DESIGNING *with* DAYLIGHT

the daylight lab

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RESEARCH

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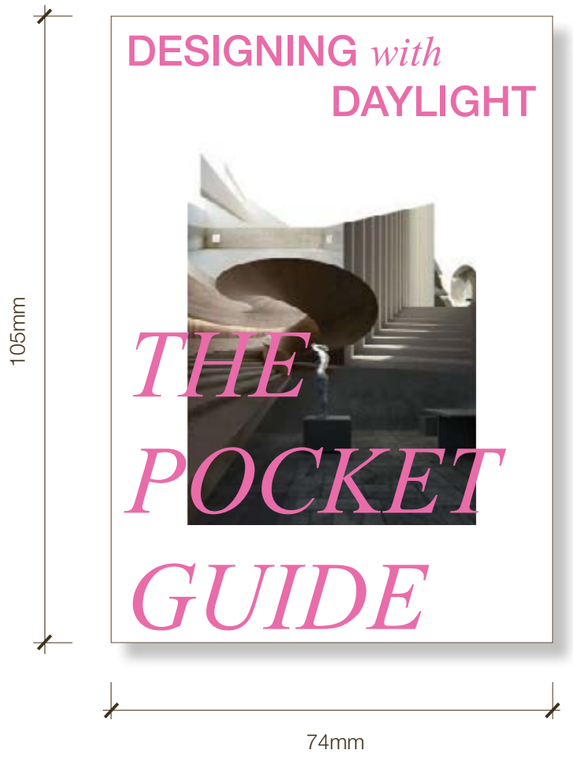
Before the research phase for the daylight lab, I first turned to the history of healing spaces (see Appendix A). At the core of this inquiry was daylight. The earliest and most enduring thread connecting architecture to human well-being. I sought to identify the first instances in which daylight truly drove architectural form, revealing precedents where light was not merely admitted but actively shaped spatial experience. This exploration ultimately led to an essay examining the role of daylight in architectural history and arguing for the need for deeper, more rigorous research on its contemporary applications.

This quickly influenced my work, navigating my research toward the teachings of architectural daylighting, or lack there of.

“Architects in planning rooms today have forgotten their faith in natural light. Depending on the touch of a finger to a switch, they are satisfied with static light and forget the endlessly changing qualities of natural light, in which a room is a different room every second of the day.”

*attributed to **Louis I. Kahn**, widely circulated through secondary sources; original publication not traceable.*



Daylight has always been central to architecture. It defines space, animates form, and connects interior life to the rhythms of the environment. Before the advent of electric lighting, daylight was not a choice but a necessity. Today, however, the abundance of artificial light and the proliferation of performance standards have altered our relationship with daylight. It is now too often treated as a variable to be controlled, quantified, and optimized, rather than as a dynamic, living element of design.

This guide (see Appendix B for the completed handbook) begins from a simple proposition: daylight cannot be reduced to a single standard. To codify light is to risk flattening its complexity, its cultural meaning, and its profound effect on human health and perception. While metrics such as daylight autonomy, circadian stimulus, or annual sunlight exposure provide valuable tools, they are only partial. They describe measurable thresholds but cannot account for the layered ways in which light is felt, remembered, and inhabited.

Daylighting today demands a dual approach, it must be both scientific and empathetic. On one hand, architects must engage with the physiological and psychological research that shows how daylight regulates circadian rhythms, improves cognition, and enhances recovery in healthcare environments. On the other, they must recognize that no two individuals experience daylight the same way. Age, cultural background, sensory sensitivity, and personal preference shape how light is absorbed and interpreted.

This guide is therefore not a prescriptive manual, but a framework for designing with daylight rather than for it. Its aim is not to define “perfect daylighting,” but to open up a range of architectural possibilities, how light might be harnessed, modulated, and celebrated across climates, building types, and communities.

By bringing together scientific research, design strategies, and critical reflection, this guide will support architects in rethinking daylight as more than a technical variable. It is a design partner, a material, and a mediator of human experience. To engage daylight fully is to embrace both precision and possibility, order and variation.

