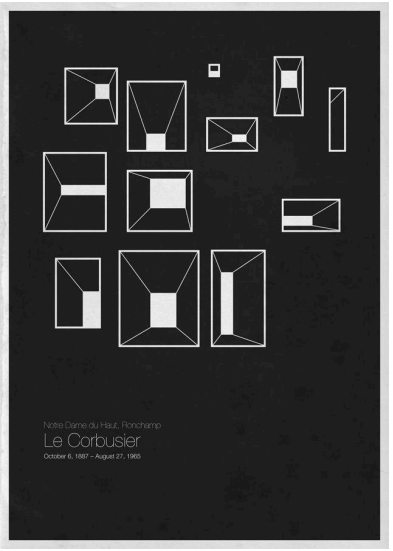


Figure 22: Sketch of the Light Cones

Daylight House – Takeshi Hosaka (Tokyo, 2011)

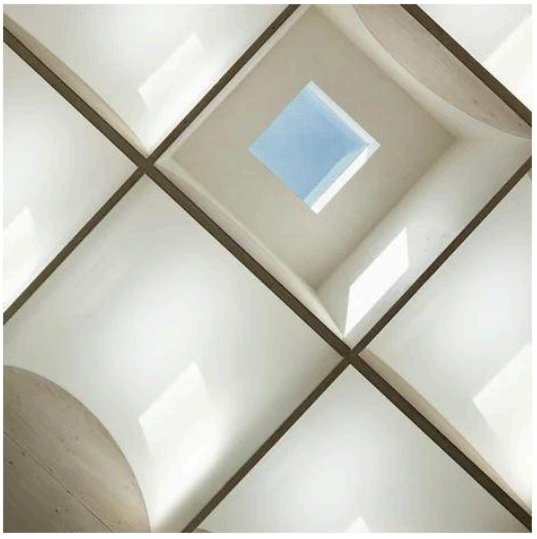


Figure 23,24: Natural light diffuses into the house

Takeshi Hosaka's Daylight House reimagines daylight as an ambient and soft presence. The translucent polycarbonate roof acts as a diffusive membrane, transforming Tokyo's intense urban light into a gentle, cloud-like glow that fills the interior. The resulting illumination is evenly distributed, fostering visual and psychological calm. This approach shifts the

emphasis from dramatic contrast to an immersive atmosphere, creating a spatial field that invites quiet reflection.

Such an approach resonates strongly with Juhani Pallasmaa's (2005) critique of "ocular centrism" and his advocacy for architecture that appeals to the whole sensorium. In Daylight House, the soft illumination invites introspection and a heightened awareness of space. The light seems to derive from the architecture, creating a cocoon-like enclosure that blurs the boundary between inside and out, body and building.

In the context of the bathhouse typology, this control of light has particular resonance. The diffused daylight reinforces feelings of enclosure and retreat, aligning with the ritualistic, meditative qualities often found in bathing spaces. It establishes a serene atmosphere that encourages slow sensory engagement and prioritizes presence over visual stimulation.

Menil Collection – Renzo Piano (1987, Houston, USA)

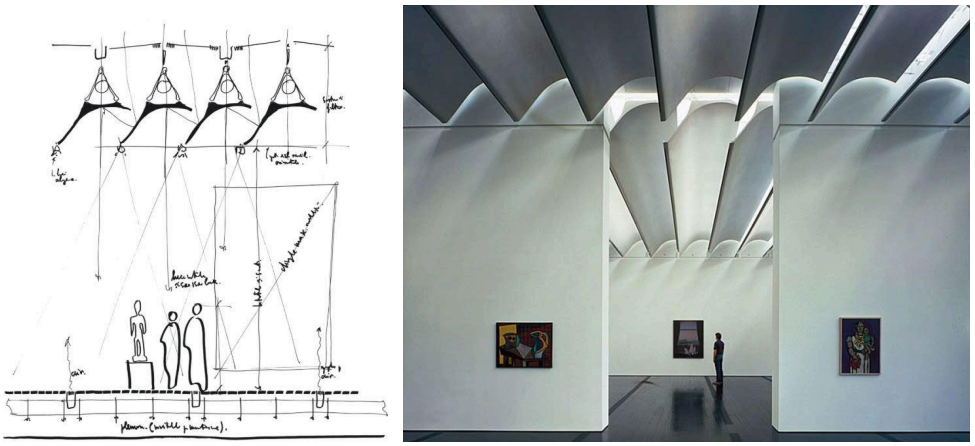


Figure 25: Controlled Daylight in Menil Collection

Renzo Piano's Menil Collection represents a poetic approach to daylighting, where natural light is carefully controlled and refined. He achieves a luminous balance by softening, redirecting, and evenly distributing daylight across interior surfaces, sensitive to the needs of both artwork and atmosphere. The roof system, composed of skylights, fixed louvers, and panels, is a sophisticated system that captures and modulates light throughout the day.

This choreography of light reveals the Piano's deep sensitivity to what Steven Holl (2006) describes as "humanistic control" - an architectural tuning of light to support particular spatial performances. At *Menil*, this means protecting delicate artworks while fostering a serene, human-centered environment.

A refined system of daylight modulation enables a similar atmosphere in a bathhouse context. Just as the Menil Collection uses light to heighten awareness of space, tone, and presence, a bathhouse uses light for sensual immersion. Ultimately, Piano's work demonstrates that daylight can shape experience as powerfully as form or function.

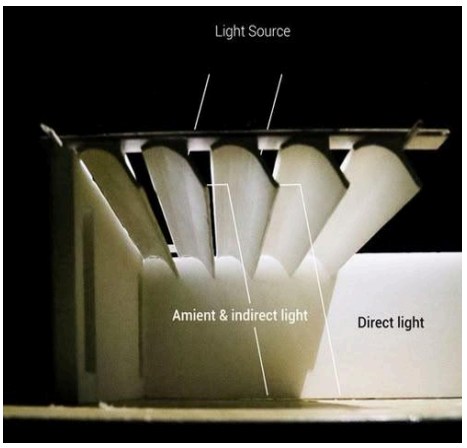


Figure 26: Types of Daylight in Menil Collection

Bagsværd Church – Jørn Utzon (1976, Denmark)

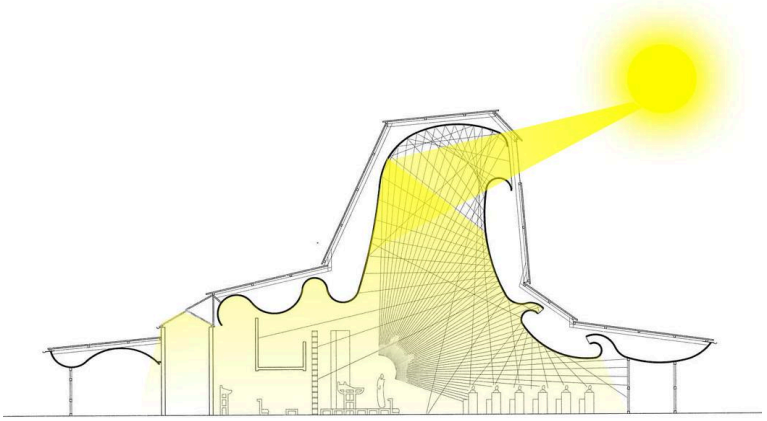


Figure 27: Daylighting in Bagsværd Church

Jørn Utzon's *Bagsværd Church* masterfully reveals how indirect daylight can be used in a space of serenity, rhythm, and ambience. Hidden from direct view, the clerestory windows (Figure 27) admit light that first meets the upper edges of the structure and then cascades down the sculptural, cloud-like ceiling. This ceiling, at once monumental and ethereal, draws inspiration from Chinese temple forms and natural cloudscapes. Its softly curving geometry is animated by the light that glides over it, never striking directly but always in motion, subtly shifting with the day and the weather.

Figure 28: Interior View of the Church

The quality of light in *Bagsværd* is diffuse, even, and deeply atmospheric. It eliminates visual noise and flattens harsh contrasts, producing a meditative clarity that supports the building's spiritual function. The light here becomes spatial as much as visual; it shapes how one moves, breathes, and dwells within the space. Norberg-Schulz (1979) refers to *Genius Loci* as the existential grounding of architecture: how a building, through light and form, can assure human experience in place and time.

In this sense, *Bagsværd Church* offers valuable insight into the design of bathing spaces. Like sacred architecture, bathhouses are environments for withdrawal, introspection, and ritual.

The softly modulated daylight in Utzon's church could be reimagined in a bathhouse context to foster bodily presence and enhance stillness, the rhythm of breath, and the weight of quiet.

2.4. Tools and Techniques

This chapter outlines the methodological tools and techniques used to explore, evaluate, and refine the bathhouse's architectural design. The selected methods integrate digital simulations, physical prototyping, spatial analysis, and controlled daylight experiments. These approaches investigate how daylight interacts with geometry and program. The research centers on qualitative spatial exploration, aiming to develop a conceptual and architectural framework. Due to time limitations, post-occupancy evaluation and user experience studies are reserved for future work.

Digital Modeling and Visualization Tools

- Rhino - Rhinoceros 3D Software

Rhino 3D is used to develop the primary digital model of the bathhouse, forming geometries such as light structures and volumes. Its parametric flexibility enables iterative testing of architectural forms and daylighting strategies, making it a primary tool in the project’s design process.

- Enscape

Integrated with Rhino, Enscape provides real-time rendering capabilities and immersive virtual walkthroughs. This visualization tool enables experiential assessment of spatial atmosphere and daylight performance, offering immediate visual feedback on how light animates and transforms interior spaces.

- Physical Models

Physical models are constructed at a 1:50 scale to observe and test daylight behavior in a tactile, analog format. These maquettes allow for intuitive, embodied evaluations of spatial atmosphere, complementing the abstract precision of digital simulations. Direct interaction with light and form provides critical insights into daylight's qualities.

- Light Lab - Royal Danish Academy

Daylight experiments are conducted in the Architectural Lighting Lab, a facility designed to simulate and investigate natural and artificial lighting conditions. The laboratory's mirror room, equipped with an artificial sun and CIE standard sky simulation, enables controlled testing of daylight behavior within a selected room of the bathhouse model. These tests offer insights into how daylight enters, shifts, and shapes spatial atmosphere over time.

3. Daylight

3.1. Daylight + Nordics

Daylight is never neutral. It is shaped by geography, climate, season, and urban context. In the Nordic region, light moves slowly and feels deeply atmospheric. For much of the year, it arrives diffused, creating conditions that invite introspection and a slower pace of experience. These qualities call for a careful, responsive composition of light in architecture.

The distinct character of Nordic daylight stems from the region's high latitude. In summer, the sun traces a long, low path across the sky, casting a warm, lingering glow into the evening. In winter, daylight is brief, with the sun remaining low or absent on the horizon. This dramatic seasonal shift gives rise to "Nordic light," marked by low solar angles, soft shadows, and prolonged transitions between day and night, including extended sunrises, sunsets, and the blue hour.

This particular light quality deeply shapes the aesthetic and emotional tone of Nordic architecture. Architects in the region work in harmony with natural variations in intensity, color, and duration. The resulting design ethos embraces ambient, fleeting light, treating it as a functional and poetic element.

Christian Norberg-Schulz (1980) notes that such an approach reflects a sensitivity to *genius loci* - the spirit of place - where light becomes an existential presence, affecting how people connect to space, time, and self. In this context, winter's lack of Nordic light heightens its significance, transforming it into something rare and intentional, curated for visibility, mood, and presence. It shapes spaces of ritual, stillness, and seasonal transformation, reinforcing architecture's role in reconnecting the body and environment.

3.1.1. Sun Path

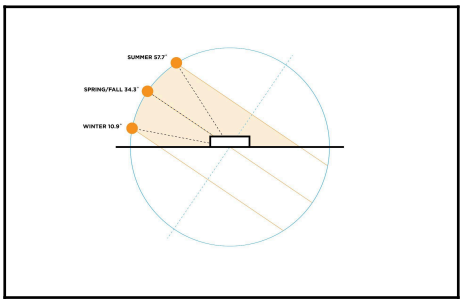


Figure 29: Sun angles during seasons in Denmark

In Nordic regions, the sun's behavior is characterized by its consistently low altitude and shallow trajectory across the sky, which impacts spatial and atmospheric conditions. Copenhagen, situated at a northern latitude of approximately 55.7° N, experiences significant seasonal shifts in daylight duration and solar angles. The low angle of the Nordic sun impacts the character of light, casting long shadows and revealing intense shadings throughout the day, even when the sun reaches its peak.

Seasonal variations strengthen these effects, controlled by the celestial characteristics of the summer and winter solstices and the equinoxes. During the summer solstice (around June 21), Copenhagen enjoys nearly 18 hours of daylight, with the sun reaching an altitude of approximately 53.5 degrees above the horizon at midday.

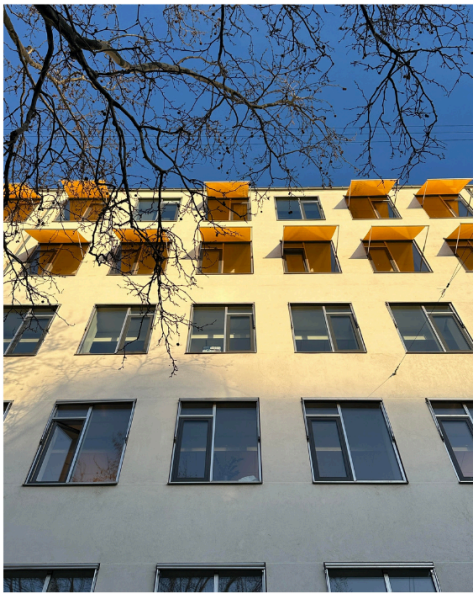


Figure 30, 31: Copenhagen during Winter, and Clear Sky

In contrast, the winter solstice (around December 21) brings approximately 7 hours of daylight, with the sun peaking at 15.5 degrees above the horizon. The light during this time is horizontal, and deeply atmospheric (Figures 30,31), casting elongated shadows and infusing interiors with a serene, contemplative glow. These conditions demand architectural responses that prioritize warmth, intimacy, and the careful choreography of light, using reflection and surface modulation to capture and extend daylight's limited reach.

The equinoxes (March 21 and September 21) present transitional moments where the sun rises directly in the east and sets in the west, resulting in equal lengths of day and night. The sun's path is moderate during these periods, producing a balanced, even illumination throughout the day. Architectural strategies can leverage this neutrality, emphasizing openness and uniform light distribution within interior spaces.

The dynamic relationship between Copenhagen's solar geometry and seasonal variation requires a subtle architectural response. Buildings must embrace the richness of prolonged summer light while offering shelter during the muted, contemplative winter hours. In this context, daylight is a shifting medium that animates, softens, and defines the experience of space throughout the year. Understanding the Nordic sun path thus becomes essential for crafting technically responsive and poetically resonant environments.

3.1.2. Colors of Light

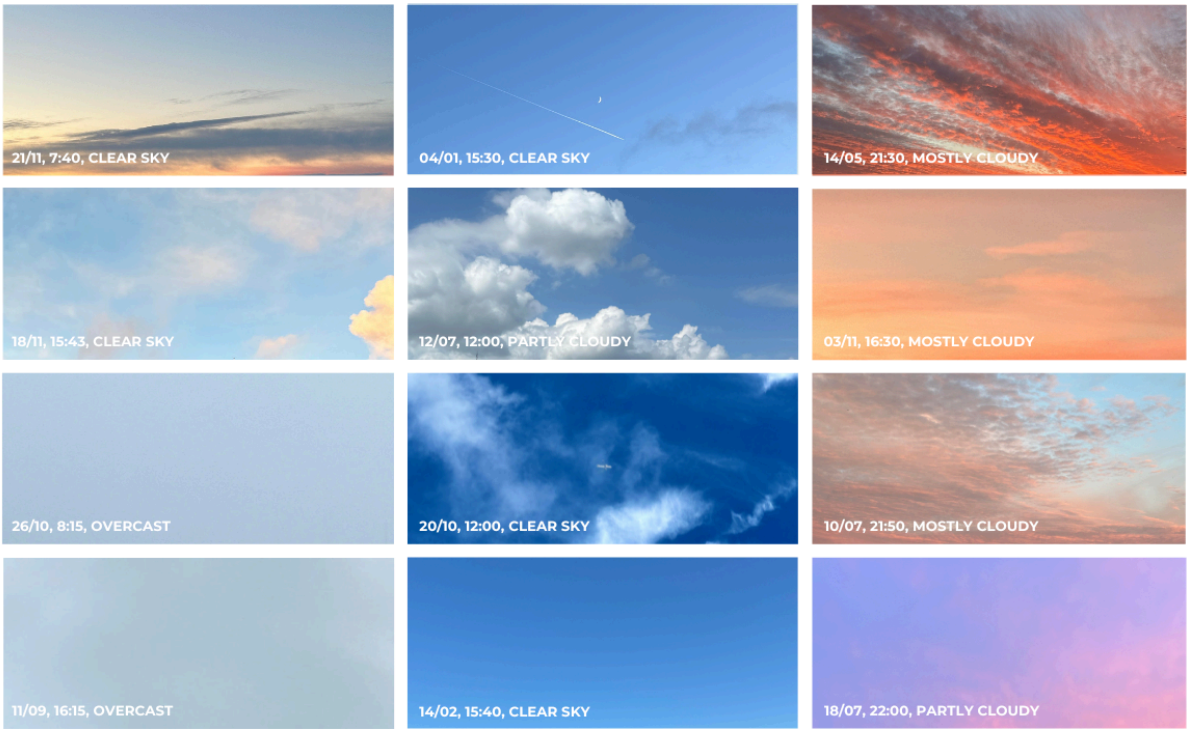


Figure 32: The shifting sky palette of Copenhagen across hours and seasons

The quality and coloration of daylight in the Nordic regions undergo dynamic transformations across the seasons. The Nordic sky is a living canvas (Figure 32), formed continuously by shifting light conditions and atmospheric phenomena. Throughout the year, subtle and dramatic changes in solar altitude, atmospheric density, and seasonal rhythm combine to create a spectrum of chromatic experiences that deeply influence landscape and architecture.

In winter, the low solar angles heavily filter the light spectrum, producing a diffuse, soft light predominantly of cool hues. The sky often takes on dusky tones, pale blues, muted greys, and delicate pinks, reflecting the low position of the sun and the brevity of daylight hours. This palette produces an ethereal atmosphere, where edges are softened, contrasts are muted, and the boundaries between sky, water, and built form become blurred. The calmness induced by these soft tonalities fosters an introspective spatial quality characteristic of Nordic winters.

In contrast, the summer season reveals a radically different light experience. The atmosphere allows the complete transmission of warmer colors. During extended daylight hours, sunsets stretch over hours, painting the sky with sequences of gold, orange, and finally cooling blues as night slowly falls. This extended transformation illuminates spaces and animates them.

The changing seasons bring a rhythm of color and light that defines the emotional and perceptual character of the Nordic environment. Therefore, architects designing within the

Nordic context must approach daylight as an active architectural driver. Sensitivity to the seasonal hues and intensities of light enables the creation of spaces that celebrate the poetic nuances of the Nordic sky.

3.1.3. Shadow Definition

Figure 33, 34: Overcast Vs Clear Sky in Copenhagen

Shadow formation in Nordic environments is highly dynamic and seasonally dependent, strongly influencing spatial perception and architectural expression. The low-angle sunlight, characteristic of the region, generates extremely elongated and distinct shadows even at midday during the winter months. These extended shadows emphasize topographical and textural variations, magnifying subtle fluctuations and crafting complex light-and-dark compositions across built surfaces. In Nordic architecture, these long shadows reveal the depth and structure of form.

Nordic light can fluctuate between being soft and diffused or sharp and defined, depending on weather conditions and the time of day. Under an overcast sky, which dominates much of the year, diffuse light eliminates shadow lines, producing a soft, uniform illumination that flattens relief and minimizes visual contrast (Figure 33). In these conditions, architectural features are highlighted through graphic detail.

On the other side, during periods of clear skies and direct sunlight, the sharpness and contrast of shadows declare themselves dramatically. Strong, elongated shadows carve spaces with a sculptural quality, bringing out the depth, texture, and form of architectural elements (Figure 34). The dynamic interplay of light and shadow under direct sunlight adds

drama, movement, and temporal dimension to built environments, transforming static structures into living, evolving spaces.

Photographic comparisons between overcast and sunny conditions vividly demonstrate how the same architectural surface can alternate between subtle flatness and intense relief, depending entirely on the character of the light.

This dynamic behavior of shadows requires an intentional architectural response. Deep facade recesses, available shading devices, and layered strategies are essential for managing the fluctuation between soft and sharp light conditions. Through manipulating shadow qualities, architecture engages users in a continuous dialogue with the ever-changing Nordic sky, transforming temporal atmospheric phenomena into enduring spatial experiences.

3.2. Daylight + Types

This chapter explores the multifaceted nature of daylight as a natural phenomenon - how it enters a space, how its intensity and quality shift over time, and how these variations shape human perception and experience. Emphasizing the distinctive conditions of the Nordic region, where seasonal changes produce unique light patterns, the discussion centers on three fundamental forms of daylight: direct, diffused, and reflected. Understanding these types of daylight is essential for interpreting the environmental and sensory dynamics they produce.

3.2.1. Direct

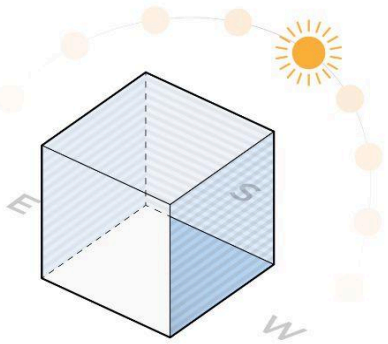


Figure 35: Direct Sunlight Sketch

Direct sunlight refers to solar radiation that travels straight from the sun to a surface (Figure 35) without being scattered by particles or atmospheric conditions. This form of illumination is characterized by its high intensity, sharp contrast, and clearly defined shadow edges. The angle of incidence and the time of day influence this light's direction and strength, resulting in a dynamic visual experience that shifts throughout the day and seasons.

Due to its clarity and power, direct sunlight creates a heightened perceptual experience. It accentuates surface textures, reveals details, and establishes a strong sense of dimensionality. The sharp contrast between illuminated and shaded areas creates environments that can feel vibrant or severe, depending on the duration and intensity of exposure.

Direct light is highly directional, travels in parallel rays, and can be predictable in pattern. At midday, for instance, it is most intense and falls nearly vertically, flattening shadows. In contrast, early morning or late afternoon light arrives at low angles, elongating shadows and emphasizing horizontal surfaces.

While visually powerful, direct sunlight can also be overwhelming. Its intensity can cause glare and visual discomfort, and prolonged exposure can contribute to heat buildup. In

natural environments, organisms adapt to direct sunlight through behaviors or features such as orientation, pigmentation, or movement to protect themselves or use the light.

Finally, direct light is a pure expression of solar presence. It is precise, energetic, and commanding, shaping perception through clarity, contrast, and the constant passage of time.

3.2.2. Diffused

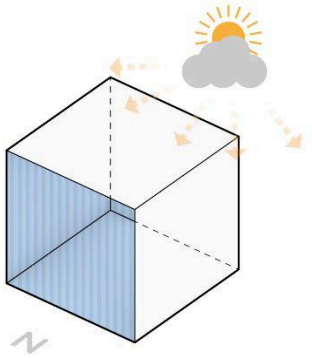


Figure 36: Diffused Daylight Sketch

Diffused daylight occurs when sunlight is scattered by atmospheric particles or cloud cover before reaching a space (Figure 36). Direct sunlight travels along a single, linear path; diffuse skylight arrives from all directions across the sky dome. This diffuse distribution creates a soft, even illumination with low contrast and minimal shadows.

Because it lacks a singular source or direction, diffused light creates an even visual field that reduces glare and flattens strong contrasts. It gently wraps around forms, subtly muting sharp edges and allowing textures to emerge.

This type of light varies with atmospheric conditions and becomes more apparent under overcast skies, fog, or pollution. It remains constant and stable, often occurring on overcast skies or in shaded environments where illumination feels ambient instead of dynamic.

Diffused daylight plays a crucial role in regulating mood and perception. It softens the environment, supporting extended visual comfort and emotional stillness. It is light, spatially generous, emotionally subtle, and perceptually balanced.

3.2.3. Reflected

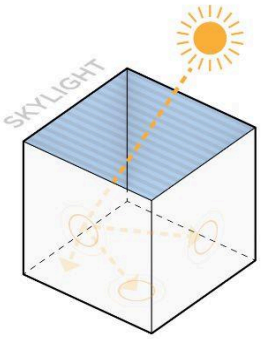


Figure 37: Reflected Light Sketch

Reflected light is a secondary form of illumination that reaches a surface after bouncing off other surfaces (Figure 37), such as walls, ground planes, water bodies, or surrounding landscapes. Unlike direct sunlight, reflected light is softened through its interaction with these elements and arrives scattered, often bearing the color and tonal qualities of the surfaces it encounters.

This phenomenon allows light to penetrate shaded or otherwise inaccessible areas by redirecting its path. It creates ambient brightness in spaces that would otherwise be dim, contributing to depth, tonal variation, and a sense of subtle illumination. The nature and effectiveness of reflected light depend on surface orientation, texture, and reflectivity.

Reflected light is dynamic yet subtle. It enters a space indirectly, softening contrasts and creating gentle tonal gradations. Shadows become faint, and edges blur, giving the illumination a diffuse, ambient quality that enhances visual depth and spatial richness. This type of light extends the reach of natural illumination while deepening its emotional resonance. Adaptive, quiet, reflected light lends a sense of calm and refinement to the environment.

3.3. Daylight + Light Structures

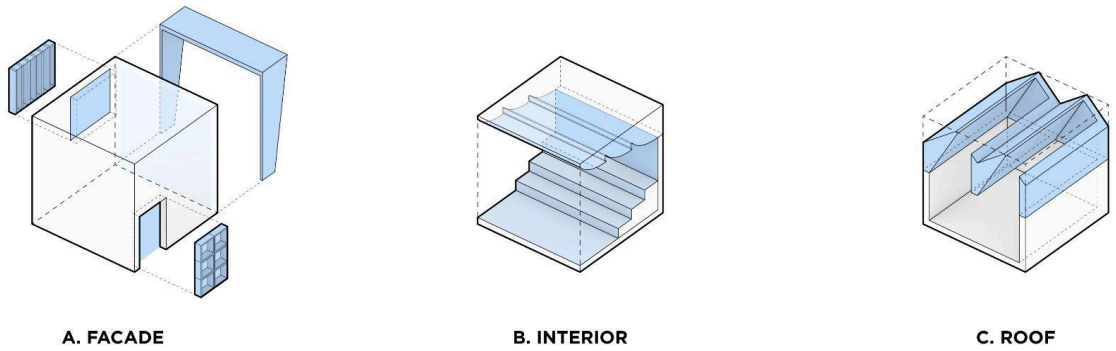


Figure 38: Light Structures

The concept of “light structures” (Figure 38) in this thesis emerges from an architectural investigation into how daylight can be intentionally shaped and controlled. The wall is at the core of this idea, an essential element that defines enclosure and boundary. Introducing a void, such as a window, skylight, or opening, transforms the wall from a barrier into an interface between inside and outside, light and shadow, exposure, and privacy.

This project explores the architectural possibilities created by these transitional moments. Once an opening exists, the focus shifts to refining it to shape the quality of light entering the space. The solution is the design of architectural components called “light structures,” which extend, frame, filter, or redirect daylight. These precise configurations are developed to mediate light according to specific spatial conditions and programmatic needs.

Light structures enhance comfort, orientation, and atmosphere by regulating light’s intensity, angle and duration. Features like extrusions, light wells, tapered and convex surfaces, add depth and performative qualities to the building envelope, creating layered interactions between solid and void. Light structures shape the user’s experience by guiding movement and anchoring the architecture in time and perception.

Below, a series of diagrams illustrates the light structures strategy used to address various types of daylight.

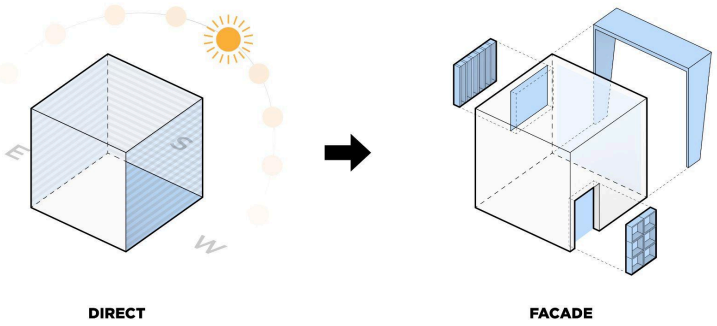


Figure 39: Light Structure when dealing with Direct Light

The facade operates as both filter and frame, mediating the intensity and angle of direct sunlight. Openings are tools - canopies, vertical louvers, or perforated infills (Figure 39) - that admit, redirect, or withhold light depending on orientation. South, east, and west-facing elements must engage with intense, directional light, achieving a delicate balance between thermal and visual comfort while establishing rhythm, opacity, and contrast. Here, light is composed with precision to animate thresholds and define public and private zones.

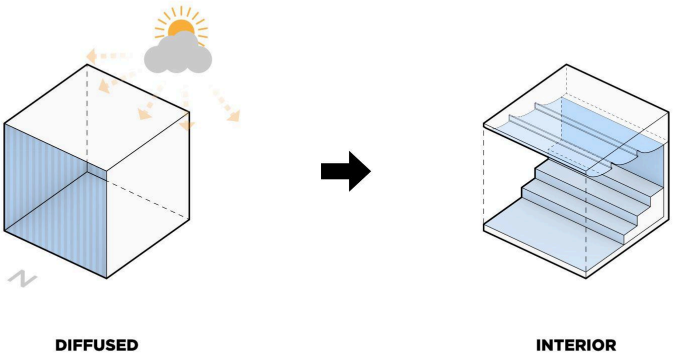


Figure 40: Light Structure when dealing with Diffused Light

Floors, ceilings, and walls modulate daylight within interiors. North-facing apertures (Figure 40, left) admit cool, diffuse light evenly distributed across surfaces. Inclined planes, volumetric shifts, and nested geometries (Figure 40, right) control this light's movement, softening contrast and enhancing spatial depth. The interior becomes an active surface that receives, reflects, and shapes light. In doing so, it becomes an engaging and dynamic part of the spatial narrative.

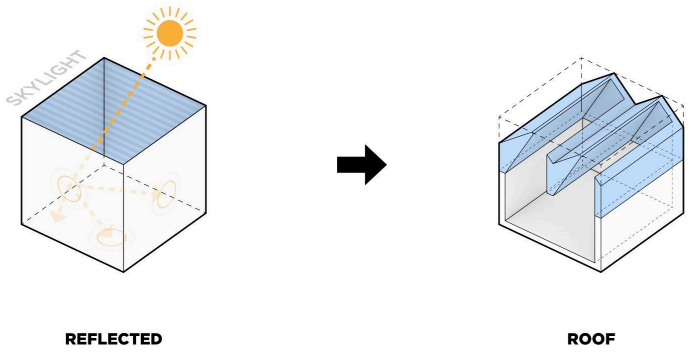


Figure 41: Light Structure when dealing with Reflected Light

Light from above introduces a vertical dimension to spatial experience. Skylights, clerestories, and overhead apertures allow sky-reflected light to enter indirectly, scattering across interior surfaces with a softness that evokes temporal and emotional resonance. As shown in the above diagram (Figure 41, right), angled surfaces beneath skylights transform light into a dynamic, spatial event, tracking the passage of time and producing immersive atmospheres. This illumination deepens the spatial experience and connects the building with celestial rhythms, fostering a sense of harmony and connection.