OBSERVATIONS

The heart of this chapter holds one simple idea, that variability is the primary affordance of natural light. Building on Louis Kahn's aphorism that material is "spent light," we read daylight as a processual medium whose legitimacy derives from change. It shifts in angle, intensity, spectrum, and shadow that gives a space its rhythm and narrative. But variability alone is insufficient as a design aim unless it is grounded in human needs and ecological conditions. Daylight must also be treated as a chronobiological signal that entrains circadian systems, as an economical source of ornamentation that composes time into spatial experience, and as a domain of user agency, where comfort is negotiated rather than dictated.

This chapter synthesizes five complementary observations that together reframe daylighting practice. First, we propose design for variability as a primary objective, strategies that cultivate contrast, sequence, and temporal depth. Second, we situate daylight within chronobiology, arguing that spatial orientation and temporal exposure are public-health design concerns. Third, we treat daylight as an ornamental practice, an architectonic means of producing rhythm, texture, and seasonal resonance. Fourth, we insist on centering the user. Technical sophistication must be mediated by choices, adaptability, and inclusive measures of comfort. Finally, we interrogate the relationship between simulation and lived experience, urging a praxis that moves from metrics to post-occupancy evaluation.

1 Material as Spent Light

Louis Kahn's notion of material as "spent light" reminds us that architecture is animated by the daily performance of sunlight and its changing qualities that reveal the character of materials. Designing with daylight is therefore not about maximizing brightness but about tuning variability so each space receives the kind of light its function and atmosphere require. When we design this way, buildings feel alive as they mark time, respond to climate, and become luminous compositions shaped by the continual passing of light.

2 Biological Wi-Fi

Daylight is the body's primary regulator, synchronizing biological clocks and maintaining sleep, focus, and overall wellbeing, so buildings that limit access to it disrupt more than visibility. Architects can support this connection by orienting key spaces for morning light, modeling daylight for timing as well as quantity, and ensuring that different programs receive the light they physiologically need. When daylight is treated as a biological signal, architecture becomes an active contributor to cognitive, emotional, and physical health.

3 Light as Ornament

Daylight embodies the ornament Venturi and Scott Brown described, creating patterns, reflections, and shadows that give spaces rhythm and depth without added material. Designing with light as ornament means using time, orientation, and surface to let sunlight animate architecture and shape its aesthetic from moment to moment. The result is a building enriched by variation, a living surface that marks the hours and connects occupants to daily and seasonal cycles.

4 The Banham Clause

Reyner Banham's principle that buildings should serve people before systems applies equally to daylight: the most advanced glazing means little if users feel glare, exposure, or a lack of control. Human-centered daylighting recognizes that comfort varies widely, so design must offer choices, from dimness to brightness, and allow users to adjust or move between light conditions. The goal is adaptability rather than uniformity, creating environments that support changing tasks, moods, and needs.

5 Alphabet Soup

Daylighting metrics like sDA, ASE, UDI, and DF are useful, but they can reduce light to data and push design discussions too late in the process. Simulation tools should guide intuition, followed by observation, sketching, and assessing how a space actually feels throughout the day and in different weather. The best daylighting comes from balancing analysis with experiential judgment, using numbers to support design rather than define it.

DESIGN PRINCIPLES

1 Solar Design is Free

Respond to Local Climate and Latitude

Goal: Use solar geometry as the foundation of design. Orientation costs nothing and gives everything.

Directive: design with the sun, not against it.

2 The Goldilocks Principle

Consider Thermal and Visual Comfort Together

Goal: Balance brightness and warmth; tune light for comfort, not abundance.

Directive: tune daylight as a dual performer, visible and thermal, sensual and sustainable.

3 Channel-ing Aalto

Diffuse and Reflect Light Strategically

Goal: Design surfaces as instruments of light, not backdrops to it.

Directive: design for reflection and scattering before resorting to glazing ratios. In daylighting, gentleness is power.

4 A Fashion Statement

Embracing Adaptive Systems

Goal: Make daylight adjustable. Treat movement as both performance and expression.

Directive: design adaptability as architecture. Shading should be worn proudly.

5 Daylight After Dark

Integrate Daylight with Electric Lighting Design

Goal: Extend the life of daylight through artificial light; maintain atmosphere after sunset.

Directive: design electric lighting as a temporal continuum. Let the building glow with consistency, evolving (not disappearing) after dark.

If daylight is the architect's raw material, design principles are the instruments through which it is tuned, refined, and made inhabitable. While observations teach us to see, the changing atmospheres, the moods of light, the physiological and social implications of its presence, principles teach us to act. They translate poetic awareness into performative strategy. This chapter turns from the experiential to the operational, from the phenomenology of daylight to its deliberate orchestration through geometry, material, and control.

Daylighting, when practiced rigorously, begins not with technology but with orientation. The first principle, Solar Design is Free, asserts that the sun's predictable movement is the architect's most reliable and economical collaborator. Every other decision, from glazing to shading to spatial hierarchy, should unfold from the reading of that solar script. Yet successful daylight is not simply abundant light, it is balanced light. Hence the Goldilocks Principle, which pairs luminous and thermal comfort, reminding designers that pleasure arises from moderation rather than extremity.

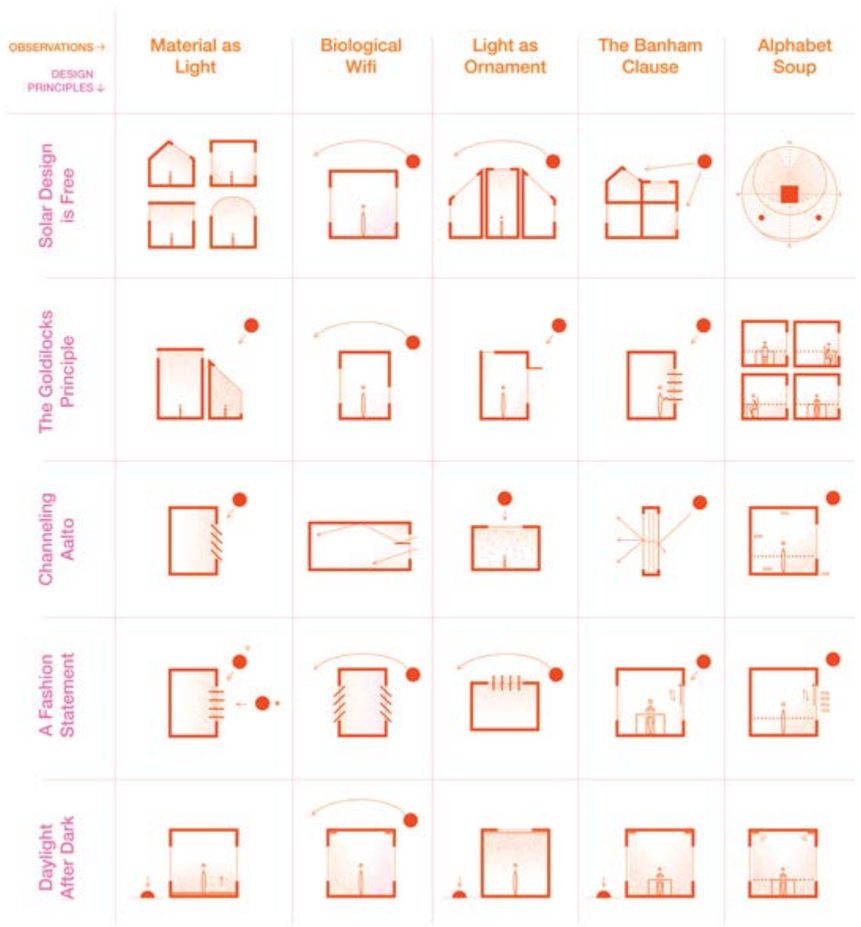
The following principles extend this calibration. Channeling Aalto emphasizes diffusion and reflection as the quiet tools of illumination, surfaces that scatter brightness rather than hoard it. A Fashion Statement shifts focus to adaptive systems, operable devices and responsive skins, that allow buildings to evolve with time and user intention. Finally, Daylight After Dark dissolves the artificial divide between daylight and electric light, proposing instead a continuum of atmosphere that carries the building's luminous identity from morning through night.

the reference guide
& the daylight interventions library

The following page (double-sided) holds your daylighting design life-line. Cut it out and keep this guide by your desk, in your bag, or open on-site. Use it when you're sketching a plan, reviewing a section, or troubleshooting glare in a finished space. Think of it as a pocket map, something that helps you navigate the many possibilities of daylight so you can design with it, not just for it.

The reference guide distills the essentials, your five observations, five design principles, and the directive that guides you. *The daylight interventions library* is the companion toolbox. It holds the concrete strategies, historic precedents, contemporary techniques, and material approaches that show how daylight can be shaped, framed, softened, redirected, or amplified.