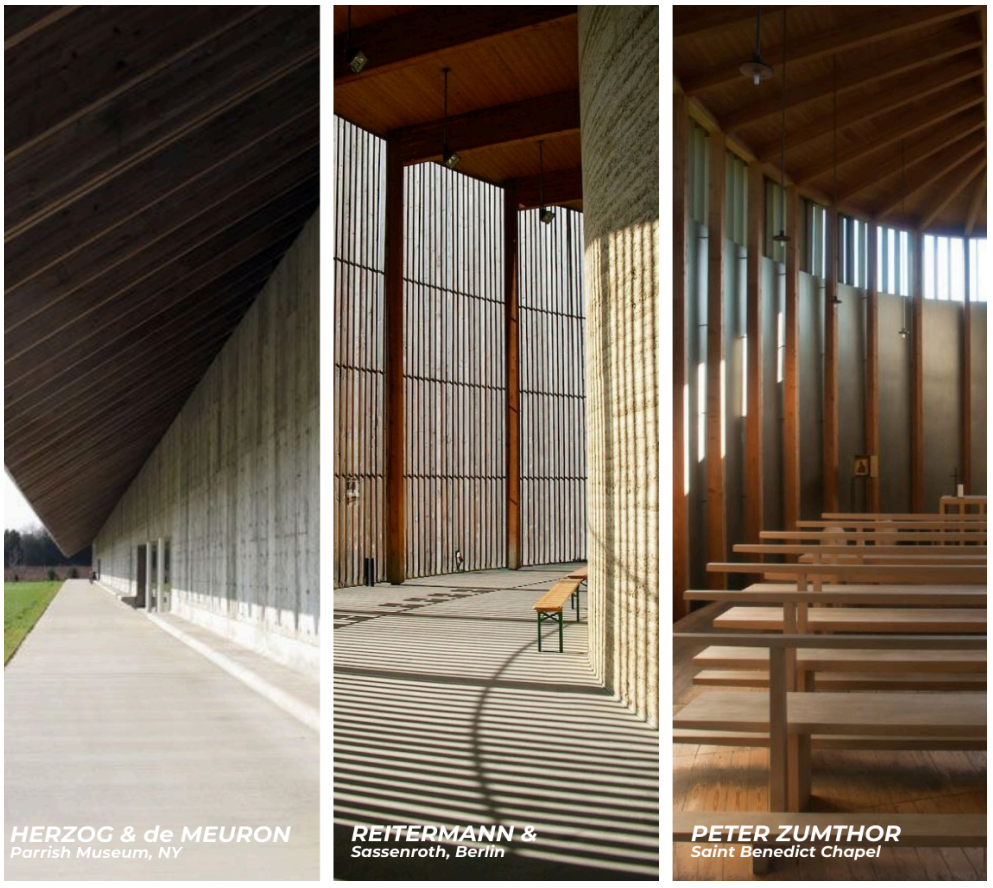
These three categories create a compositional grammar of daylight, a system that shapes light through light types and structures. Recognizing daylight as a structural element gives architecture a new vocabulary. Light becomes a spatial framework: it defines where architecture begins and fades, where attention is focused or softened, and, most importantly, how emotional tone unfolds throughout the day.

3.4. Daylight + Frameworks

While environmental and atmospheric conditions determine the presence and character of daylight, it is through architecture that light gains direction, depth, and significance. This section explores how specific design strategies can gather, redirect, and soften daylight to animate space and heighten perception.

Both theoretical perspectives and practical methods inform these strategies. Architects such as Renzo Piano, Peter Zumthor, and Herzog de Meuron have demonstrated how daylight types can be composed intentionally to illuminate while defining the atmosphere and influencing how the body senses and inhabits space.

3.4.1. Light Structures for Direct Daylight: Blocking and filtering daylight through layered architectural elements



Figures 42, 43, 44: Blocking and Filtering Daylight

While direct light is powerful and visually expressive, it requires modulation to prevent glare, discomfort, and overheating. Architects use various strategies to manage its intensity, emphasizing its dramatic potential or softening its effects. These approaches include

blocking sunlight to control heat, focusing it on creating moments of heightened intensity, filtering it through architectural elements to diffuse its entry, and spreading it across surfaces to enrich spatial perception (Lechner, 2014). These interventions transform sunlight from harsh brightness into an ambient, atmospheric presence.

Filtering light balances the brightness outside with the calmness inside, softening and texturizing illumination to enhance visual comfort and intimacy. This is often achieved using layered façades, overhangs, vertical slats, and other structures that interrupt and reshape the light's path. As sunlight passes through these filters, it disperses gently across interior surfaces, creating a dynamic play of brightness and shadow. Such conditions nurture contemplation, intimacy, and sensory depth.

Several notable projects demonstrate this approach. At the Parrish Art Museum in New York (Figure 42), Herzog & de Meuron use deep canopies that block direct overhead sun while allowing natural light to wash along the perimeter, creating shaded, visually balanced interiors. In Berlin's Chapel of Reconciliation (Figure 43), Reitermann & Sassenroth Architekten use vertical wooden slats to filter direct sunlight into a diffuse, pulsating pattern, generating a serene and contemplative spatial quality.

These filtering strategies serve both technical requirements and phenomenological purposes. As Juhani Pallasmaa (2005) notes, light in architecture is visual and tactile, engaging the body through rhythm, atmosphere, and temporal variation. When light is filtered through surfaces and structures, it becomes dynamic, changing throughout the day, enriching perception, and reinforcing a space's emotional tone.

3.4.2. Light Structures for Diffused Daylight: Shaping interior spaces for uniform and ambient light

Figures 45, 46, 47: Shaping Interior Spaces for Uniform and Ambient Light

Architecture highly values diffused daylight for its ability to create calm, contemplative, and nuanced spatial experiences. Spaces illuminated by diffused light often evoke a sense of slowness, introspection, and emotional connection through their soft, immersive atmosphere. Architects intentionally shape diffused light to maximize its atmospheric qualities while ensuring visual comfort. Common strategies include using perforated surfaces, louvers, fins, and layered apertures that block harsh direct rays yet allow a gentle ambient glow to fill interiors. These techniques minimize glare, soften spatial transitions, and foster serene environments, ideal for sensitive settings like bathhouses, galleries, and meditative spaces.

Takeshi Hosaka's *Daylight House* in Tokyo (Figure 45) demonstrates this approach through a ceiling system that filters daylight into the heart of the home, crafting a tranquil and open atmosphere. Viewpoint Snøhetta (Figure 46) is a reindeer observation pavilion that frames an expansive mountain. Its sculpted wooden interior, with its fluid, organic form, creates a tactile and intimate atmosphere. Looking North, the large glass facade allows soft, diffused daylight to fill the space gently. This even, natural light dissolves hard shadows, emphasizing the pavilion's quiet, contemplative character and reinforcing the sensory connection between interior space and the vast Nordic landscape beyond. Renzo Piano's *Menil Collection* in Houston (Figure 47) uses an innovative roof structure to diffuse incoming light, protecting

delicate artworks while maintaining a luminous, uplifting ambiance that animates the museum without overwhelming it.

3.4.3. Light Structures for Reflected Daylight: Capturing and redirecting daylight

Figures 48, 49, 50: Capturing and Redirecting Daylight

The reflected light is indirect illumination, softened and scattered to cast a gentle ambient glow that enriches spatial depth and sensory experience. Coming from multiple angles at lower intensity, it fosters subtle contrast, visual comfort, and emotional warmth.

Architectural design often leverages this light through thoughtfully considered geometry and aperture placement. Inclined planes, vaulted ceilings, and textured surfaces are crafted to capture, direct, and diffuse light as it bounces within the interior. Roof openings, skylights, clerestories, and strategically positioned apertures admit unobstructed daylight, which is then redirected to animate thresholds, guide circulation, or emphasize key spatial moments. By designing volumetric spaces encouraging reflection and scattering, architects create an ambient glow that deepens warmth and sensory richness without harsh shadows or glare. These strategies are especially vital in bathhouses, where privacy, intimacy, and emotional resonance are essential.

A range of architectural projects presents this approach. In the *Poetic Daylight Pavilion* in Copenhagen (Figure 48), skylights reflect light across adjacent surfaces, producing a soft, hovering luminance that subtly transforms the interior throughout the day. Herzog & de Meuron's staircase at 433 MKM (Figure 49) demonstrates how reflected light can animate architectural detail and movement. As light bounces along the contours and finishes of the stairs, it generates a layered visual rhythm, transforming a utilitarian element into a moment of heightened spatial experience. Jørn Utzon's *Bagsværd Church* in Copenhagen (Figure 50) presents a more sacred approach: curved ceilings and deeply set apertures bounce light into the sanctuary, creating a luminous and tranquil atmosphere that uplifts the spirit while preserving stillness and reverence.

Lisa Heschong's seminal work, *Thermal Delight in Architecture* (1979), highlights that light is visual but also emotional and tactile. She observes that reflected light produces a soft, enveloping glow that deepens feelings of intimacy and retreat. This gentle illumination encourages introspection and calm in moist, enclosed spaces like saunas. Reflected light subtly envelops the user, reinforcing the meditative quality of the environment. Thus, it serves as a practical daylighting strategy and a poetic medium, expressing emotional depth and sensory richness.

3.4.4. Apertures of Daylight: Form, Scale, and Distribution

The daylight experience in architecture emerges from a constellation of design variables that influence how light is perceived and modulated. These include its expression, the building's climatic and spatial context, and each space's specific functional and sensory needs, all of which inform the architecture's form, atmosphere, and performance. This section examines how these interrelated factors define the character of light within the bathhouse, revealing the architectural potential to unify technical efficiency with atmospheric richness.

Openings, whether windows, skylights, clerestories, or carved apertures, are the primary passage for daylight to enter a space. Their configuration directly influences the quality, direction, and intensity. In the bathhouse, where mood and sensory perception are essential to the experience, the openings' precise design and placement play a critical role in shaping the spatial atmosphere.

The form of an opening influences the spatial reading of light. Vertical slits may heighten the perception of elevation and introduce narrow shafts of light that fall with intensity and clarity. Horizontal apertures extend light laterally, drawing it across floors and walls and framing longer views. The scale of an opening controls how much light is admitted; large openings invite abundant illumination but may require shading to prevent glare or overheating, while smaller openings offer a more controlled and intimate glow. Distribution, both in terms of spacing and orientation, is equally critical. The arrangement and directional alignment of openings - whether following the sun's path or positioned to capture reflected light - dictate

how and when light animates a space. This careful distribution allows daylight to align with each room’s rhythm and function, enhancing the day's comfort, atmosphere, and usability.

Architects such as Luis Barragán have shown how light openings can serve as expressive, even spiritual, components of architecture. In *Casa Estudio Luis Barragán* (1948), narrow vertical cuts and recessed windows permit light to enter as focused beams, creating quiet intensity and moments of reflection.

3.4.5. Relationship between Light, Program, and Space

Daylight behavior is shaped by a building’s orientation and its relationship to the surrounding environment. The position of a structure to cardinal directions determines how and when light enters interior spaces, affecting both its intensity and character - natural elements like the sky, nearby buildings, and reflective surfaces like water further influence light distribution. The sky provides sharp, contrast-rich illumination on clear days or soft, diffuse light under overcast conditions. Reflections from water introduce dynamic patterns, ripples, and glimmers that animate ceilings and walls. In Nordic contexts, where light is low-angled and seasonally variable, sensitivity to orientation, site, and climate becomes essential to enriching the interior experience.

Each programmatic function imposes distinct requirements on how daylight is modulated. In bathhouses, where users transition through a sequence of spaces - from communal gathering areas to quiet, introspective zones - light must serve both practical needs and emotional intent. It supports wayfinding, enhances comfort, and establishes a coherent sensory narrative throughout the spatial journey.

Finally, spatial configuration determines how daylight interacts with and supports the program. South-facing façades admit abundant natural light, evoking openness and vitality while north-facing ones favor diffuse, steady illumination. Intimate spaces such as saunas, showers, or resting niches call for indirect, subdued light to preserve privacy and promote calm. In transitional areas like corridors, ambient lighting subtly marks passage and rhythm, guiding movement without dominating attention.

3.5. Daylight + Bathhouses

3.5.1. Historical and Cultural Context

Bathhouses have long served as vital cultural and social spaces across diverse civilizations, functioning as centers for ritual cleansing, social interaction, and personal reflection. From the communal Roman thermae, where public life and intellectual discourse flourished (Yegül, 1992), to the Ottoman hammams that emphasized purification and spiritual preparation through carefully crafted spatial and luminous effects (Necipoğlu, 1995), these structures embody evolving architectural ideas and societal values.

Architectural features such as narrow shafts, clerestories, and domed perforations softened and diffused incoming light, creating shadows and gradients that encouraged calm and contemplation. These interventions illuminated while framing ritual, conveying symbolism of cleansing and renewal, and enriching the sensory environment (Çelik, 2008).

Light, a powerful and ever-changing force throughout history, has uniquely determined architectural experiences. It guides perception, marks time, and deepens the atmosphere. Mary Ann Steane highlights in *The Architecture of Light* that while artificial light can be designed, it remains constant; natural light, by contrast, changes with the time of day and seasons, adding emotional depth to space (Steane, 2011).

This project builds on these historical and cultural insights to explore how architectural design can engage daylight in a way that is both practical and poetic. Focusing on the bathhouse typology within the Nordic context, where seasonal shifts produce dramatic variations in light, it seeks to balance technical precision with sensory awareness, crafting spaces that resonate with tradition while responding to their unique environment.

3.5.2. The Role of Harbor Baths in Nordic Culture

Figure 51: Nordic Bathing Culture

Contemporary bathhouse design merges historical principles with modern sustainable practices, placing daylight as a key spatial and atmospheric driver at the center. Passive daylighting strategies minimize dependence on artificial lighting and help regulate indoor thermal conditions, particularly in humid environments. Architects enhance spatial comfort by modulating natural light while advancing energy-conscious design.

These strategies conserve resources and enrich the spatial experience, making daylight an active architectural driver, animating surfaces, guiding movement, and sustaining the atmosphere without mechanical means. In line with broader goals of sustainable architecture, daylighting contributes to thermal stability, lowers energy use, and continues the architectural tradition of treating light as functional and poetic (Szokolay, 2014).

Nordic Light refers to the unique daylight qualities found in northern latitudes, which are characterized by low sun angles, long shadows, and stark seasonal shifts. In response, Nordic architects have developed an approach that privileges soft, indirect light attuned to natural cycles and human well-being. This sensibility aligns with biophilic and sensory design principles, fostering psychological restoration and physical comfort, which are especially important in wellness-focused spaces like bathhouses.

The gentle tonal qualities of Nordic Light enrich the temporal dimension of architecture. Prolonged twilight, gradual transitions, and diffuse illumination allow spaces to transform over the day and year. Architects such as Sverre Fehn and Alvar Aalto, as well as contemporary Nordic practices, have consistently explored this phenomenon, integrating daylight as a central element in their architectural vocabulary.

By integrating the principles of Nordic Light, bathhouse designs can create emotionally resonant spaces that foster connection and well-being. Daylight is a quiet yet powerful atmosphere agent, enhancing the environment's restorative qualities.

Across Scandinavia, harbor baths, or *havnebade*, have become emblematic of urban life. These structures embody Nordic values of accessibility, wellness, and environmental awareness. In Copenhagen, PLOT's Islands Brygge Harbor Bath transformed an industrial waterfront into a vibrant public space, inviting movement between platforms, views, and surfaces, while engaging with the water and changing daylight. Its decks, saunas, and swimming platforms immerse visitors in a space where light and landscape are inseparable.

Harbor baths serve as thresholds between the city and nature, blending the built and natural worlds. Their clear and responsive architectural language makes daylight the protagonist in the design, creating environments that are integral to the user experience.

3.5.3. The Role of Daylight in the Architecture of Bathhouses

The bathhouse, as an architectural typology, is structured around progression. Moving from entrance to immersion, each space is distinguished by specific thermal, acoustic, and atmospheric qualities. Daylight becomes an essential tool in articulating this sequence. Variations in brightness, the modulation of shadow, and the strategic distribution of apertures establish a spatial rhythm that mirrors the body's journey through stages of preparation, cleansing, and rest.

Transitional areas are often illuminated by direct daylight, which supports orientation and movement. In contrast, more introspective zones, such as saunas or spa pools, are characterized by diffused light, which fosters stillness, tactility, and sensory focus. This deliberate contrast in illumination differentiates functional zones.

Corridors and transitional passages function as visual bridges, where daylight traces paths along walls and floors to signal movement. These transitional moments incorporate distinct areas into a cohesive architectural narrative that engages the senses, invites reflection, and marks progression through the space.

The integration of daylight also contributes to thermal comfort and sustainability. In hot, humid environments typical of bathhouses, artificial lighting can increase the perception of heat and discomfort. Daylight, by contrast, provides a cooler, more natural illumination that enhances energy efficiency and promotes well-being (Baker & Steemers, 2002).

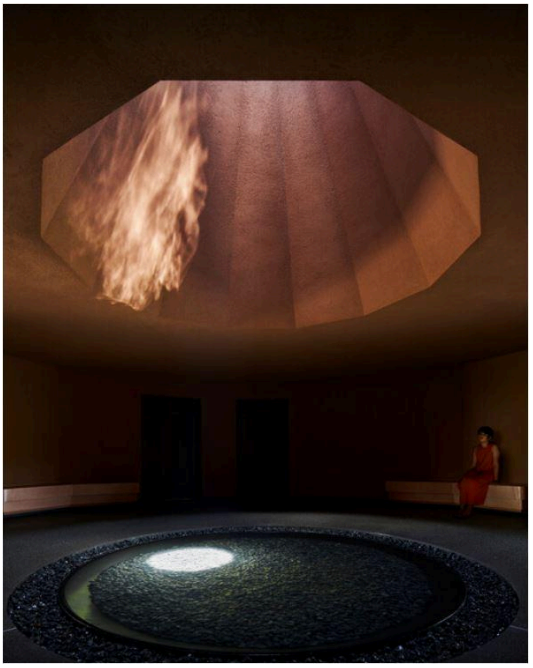


Figure 52: Light Chimney, Japan

Oculi and skylights (Figure 52) are roof-level openings that introduce daylight while preserving the sense of enclosure. These apertures allow light to fall directly into the space, accentuating the play of steam, movement, and surface texture while preserving enclosure and privacy (González-Longo & Theodossopoulos, 2010).

High-level windows and clerestory openings are positioned above eye level, allowing diffused daylight to wash across the interior. These openings enhance ambient quality, promote visual comfort, and maintain separation between interior and exterior, preserving the space's introspective character (Lechner, 2015).

Daylight emerges as a primary architectural driver in the bathhouse, establishing spatial hierarchy, and composing the experiential rhythm of the interior. It acts as a medium for evoking emotion, reinforcing bodily awareness, and supporting psychological well-being. Through the careful balance of direct, diffused, and reflected light, bathhouse architecture elevates bathing into a rich, multisensory experience that nurtures body and spirit.

4. Site and Context

The architectural principles explored in the previous chapters find their full expression only when situated within a specific landscape. In Nordic settings, where seasonal extremes define the rhythm of light and shadow, the role of daylight in architecture becomes both a technical and cultural act. To translate the conceptual framework of this thesis into a tangible proposal, the project grounds itself in a site where light, water, and public life converge. The chosen location in Copenhagen presents a layered context shaped by climate, urban rituals, and a longstanding relationship with bathing culture. The following section introduces the rationale for site selection. It explores how local conditions inform the design of a bathhouse adjusted to the movement of light, the presence of water, and the sensory engagement of the body.

4.1. Site Selection: Svaneknoppen, Copenhagen

Figure 53: Aerial view of Copenhagen

The project is located in Copenhagen, Denmark. Copenhagen is defined by a strong and historically significant relationship with its waterfront. The city's harbor and the Øresund Strait are active zones for recreational water-based activities, indicating a vibrant urban connection to the aquatic environment. This deep-seated connection to the water is integral to Copenhagen's identity and urban life.

Figure 54: Bathing Culture + Connection to the Water

Copenhagen is notable for its dynamic and evolving relationship with its waterfront. The Inner Harbor and the broader Øresund Strait are geographical features and active urban life hubs, characterized by a strong bathing culture and a deep-rooted connection to the water. This reflects a growing trend in recent years where the city's waterfront areas have been revitalized and transformed into spaces for recreation, leisure, and social interaction. These spaces contribute significantly to Copenhagen's overall quality of life and highlight the importance of integrating aquatic environments into the urban fabric.

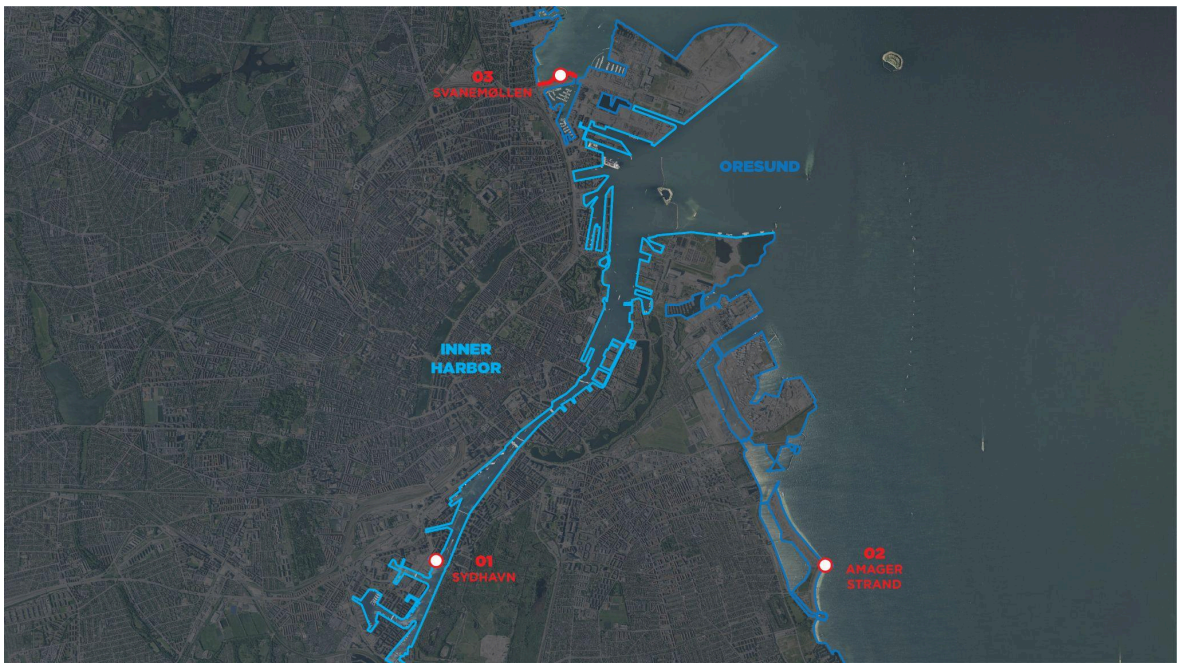


Figure 55: Potential Sites

Several potential locations are thoughtfully considered for the bathhouse in the site selection process, each offering unique contextual characteristics. These included sites within the Inner Harbor, providing proximity to the city center and established urban amenities; areas along the Øresund, characterized by more open expanses and direct exposure to maritime influences; and developments in Sydhavn and Amager Strand, representing areas of urban expansion and recreational focus.

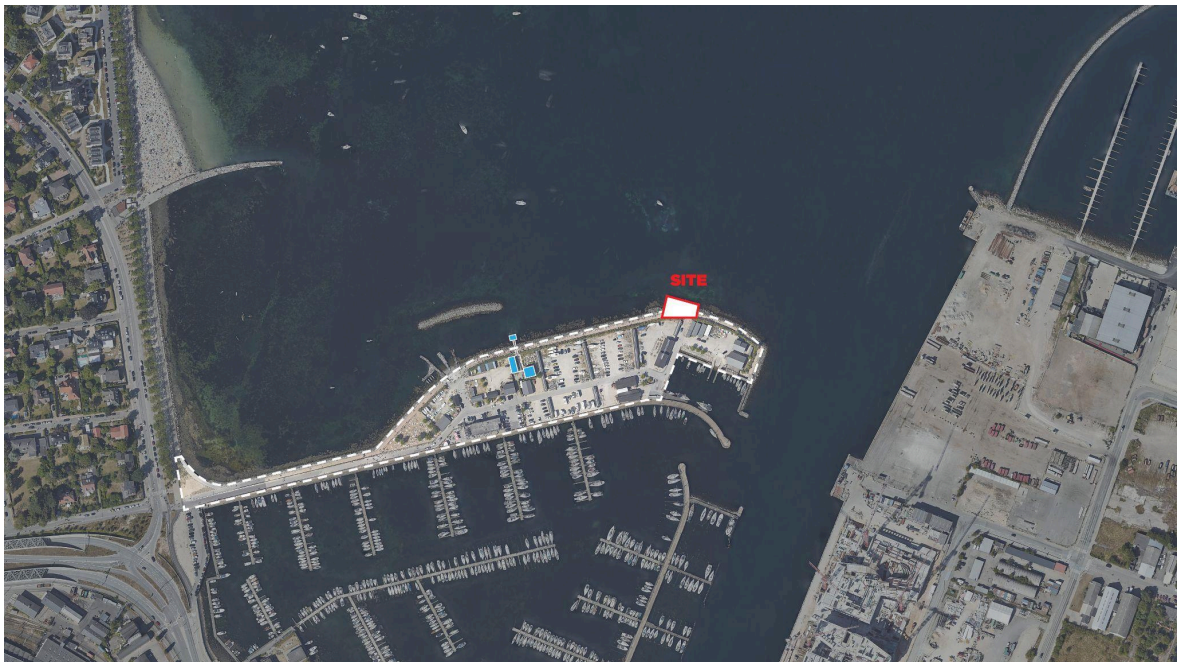


Figure 56: Svaneknoppen

The selected site for the project is SvaneKnoppen, located within the Nordhavn district of Copenhagen, an area undergoing significant urban transformation. This evolving context offers a fitting backdrop for a project that explores contemporary interpretations of leisure, wellness, and architectural atmosphere. The bathhouse's position at SvaneKnoppen is key in defining its design identity and influencing its environmental responsiveness and sensory character. With expansive views and direct proximity to Svanemøllen Strand, the site establishes an intense visual and spatial dialogue with its coastal surroundings.

While a south-facing orientation initially appeared optimal for capturing daylight, further site analysis led to a different strategy. The final design embraces a northward orientation, particularly in the sauna, to foster a deeper symbolic and atmospheric connection with the Nordic sky. This decision also reflects the careful balancing of daylight needs between cold, low-light winters and short, bright summers, resulting in a spatial experience that is both attuned to the climate and evocative in mood.

4.2. Orientation and Sun Path Considerations

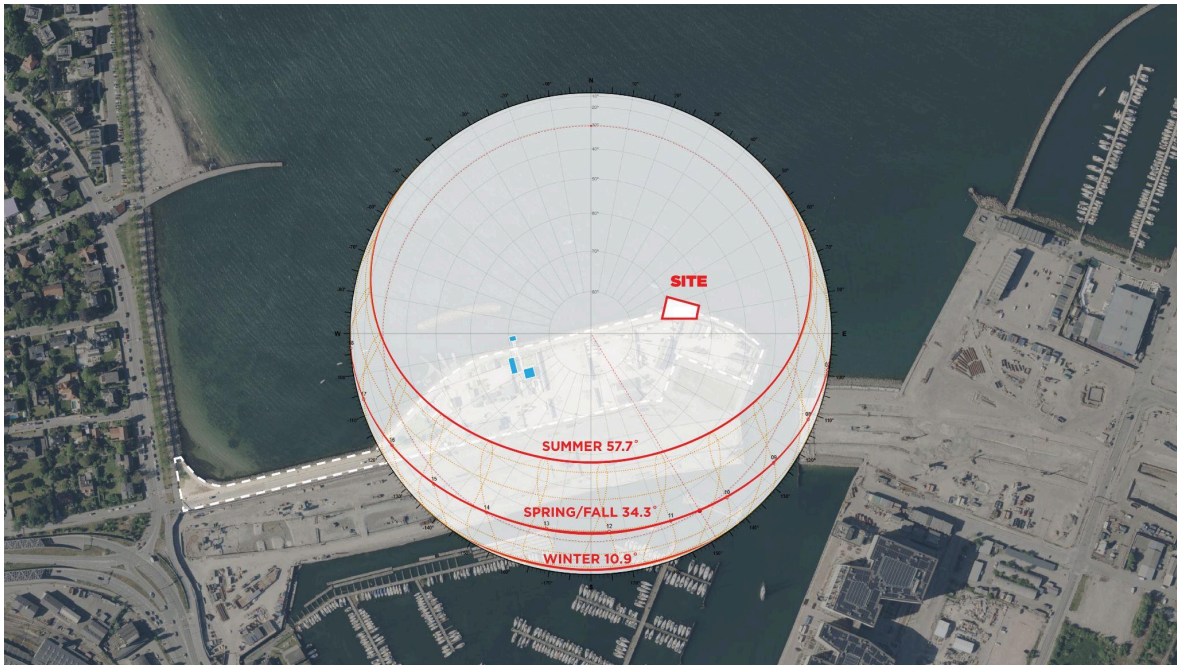


Figure 57: Sun Angles, Plan View

While a south-facing layout might initially appear ideal for maximizing daylight penetration, particularly in northern latitudes, the design prioritizes a more nuanced approach. The final design strategically prioritizes a north orientation for the sauna spaces to cultivate a symbolic and sensory connection with the Nordic sky. This deliberate orientation choice reflects Nordic traditions that often value introspection, a heightened awareness of seasonal changes, and a quiet dialogue with the surrounding landscape.

To fully understand the rationale behind this orientation, it is crucial to consider Copenhagen's sun path and the varying angles of incidence of sunlight throughout the year. As illustrated in Figures 57 and 58, the solar angles have significant variations:

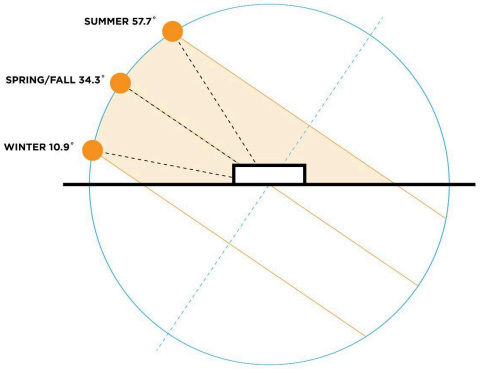


Figure 58: Sun Singles, Elevation View

- Summer: During summer, the sun reaches a high angle of 57.7°.
- Spring/Fall: During the spring and fall equinoxes, the sun's angle is 34.3°.
- Winter: In the winter, the sun has a notably low angle of 10.9°.

This seasonal variation in solar angles significantly influences the quality and intensity of daylight, impacting design decisions related to solar gain, glare control, and the overall luminous environment of the bathhouse. In winter, the low sun provides a warm, golden light that creates elongated shadows, while in summer, the higher sun can result in increased intensity and potential glare, necessitating strategies for shading and diffusion.

Site Conditions

Located at Svaneknoppen, the bathhouse establishes a quiet dialogue with its environment, sensitively engaging with the surrounding water, sky, and shifting daylight without imposing upon its context. Its orientation toward the horizon and strategic framing of views allow the building to become an integrated element of the site, mediating the dynamic interplay between built form and natural light.

Figure 59: Svaneknoppen, Site

The sauna's orientation toward the north fosters a contemplative atmosphere shaped by the soft and diffused Nordic Light. This orientation minimizes exposure to direct sunlight, immersing the bather in a serene environment that enhances the meditative and ritualistic qualities of the sauna experience. The quality of light in the sauna is intentionally subdued, encouraging introspection and bodily awareness, key aspects of traditional Nordic bathing rituals.

While the sauna's orientation prioritizes experiential qualities, other spaces within the bathhouse are organized according to functional and environmental considerations. The entrance and changing rooms face south, maximizing solar gain to create warm, welcoming thresholds. The spa and cold plunge areas are strategically positioned to harness ambient reflections from the water, selectively drawing in indirect light. These spaces balance the need for intimacy with the dynamic sensory enrichment provided by modulated natural illumination, supporting a rich and varied experiential journey through the bathhouse.