Together, they give you both the logic and the moves, the concepts that guide design, and the interventions that put those concepts into action.



the matrix

In case of emergency, treat this matrix as your daylighting survival kit. It links each observation to each design principle, turning broad ideas into quick, workable design moves. It keeps variability, circadian health, ornament, user comfort, and evaluation tied directly to orientation, shading, diffusion, adaptability, and integration. Think of it as a visual reference guide that offers options for design.

OBSERVATION	QUICK NOTE	DIRECTIVE
Material as Light	**Design for Variability.** Daylight is a mood, not a metric. Vary conditions across a building.	Light should change through the day, animating space with cycles of brilliance, shadow, and glow. Variability creates depth and character.
Biological Wifi	**Prioritize Circadian Health.** Connect users to natural rhythms. Morning light is critical.	Daylight entrains our biological clocks. Orient spaces and tune light quality to support human health, productivity, and wellbeing.
Light as Ornament	**Daylight as Decoration.** Daylight itself as decoration; changing patterns & shadows create rhythm.	Treat daylight as the building's ornament. Patterns, shadows, and reflections give rhythm, atmosphere, and temporal richness without excess.
The Banham Clause	**Center the User Experience.** People first, technology second; comfort > gadgets.	Technology and metrics mean little if users feel uncomfortable. Design for diversity, provide options, and respect occupant agency.
Alphabet Soup	**Simulation + Evaluation.** Metrics matter only if translated into experience; verify with real users.	Metrics (sDA, UDI, ASE) guide design, but must be paired with post-occupancy feedback to confirm real human experience.

DESIGN PRINCIPLE	QUICK NOTE	DIRECTIVE
Solar Design is Free	**Work with the Sun.** Use predictable sun paths to guide form; free, low-tech strategy.	Begin with solar geometry. Orientation, overhangs, and section cuts aligned to latitude and climate deliver free, effective daylighting.
The Goldilocks Principle	**Balance Light + Heat.** Not too bright, not too dim, not too hot. Balance is key.	Design daylight for both visual and thermal comfort—avoid glare, control solar gain, and tune for seasonal balance.
Channeling Aalto	**Diffuse + Reflect.** Soft, bounced, warm light; surfaces as collaborators.	Use surfaces, shelves, and membranes to soften, scatter, and balance light, creating atmospheres that feel humane and alive.
A Fashion Statement	**Adaptive Systems.** Shading is both functional and expressive. Let users control it.	Integrate shading, blinds, or smart glazing as core design elements. Give buildings and users the ability to adapt with the sun.
Daylight After Dark	**Unify with Artificial Light.** Electric lighting extends daylight drama; do not replace it.	Treat electric lighting as a continuation of daylight, extending atmosphere and rhythm seamlessly into the evening.