As Juhani Pallasmaa articulates, architecture resonates visually and across all the senses. This sensory philosophy underpins the bathhouse’s sequence of light and space. Here, light transcends its functional role to become, as Gernot Böhme describes, a "luminous atmosphere", an immersive field that shapes visual perception and the emotional depth of spatial experience.

Copenhagen’s distinctive seasonal light influences the spatial character of the bathhouse. In the colder months, the sun's low trajectory casts elongated, soft-edged shadows, gently animating interior surfaces and deepening the sense of stillness. In summer, shading devices and filtered apertures temper the intensity of higher-angle sunlight, maintaining thermal comfort while preserving a calm, meditative mood.

These ephemeral light effects reinforce the bathhouse architecture’s immersive qualities, creating contemplative spaces that unfold with the changing time of day and seasons.

5. The Bathhouse: Design Development

5.1. Program and Zoning

The design of the bathhouse begins with a desire to enhance atmospheric experiences. The vision is to investigate how daylight can create a sequence of moods, shifting from open to more intimate and enclosed spaces, guiding both body and mind through a ritual of slowness, cleansing, and retreat. The bathhouse is animated by daylight and attuned to time, weather, and movement.

The programmatic layout of the bathhouse includes a clear set of spaces - entrance, Changing Rooms, Showers, Corridor, Spa Pool, Cold Plunge, and Sauna - each with specific spatial and atmospheric demands. The design approaches these spaces as part of a flowing sequence, where transitions between dry and wet, bright and dim, public and private become part of the spatial narrative.

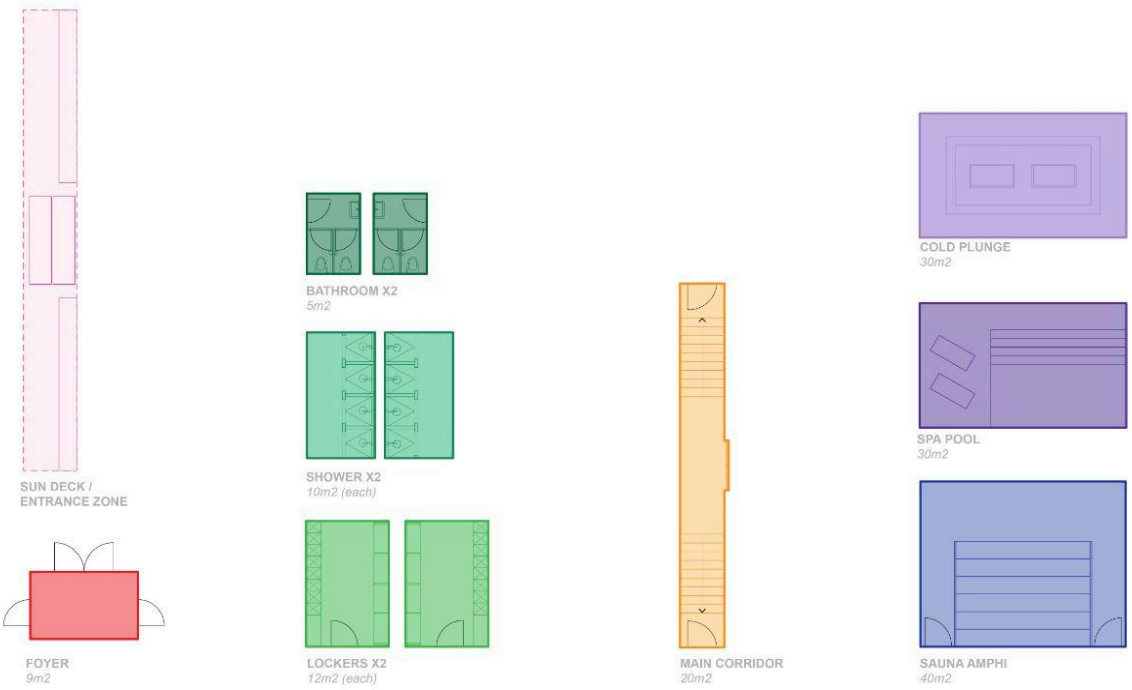


Figure 60: Program Breakdown

The spatial configuration is based on programmatic clarity and atmospheric intent to realize this vision. The layout spans approximately 250 m². Several strategies are examined to organize the spatial sequence, testing configurations, and adjacencies. The preferred approach (Figure 60) emerged by dividing the building into four distinct zones: Access, Pre-Bathing, Circulation, and Bathing.

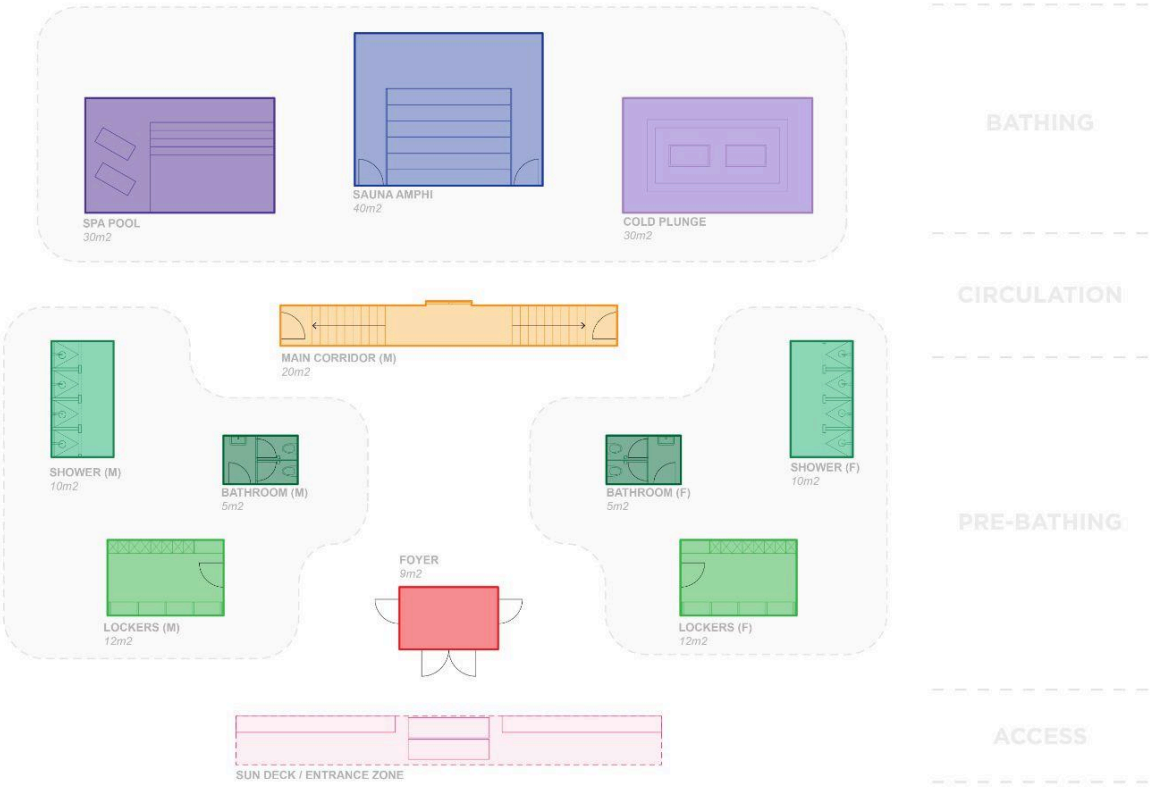


Figure 61: Clustering Program

This configuration enabled the grouping of spaces according to function, light conditions, and spatial experience. Some zones accommodate the more static, dry, and transitional spaces, such as the Entrance, Changing Rooms, and Corridor. The other contains immersive, humid, and luminous environments, including the Spa Pool, Cold Plunge, and Sauna. This division facilitates a gradual transition from one spatial condition to another.

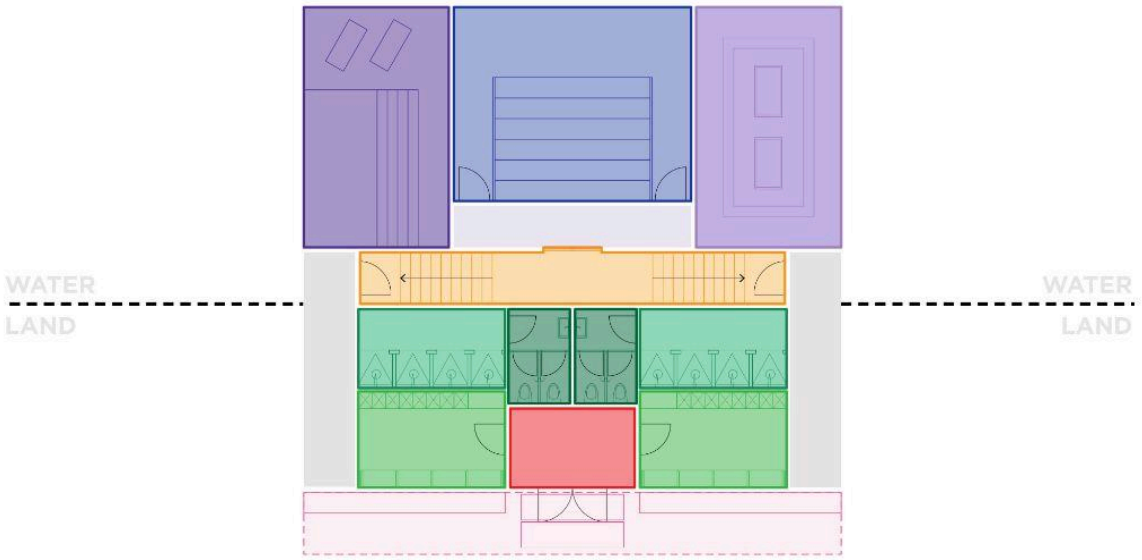


Figure 62: Combined Program

The Entrance acts as a physical boundary and an introduction to the following spatial experience. Positioned at the site's southern edge, it is open, luminous, and outward-facing, welcoming users into the sequence of spaces. Framed views and abundant daylight mark the moment of arrival.

Behind the entrance facade are the changing rooms, which include lockers, showers, and bathrooms. These spaces are more enclosed and private, supporting practical needs and transitioning into a quieter, more intimate experience. This area is a mediator between the outside world and the bathing space, helping users shift from public to private, from dressed to undressed, from movement to stillness.

The Corridor is the main transitional path, linking all rooms and creating a sense of flow in movement and mood. Its long, narrow design acts as a spatial bridge between the zones. It guides movement and establishes a rhythm that deepens engagement with the space’s rhythm.

The final group holds the core bathing spaces: the Cold Plunge, the Spa Pool, and the Sauna. These rooms are immersive and contemplative, formed by the unique character of Nordic daylight. Each space responds to a distinct quality of light. The Sauna, facing north, receives cool, diffused daylight that enhances its meditative atmosphere. The Cold Plunge captures the vertical and horizontal daylight from the east, emphasizing the space's stillness. On the opposite side is the Spa Pool, located to the northwest, for an afternoon of relaxation.

5.2. Design Strategies

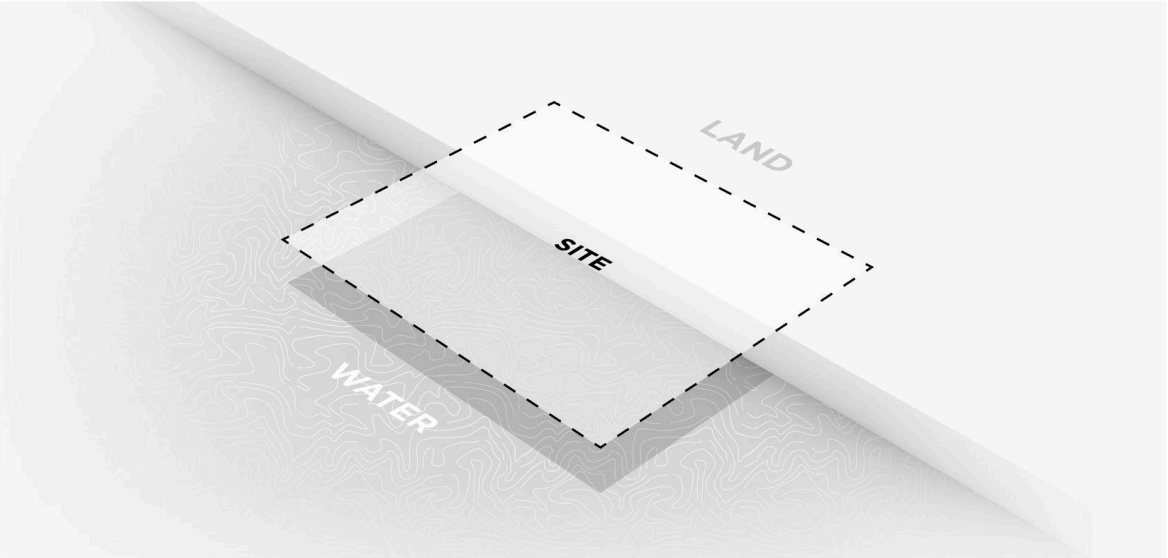


Figure 63: Site

The bathhouse is positioned at a transitional edge, where land meets water (Figure 63), creating a hybrid condition that supplements the spatial and atmospheric potential of the site. This location allows the architecture to interact directly with its surroundings, including the sky's reflections on the harbor and the expansive horizon. The design emphasizes the bathhouse's role as a threshold, connecting the urban environment with the natural elements and the physical and sensory experience. The bathhouse cautiously integrates with the site, extending partly over the water while staying anchored to the land, strengthening its connection to daylight, reflection, and movement.

Base Volume and Orientation

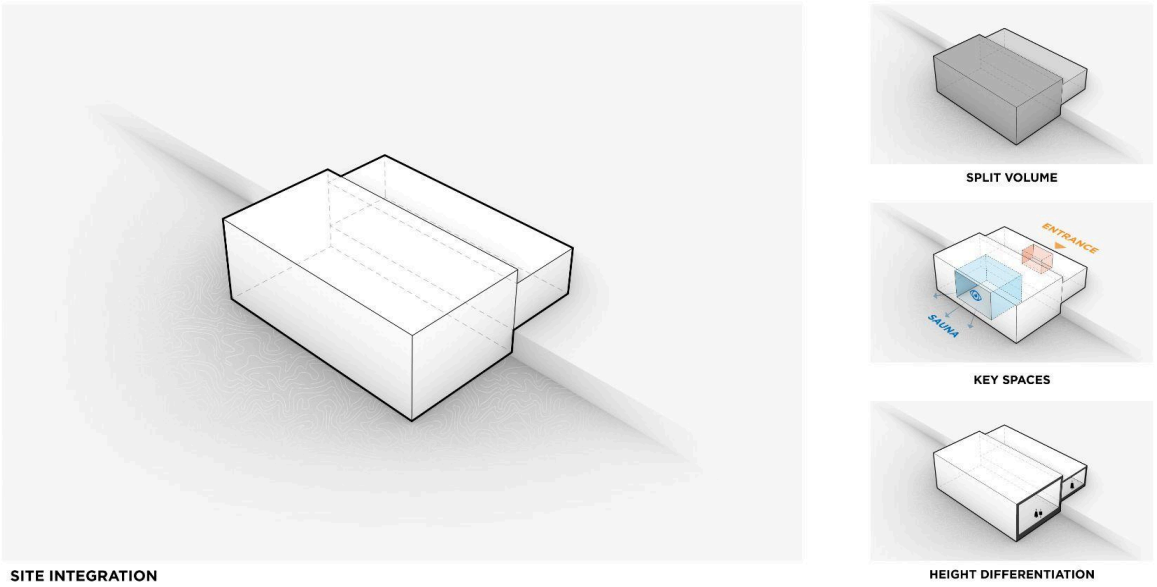


Figure 64: Base Volume

The bathhouse's primary form presents a controlled yet adaptable volume comprising two distinct facades (Figure 64). These respond to spatial functions and height variations, organizing internal volumes while adjusting how daylight enters and moves through the bathhouse. The southern facade, where the main Entrance is located, is open and welcoming. It allows direct sunlight and warmth to enter, supporting the exterior and interior transition.

In contrast, the northern façade, which contains the Sauna, is oriented away from direct sunlight. While this may seem counterintuitive, it is a considered choice. Thermal spaces typically benefit from southern exposure, but the north-facing orientation frames the Nordic Sky, known for its cool, diffused light. This orientation enriches the sauna's introspective character, aligning the bathing experience with the qualities of northern light, emphasizing temporality and atmosphere.

Form and Roof Modulation

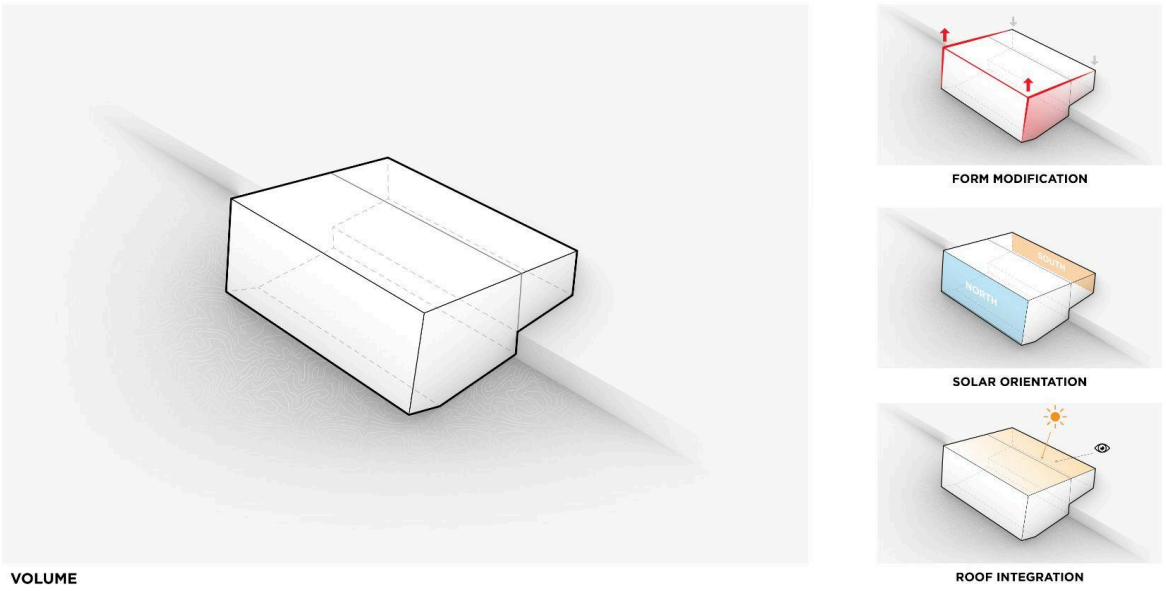


Figure 65: Form and Roof

A key feature of the bathhouse is the 10% rotation of the roof plane (Figure 65), which adjusts the geometry to align with solar angles, enhancing visual and thermal performance. This subtle rotation modulates sunlight throughout the day, creating dynamic internal conditions that shift with the time of day and season.

Above the roofline, extruded apertures control daylight entry while remaining visible from the exterior. These elements punctuate the roof, drawing the eye upward and expressing the building's internal spatial and atmospheric logic outward.

Both the north and south façades serve as primary exposure surfaces. Their design carefully balances solar access, privacy, and views, ensuring the bathhouse remains visually porous yet thermally and emotionally enclosed. This organizational strategy is refined through a study of the building's orientation. Instead of treating orientation solely as a climatic factor, it is used as a compositional tool to align spatial experiences with natural light. The building follows a north-south axis, incorporating deliberate asymmetry. Spaces like the entrance, changing rooms, and corridor face south to capture direct, energizing light, while the sauna faces north, receiving diffused light that creates a softer, more contemplative atmosphere. The spa and cold plunge occupy an intermediate zone facing north, receiving both direct and indirect light.

This sensitivity to orientation enhances the experiential quality of the space. The sun becomes an integral part of the bathing ritual. As users move from south to north, from dry to wet, and bright to dim, the architecture responds with a gradient of openness, lightness, and sensory intensity.

Program and Zoning

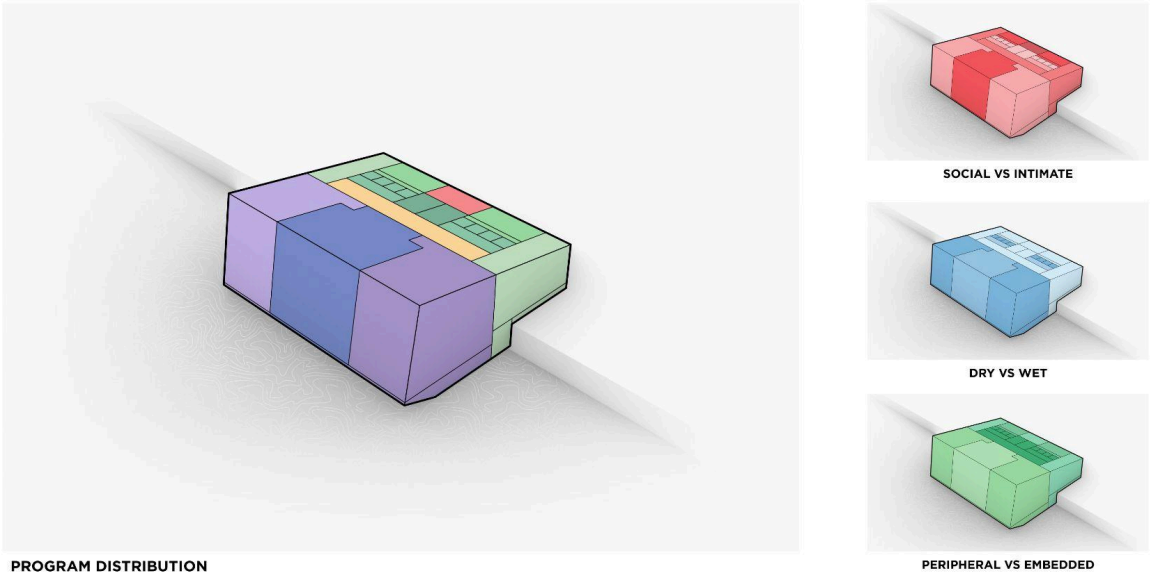


Figure 66: Zoning

A balance between functional and experiential intention affects the internal zoning of the bathhouse. Spaces are organized into three primary atmospheric categories: social versus intimate, dry versus wet, and peripheral versus embedded (Figure 66). These zones unfold sequentially along the building's axis, with daylight as a mediator. Social and transitional areas, such as the entrance and corridor, are more open, utilizing direct or ambient light to create a welcoming atmosphere. In contrast, intimate spaces, including the sauna and cold plunge, are more enclosed and defined by filtered or reflected light, contributing to a sense of privacy and introspection. Dry zones, brighter and more open to the exterior, contrast with the wet zones, which are dimmer, inward-facing, and thermally contained. Peripheral spaces receive direct daylight, while embedded spaces rely on light modulation through reflection or diffusion to create a controlled atmosphere.

Each spatial zone in the bathhouse is thoughtfully composed to respond to daylight. The design integrates functional needs with atmospheric intent, where light is filtered through light structures. This way, function and emotion are combined, and light becomes a defining element of spatial experience.

Daylight Bathhouse

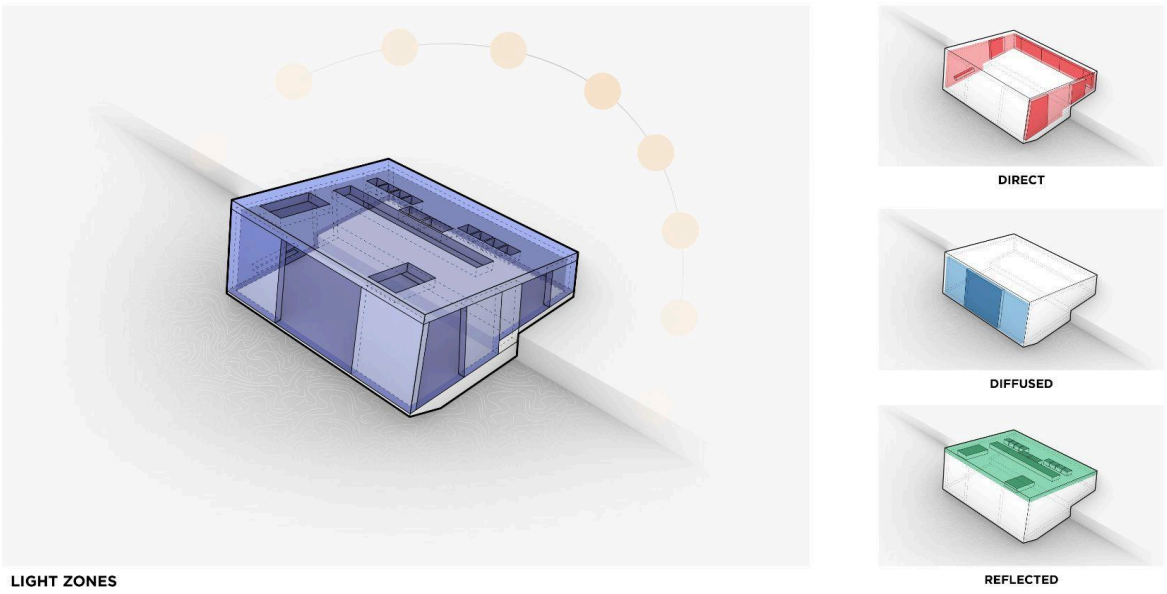


Figure 67: Daylight Shell

Light is a fundamental design component in the daylight bathhouse, informing shape, orientation, and spatial experience. The bathhouse shell is designed to accommodate different Light Zones that mediate, modulate, and amplify natural light. The bathhouse is conceived as a vessel that receives, reflects, and diffuses daylight, responding to solar orientation and programmatic needs throughout the day and seasons.

The central volumetric diagram (Figure 67, left) illustrates how the bathhouse operates as a responsive light envelope. The 10% rotation of the roof plane serves dual purposes: organizing daylight internally and expressing the bathhouse's luminous logic externally. The extruded apertures above the roof surface function as light screens. These sculptural elements capture attention from a distance, drawing visitors in. The mass and orientation are strategically placed to support three primary daylight strategies, each tailored to create specific spatial and emotional conditions within the program (Figure 67, right):

Direct Light
Zones requiring sharp, directional light are positioned to face south. Openings in these areas are intentionally designed to allow direct light to define surfaces, animate movement, and provide clarity. This strategy enhances arrival, orientation, and the transition from exterior to interior, reinforcing the building's welcome.

Diffused Light
Intimate and introspective spaces are oriented to the north side. These zones receive diffused light, characterized by low contrast and soft shadows. Higher, or screened openings, filter daylight into these areas, enhancing the meditative atmosphere. The north-facing Sauna, in particular, rejects the typical southern exposure in favor of a connection to the Nordic sky, reinforcing northern light's emotional resonance.

Reflected Light
The roof structure is critical in guiding reflected daylight into more embedded and central spaces such as the Showers, Spa Pool, and Cold Plunge zones. These areas are designed to be immersive and restful and require reflected light. The roof is tilted at a 10% angle, allowing sunlight to bounce off upper surfaces and diffuse into the interior volumes.

Through this integrated daylight strategy, the bathhouse becomes a constructed sky, capturing the qualities of Nordic light and transforming them into a deeply spatial and sensory experience.

5.3. Technical Drawings

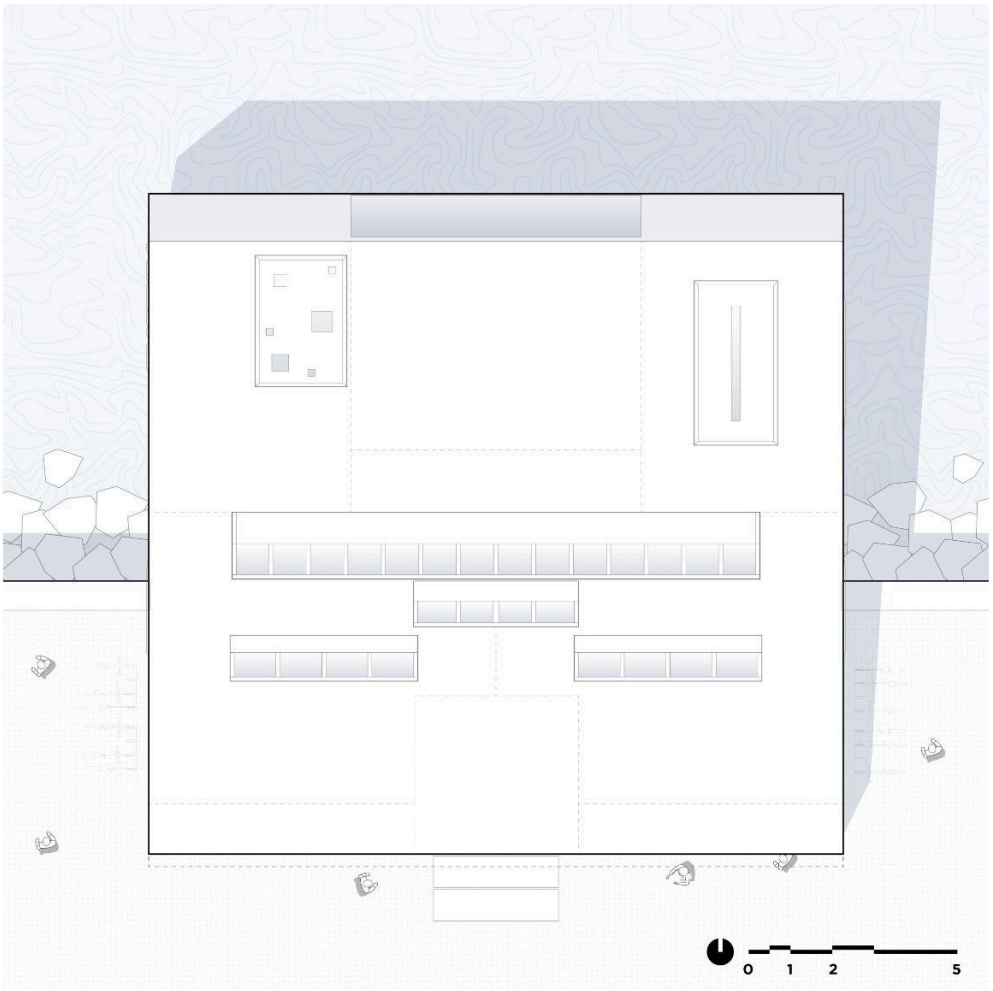


Figure 68: Bathhouse Roof Plan

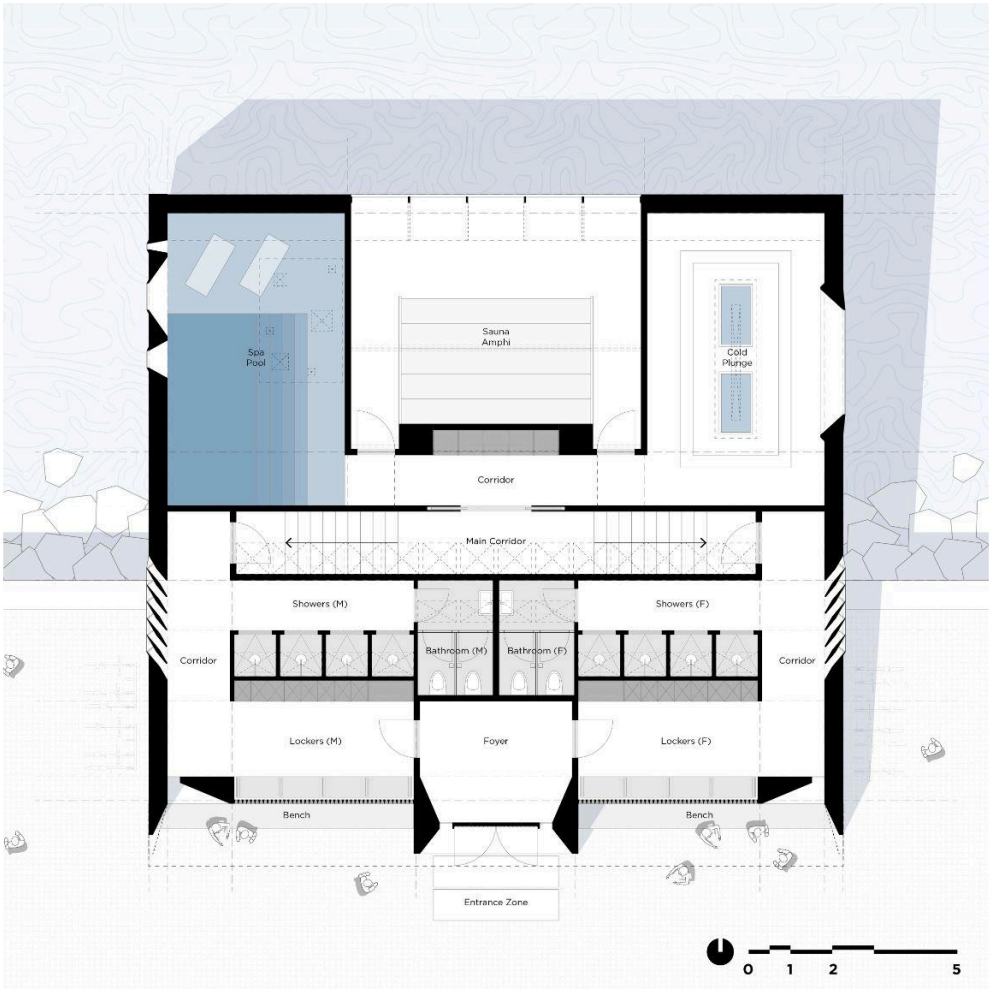


Figure 69: Bathhouse Plan

The plans illustrate both the roof (Figure 68) and spatial layout (Figure 69). The roof plan highlights the light structures integrated into the roof plane. In addition, the spatial plan reveals the sequence of rooms, illustrating zones that transition smoothly from the entrance to the immersive bathing areas. Each room is positioned to maximize natural light and views, with a design tailored to support its specific function.