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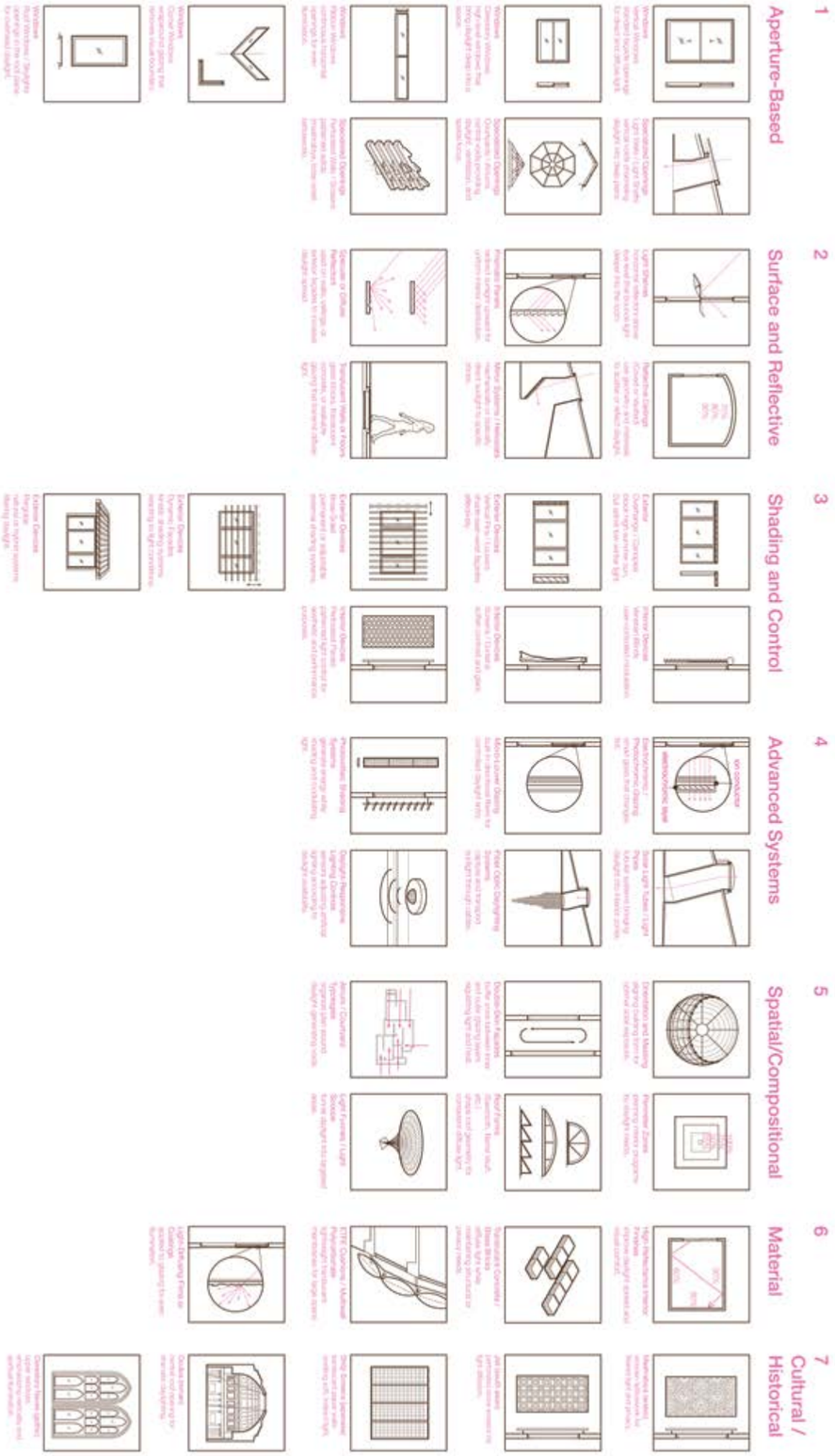
DAYLIGHTING INTERVENTION LIBRARY



cut line

research conclusions

From the open courtyards of Roman villas to the clerestories of Gothic cathedrals, from Kahn's solemn shafts of light to Aalto's luminous interiors, architects have relied on daylight not only to illuminate but to define space, mark time, and shape experience. Yet, somewhere between the demands of efficiency, technology, and standardization, natural light has too often slipped into the background. It has become secondary, something considered only after the structure is drawn and the mechanical systems specified.

In my own career, I have seen the pattern repeat itself. Architects orient a building to the south and congratulate themselves on good passive design, but then forget the question of daylight until the end of the process, carving windows where they "fit" rather than where they belong. The result is an architecture that acknowledges the sun but doesn't truly collaborate with it. What could have been a living relationship between light and space becomes an afterthought, an accessory added to a completed form rather than an essential partner in its making. This guide is written as a counterpoint to that habit. The five observations, variability, circadian health, ornament, user experience, and post-occupancy insight, are meant as reminders of what architects before us already understood. They show us that daylight is not a metric, not just lux levels or solar heat gain coefficients, but an evolving atmosphere that makes architecture memorable. The five design principles, solar geometry, thermal and visual balance, diffusion and reflection, adaptive systems, and integration with electric light, are tools to make those observations actionable today. Together, they provide a framework for designing with daylight as both inspiration and instrument.

What matters most is shifting the mindset. Daylight should not be a last-minute layer of glass, but the starting point of design. When we approach architecture this way, designing with the sun instead of around it, we are forced to reckon with the environment, climate, and time. This is not a constraint; it is a liberation. It ties architecture to something larger than a program brief or a stylistic preference. A school that tracks the sun will naturally nurture rhythm in its students' lives. A hospital that softens glare and invites the morning glow will naturally aid recovery. A house of worship oriented toward the setting sun will naturally deepen ritual. The building's purpose becomes amplified by its alignment with the natural cycle. And this, ultimately, is what makes great architecture. Not the novelty of its form or the complexity of its systems, but its ability to belong to its site, its time, and its users. Daylight, when treated as a partner rather than an accessory, ensures this belonging. It makes the architecture breathe, evolve, and endure.