The final form of the bathhouse condenses its fundamental concept. Early explorations with curved and angled geometries led to a resolved orthogonal volume. This clear, disciplined form establishes a grounded framework for light and atmosphere. Its simplicity allows for intentionally positioning openings, alignments, and circulation paths, enabling precise modulation of daylight as it animates and defines the interior spaces.

Light plays a central role in defining the experience of each space, whether supporting rest, guiding movement, or inviting contemplation. Thus, the bathhouse becomes a subtle composition, brought to life by its environment and the ever-changing rhythms of light, water, and human presence.

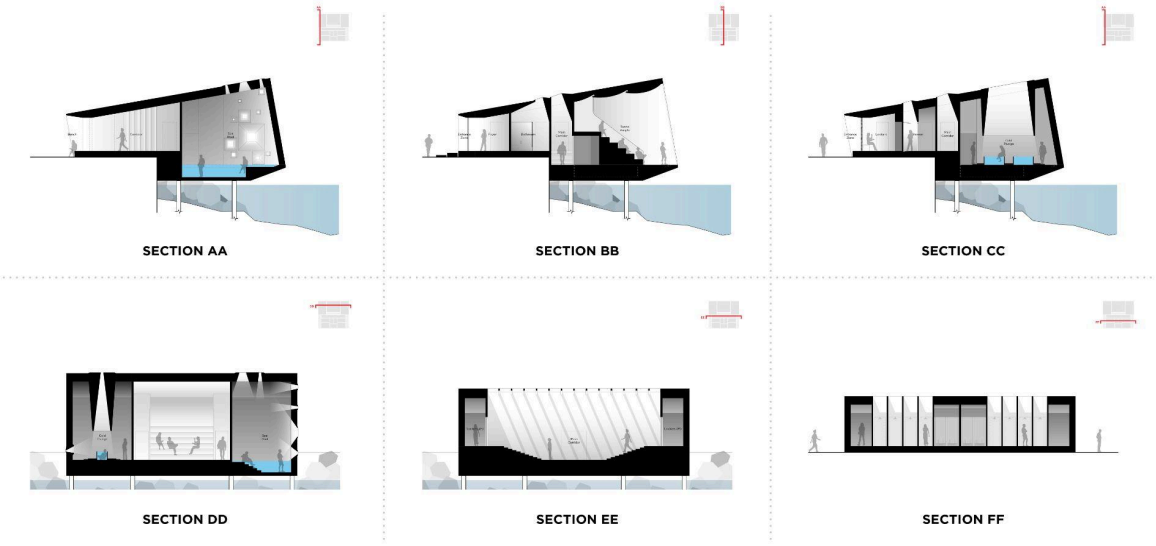


Figure 70: Sections

The sectional drawings (Figure 70) collectively offer a layered understanding of how the bathhouse choreographs daylight across different spatial conditions. Sections AA, BB, and CC illustrate the relationship between light and volume in vertically dynamic spaces like the Spa Pool, Sauna, and Cold Plunge. These drawings emphasize how roof geometry, interior surface angles, and the light structures modulate the entry and distribution of natural light, creating distinct atmospheres within each zone. Shifts in ceiling height and wall tapering mark transitions between programs, using daylight to signal movement and emotional tone.

The lower sections - DD, EE, and FF - reveal how light is integrated along more extended horizontal sequences. Cutting through the Cold Plunge, Sauna, and the Spa Pool, Section DD showcases contrasting light conditions: dim, enclosed volumes that foster intimacy and release, emphasised by focused apertures that direct light in scaled bursts. In Section EE, the linear skylight system above the Corridor introduces a rhythm of daylight, guiding users through the spine of the building. Section FF illustrates the most enclosed spaces, where vertical walls in the shower areas provide privacy while allowing an even wash of daylight to enter from the roof openings.

Together, these sections create a spatial narrative shaped by daylight. Each cut reveals how the form has been carefully designed to accommodate function and elevate the user's sensory and emotional experience, framing daylight as a practical and poetic architectural medium.

6. Light Structures

This chapter investigates how architectural form can be shaped by, and in turn, inform the behavior of light. At the core of the bathhouse design is the notion that daylight is an active spatial driver. The final 3D model illustrates how distinct roof profiles, apertures, and surface treatments are designed to create a sequence of luminous atmospheres tailored to each interior space.

The axonometric view below (Figure 71) shows the bathhouse's overall geometry, emphasizing the light-guiding structures embedded in the roof. These structures vary in form, scale, and distribution to modulate daylight, sometimes capturing it directly and diffusing or reflecting it into the interior.

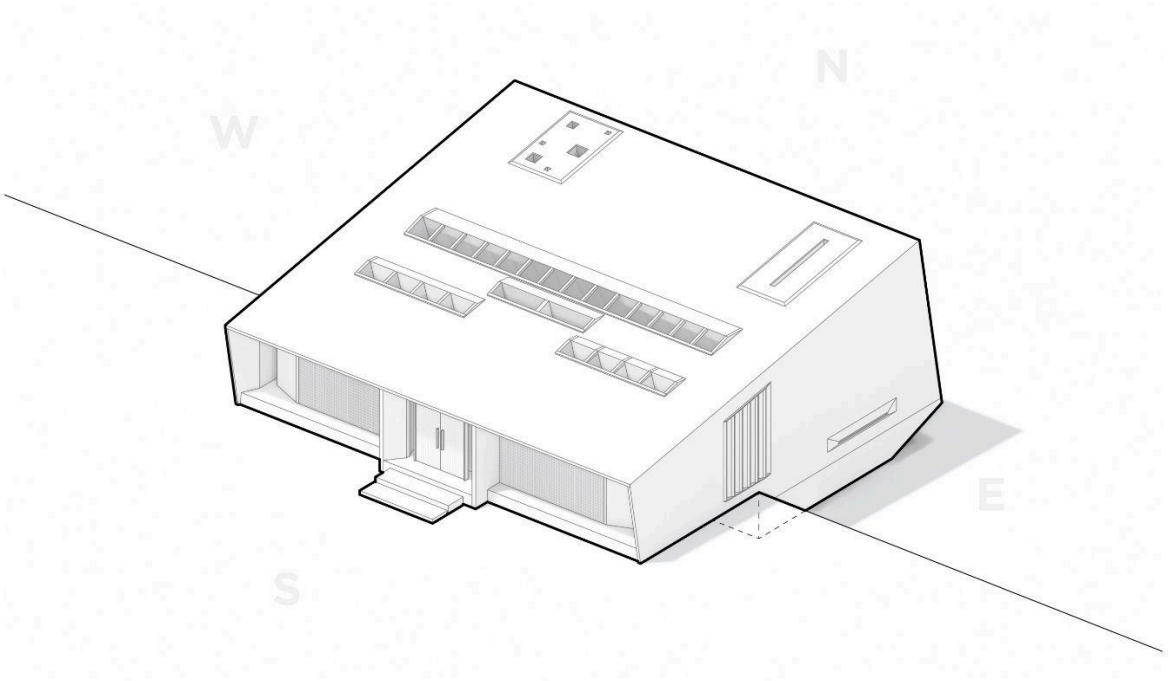


Figure 71: Bathhouse: Axonometric View

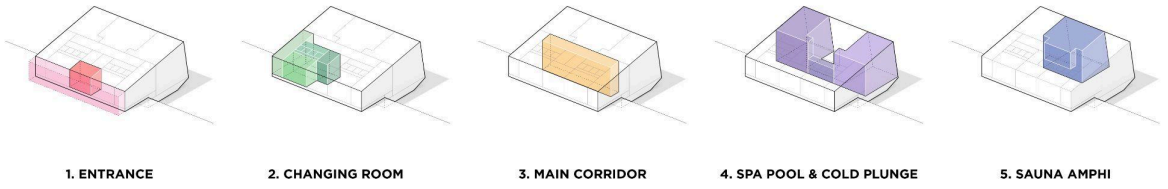


Figure 72: Bathhouse: Programs

To support a clear reading of the internal organization, the diagram in Figure 72 breaks the program into five primary spatial units: (1) Entrance, (2) Changing Rooms, (3) Corridor, (4) Spa Pool and Cold Plunge, and (5) Sauna Amphi. Each zone is rendered in a distinct color to help readers understand the bathhouse's spatial layout and flow. These spaces are designed for specific luminous goals - whether to create intimacy, enhance clarity of movement, or evoke sensory calmness - and will be analyzed individually in the following sections.

6.1. User Experience: Space + Light

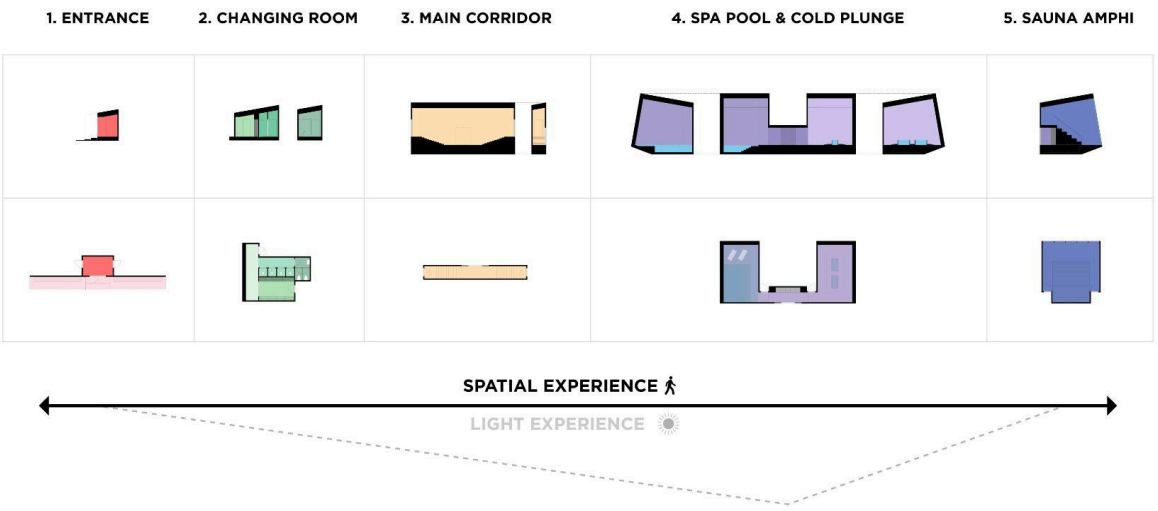


Figure 73: Spatial Experience

Spatial Experience

Establishing a defined user experience early in the design process is essential to how the spatial atmosphere unfolds throughout the bathhouse. This required a clear understanding of how each room would operate physically, emotionally, and temporally, guiding users through a sequence that supports arrival, cleansing, transition, immersion, and rest. The design prioritizes a continuous progression aligned with bodily presence, sensory engagement, and pacing. The objective is to create functional coherence while supporting an emotional arc that moves from openness to introspection. Figure 73 presents a diagrammatic representation of this experiential sequence, using simplified plans and sections to outline six core spatial zones: Entrance, Changing Rooms, Corridor, Spa Pool and Cold Plunge, and Sauna.

The sequence begins at the Entrance, where a clearly defined threshold marks the shift from the exterior context to the interior atmosphere. A centered doorway, framed by a restrained extrusion, introduces the user to a compressed volume. The transition is immediate, with a reduction in ambient stimuli signaling a change in pace and initiating the shift from external to internal focus.

In the Changing Rooms, the experience becomes more personal and enclosed. The atmosphere supports privacy and quiet preparation, reinforcing the psychological transition from public to private space.

The Corridor serves as a linear connector and sensory interlude. Variations in ceiling height and enclosure conditions the rhythm of movement. Alternating zones of compression and release support orientation and build anticipation.

The Spa Pool is defined by lateral openness and a horizontal spatial reading. The room encourages stillness and reflection through its expansive visual field and the surface's calm, tactile quality. In contrast, the Cold Plunge introduces a moment of intensity through spatial reduction and focused design elements. The enclosure is minimal and concentrated, emphasizing clarity, physical impact, and immediate sensory activation.

The sequence concludes in the Sauna Amphi, a space of warmth and introspection. Its design proportions foster stillness and quietude, marking the final stage of retreat.

Across all rooms, the spatial organization responds directly to the user's intended experience. Transitions are orchestrated through proportion, surface, and enclosure, structuring a rhythm of contrast and continuity. The bathhouse becomes a spatial sequence shaped by functional intent and an understanding of embodied, emotional experience. It guides users through a deliberate process of slowing down, engaging the senses, and restoring presence.

Light Experience

A distinct luminous experience is established early in the design process to explore how daylight could define the atmosphere and influence user perception throughout the bathhouse. This required a careful study of how light enters, transforms, and animates each space in alignment with the emotional and sensory rhythm of the program. Before finalizing the spatial configuration, daylight sequencing studies are developed to investigate the light modulation. The diagrams below examine how gradients of brightness and shadow could reinforce the thematic phases of cleansing, immersion, and restoration.

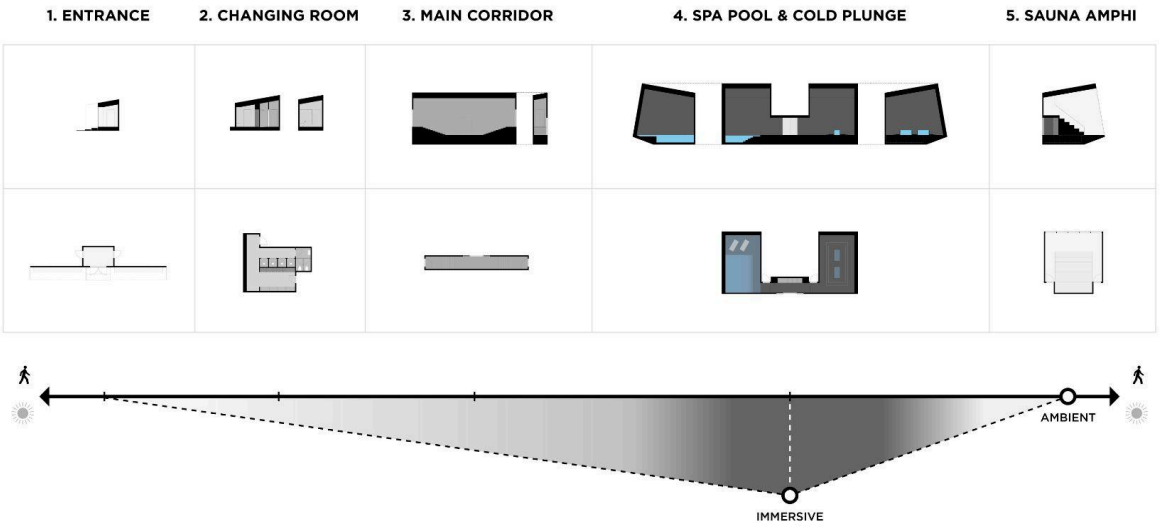


Figure 74: Light Experience 01

Each scenario proposed a distinct spatial rhythm shaped by contrasts between immersive and ambient zones. In one iteration, *Light Experience 01* (Figure 74), the Spa Pool and Cold Plunge are envisioned as the darkest points in the sequence, with light gradually intensifying through transitional and social spaces, culminating in a luminous Entrance and an abundance of Nordic light in the Sauna. This progression emphasized a sense of emergence and reawakening, aligning the lighting atmosphere with the emotional arc of the experience.

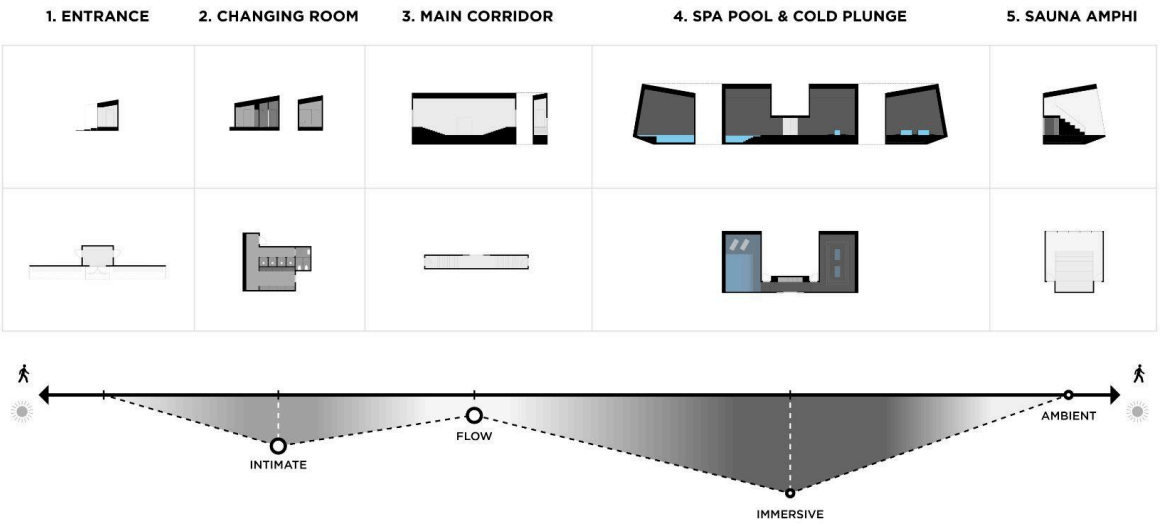


Figure 75: Light Experience 02

Another approach, *Light Experience 02* (Figure 75), began with a bright, sunlit Entrance, transitioned into the dimmer, more intimate Changing Rooms, moved through a brighter Corridor that encouraged flow and movement, and developed in the darker, immersive volumes of the Spa Pool and Cold Plunge, before returning to brightness in the Sauna. While this alternating sequence echoed the body's internal rhythms, it lacked the immersive continuity and emotional coherence necessary to support the project's intent fully.

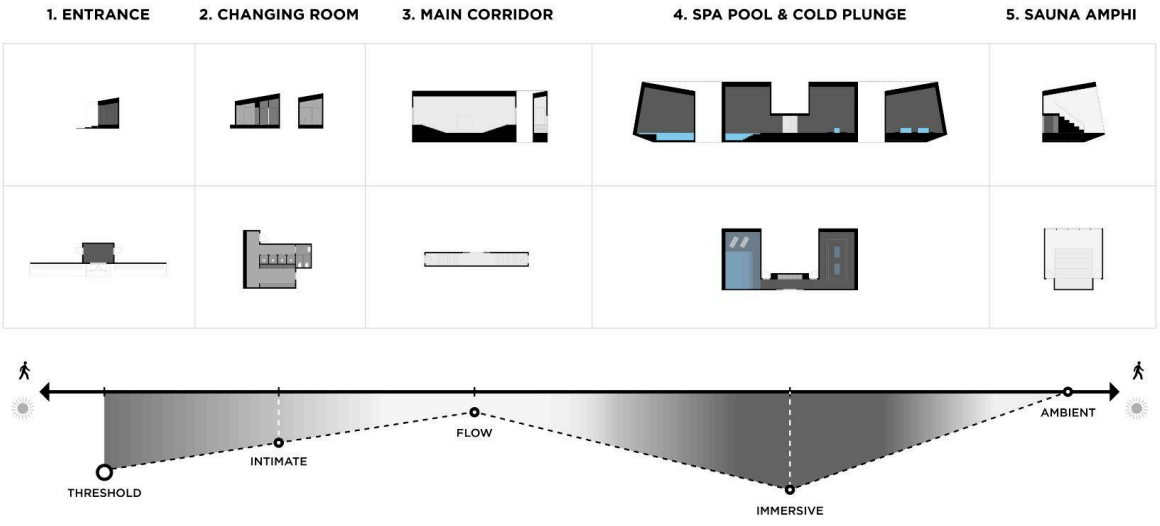


Figure 76: Light Experience 03

The selected approach, *Light Experience 03* (Figure 76), inverts the conventional relationship between ambient and immersive illumination. The sequence begins with an intentional rupture at the entrance - a visual and spatial threshold marked by darkness - signaling a withdrawal from the exterior world. From this point, light gradually increases: first

gently in the Changing Rooms, then more fully in the Corridor, where openings offer moments of reorientation. Darkness returns in the Spa Pool and Cold Plunge, where the subtle atmosphere invites introspection. The experience ends in the Sauna, where diffuse Northern light conveys a sense of stillness.

This strategy is chosen for its ability to structure spatial perception through deliberate contrast and rhythm. Light becomes an active driver in the architectural narrative, guiding users through a sequence of contraction and expansion, exposure and retreat.

6.2. Catalogue of Light Structures

Figure 77: Light Structures

As the design transitions from conceptual to spatial resolution, this section outlines the approach to the bathhouse interior through daylight manipulation. Apertures are treated as light interventions, forming “light structures” (Figure 77) - architectural devices designed to modulate daylight's quality, direction, and rhythm. Each structure is conceived in direct response to its solar orientation and spatial role.

For example, east- and west-facing light structures respond to low-angle sunlight by filtering or blocking it to preserve atmospheric consistency, while north-facing structures - such as those in the sauna (5) - provide cool, stable illumination. Light is distributed differently in introspective zones like the Cold Plunge (4A) and Spa Pool (4B) to support stillness and sensory immersion.

These spatial strategies reinforce the bathhouse as a progression of environments shaped by the interplay between light and structure (Figure 78). The following pages examine each interior zone - entrance, Changing Rooms, Corridor, Spa Pool, Cold Plunge, and Sauna - as a distinct light condition shaped by orientation, programmatic need, and sensory intent.

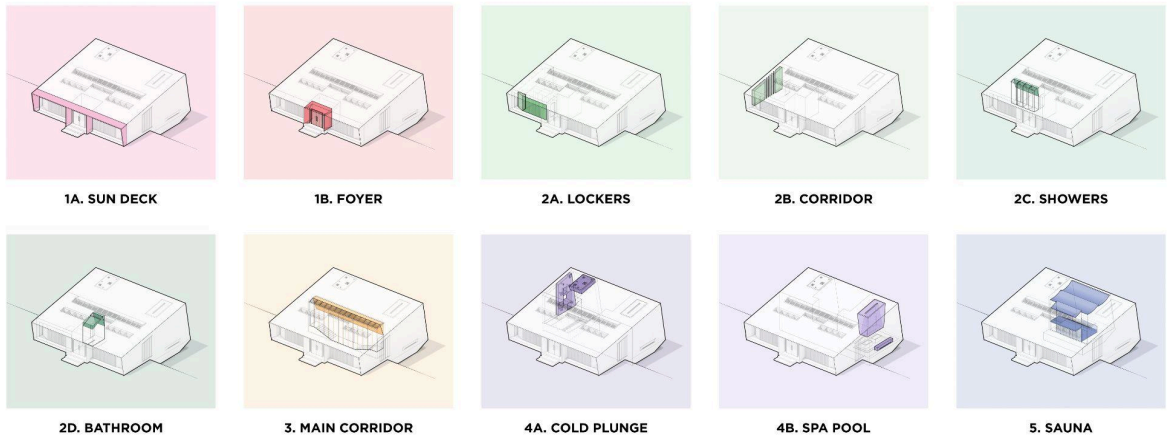


Figure 78: Light Structures integrated in the Bathhouse

6.2.1. Entrance

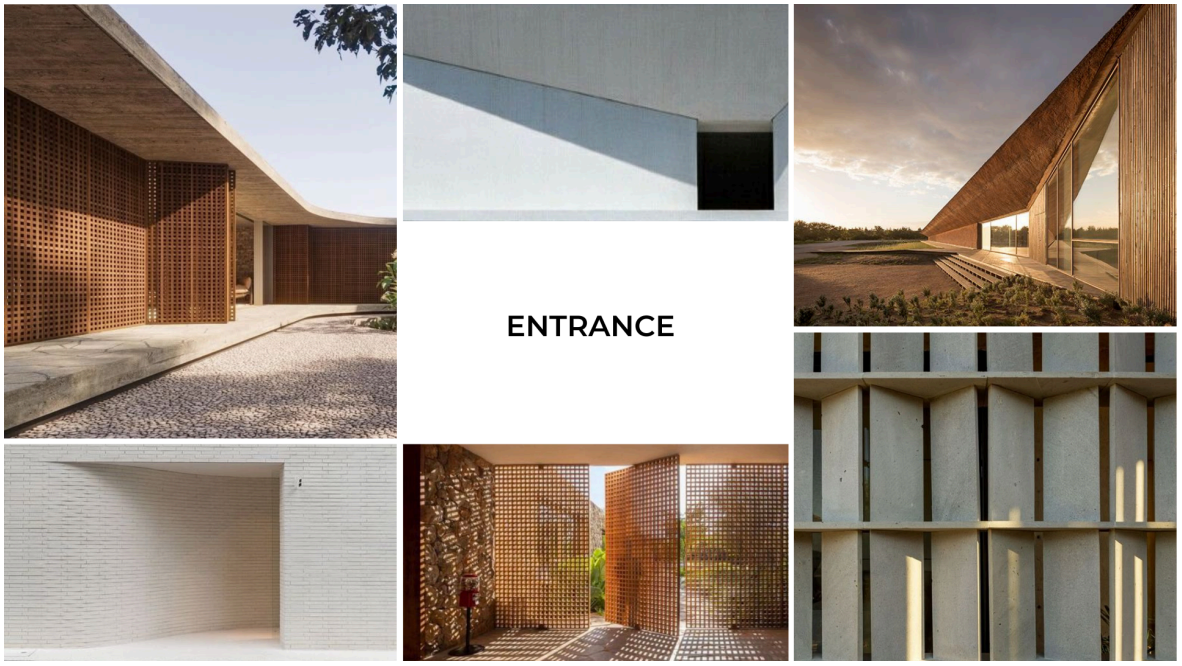
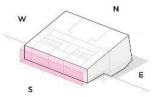


Figure 79: Entrance: Moodboard

The Entrance comprises both the facade and the foyer, forming the initial threshold where the spatial and sensory experience of the bathhouse begins.

Entrance - Facade



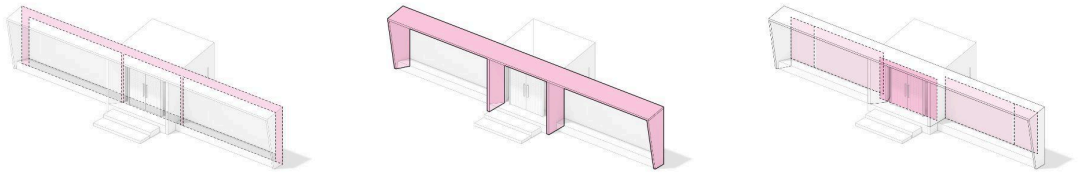


Figure 80: Facade: Design Strategy

The design strategy illustrated in the above diagram (Figure 80) communicates a layered approach to daylight integration along the south facade of the building, structured through three key components: the *light zone*, the *light structure*, and the *light aperture*. Rather than

presenting as a flat surface, the facade is shaped by tapered geometries that introduce depth, shadow, and visual orientation.

The light zone identifies the direct light coming from the South. The light structure, angled and extruded from the façade, performs as horizontal canopies that shade interior spaces from direct southern exposure and enhance the contrast between lit and shaded surfaces. This strategy improves visual legibility and frames the entrance for intuitive wayfinding.

Finally, the light apertures here are placed to mediate light intensity and direction. Their graduated placement and scale allow varying degrees of brightness to reach interior spaces, aligning with the differing daylight requirements of adjacent programs. These elements produce a design responsive to solar orientation, perceptually dynamic, and programmatically legible, demonstrating how coordinated lighting and facade strategies can elevate the bathhouse's environmental performance and spatial experience.

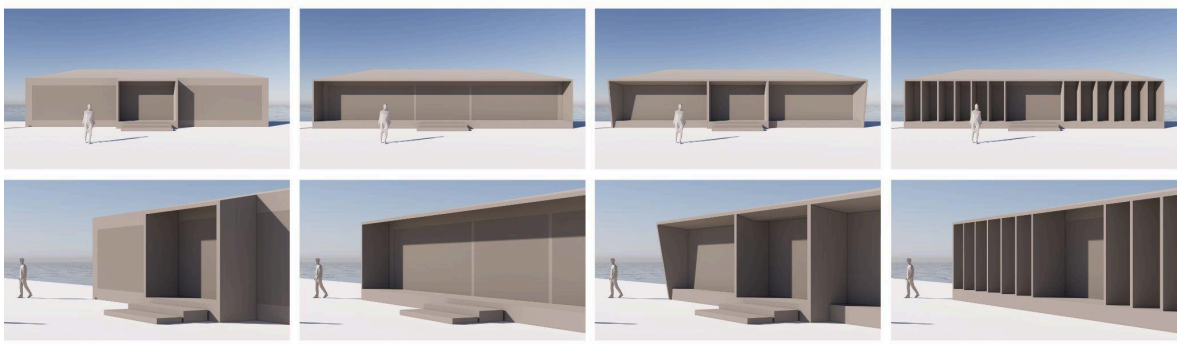


Figure 81: Facade Investigations, 3D Views

Figure 81 presents a series of facade investigations, exploring different formal strategies to evaluate how depth, framing, and distribution affect spatial perception and daylight performance. This iterative process ranges from flat, minimal surfaces to more repetitive designs with recessed and extruded volumes.

Figure 82: Facades Comparison, 3D Views

In the bottom row, the comparison becomes evident: the transition from a flat facade to one that introduces framed and tapered elements significantly enhances the architectural expression. The final design on the bottom (Figure 82, bottom) demonstrates how spatial depth, shadow casting, and visual framing contribute to a more dynamic and inviting entrance. This version improves visual legibility and entrance clarity and aligns with the broader daylighting strategy by enabling better solar shading and richer shadow-play across the surface.

Entrance - Foyer

A centered doorway, framed by a distinct extrusion (Figure 83, middle), introduces the user to a compressed volume. The transition is immediate: a noticeable reduction in light signals a slower pace and initiates the shift from external awareness to internal focus. The design extends the formal language of the facade inward. A deliberate visual break is introduced, a sharp change from the bright exterior to a dim, enclosed interior. This shift in lighting acts as a sensory reset, marking the threshold into a more introspective experience.

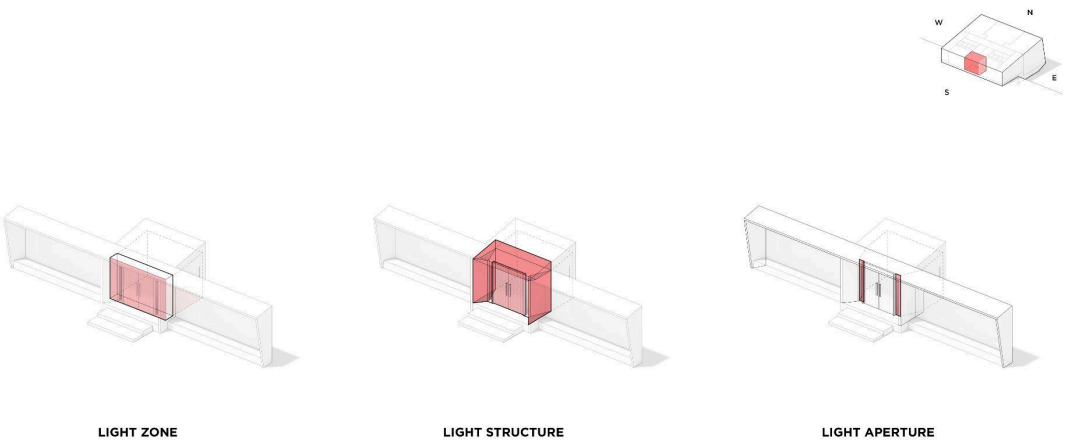


Figure 83: Foyer: Design Strategy

The strategy is again structured through three key components: the light zone, which defines the foyer as a threshold space; the light structure, shaped by the narrowing geometry and layered enclosure; and the light aperture, which limits direct daylight to create a darker atmosphere. Together, these elements define a transitional sequence that slows the arrival, invites pause, and gently guides visitors from the open, external context into the spatial and emotional rhythm of the bathhouse.

To achieve this sensory threshold, several daylighting configurations are investigated during the design process. Various geometries, including lateral and overhead openings, are tested for their spatial and atmospheric impact. The final approach uses linear vertical openings framed by tapered facade walls (Figure 84, right), chosen for their ability to channel direct light while maintaining enclosure and spatial clarity. The angled surfaces enhance the depth of the facade and allow for more precise modulation of light.

Figure 84: Foyer Investigations, 3D Views

Once the vertical strategy is established, a series of tests is conducted to refine the scale of the openings (Figure 85). The goal of experimenting with varying aperture widths is to modulate light intensity to support the intended atmosphere. Digital simulations identify 20 centimeters as the optimal width. This dimension produces a focused beam of light that frames the entrance and enriches the spatial depth through sharp contrasts and layered shadow, marking the transition from exterior to interior without overwhelming the space with brightness.

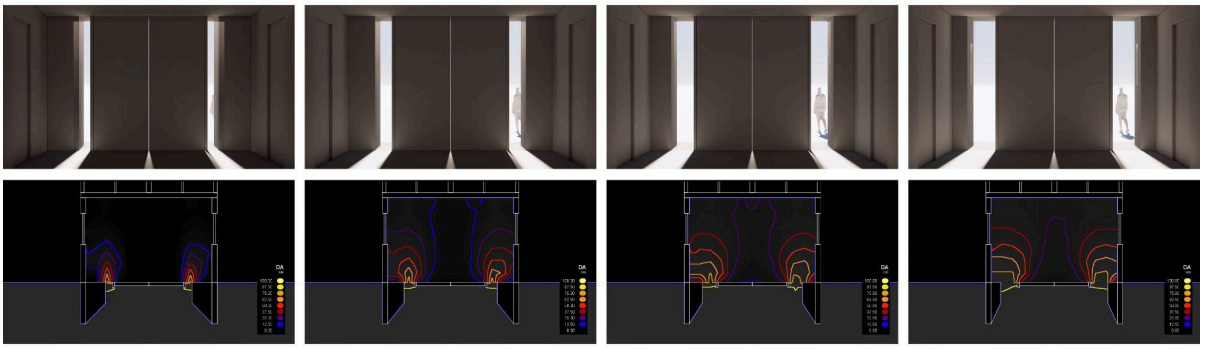


Figure 85: Opening Investigations

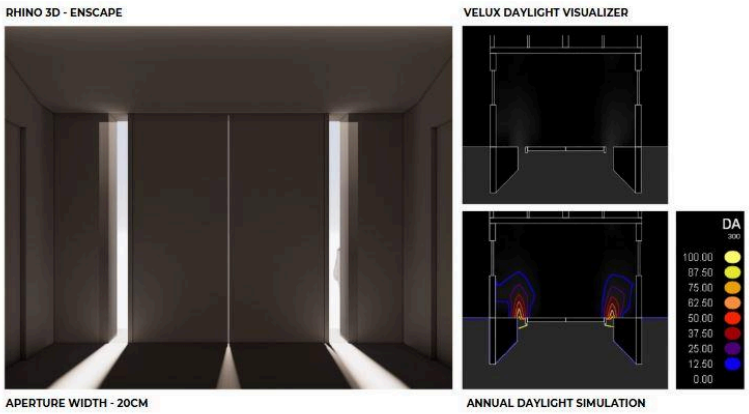


Figure 86: Selected Opening Investigation

The Velux Daylight Visualizer (Figure 85, bottom, Figure 86, right) is a simulation tool that models annual daylight availability within architectural spaces, offering detailed data on light intensity and distribution throughout the year. Initially, it is used to assess illuminance levels according to EN 17037 standards, providing a foundational understanding of light behavior that informs early decisions on aperture size, orientation, and placement.

The Visualizer confirms that 20cm narrow openings in the foyer supply sufficient daylight, with Annual Daylight Simulation (DA) varying from 100 to 12.5 lux.

To better understand these values, a Lightmeter app (Figure 87, right) is further used to measure and verify real-world illuminance levels, targeting a range between 1 and 69 lux that ensures visual comfort and perceptual clarity.

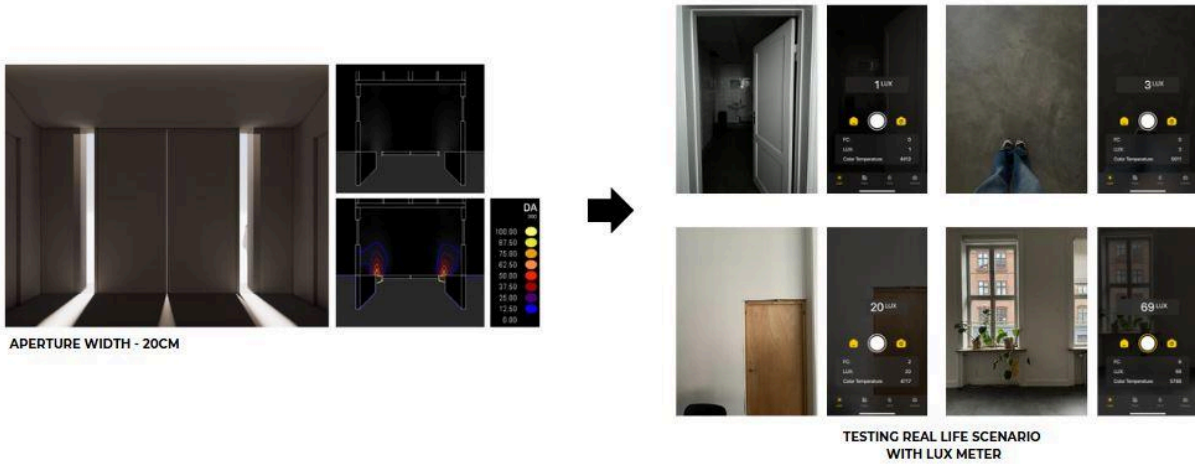


Figure 87: Velux Daylight Vizualiser versus LightMetter App

As the design progresses to the next spaces, reliance on the Velux Daylight Visualizer or the LightMetter App decreases in favor of theoretical observations and qualitative analysis, with greater emphasis on enhancing visual comfort, meeting programmatic needs, and enriching the spatial experience of the bathhouse.

6.2.2. Changing Rooms

Figure 88: Changing Rooms: Moodboard

Exposed to the south-facing façade, the Changing Rooms form a transitional zone between arrival and immersion. This area includes lockers, internal corridors, showers, and bathrooms - spaces that demand varying degrees of enclosure, privacy, and sensory tone. Given the extended solar exposure from the southern orientation, the design modulates light to ensure visual comfort, thermal regulation, and clarity of spatial experience.

Changing Rooms - Lockers

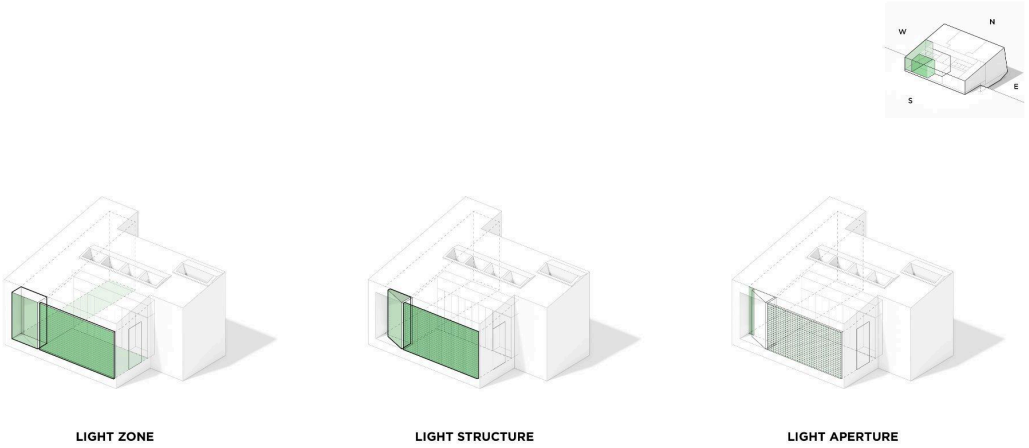


Figure 89: Changing Rooms, Lockers: Design Strategy

In the Changing Rooms, the spatial experience becomes more intimate and enclosed. Openings along the southern wall filtering daylight (Figure 89) - sufficient for visibility yet concealed to maintain privacy. The lower light levels foster a quiet atmosphere of preparation, reinforcing the psychological shift from public to private. This zone utilizes small, perforated openings as its primary light structure to manage the intensity of the south-facing exposure. These elements block, filter, and channel daylight, reducing glare and solar heat gain while cultivating a sheltered environment.

Repeating the design language of the Entrance and Foyer, the linear vertical openings framed by tapered walls are also introduced here. Their placement reinforces spatial continuity and creates movement through a sequence of transitions, gradually revealing the path ahead. These interventions heighten the sensory rhythm of the bathhouse, interweaving orientation with the atmosphere.

Several daylight-filtering strategies are explored in the locker area, where a careful balance between openness and privacy is required. Given the southern exposure and strong sunlight throughout the day, mitigating glare, heat gain, and harsh contrasts is essential for maintaining comfort and calm. Three shading options are tested - horizontal, vertical, and a grid system (Figure 90).

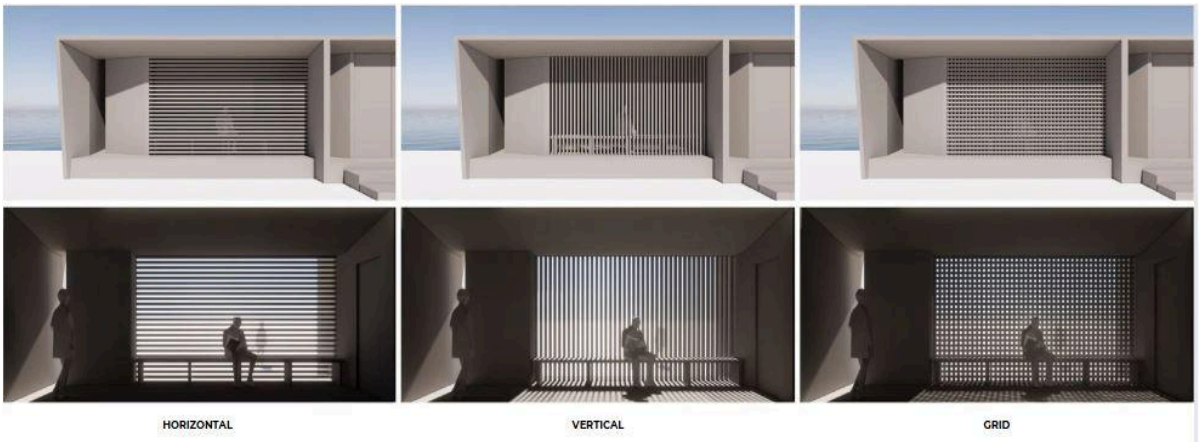


Figure 90: Changing Rooms: South Daylight Strategies

The grid appears as the most effective solution, offering consistent light diffusion while preserving spatial legibility and a sense of enclosure. It tempers direct sunlight, softening glare and casting an even, ambient glow conducive to function and relaxation.

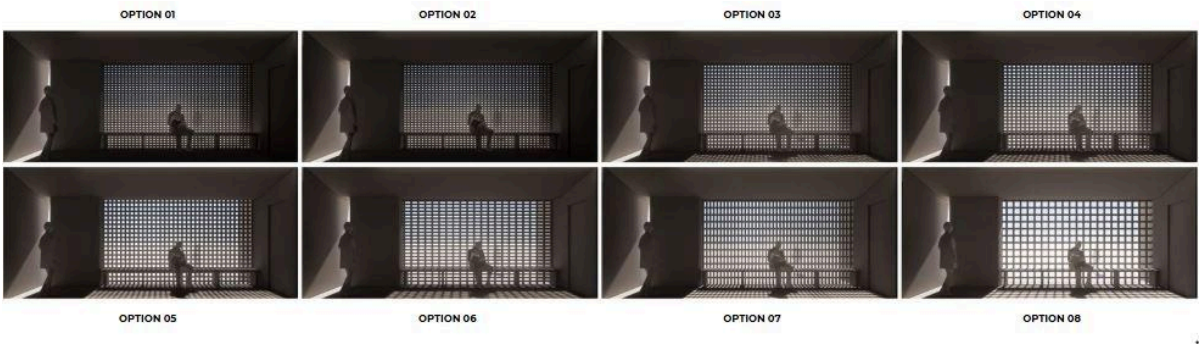


Figure 91: Changing Rooms: South Daylight Strategies

Subsequent studies refine the grid's aperture to optimize performance (Figure 91). A final module of 10 by 10 centimeters is selected (Oprion 4), balancing daylight entry with privacy and visual comfort. This dimension allows filtered light to animate surfaces with subtle shadow play, enriching the atmosphere without sacrificing intimacy.

Changing Rooms - Interior Corridor

The interior corridor defines the light zone by a square-shaped opening paired with linear vertical louvers (Figure 92). This orientation is carefully selected to block harsh, low-angle sunlight while permitting selective outward views toward the waterfront (Figure 93). The light structures effectively reduce glare while framing views of the sea, strengthening the connection to the landscape, and providing moments of orientation within the narrow passage.

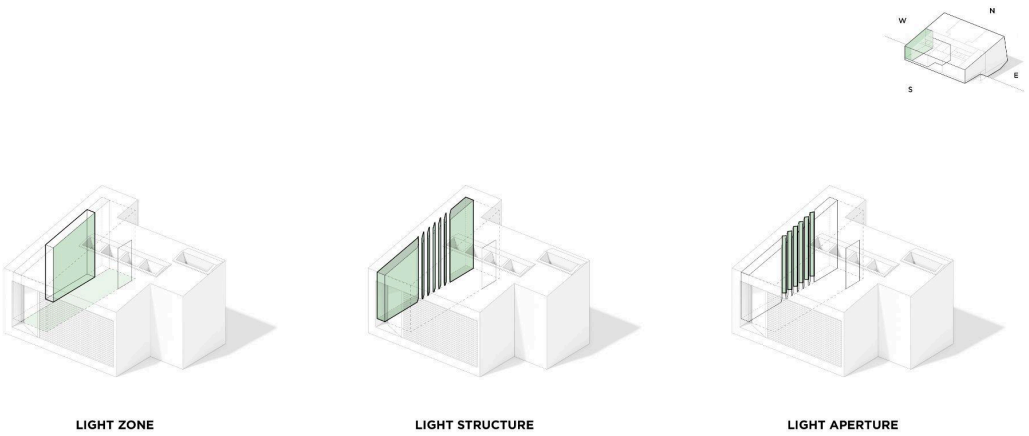


Figure 92: Changing Rooms, Interior Corridor: Design Strategy

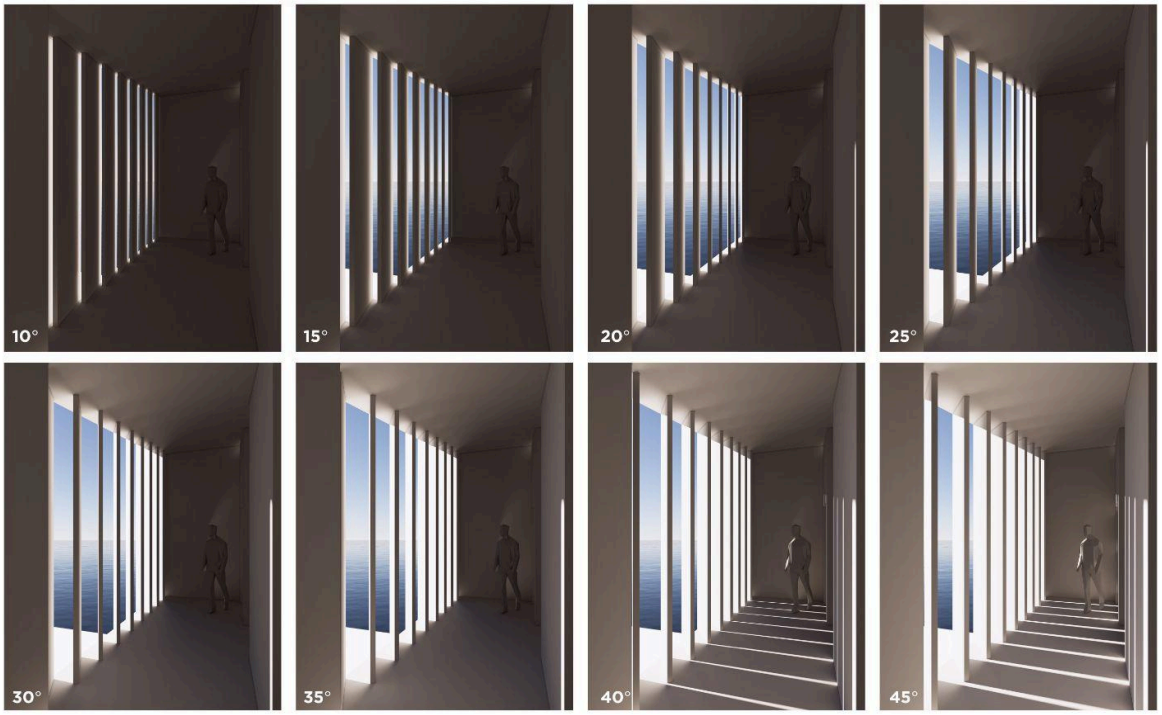


Figure 93: Changing Rooms, Interior Corridor: East/West Daylight Strategies

A series of sun path studies, testing louver angles from 10° to 45°, identified the fixed 30-degree orientation as the optimal balance, blocking direct sunlight while preserving carefully framed views toward the water.

The light structure introduces glimpses of the sea and activates movement through the corridor. As one moves, sunlight is redirected across the angled surfaces, generating a calming visual experience. Controlling solar access while directing visual focus transforms the interior corridor into a protective threshold.

Changing Rooms - Showers

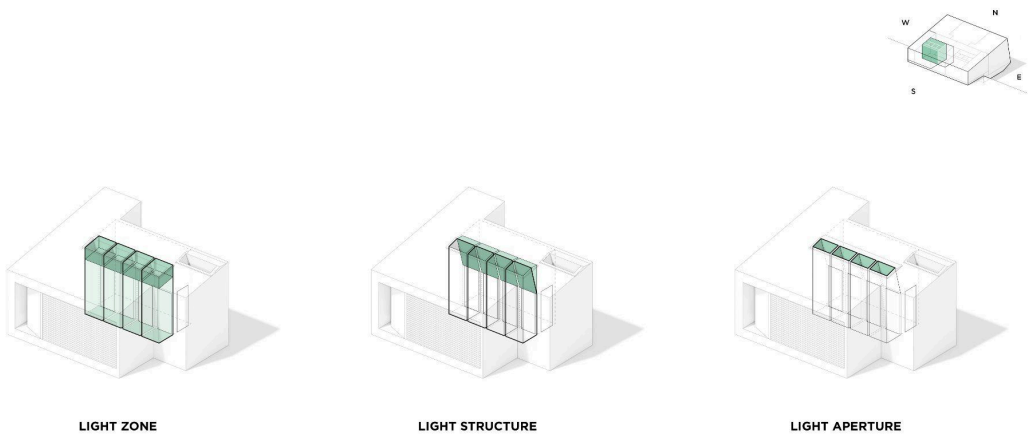


Figure 94: Changing Rooms, Showers: Design Strategy

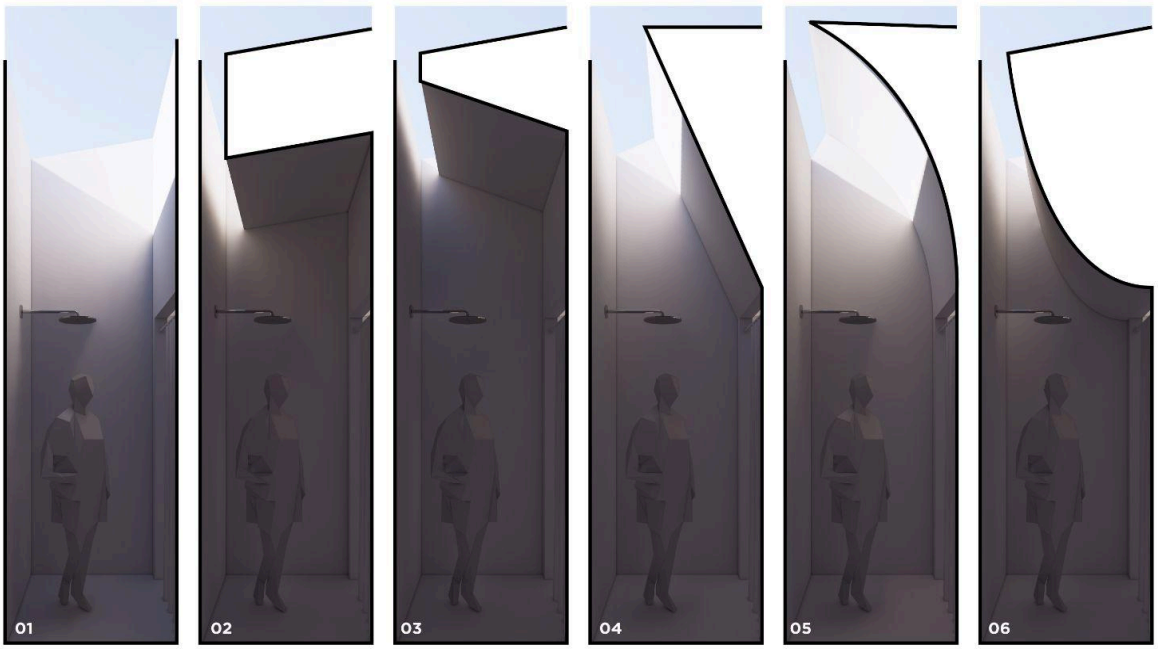


Figure 95: Changing Rooms, Showers: Skylight Strategies

The showers' design—embedded spaces within the bathhouse—transitions from side-lit strategies to overhead apertures, responding to the need for privacy, enclosure, and sensory stillness (see Figures 92). Here, daylight enters not from the sides but from above, reflecting through a sequence of angled skylights. Each opening, precisely measured at 55 centimeters, introduces light in a controlled, intentional way.

Different tests, shown in Figure 95, explored a range of skylight configurations. Instead of curved surfaces, the selected solution is Option 4, which uses a planar surface tilted at a 15-degree angle from the adjacent wall. These angled planes are designed to catch sunlight

and gently redirect it downward, allowing light to wash across the interior without harshness or intrusion. The result is a soft, ambient glow that elevates the sensory presence of water and steam while reinforcing a sense of isolation.

Changing Room - Bathrooms

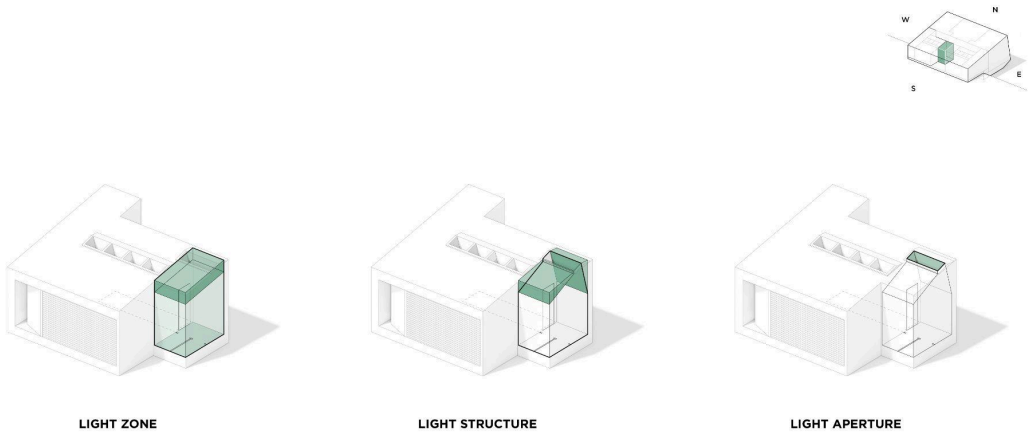


Figure 96: Changing Rooms, Bathrooms: Design Strategy

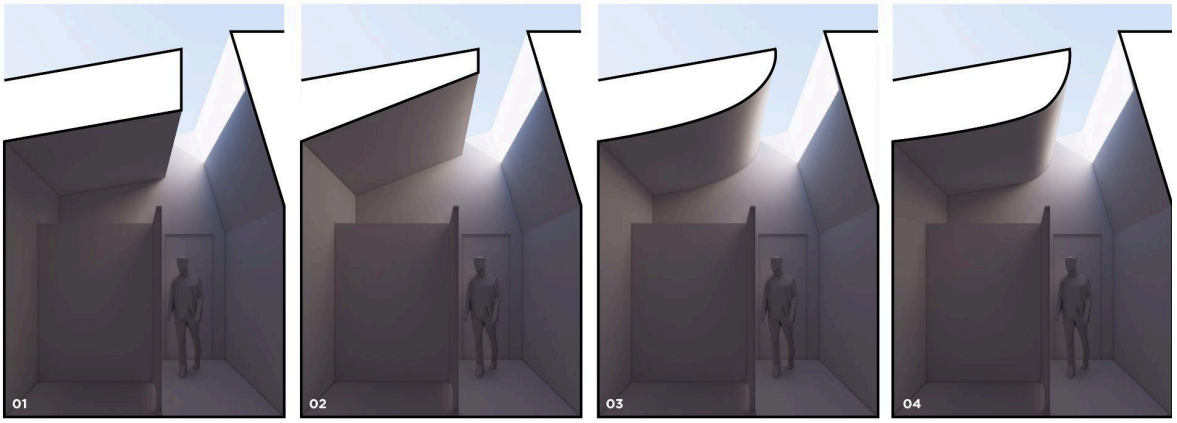


Figure 97: Changing Rooms, Bathrooms: Skylight Strategies

In the bathrooms, the system evolves through Light Wells Option 02 (Figure 97), a more advanced adaptation that enhances light diffusion while reinforcing visual privacy from above. This refinement builds on the principles established in the showers, thoughtfully adjusted to meet the bathroom environment's spatial needs.

Each space becomes a carefully designed chamber of light throughout the changing rooms. Light structures function as architectural instruments, supporting the program’s needs.

6.2.3. Corridor

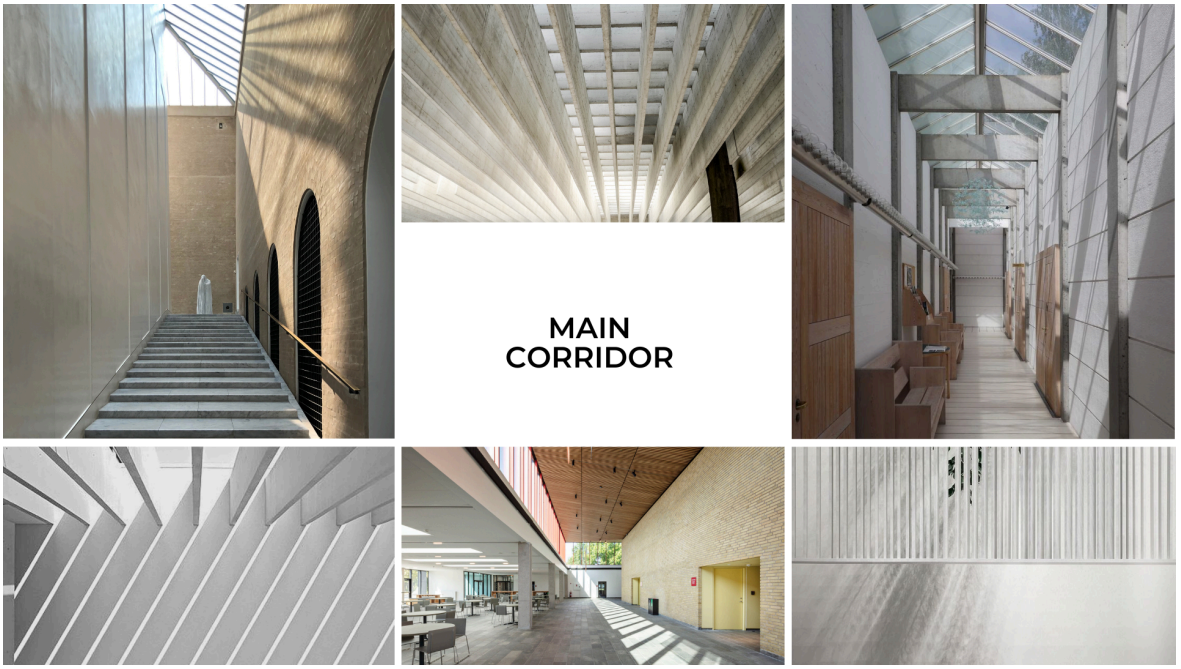
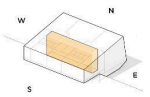


Figure 98: Corridor: Moodboard

The main corridor is a physical connector and a perceptual threshold within the bathhouse. It links the building's various programs and guides movement as a transitional zone, offering architectural and experiential depth. Though narrow and linear, the corridor becomes a spatial framework where perception is shaped through rhythms of light.