The past reminds us what daylight can do. The tools of today give us the ability to refine and measure it. The task ahead is simple, to design buildings that live with the sun, and in doing so, to create spaces that are healthier, more humane, and more deeply connected to the world.

2

DEVELOPMENT

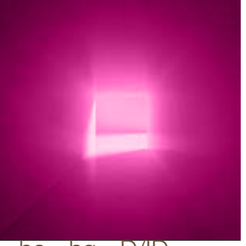
the daylight study
the program
the goals

What emerged from this research is a simple but necessary proposition; to meaningfully design with daylight, we must learn through daylight. This phase introduces a system, a new layer within architectural education dedicated entirely to that idea. (See Appendix C, “How much Light is Too Much?”)

Instead of treating daylight as a technical add-on or a late-stage consideration, this framework imagines an educational institution where light itself becomes the primary instructor. I propose an addition to our existing curriculum, a place to study daylight not through simulations alone, but through direct experience. A place where students can observe, measure, inhabit, and be transformed by light.

To be immersed in a well-daylit building is already to learn from it. Architecture has always been one of our most patient teachers, this proposal extends that truth into a structured environment designed specifically for that purpose.

A daylighting laboratory. *The Daylight Lab.*
Where the daylighting design guide gets put to the test. Where architecture is entirely informed by the sun.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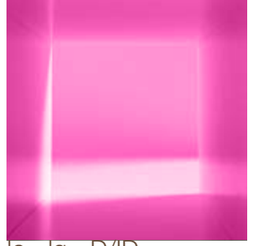
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l_low
c_contrast
g_glare
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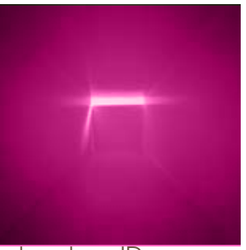
ID_indirect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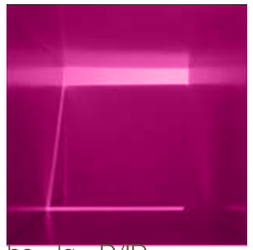
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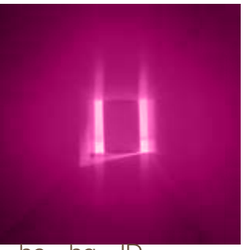
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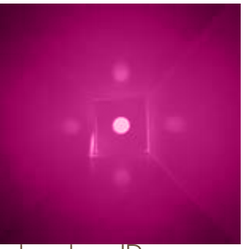
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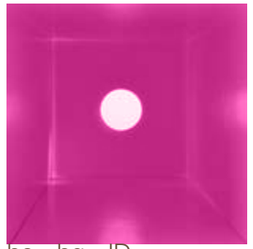
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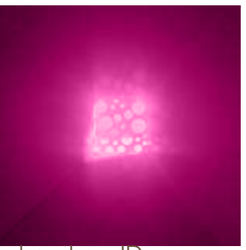
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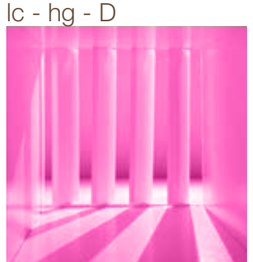
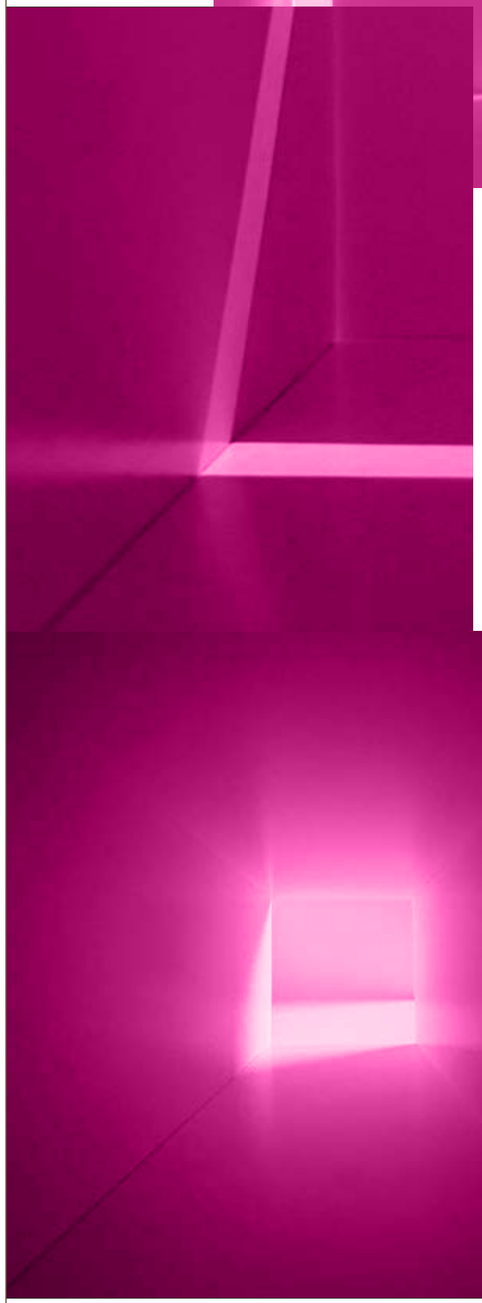




the daylight study

The first step of this phase begins with a simple daylight study, a series of physical models testing how direct light interacts with form through open windows, sharp cuts, mechanical blinds, perforated sheets, and calibrated openings. Each model was built with one question in mind, where does the beauty of daylight begin? These experiments search for that answer in the geometry of shadows, the sharpness of contrast, and the softness that diffusers and apertures can produce.

Every study though, has its limits. These models freeze daylight into a single instant, capturing its presence but not its life. Daylight's true beauty lies in movement, the slow shift across a wall, the seasonal tilt, the way brightness and shadow trade places throughout the day. While the study offers glimpses of this, it cannot fully hold the temporal nature of light. This limitation becomes the lesson. To understand daylight deeply, one must design not only for a moment, but for time itself.

the program

The next stage of development moves from studying daylight to imagining the building that could hold this work. Trying to design daylight in motion eventually became an attempt to design the Daylight Lab itself. For this project, Designing with Daylight means creating a place where light can be observed, worked with, and tested, a place that protects both the beauty of daylight and the practical demands of learning it.

Daylight is inherently programmatic. Every task needs a different amount or quality of light, and any building meant to teach daylight must be able to support these shifts. Because the future users of this space will be students, architects, and other design professionals, the program has to allow for many different modes of learning. Some moments require quiet observation, others require focused work, and others call for hands-on experimentation.

To begin understanding daylight in motion, the program had to be defined. Three types of spaces became essential. There are **spaces for observation** where people can sit with the changing light throughout the day. There are **spaces for work** where daylight supports drawing, modeling, and research. And there are **spaces for testing** where light can be shaped, adjusted, measured, and challenged.