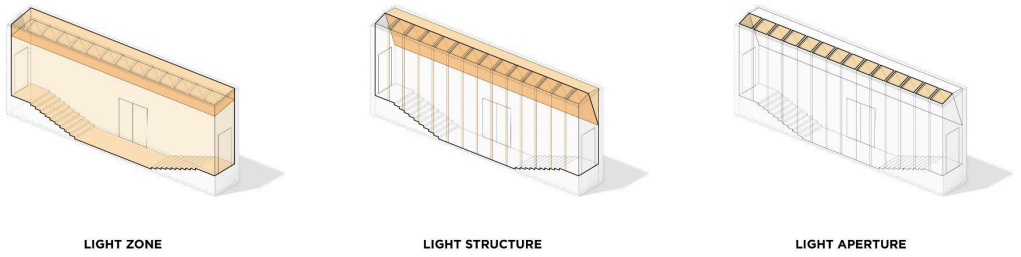


Figure 99: Corridor: Design Strategy

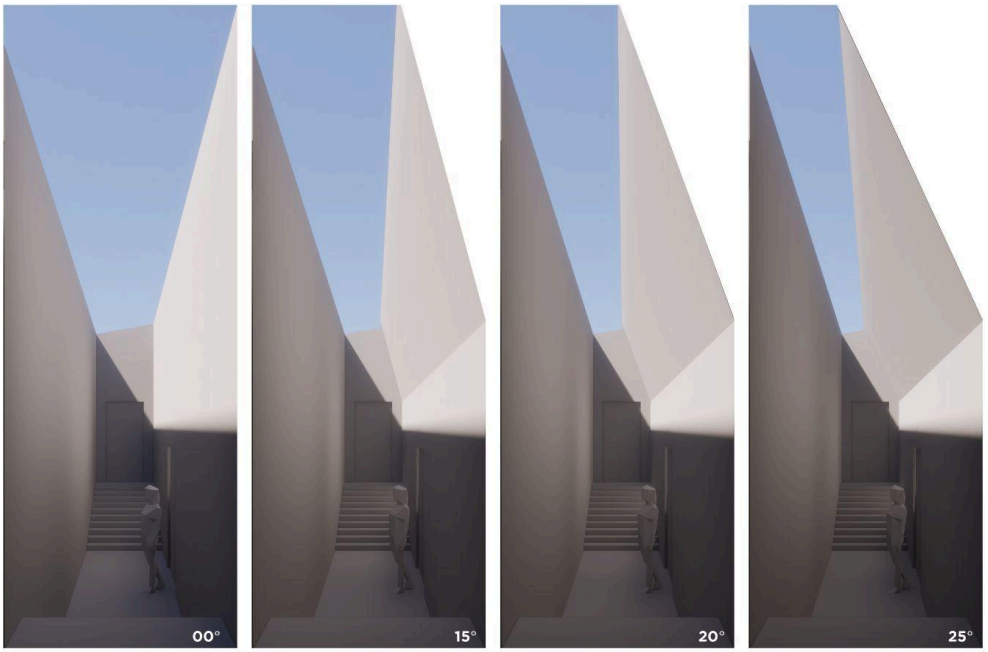


Figure 100: Corridor: Skylight Strategies, Angled/Tilted

Aligned along an east-west axis, the corridor receives strong, direct sunlight from above. This orientation introduces challenges and opportunities for choreographing dynamic light. As a transitional spine connecting the bathhouse's primary spaces, the corridor's daylighting strategy emphasizes clarity, rhythm, and visual momentum.

To explore how light can be modulated across this linear volume, a series of surface angle tests are conducted, varying the tilt of surfaces at 0°, 15°, 20°, and 25°. These angles influenced how light enters and is distributed along the walls and floor:

- 0° (fully open) allows maximum daylight penetration but produces harsh glare and limited control.
- 15° and 20° tilts introduce a more balanced condition, softening intensity while permitting directional flow.
- 25° tilt provides the most diffuse effect, emphasizing rhythm through moving light traces while reducing visual discomfort.

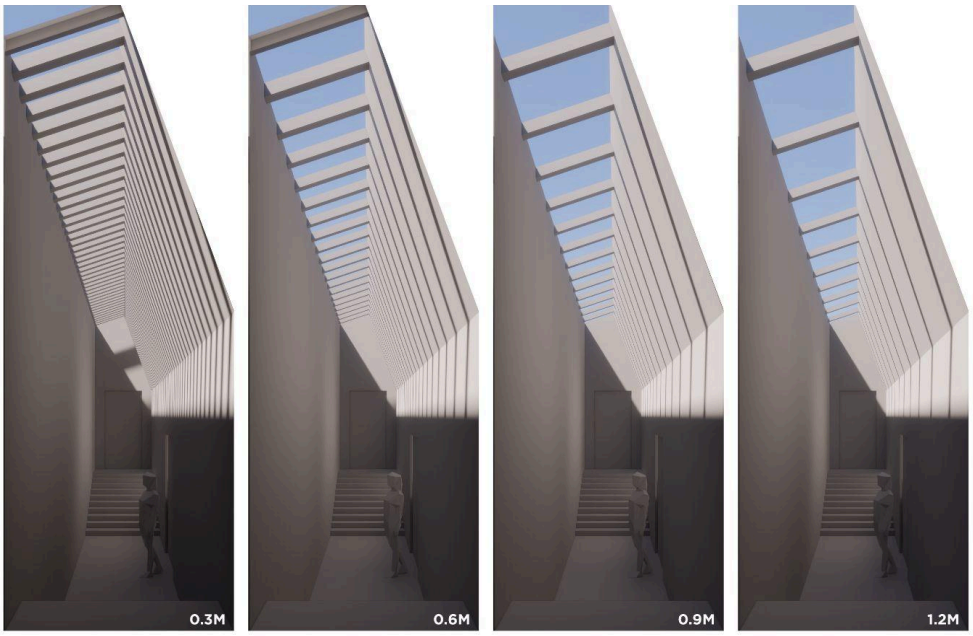


Figure 101: Corridor: Skylight Strategies, Distribution of Beams

To further refine the corridor's spatial quality, a series of tests are conducted on the spacing of overhead beams, evaluating intervals at 0.3 m, 0.6 m, 0.9 m, and 1.2 m. Each configuration influences the rhythm, density, and movement of light across the narrow volume.

Tighter intervals (0.3 m and 0.6 m) create a dense, repetitive pattern that overwhelms the corridor with visual noise. The widest spacing (1.2 m) results in uneven illumination and disrupts the sense of progression. The selected 0.9 m spacing offers the most balanced outcome, establishing a clear yet unobtrusive rhythm of light and shadow.

Paired with light wells above, the beams reflect and diffuse daylight, shaping a dynamic sequence of alternating brightness and shade. This configuration controls the intensity and animates the corridor with a legible rhythm that reinforces movement and orientation, blending performance with atmosphere.

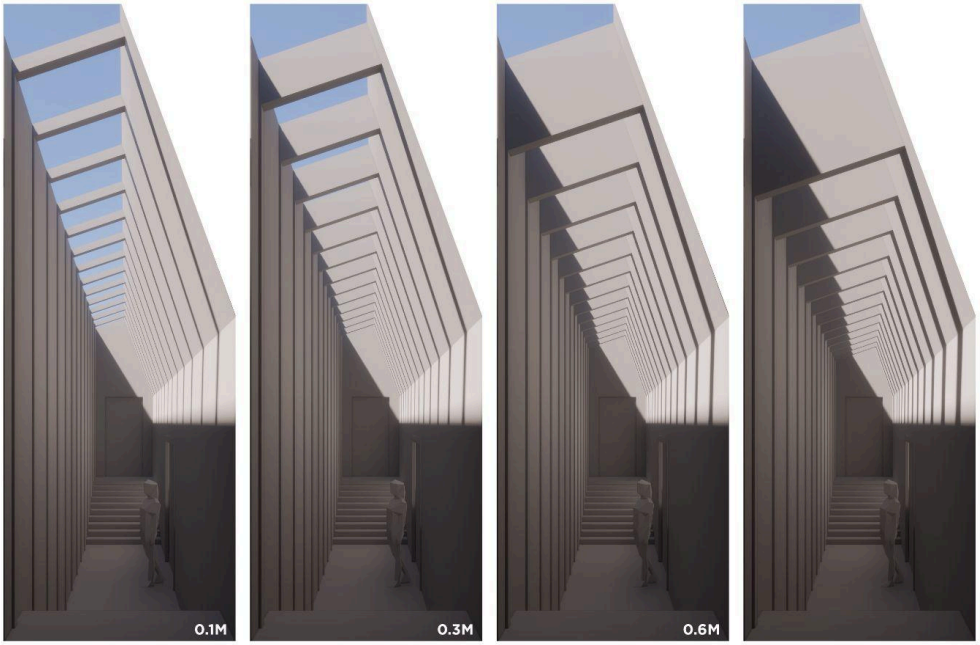


Figure 102: Corridor: Skylight Strategies, Depth of Beams

In parallel, beam depth is tested at 0.1 m, 0.3 m, 0.6 m, and 0.9 m to assess how thickness would influence shadow density, visual weight, and overall spatial clarity. Deeper beams (0.6 m and 0.9 m) produce strong, heavy shadows that interrupt the corridor's continuity and reduce its openness. While the 0.3 m depth offers a moderate effect, it still introduces unnecessary bulk within the confined space.

The final configuration adopts the shallowest option, 0.1 m depth (Figure 102 left), which delivers subtle shadow articulation without visually crowding the volume. Combined with the previously selected 0.9 m beam spacing and tilted ceiling surface angled at 25 degrees, this strategy ensures a refined daylight modulation. It balances rhythm and guiding movement while maintaining a light, expansive atmosphere that aligns with the corridor's transitional role in the bathhouse sequence.

6.2.4. Cold Plunge

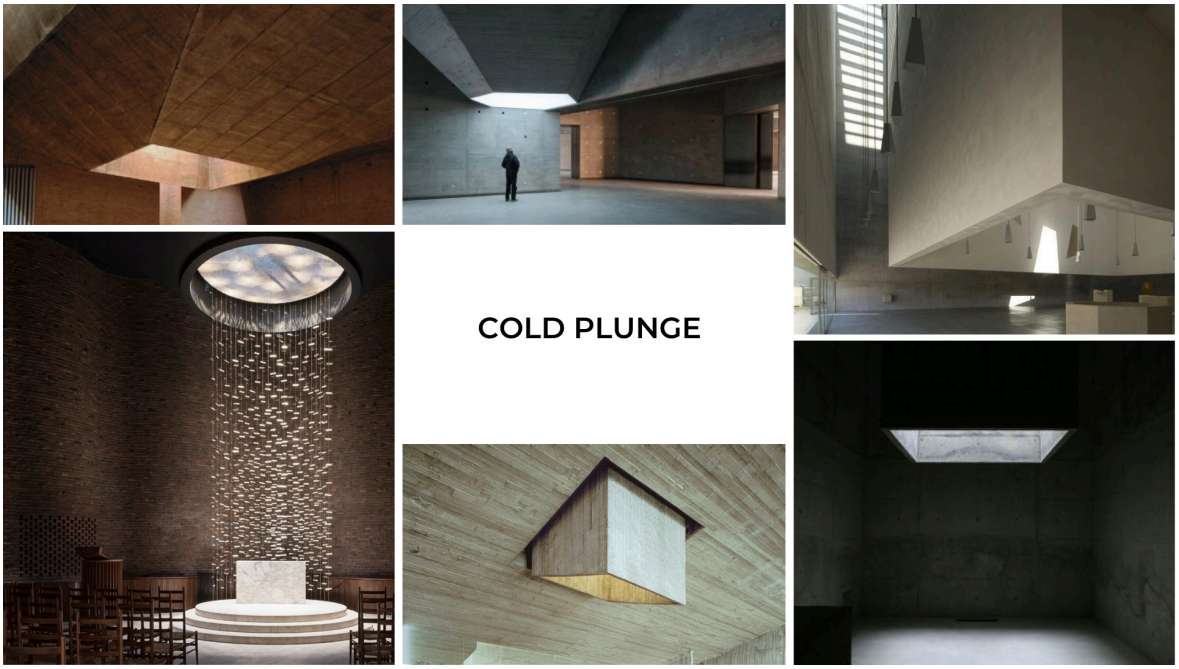


Figure 103: Cold Plunge: Moodboard

Located on the northeast edge of the bathhouse, the cold plunge room receives morning light, offering a quieter quality of daylight. This orientation allows for carefully positioned light entry that emphasizes stillness and clarity, aligning with the room's function as a space for contrast and contemplation.

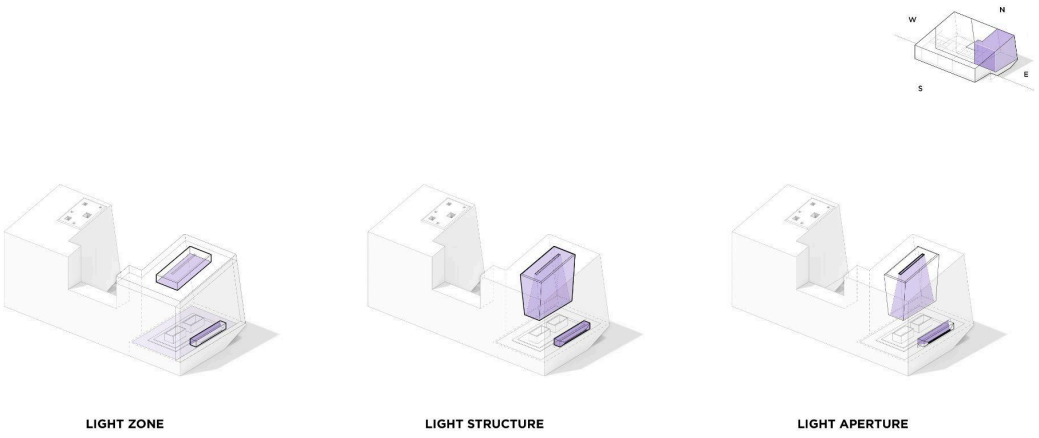


Figure 104: Cold Plunge: Design Strategy

Two distinct daylighting strategies define the spatial atmosphere: a vertical skylight and a horizontal slit opening. Both use tapered surfaces to control light direction and diffusion, enhancing the experience through contrast and visual layering.

The skylight above the plunge basin creates a focused beam that draws the gaze upward. Opening toward the sky, it acts as a focal light source, generating a quiet yet powerful vertical emphasis. Beginning 2.1 meters above the floor and rising to 3.6 meters, the aperture has a base width of 1.2 meters. At the ceiling, it expands into a narrow slot measuring 2.8 meters long by 0.2 meters wide. This tapering geometry allows natural light to enter from above, bouncing off vertical angled surfaces and reflecting softly onto the water below. This produces a layered, immersive light condition that shifts with the morning hours.

Complementing this vertical movement, a horizontal opening on the right-hand wall aligns with the bather's seated perspective. Formed by tapered surfaces, this linear aperture also frames a precise view of the distant horizon. Measuring 3.5 meters long and 0.5 meters high from the interior, it narrows on the exterior to 2.5 meters by 0.1 meters. This taper enhances depth and compression, transforming daylight into a thin, glowing line that defines the visual boundary between interior space and the natural landscape.

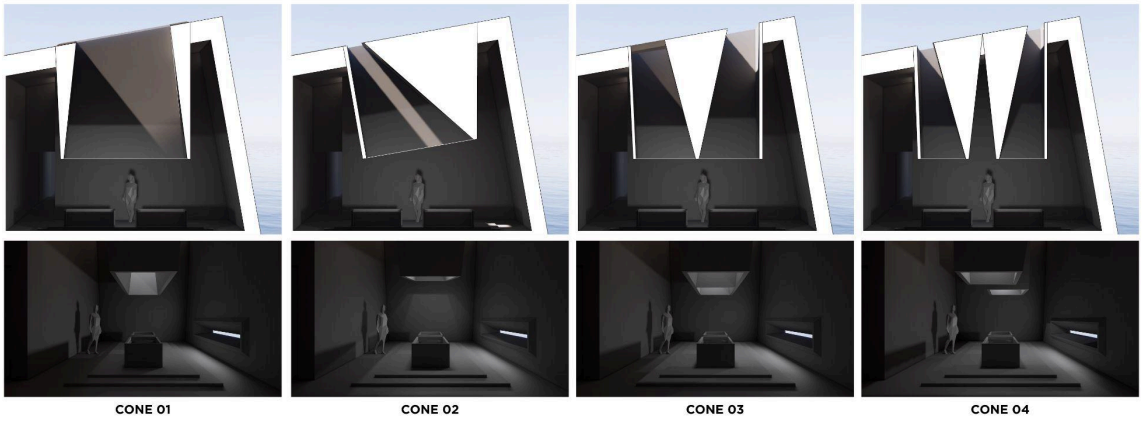


Figure 105: Cold Plunge: Daylight Strategies, Cones

Two configurations are tested to achieve this focused effect: a series of cones and a grid design of smaller openings. The conical form (Figure 105) concentrates light into a single vertical beam, reinforcing the spatial clarity and intensity desired in the plunge. In contrast, the grid design (Figure 106) disperses light too broadly, weakening the intended contrast and focus.

The final design (Figure 105, Cone 01) adopts the singular volumetric cone, whose shape not only sculpts the light but enhances the space's sensory depth, creating a moment of pause and clarity within the overall bathhouse sequence.

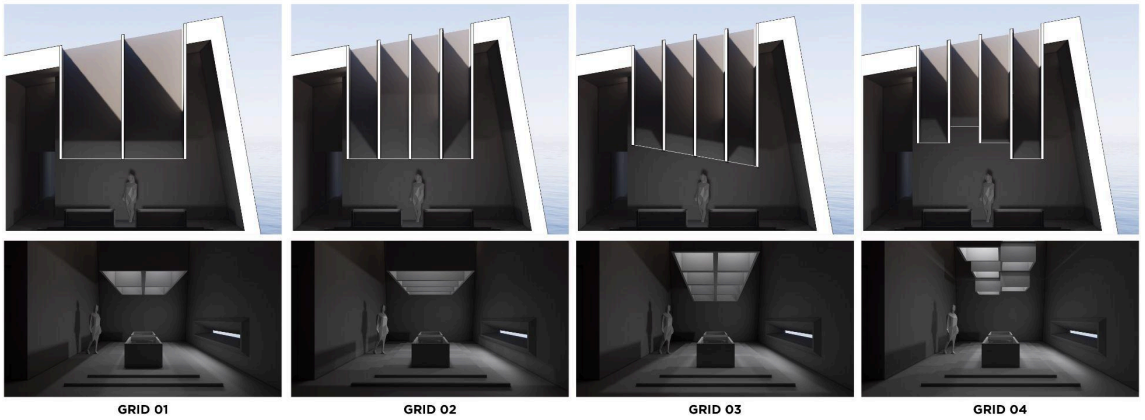


Figure 106: Cold Plunge: Daylight Strategies, Grid

These cone-shaped light structures articulate a relationship between body, light, and view. The vertical skylight invites introspection and openness to the sky, while the horizontal aperture connects the user to the distant landscape. The result is a space of contrasting directions and perceptual balance where cold immersion is softened by calm light, and the spatial narrative unfolds between the earth's grounded line and the sky's boundless expanse.

6.2.5. Spa Pool

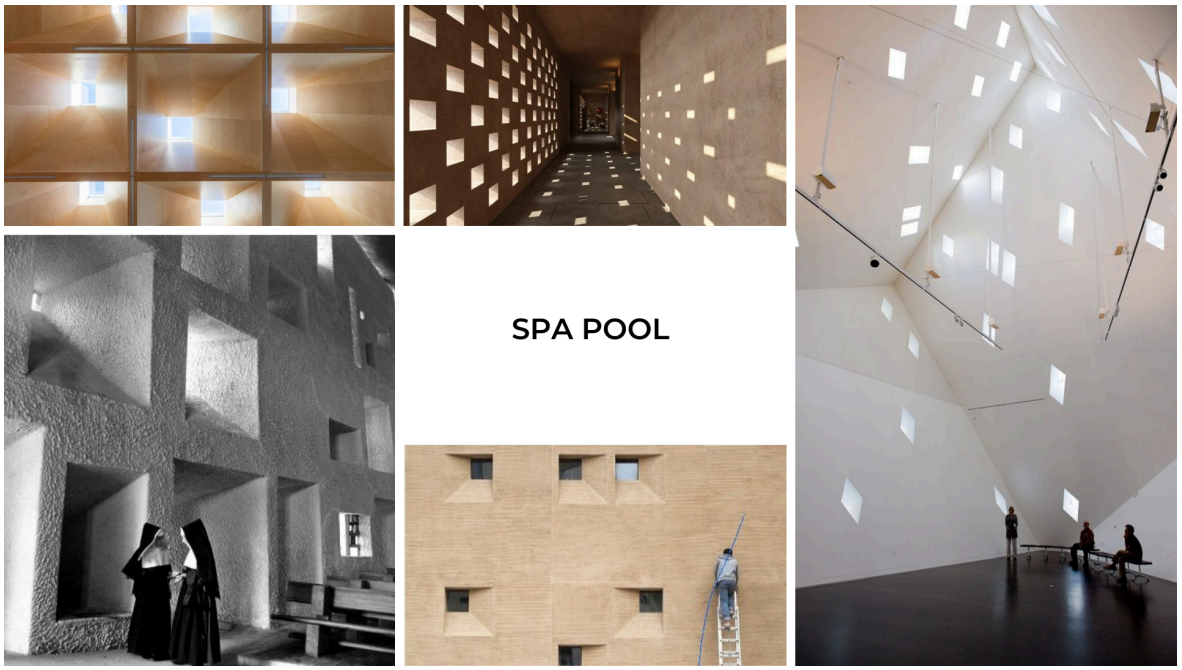


Figure 107: Spa Pool: Moodboard

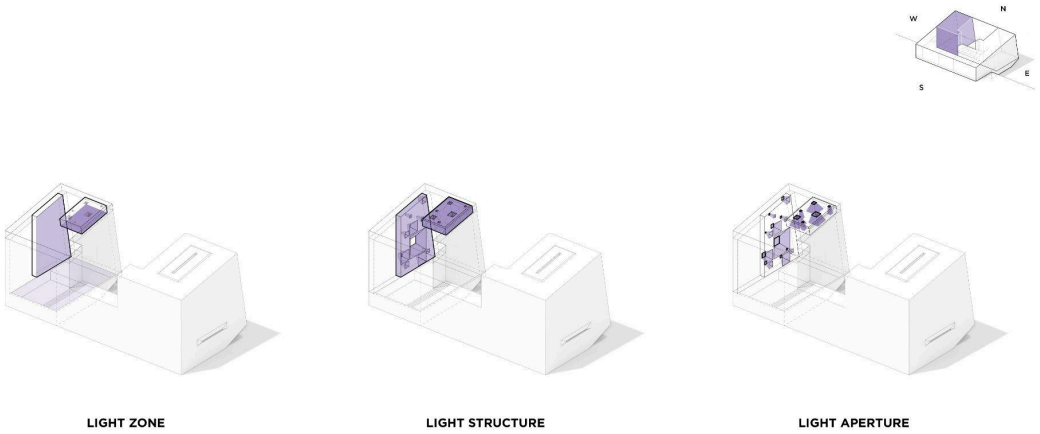


Figure 108: Spa Pool: Design Strategy

Situated on the northwestern edge of the bathhouse, the Spa-Pool Room is conceived as a restorative space, adjusted to the atmospheric conditions of the later hours of the day. The design centers on stimulating the sensory essence of a spa, where glimmering reflections on water surfaces and dispersed daylight contribute to a setting for rest, introspection, and recovery.

To enable this atmosphere, the daylighting strategy uses a modulated system of apertures oriented to shape and filter incoming light. Drawing conceptual inspiration from Le Corbusier's Notre Dame du Haut, the design incorporates a frequent architectural motif: square, tapered light wells. These elements are iteratively evaluated for their ability to engage with shifting solar angles. The apertures animate the space by redirecting and dispersing daylight, casting fluctuating light patterns across walls, ceilings, and water surfaces, while minimizing direct glare. In turn, the water becomes a secondary light source, reflecting light into the space, enhancing the room's immersive and luminous quality.

The light structures are initially positioned along the left wall (Figure 108), responding to the room's orientation and primary use during the afternoon. This lateral daylight entry creates an ambient glow that gently disperses across the interior, reinforcing the room's tranquil atmosphere. However, as the design process advances, it becomes evident that morning and midday light also play a critical role in shaping the spatial experience.

To address this, a second layer of apertures is introduced overhead. These vertical openings, formally aligned with the lateral structures, are designed to intercept higher solar angles, particularly those present earlier in the day. The result is a complementary system of light intake, where both lateral and vertical apertures work together to produce a fine and temporally dynamic daylighting experience responsive to the spa's varied patterns throughout the day.
The testing begins with a gridded framework that organizes the placement of square light structures, establishing a spatial logic for evaluating how aperture quantity, distribution, and typology shape the overall atmosphere.

Three sets of aperture tests are conducted to refine this intent. The first explored the number of perforations (Figure 109), beginning with a single opening, then two, four, and finally seven smaller ones. The final configuration, with seven apertures (Test 04), is selected for its ability to distribute light softly across the space without overpowering it.

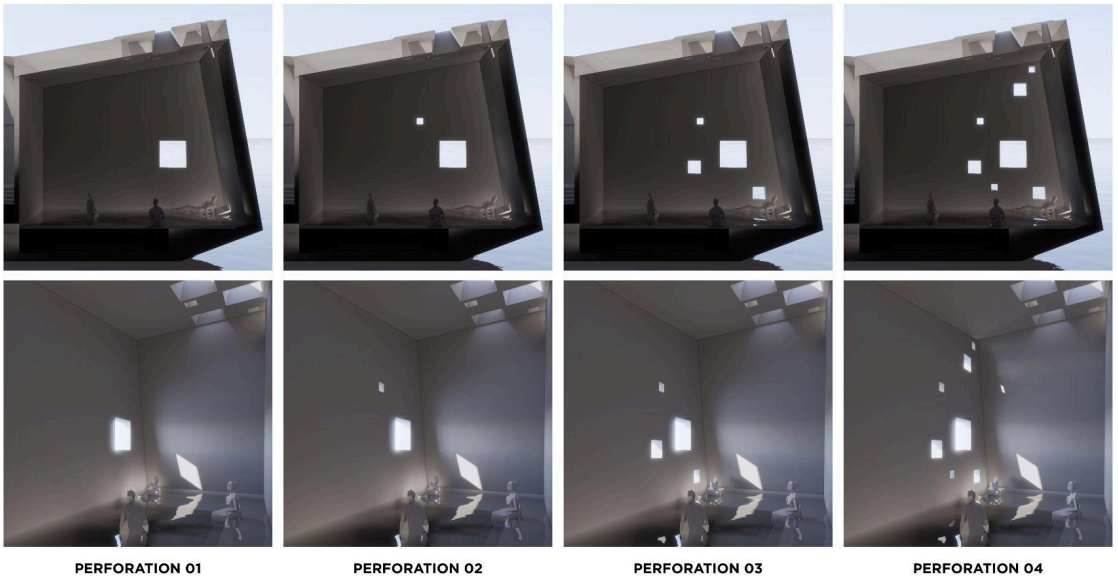


Figure 109: Spa Pool: Daylight Strategies

The second test examined distribution patterns, evaluating variations in placement and density. Configuration 04, Test 04 (Figure 110), proved most effective, balancing visual rhythm with spatial calm.

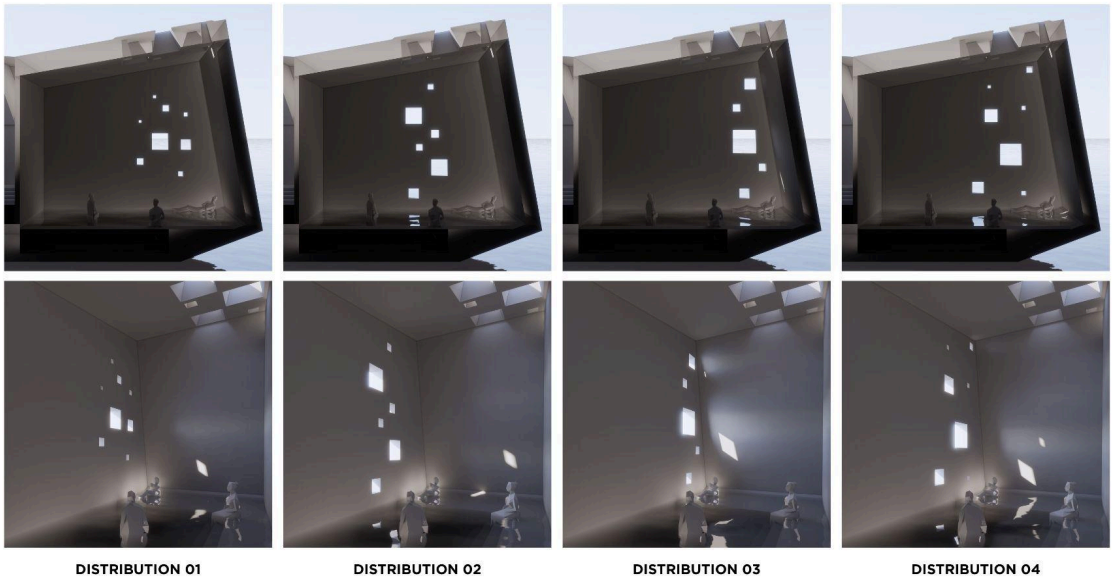


Figure 110: Spa Pool: Daylight Strategies

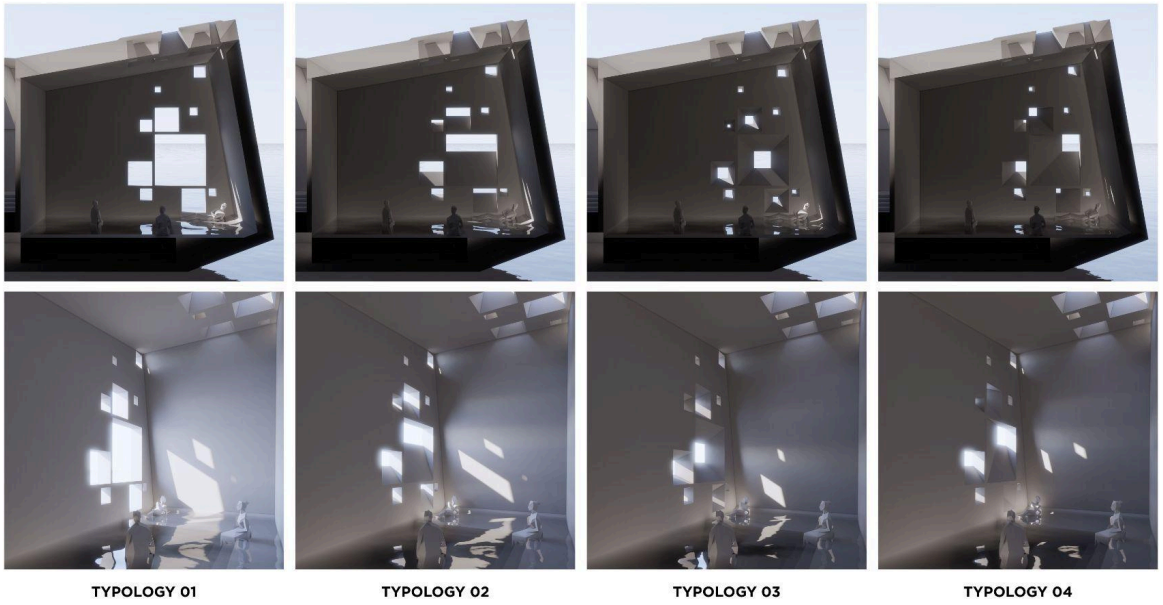


Figure 111: Spa Pool: Daylight Strategies

Lastly, a study of light typologies assessed the character of incoming light. Light Typology 03 (Figure 111) is chosen because it allows indirect illumination to gently activate the surrounding surfaces, reinforcing the immersive quality desired in the Spa Pool environment. Together, these tests shaped an aperture design that supports the sensory experience of the space through softness, subtlety, and continuity.

Iterative Testing and Physical Simulation

Figure 112: Lighting Lab, Royal Danish Academy

To evaluate the spatial and atmospheric role of daylight within the North-West Spa Pool Room, a new series of simulation tests is conducted at the Architectural Lighting Lab of the Royal Danish Academy (Figure 112). This investigation employs physical prototyping within a mirrored artificial sun facility, operating under CIE standard sky conditions to accurately replicate seasonal and temporal variations in sunlight.

The controlled simulation environment allows for precise manipulation of solar angles and light intensity, enabling detailed analysis of daylight behavior and shadow patterns across different times of day and throughout the year.

Experimental Setup and Findings

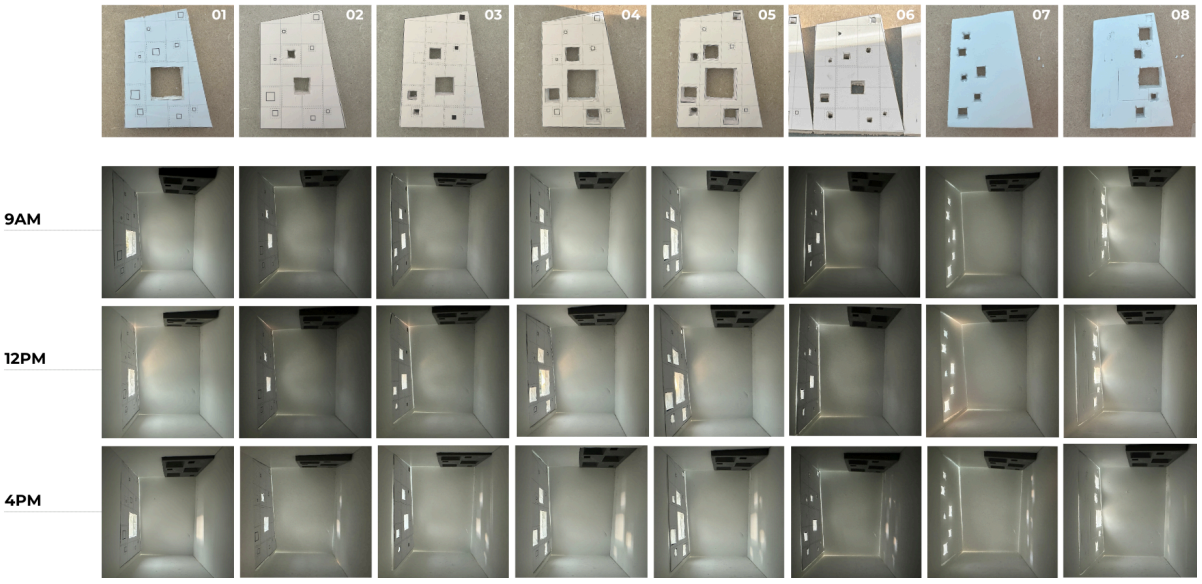


Figure 113: Initial Light Configurations / March Equinox / Clear Sky

The testing sequence begins with initial light structures under clear sky conditions during the March Equinox (Figure 113). Simulations are performed at three pivotal times - 9 AM, 12 PM, and 4 PM - to observe the daily arc of sunlight and its interaction with the early aperture configurations. These first iterations provide a baseline understanding of how direct light enters and moves through the spa space, exposing the limitations and potentials of unrefined geometries.

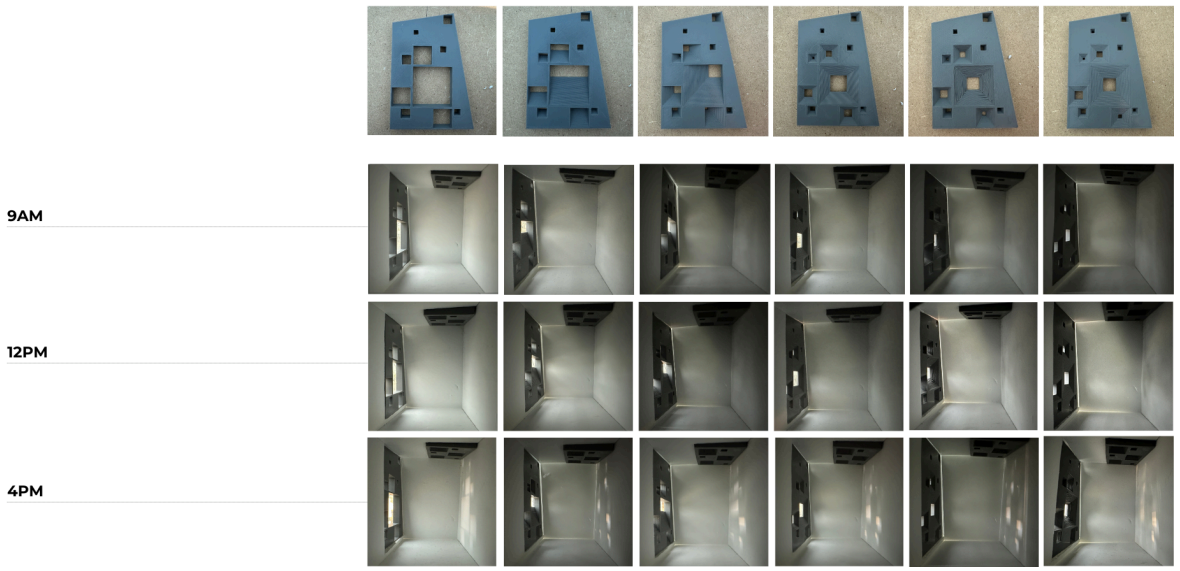


Figure 114: Selected Light Configuration with different angles / March Equinox / Clear Sky

Building upon the initial findings, a hybrid configuration combining elements from Configuration No. 5 and No. 6 is developed and tested, introducing variations in aperture angles and geometries (Figure 114). These iterations are subjected to the same temporal intervals during the spring equinox, enabling comparative analysis under consistent solar conditions. The resulting design adopts an optimized aperture form - smaller openings on the exterior surface and wider reveals on the interior - enhancing the system's ability to modulate daylight accurately. This tapered geometry and angled orientation significantly improve directional light control, allowing the apertures to effectively capture low-angle sunlight during the morning and late afternoon while reducing the intensity and potential glare of the midday sun. The outcome is finely tuned to the temporal and spatial dynamics of the spa-pool room.

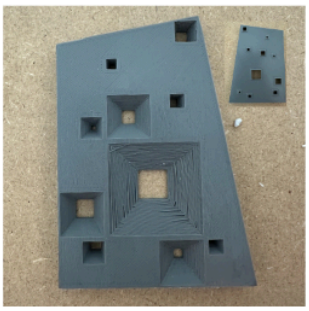


Figure 115: Final Design of Spa's Light Structure

Following the selection of the optimal light structure (Figure 115), the design is further refined by developing a systematic ceiling configuration, applying a consistent formal language of apertures positioned along the left side of the ceiling. This placement responds strategically to the room's orientation and the sun's rotation while ensuring that daylight enters the space obliquely, avoiding direct glare into the eyes of occupants engaged in rest or bathing.

During the March equinox, the configuration undergoes hourly testing from 9:00 to 17:00 (Figure 116), enabling a high-resolution temporal analysis of daylight behavior. The simulations reveal a dynamic modulation of natural light, as shifting solar angles produced a rhythmic interplay of illumination and shadow across the surfaces. This evolving luminous environment reinforced the immersive and contemplative character of the space, aligning with the spa's atmospheric and experiential goals.

Figure 116: Final Design of Spa's Light Structure with same language on the ceiling / March Equinox / Clear Sky

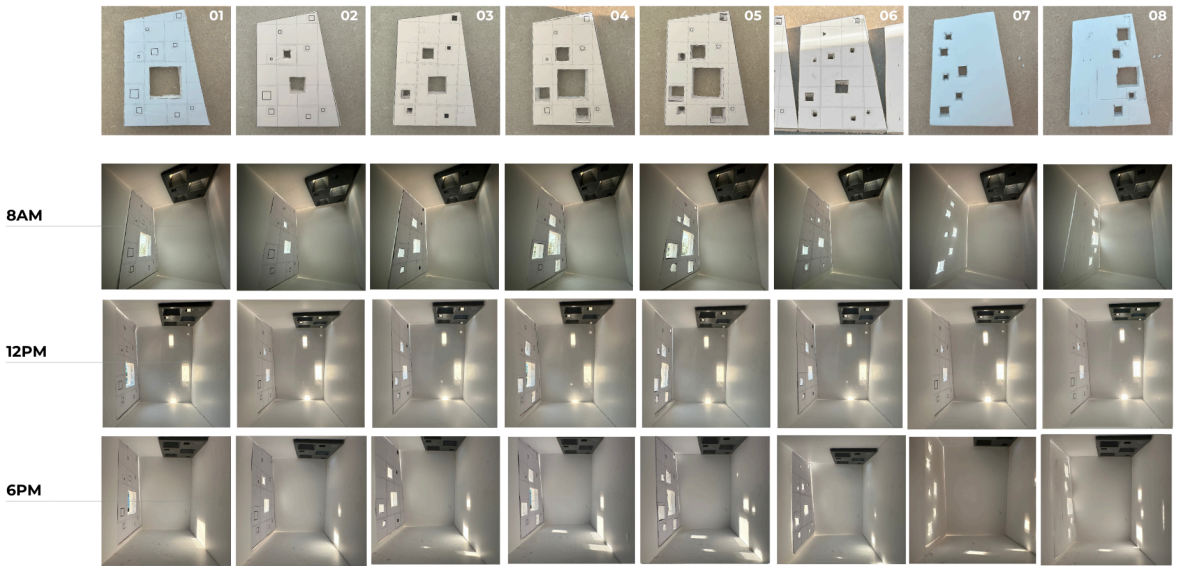


Figure 117: Initial Light Configurations / June Solstice / Clear Sky

To assess the effect of seasonal solar geometry, the same series of configurations is replicated under June solstice conditions. Given the extended duration of daylight during this period, the testing schedule is adjusted to three key intervals: 8:00 AM, 12:00 PM, and 6:00 PM (Figure 117). These simulations capture the effects of higher solar altitudes and longer sun paths, revealing how daylight enters space more vertically and with increased intensity. This shift in solar behavior alters the spatial distribution of light, producing steeper illumination gradients and offering critical insights into thermal exposure and glare potential, particularly during midday and early evening hours.

Figure 118: Selected Light Configuration with different angles / June Solstice / Clear Sky

The tests continue under June solstice conditions to assess performance during extended summer daylight. These configurations, incorporating variations in aperture angles and tapered geometries (Figure 118), are optimized to redirect and diffuse incoming light with heightened precision. Under the intensified solar exposure of summer, the angled structures continue to demonstrate highly responsive behavior, effectively controlling direct sunlight while maintaining visual comfort and enhancing the spatial atmosphere.

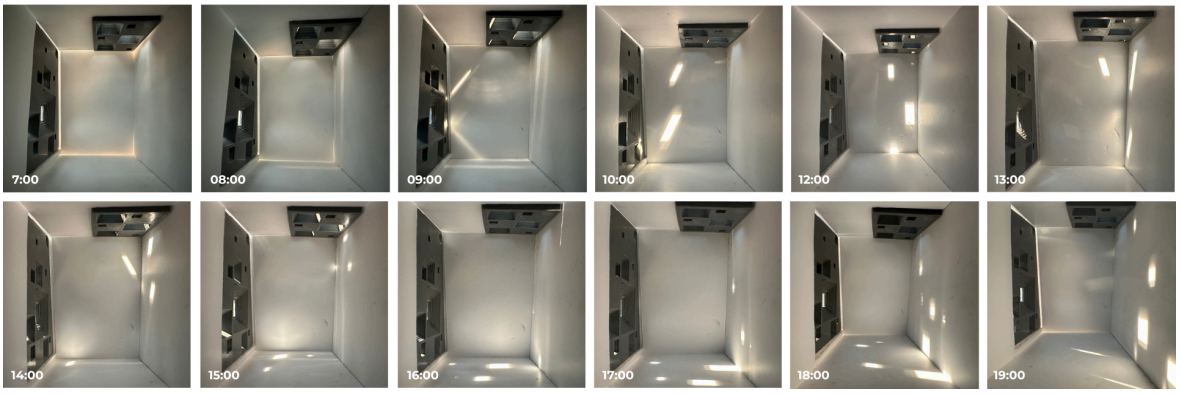


Figure 119: Final Design of Spa's Light Structure with same language on the ceiling / June Solstice / Clear Sky

Integrated into the full-ceiling aperture configuration, the system is tested across a broadened temporal range - from 7:00 AM to 7:00 PM (Figure 119), capturing the sun's whole arc throughout the year's longest days. This comprehensive analysis reveals a finely adjusted temporal choreography of light, evolving from the soft diffusion of early morning to the warm, ambient glow of late afternoon. The result is a continuously shifting luminous environment that reinforces the ritualistic and restorative qualities of the spa pool room, confirming its identity as a spatial shelter defined by daylight.

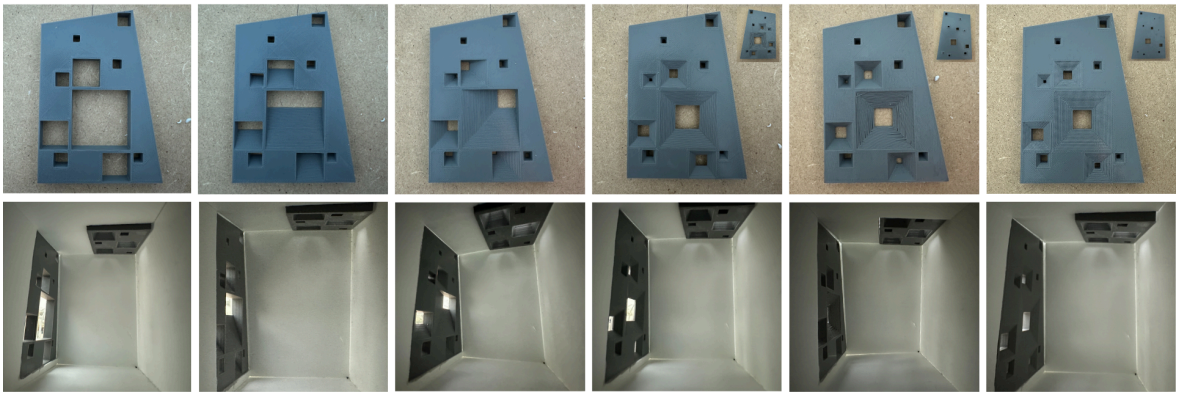


Figure 120: Selected Light Configuration with different angles / Overcast Sky

Finally, a key scenario is tested under overcast sky conditions to address atmospheric variability (Figure 120). Though designed with direct light in mind, the angled apertures still offered diffuse modulation and gentle shadow play, confirming their effectiveness even without strong sunlight.

Through this iterative and seasonally responsive methodology - spanning digital simulation and physical prototyping with real-time solar emulation - the light structures evolve from theoretical formal devices into performative architectural instruments. They frame the spa pool room not only as a place of retreat and reflection but as a temporal chamber defined by the living dynamics of daylight.

6.2.6. Sauna Amphi

Sauna-Amphitheater Room: Diffused Light

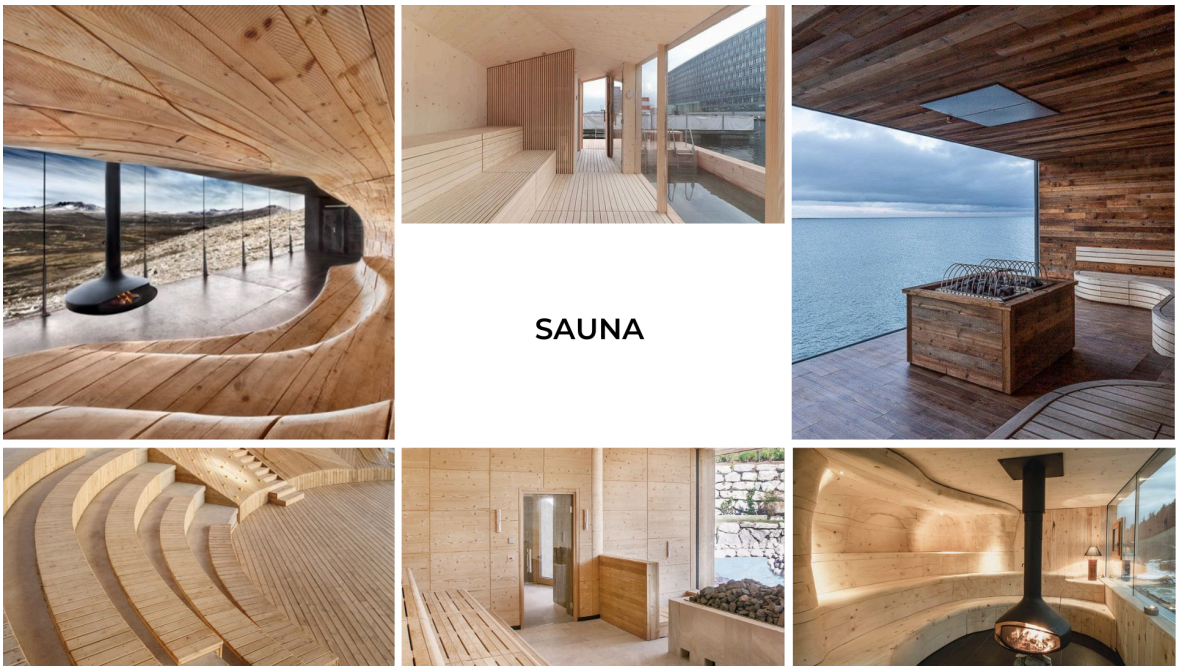


Figure 121: Sauna Amphi: Moodboard

Positioned at the northern edge of the bathhouse complex, the Sauna-Amphitheater is oriented north to receive cool, diffused daylight throughout the day. This deliberate location avoids southern exposure, ensuring a stable thermal environment ideal for a sauna while drawing on the calm, even illumination of the northern sky.

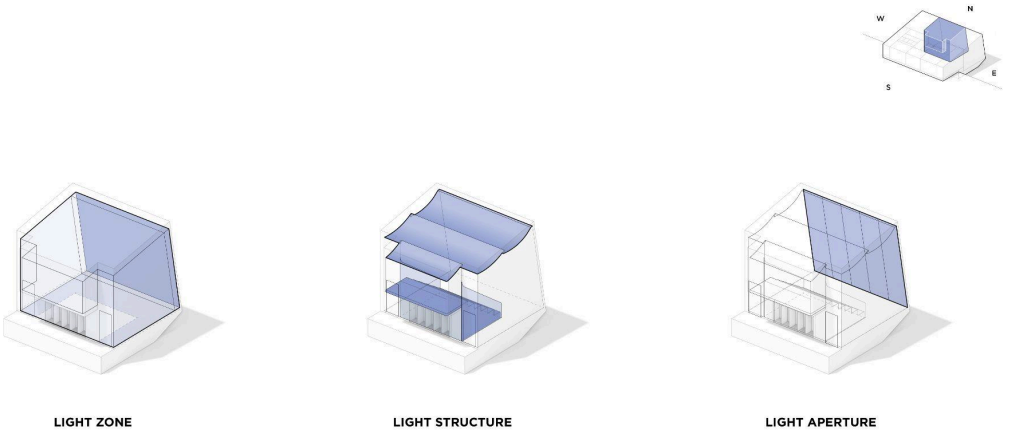


Figure 122: Design Strategy

From the beginning, the conceptual vision for this space shapes a quiet, contemplative chamber where users gather, observe, and reflect. The amphitheater configuration supports this communal function, creating a stepped, inclusive spatial arrangement where each seat offers an unobstructed visual connection to the outside. The interior geometry encourages shared experience and personal introspection, grounding the space in a strong spatial and social identity.

The design supports this vision using a single, expansive aperture, the largest within the entire bathhouse (Figure 122, right). This generous opening draws in as soft, diffuse daylight as possible, emphasizing northern light's ambient, non-directional quality. Unlike other spaces where light is modulated or redirected, the sauna room embraces openness and continuity, allowing the sky's presence to permeate the interior.

This opening brings visual calm and reinforces the amphitheater's architectural narrative. Here, light is not framed or focused but enters freely, settling gently over the wooden surfaces and occupied tiers. The room becomes a luminous void where light defines space not through contrast but through evenness, warmth, and stillness.

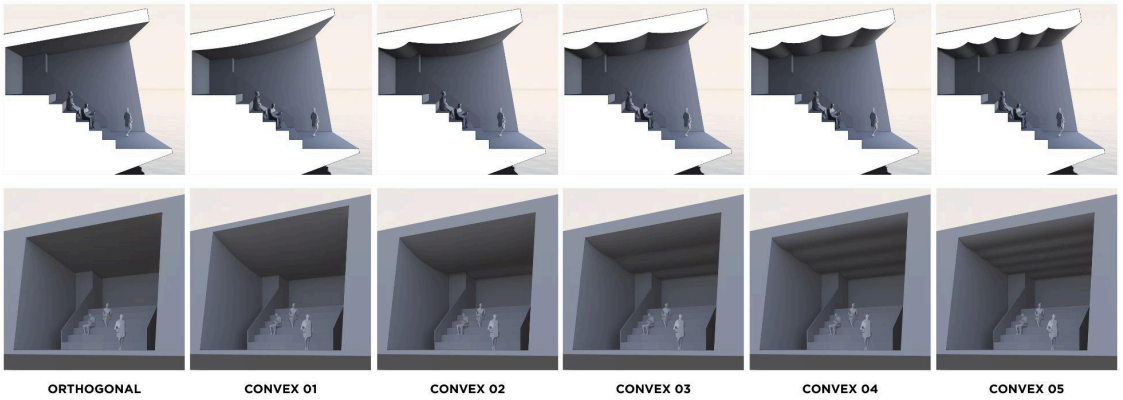


Figure 123: Design Daylight Strategy

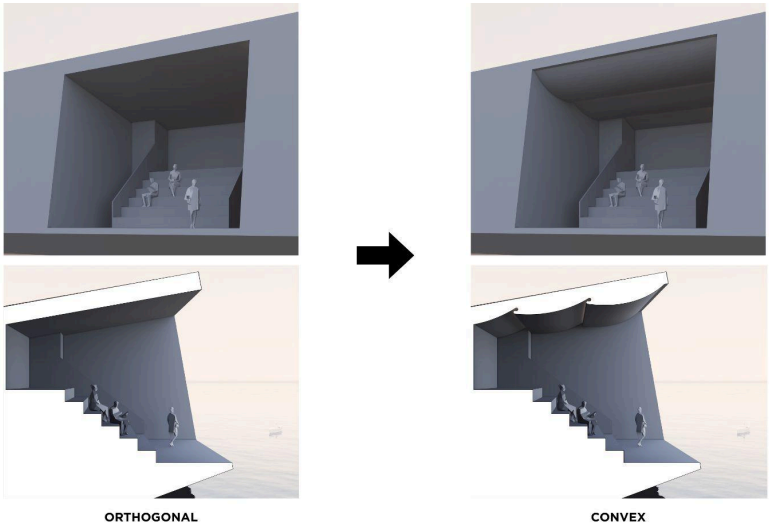


Figure 124: Daylight Strategy Comparison

A key spatial strategy is the introduction of curved forms, both in the roof geometry and the seating tiers. Several variations of convex ceiling designs are tested (Figure 123) to optimize the quality and distribution of ambient light within the sauna. Option No. 3 is the most effective option for admitting soft, diffuse daylight, creating a serene and immersive atmosphere. The chosen convex ceiling (No3) and gently curved seating tiers soften spatial perception and shape how light moves through the space. The filleted corners of each seating facilitate a smooth flow of daylight across surfaces, preventing harsh shadows.

The benefits of this curved design become clear compared to a conventional orthogonal-shaped room (Figure 124). The orthogonal geometry creates sharp contrasts to flat surfaces, and its angles interrupt light paths. In contrast, the sauna-amphitheater's convex ceiling and rounded tiers modulate incoming daylight much like Jørn Utzon’s Bagsværd Church, scattering light to evoke stillness and calm.

6.3. Final Design Proposal

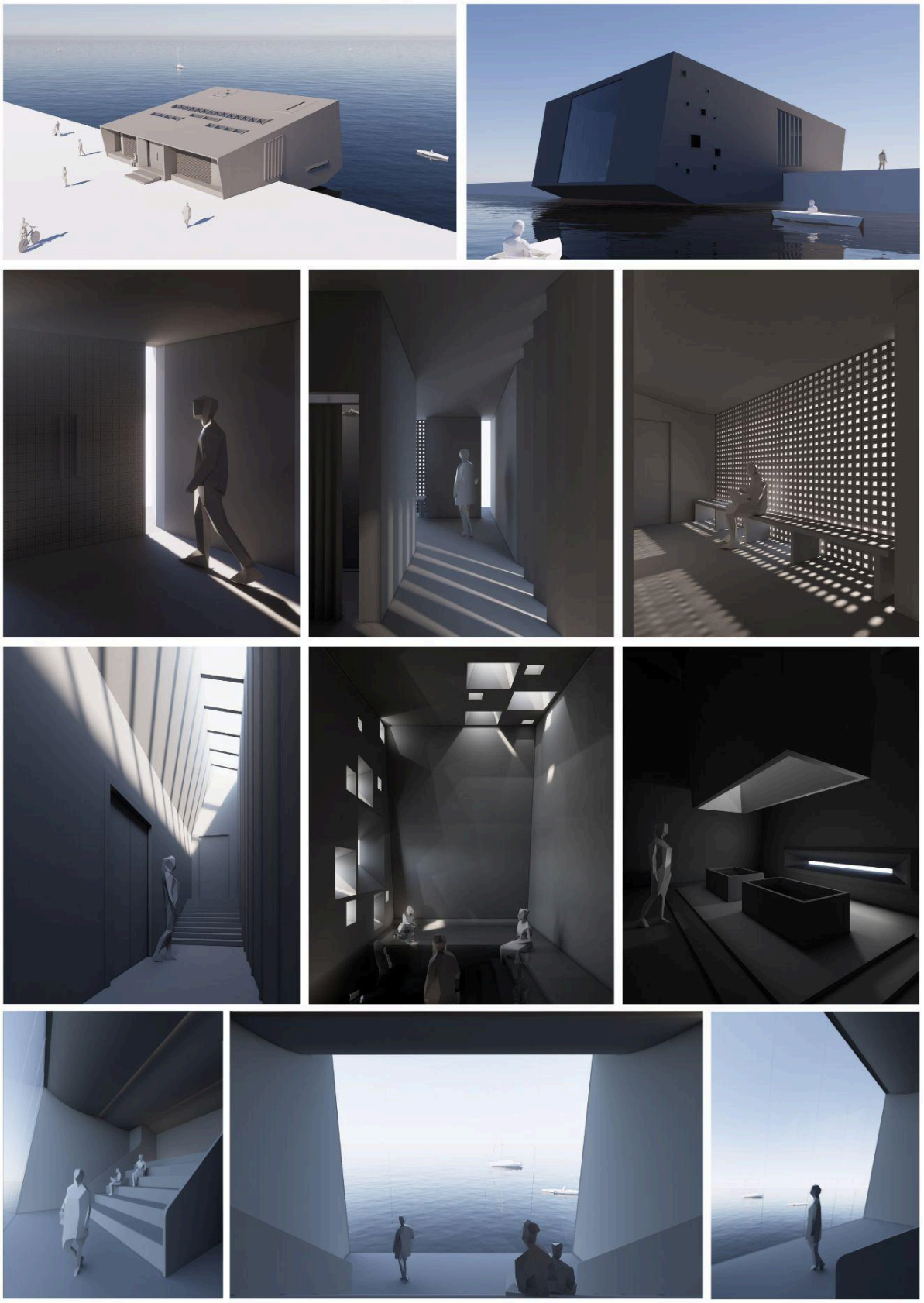


Figure 125: Final Design

7. Discussion: Validation of Hypotheses and Design Analysis

The investigation across the six spatial zones of the bathhouse confirms that daylight functions as a generative architectural element, shaping spatial experience, structure, and meaning. Each room reveals how the atmosphere emerges through the program, daylight type, and light structures. In this way, the design process affirms the three core hypotheses underpinning the research:

7.1. Evaluation of Hypothesis 1: Program

This hypothesis proposed that the characteristics and orientation of each programmatic element within the bathhouse directly inform its daylighting strategy. Each spatial component - changing rooms, transitional corridors, cold plunge, spa pool, and sauna - requires distinct lighting conditions shaped by privacy, movement, thermal needs, and the desired sensory atmosphere.

For example, north-facing spaces like the sauna benefit from generous, diffused daylight, reinforcing a sense of openness, energy, and warmth, complementing the space's active and social function. Conversely, more introspective areas, such as the spa pool and cold plunge, thrive under subtle, indirect lighting, which preserves a feeling of intimacy, calm, and retreat. These environments depend on a nuanced modulation of daylight to support emotional comfort and slower, restorative experiences.

Therefore, the light structures in these spaces were carefully designed and adjusted to reflect programmatic function and solar orientation, revealing a deep interdependence between spatial intention and luminous quality. This approach demonstrates that a responsive and meaningful daylighting strategy cannot be universal but must be tailored to each space's specific behavioral, emotional, and environmental needs within the architectural composition.

7.2. Evaluation of Hypothesis 2: Types of Daylight

This hypothesis examined how direct, diffuse, and reflected daylight generate distinct spatial conditions influencing users' emotional and sensory experiences. Through the integration of precise aperture design (light structures), the project investigated how different qualities of light could be manipulated to support a range of functional needs and atmospheric intentions within the bathhouse.

Direct daylight was used sparingly and with deliberate intent, introduced through narrow, focused openings to create punctuated moments of intensity and visual contrast. These beams of sunlight mark transitions or accentuate specific elements, fostering awareness and presence. In comparison, diffused light, achieved through layered surfaces, skylights, and perforated surfaces, generated a soft, ambient glow, particularly suited to spaces oriented toward ritual, contemplation, and slow movement. This gentle luminance minimizes glare and sharp shadows, promoting visual comfort and emotional calm.

In more enclosed or inward-facing spaces, reflected light became the primary medium. By giving depth to the design of the aperture using angled surfaces and additionally having the roof angled by 10 degrees, daylight was effectively captured and redirected, creating a muted, immersive atmosphere. This technique allowed natural light to reach deeper into the space, maintaining luminosity while preserving privacy and intimacy.

Together, these three modalities of daylight shaped diverse atmospheric tones across the bathhouse and affirmed the hypothesis that distinct light types can be strategically placed to support varying programmatic, emotional, and sensory outcomes. The result is a spatial composition where light does not merely illuminate but actively orchestrates the user's experience.

7.3. Evaluation of Hypothesis 3: Light Structures

The third hypothesis investigated how the form, scale, and distribution influence daylight performance and space perception. The design process approached light structures - including extruded forms, tapered openings, and deep light wells - as active architectural elements that helped elevate the user's sensory and emotional experience.

These structures served multiple functions: they framed specific views, regulated light intensity, and orchestrated transitions between brightness and shadow. Through iterative adjustments to depth, orientation, and surface finish, the light structures generated a temporal rhythm of illumination that corresponded with the spatial sequence of movement through the bathhouse. This approach emphasized daylight's kinetic and narrative dimension, turning each space into a unique atmosphere.

The hypothesis was stated through both simulation and physical testing. These interventions increased sensory immersion, drawing attention to changing conditions and enhancing the architecture's experiential depth. In doing so, the project reveals the latent potential of light structures as architectural devices - elements that embody and express the architectural intent.

7.4. Integration of Findings: Program, Space, and Light

The evaluations argue the interdependence between program, spatial form, and daylight. Programmatic requirements dictated where and how daylight should enter, with each space demanding its luminous conditions based on use, privacy, and rhythm of occupation. In response, light structures functioned as precise architectural instruments, capturing, filtering, and directing light to support the intended spatial atmosphere.

The resulting spatial experience emerged from an interplay between multiple layers: function, light type, orientation, and geometry. Light became integral to architectural meaning and experience; more than a means of illumination, it animated the building as a lived atmosphere. In this synthesis, architecture reveals itself through light, where each moment of brightness or shadow deepens the user's emotional and perceptual engagement.

This integrated design approach elevates daylight from a technical component to a spatial scaffold that guides movement, shapes emotional tone, and enhances comfort without

reliance on artificial lighting. The findings position daylight as a foundational architectural structure and narrative element, crucial to the bathhouse's performance.

7.5. Reflection on Methodology and Design Process

The research-by-design methodology proved to be a highly effective framework for exploring, testing, and refining daylight-responsive architectural strategies. Digital modeling tools such as Rhinoceros 3D and Enscape allowed for the precise manipulation of aperture geometries and enabled real-time simulations of light behavior under varying spatial and temporal conditions. This digital experimentation was expanded through physical prototyping and simulation testing conducted at the Architectural Lighting Lab of the Royal Danish Academy in Copenhagen. There, 1:50 scaled models were examined under an artificial sun and CIE standard skies, providing a controlled environment to study how light interacts with geometry across seasonal and daily cycles.

This combination of digital and physical tools formed a rigorous iterative process where conceptual strategies could be tested and refined in response to measurable outcomes and sensory observations. The physical tests, in particular, revealed how orientation and surface articulation affect light distribution and how slight geometric changes can lead to thoughtful shifts in spatial experience, from brightness and contrast to mood and rhythm.

This integrated design methodology clarified that working with daylight requires a careful equilibrium between spatial intuition and technical precision. The synthesis of environmental performance data, sensory perception, and programmatic insight allowed daylight to emerge as a central, performative, and poetic force in the architectural process. In this context, the light operates as an architectural driver, shaping the emotional tone, guiding movement, and structuring the experiential depth of the built environment.

8. Conclusion: Daylight and Light Structures

8.1. Revisiting the Vision and Research Question

From its inception, this thesis posed a speculative yet fundamental question: *What if daylight could become a primary architectural driver that informs shape, guides movement, and choreographs atmospheres?* This inquiry framed the design research on how careful design and integration of light structures could enrich a bathhouse's functional performance and atmospheric experience in the Nordic context.

Through the development, testing, and iterative refinement of a series of spatial configurations, evaluated via digital simulation, 3D modeling, and physical prototyping, the research declared the central role of daylight in architectural formation. The validation of three interrelated hypotheses demonstrated that the program, the type of daylight (direct, diffused, or reflected), and the light structures (form, scale, and distribution) significantly influence spatial and emotional resonance.

The findings show that when daylight is treated as an architectural structure in its own right, it becomes more than a means of illumination. It emerges as a generative force capable of defining space, articulating programmatic distinctions, and crafting atmospheric experiences. In this context, light structures are not just technical interventions; they are architectural instruments that mediate between performance and poetics, between environmental responsiveness and human perception.

Thus, the research question "*How can the design and integration of different light structures enhance both the functional performance and atmospheric experience of a bathhouse within the Nordic context?"* is answered: Daylight can, and should, be considered a primary architectural driver. When thoughtfully conceived, light structures can support functional clarity, enhance thermal and visual comfort, and evoke deep sensory and emotional experiences.

8.2. Synthesis of Key Insights

The research offers key insights into the architectural use of daylight:

- **Daylight Types and Spatial Atmosphere**

  The type of daylight - whether direct, diffused, or reflected - significantly influences interior spaces' sensory and emotional atmosphere. Each variation generates distinct qualities: sharp beams of direct light define circulation areas like foyers and corridors, while the cool, even tones of diffused light foster introspection in the sauna. Reflected light, in turn, creates ambient softness that enhances intimacy in enclosed, moist environments. These effects are not incidental but intentionally choreographed to reinforce each space's mood and function.

- **Programmatic Function and Spatial Orientation**

  Effective daylighting begins with a clear understanding of programmatic needs and spatial orientation. The characteristics and placement of each program zone -

whether a cold plunge, sauna, or spa pool - directly inform how light is introduced. Daylight becomes a tailored tool, enhancing both functional clarity and emotional tone. South-facing areas receive vibrant, welcoming light, while more inward-facing or private spaces are lit softly to preserve a sense of retreat. Tailoring light to each zone's orientation ensures visual comfort and an immersive experience.

- **Light Structures as Spatial Instruments**

  The form, scale, and distribution of light structures - grids, skylights, tapered walls, and layered apertures - play a critical role in mediating daylight. These are openings and calibrated instruments that modulate light, shape perception, and articulate spatial rhythm. Through iterative prototyping and simulation, the design hones these geometries to respond precisely to the changing qualities of daylight, supporting a range of sensory conditions while demonstrating a high level of spatial intentionality.

- **Toward a Holistic Daylighting Approach**

  A successful daylighting strategy integrates type, program, and geometry into a cohesive architectural language. Rather than isolating light as a technical component, it is embedded as a generative force that unites sensory experience with spatial logic. When programmatic clarity aligns with atmospheric sensitivity, the result is an architecture that breathes with time, resonates emotionally, performs functionally, and remains attuned to its context.

9. Future Works and Limitations

9.1. Future Directions and Final Thoughts

The investigation began with the valuable question, "*How can daylight enhance function?*" and gradually unfolded into a deeper recognition of daylight as a spatial ethos: a quiet yet powerful force that organizes architecture from within. The work proposes a way of seeing in which structure and atmosphere are inseparable, and light is given deliberate form, rhythm, and intention.

Though focused on the bathhouse as a case study, the findings extend beyond this typology. The principles explored daylight as a programmatic guide and atmospheric agent, which resonate across various architectural environments concerned with wellness, ritual, and sensory experience. These insights are equally applicable to public, domestic, and therapeutic spaces. Future investigations might apply this approach to different building types or geographic contexts, using advanced simulation tools to refine the performance and nuance of daylight integration.

While form, orientation, and daylight modulation were central to the design process, the study also gestures toward materiality as a critical mediator of daylight. Texture, tone, and surface finish shape how light is absorbed, reflected, and perceived, qualities that are especially important. Further research could examine empirical studies of light-material

interactions, surface thermal response, and responsive or adaptive materials that enhance spatial atmospheres under changing conditions.

At the same time, human experience remains necessary, yet it is underdeveloped in this work. Though visual walkthroughs and simulation offered initial insights, immersive user research could further illuminate how people engage with daylight across time. Perceptual mapping, post-occupancy evaluations, and long-term studies across seasonal cycles would enrich the understanding of comfort, clarity, and emotional resonance, especially in spaces where rhythm and ritual are central to the experience.

This design logic is also open to reinterpretation across regions and cultures. Solar orientation, seasonal dynamics, and local practices offer diverse contexts for adaptation, expanding the framework toward a broader typology of sustainable, light-conscious public architecture.

Taken together, these trajectories point toward a more holistic research scope that bridges intuitive design with technical rigor and material behavior with perceptual depth. When daylight is no longer treated as a byproduct of architectural form but as its generative core, architecture begins to breathe with time and atmosphere. Light becomes the structure of presence, memory, and poetic intensity.

9.2. Project Limitations

Time constraints significantly influenced the scope and depth of this research. While the thesis advances a comprehensive daylighting strategy through iterative design, simulation, and conceptual development, several areas remain underexplored due to limitations in time and resources. These include empirical material studies, in-depth user engagement, and advanced seasonal daylight simulations using expanded physical modeling techniques, all of which offer promising future inquiry directions.

The design process focused primarily on spatial and atmospheric articulation rather than construction-level detailing. As such, systems integration, structural resolution, and buildability were addressed at a conceptual level. Future research could expand this framework to refine technical precision, exploring assembly methods, junction design, and integrating passive and active energy systems.

Material performance was referenced for daylight but was not thoroughly tested. More detailed studies, such as measuring surface reflectance, texture, and thermal response, could yield critical insights into how light interacts with physical surfaces, especially in Nordic climates where seasonal variations dramatically affect material appearance and behavior.

User experience was considered primarily through representational tools, including 3D visualizations and atmospheric narratives. Subsequent research could adopt immersive, user-centered methodologies such as perceptual mapping, behavioral tracking, or longitudinal post-occupancy studies. These approaches would offer more grounded evaluations of how occupants engage with light across different conditions and timescales.

The integration of artificial lighting remains beyond the scope of this study. While natural light serves as the project's primary generative element, electric lighting is essential for ensuring usability during evening hours, overcast days, and long winter nights. Future iterations could explore lighting systems that respond to circadian rhythms, incorporate adaptive controls, and extend the spatial narrative into darker periods without compromising the atmosphere.

Collectively, these limitations mark the boundaries of the current investigation while opening pathways for continued exploration. The bathhouse is a prototype, a testing ground for a broader, light-driven methodology rooted in climatic sensitivity, experiential depth, and material awareness. Future research could deepen this framework by fully integrating daylight performance, material experimentation, and user immersion into a more holistic architectural practice.

Acknowledgment

OpenAI's ChatGPT is acknowledged for its assistance in language refinement and corrections in some parts of the writing process. The tool was used under the author's supervision to improve clarity and grammar.

10. References

Books

- *Architecture and Urbanism*. (2013, July). *Structured to capture light*. A+U Publishing.
- Baker, N., & Steemers, K. (2002). *Daylight Design of Buildings.* Routledge.
- Lewis, P., Tsurumaki, M., & Lewis, D. J. (2016). *Manual of the section*. Princeton Architectural Press.
- Reinhart, C. F. (2014). *Daylighting handbook I: Fundamentals, designing with the sun*. Building Technology Press.
- Steane, M. (2011). *The Architecture of Light: A Textbook of Lighting Design.* Routledge.
- Steane, M. A. (2011). *The Architecture of Light: Recent Approaches to Designing with Natural Light*. Routledge.
- Unwin, S. (2014). *Analysing Architecture.* Routledge.
- Zumthor, P. (2006). *Atmospheres: Architectural Environments - Surrounding Objects.*

Articles + Journals

- Barragán, L. (1948). *Casa Estudio Luis Barragán*. Architectural Journal.
- Madsen, M. (2007). Light-zone(s): As a concept and tool. *Enquiry (Washington, D.C.)*, *4*(1).
- Mardaljevic, J. (2000). *Simulation of annual daylighting profiles.* Lighting Research & Technology.
- Veitch, J. A., Christoffersen, J., & Galasiu, A. D. (2012). *Daylight and view through residential windows: Effects on well-being*. National Research Council of Canada & VELUX A/S.

Websites

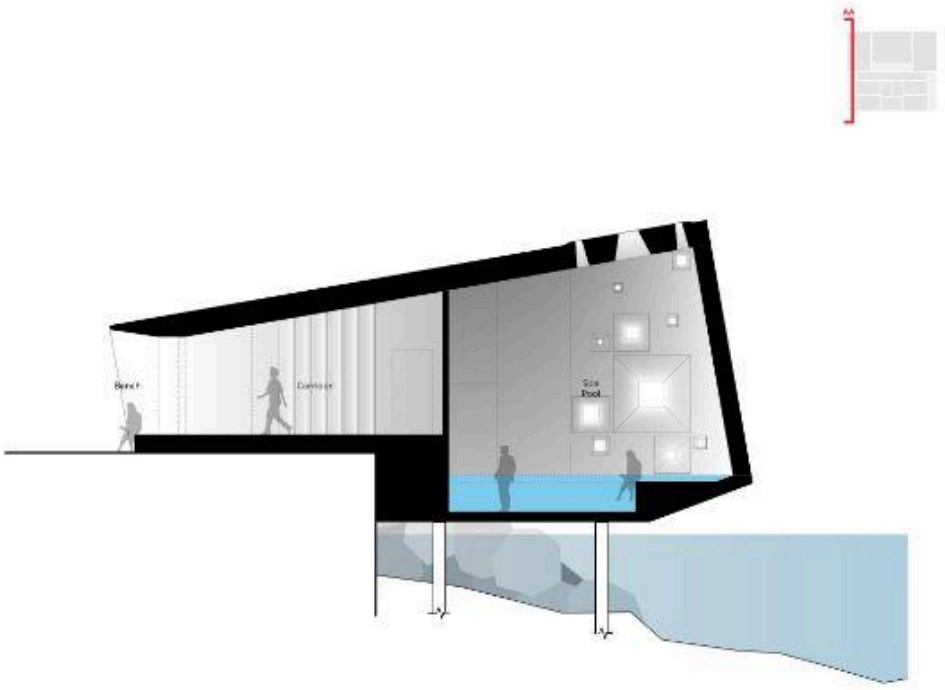
- Aalto, A. (1952). *Säynätsalo Town Hall*. Alvar Aalto Foundation.
- Ando, T. (1989). *Church of the Light*. Tadao Ando.
- Baker, N., & Steemers, K. (2002). *Energy and Environment in Architecture: A Technical Design Guide*. Taylor & Francis.
- Boyce, P. R., Hunter, C., & Howlett, O. (2003). *The Benefits of Daylight through Windows*. Rensselaer Polytechnic Institute.
- Çelik, Z. (2008). *The Remaking of Istanbul: Portrait of an Ottoman City in the Nineteenth Century*. University of California Press.

- González-Longo, C., & Theodossopoulos, D. (2010). *The Roman Bathhouse in Britain: Light and Shade in the Architecture of Bathing*. *Journal of Architectural History*, 69(1), 45–67.
- Heschong, L. (1979). *Thermal Delight in Architecture*. MIT Press.
- Holl, S., Pallasmaa, J., & Pérez-Gómez, A. (2006). *Questions of Perception: Phenomenology of Architecture*. William Stout Publishers.
- Kahn, L. (1974). *Louis Kahn: The Kimbell Art Museum*. *Architectural Review*, 155(935).
- Kellert, S. R. (2008). *Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life*. John Wiley & Sons.
- Le Corbusier. (1931). *Villa Savoye*. ArchDaily.
- Lechner, N. (2014). *Heating, Cooling, Lighting: Sustainable Design Methods for Architects*. John Wiley & Sons.
- Lechner, N. (2015). *Heating, Cooling, Lighting: Sustainable Design Methods for Architects*. John Wiley & Sons.
- Necipoğlu, G. (1995). *The Age of Sinan: Architectural Culture in the Ottoman Empire*. Princeton University Press.
- Norberg-Schulz, C. (1980). *Genius Loci: Towards a Phenomenology of Architecture*. Rizzoli.
- Pallasmaa, J. (2005). *The Eyes of the Skin: Architecture and the Senses*. Wiley.
- Plummer, H. (2009). *Poetics of Light in Architecture*. Architectural Press.
- Siza, A. (2008). *Ibere Camargo Museum*. El Croquis.
- Szokolay, S. V. (2014). *Introduction to Architectural Science: The Basis of Sustainable Design*. Routledge.
- Yegül, F. (1992). *Baths and Bathing in Classical Antiquity*. MIT Press.
- Zumthor, P. (1996). *Therme Vals*. Birkhäuser.
- Zumthor, P. (2006). *Thinking Architecture*. Birkhäuser.

List of Figures:

Figure 22: Gallo, A. (2017, December 8). *Six Architects - Le Corbusier*. Arthur.io. https://arthur.io/art/andrea-gallo/six-architects-le-corbusier
Figure 23: Frearson, A. (2011, September 28). *Daylight House by Takeshi Hosaka*. Dezeen. https://www.dezeen.com/2011/09/28/daylight-house-by-takeshi-hosaka/
Figure 24: Frearson, A. (2011, September 28). *Daylight House by Takeshi Hosaka*. Dezeen. https://www.dezeen.com/2011/09/28/daylight-house-by-takeshi-hosaka/
Figure 25: ARCHISCAPES. (2015, April 6). *The art of sketches | Renzo Piano*. WordPress. https://archiscapes.wordpress.com/2015/04/06/the-art-of-sketches-rpbw/
Figure 26: Middleton, W. (2025, April 14). *Double Vision*. Arquitectura Viva. https://arquitecturaviva.com/libros/double-vision
Figure 27: Jesydesigns. (2018, March 27). *Daylight: Bagsværd Church*. WordPress. https://jesydesigns.wordpress.com/2018/03/27/daylight-bagsvaerd-church/
Figure 28: Fawakherji, I. (2023, January 7). *Bagsværd Church, 1976 I Jørn Utzon*. ArchUp. https://archup.net/bagsvaerd-church-1976-i-jorn-utzon/
Figure 29: Author's Illustration.
Figure 30: Author's Illustration.
Figure 31: Author's Illustration.
Figure 32: Author's Illustration.
Figure 33: Author's Illustration.
Figure 34: Author's Illustration.
Figure 35: Author's Illustration.
Figure 36: Author's Illustration.
Figure 37: Author's Illustration.
Figure 38: Author's Illustration.
Figure 39: Author's Illustration.
Figure 40: Author's Illustration.
Figure 41: Author's Illustration.
Figure 42: Frearson, A. (2012, November 14). *Parrish Art Museum by Herzog & de Meuron*. Dezeen. https://www.dezeen.com/2012/11/14/parrish-art-museum-by-herzog-de-meuron-2/
Figure 43: Biju, A. (2025, May 7). *10 Stunning examples of Earth Architecture around the world*. RTF | Rethinking The Future. https://www.re-thinkingthefuture.com/rtf-fresh-perspectives/a1627-10-stunning-examples-of-earth-architecture-around-the-world/
Figure 44: Merin, G. (2013, August 25). *AD Classics: Saint Benedict Chapel / Peter Zumthor*. ArchDaily. https://www.archdaily.com/418996/ad-classics-saint-benedict-chapel-peter-zumthor
Figure 45: Architizer. (2015, December 4). *Daylight House*. https://architizer.com/projects/daylight-house/
Figure 46: Snøhetta. (n.d.). *Viewpoint*. Snøhetta. Retrieved May 23, 2025, from https://www.snohetta.com/projects/viewpoint-snohetta
Figure 47: ARCHISCAPES. (2015, April 6). *The art of sketches | Renzo Piano*. WordPress. https://archiscapes.wordpress.com/2015/04/06/the-art-of-sketches-rpbw/
Figure 48: Daylight & Architecture. (2023, September 19). *Poetic Daylight Pavilion*. https://www.daylightandarchitecture.com/news/poetic-daylight-pavilion/
Figure 49: Herzog & de Meuron. (2021, December). *433 MKM Museum Küppersmühle, Extension*. https://www.herzogdemeuron.com/projects/433-mkm-museum-kuppersmuhle-extension/

Appendix



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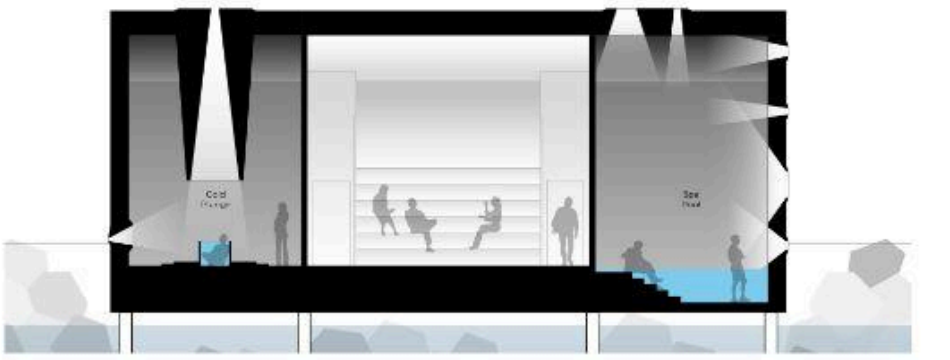

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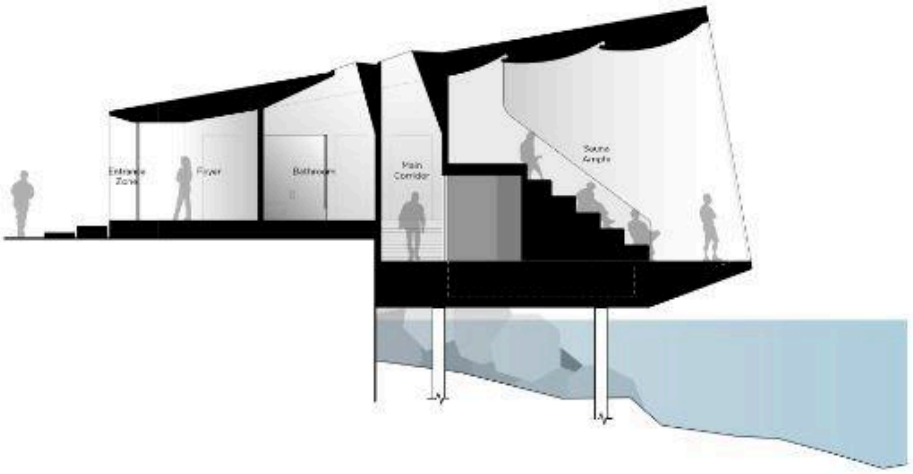

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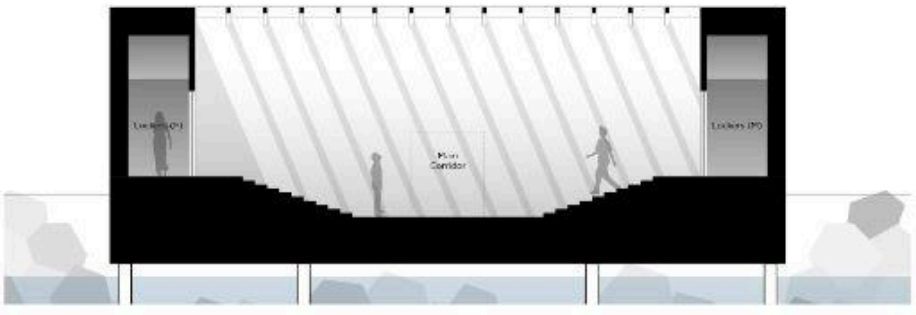

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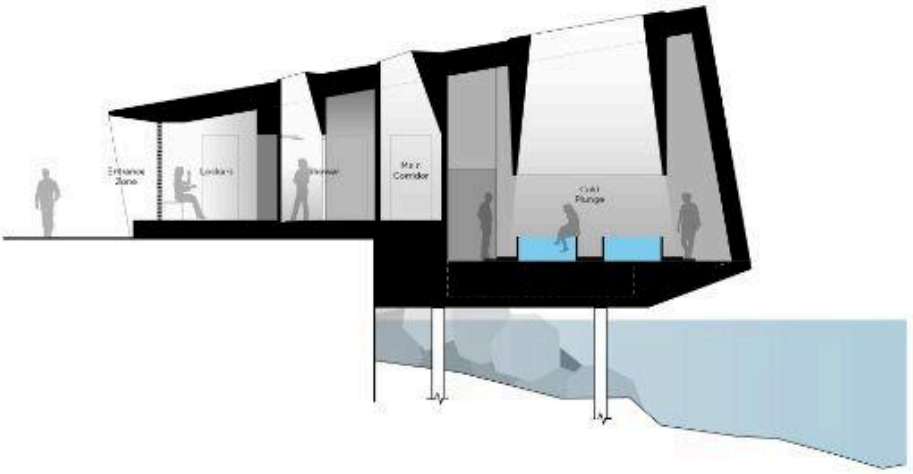

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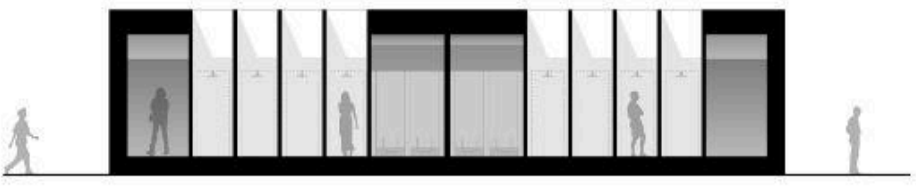

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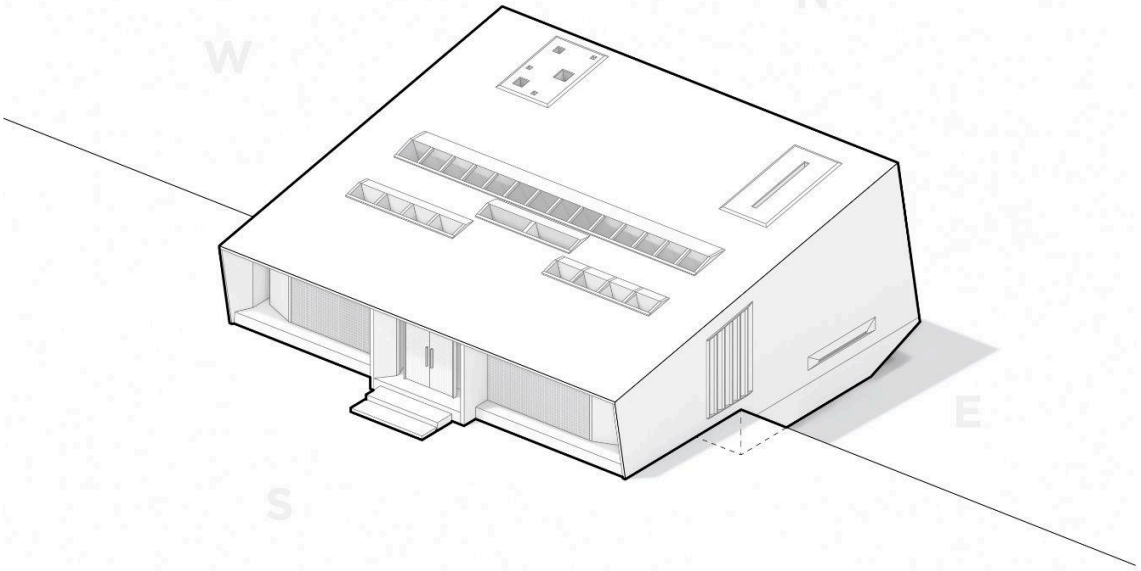
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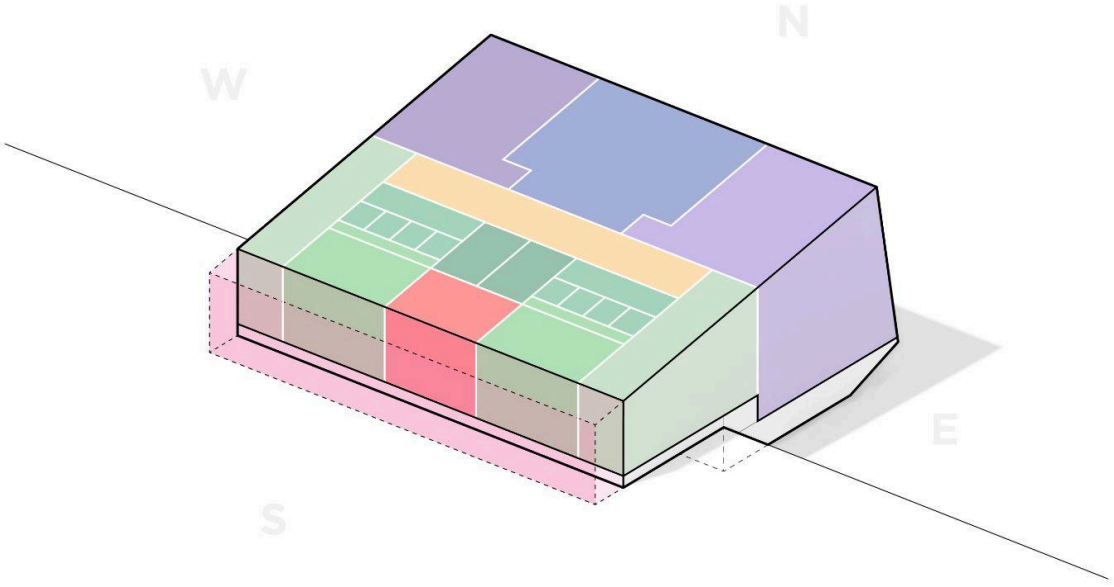
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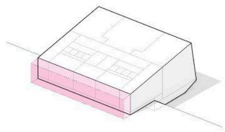
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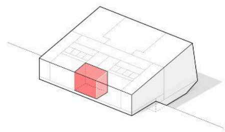
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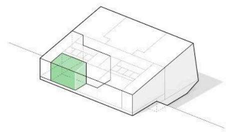
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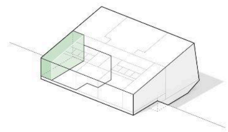
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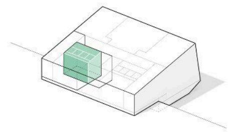
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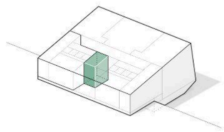
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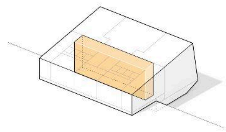
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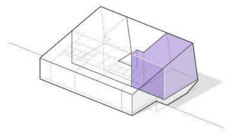
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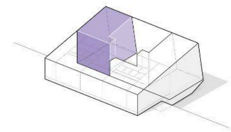
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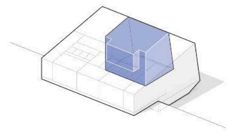
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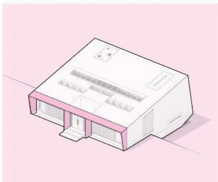
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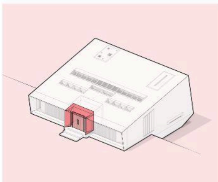
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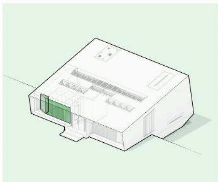
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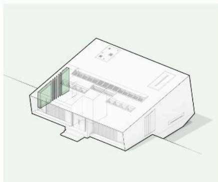
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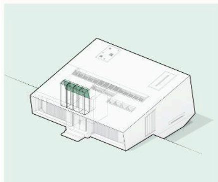
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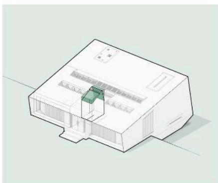
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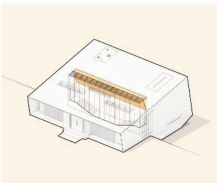
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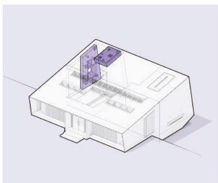
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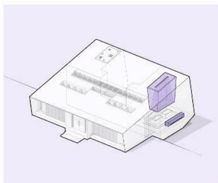
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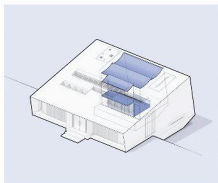
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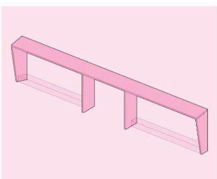
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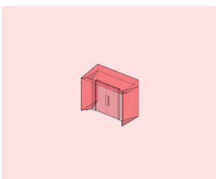
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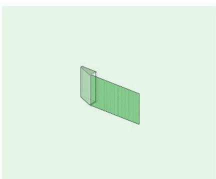
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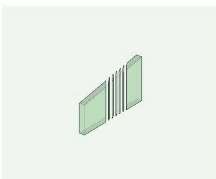
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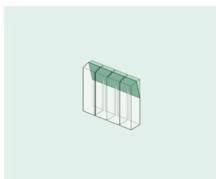
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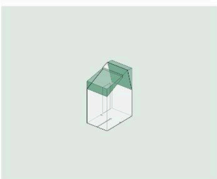
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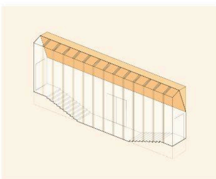
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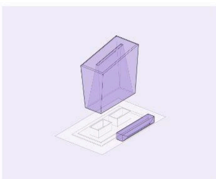
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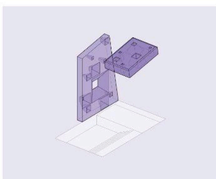
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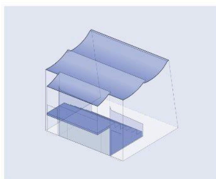
5. SAUNA

Space	Recommended Illuminance (lux)	Recommended Daylight Factor (DF)	Notes / Sources
Entrance (Indoor)	100–200 lux	2–4%	EN 12464-1, IESNA, CIBSE LG7 – Good visibility and orientation
Changing Room	300 lux	≥5%	EN 12464-1, CIBSE LG10 – Grooming, mirror use, comfort
Corridor	≥100 lux	≥2%	EN 12464-1, CIBSE LG10 – Circulation and safety
Relaxation Lounge	50–150 lux	2–3%	EN 17037, CIBSE LG10 – Calm, ambient daylight
Wet Area (Showers, Steam)	50–100 lux	2–3%	SLL LG02, CIBSE LG10 – Moisture-safe, glare-free daylight
Sauna	30–50 lux	1–2%	CIBSE LG10, SLL LG02 – Minimal, diffused daylight for a tranquil environment
Toilet	100–200 lux	2–4%	EN 12464-1, CIBSE LG7 – Visual hygiene, privacy, and glare control