observation


testing


work

OBSERVATION

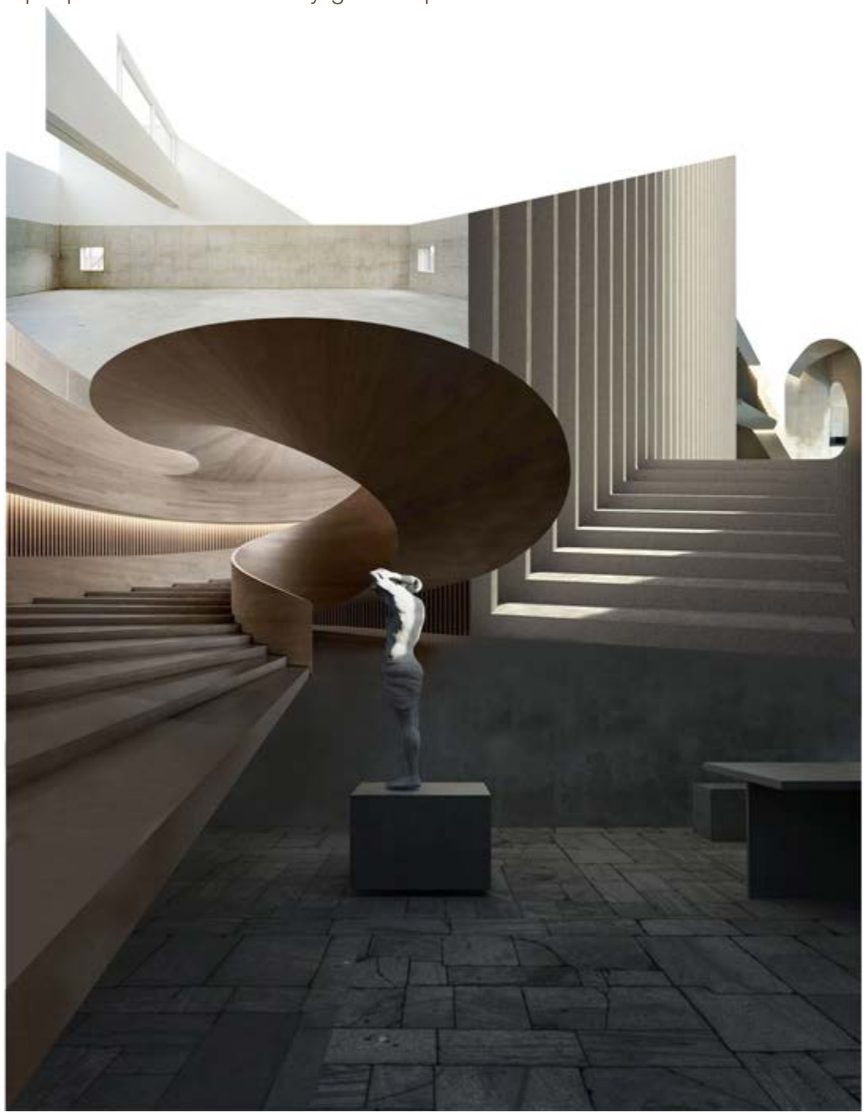
The observation program focuses on the most essential act in any daylight laboratory: looking carefully at how light behaves. These spaces were selected because each one isolates a different aspect of daylight, allowing the visitor to slow down and pay attention to qualities of light that are usually overlooked. Together they form a quiet sequence that teaches people to understand light not through measurement or performance, but through direct sensory experience. This part of the lab is meant to train the eye, to make the movement of the sun feel legible, and to show how light can shape space in its most elemental forms.

The program is divided into three rooms, each with a distinct purpose. **The observation room** is a controlled interior that recalls the spirit of a James Turrell environment, where the visitor can study how daylight enters and changes over time without distractions. **The exterior court** provides an open, outdoor frame that makes seasonal and directional shifts in sunlight easy to read by placing the body directly under the sky. **The light-well gallery** gathers a series of vertical shafts with different orientations and construction methods, creating a set of comparative conditions that make the behavior of light more understandable. Each room has its own spatial and technical requirements, but all three support the same goal: to observe daylight with clarity and intention.

TESTING

The testing program is designed for people who need to push daylight beyond passive observation. These spaces were selected because they allow users to actively manipulate conditions, explore hypotheses, and see how light interacts with space and material in a controlled, experimental way. Where the observation program invites reflection, the testing program invites intervention. It gives architects, designers, and researchers the ability to adjust variables, track outcomes, and build a deeper understanding of how daylight performs when design decisions are introduced.

The program is divided into two rooms, each supporting a different kind of experimentation. **The daylight testing room** is a highly flexible environment that can be adjusted by the user through movable panels, interchangeable apertures, and modifiable surfaces. It is meant for testing spatial configurations and architectural forms under different lighting conditions. **The materials and surface studio** provides a workshop-like setting where materials can be handled, arranged, and tested directly. It helps users see how texture, color, reflectance, and geometry shape the behavior of light. Together, these rooms give people the tools to test daylight with precision and intention.



WORK

The work program supports the part of daylight learning that happens through making. I included these rooms because designing with daylight requires more than looking and testing. It also demands time to translate ideas into models, drawings, and digital studies that help me and other users refine concepts and prepare them for real architectural decisions. These spaces sit between observation and experimentation. They give students, architects, and other design professionals a place to process what they have seen, develop proposals, and build the physical and digital tools needed to guide further testing.

I divided the program into two rooms that reflect the different modes of working with daylight. **The physical modelling workshop** is where users can build scaled models that capture how daylight moves through form and mass. It supports hands-on learning and offers a tangible way to explore shadows, apertures, and material configurations. **The digital modeling workshop** complements this by giving users a place to simulate daylight conditions, run iterative studies, and refine designs with more precision. Together, these rooms create a productive setting where making becomes a core part of understanding daylight.

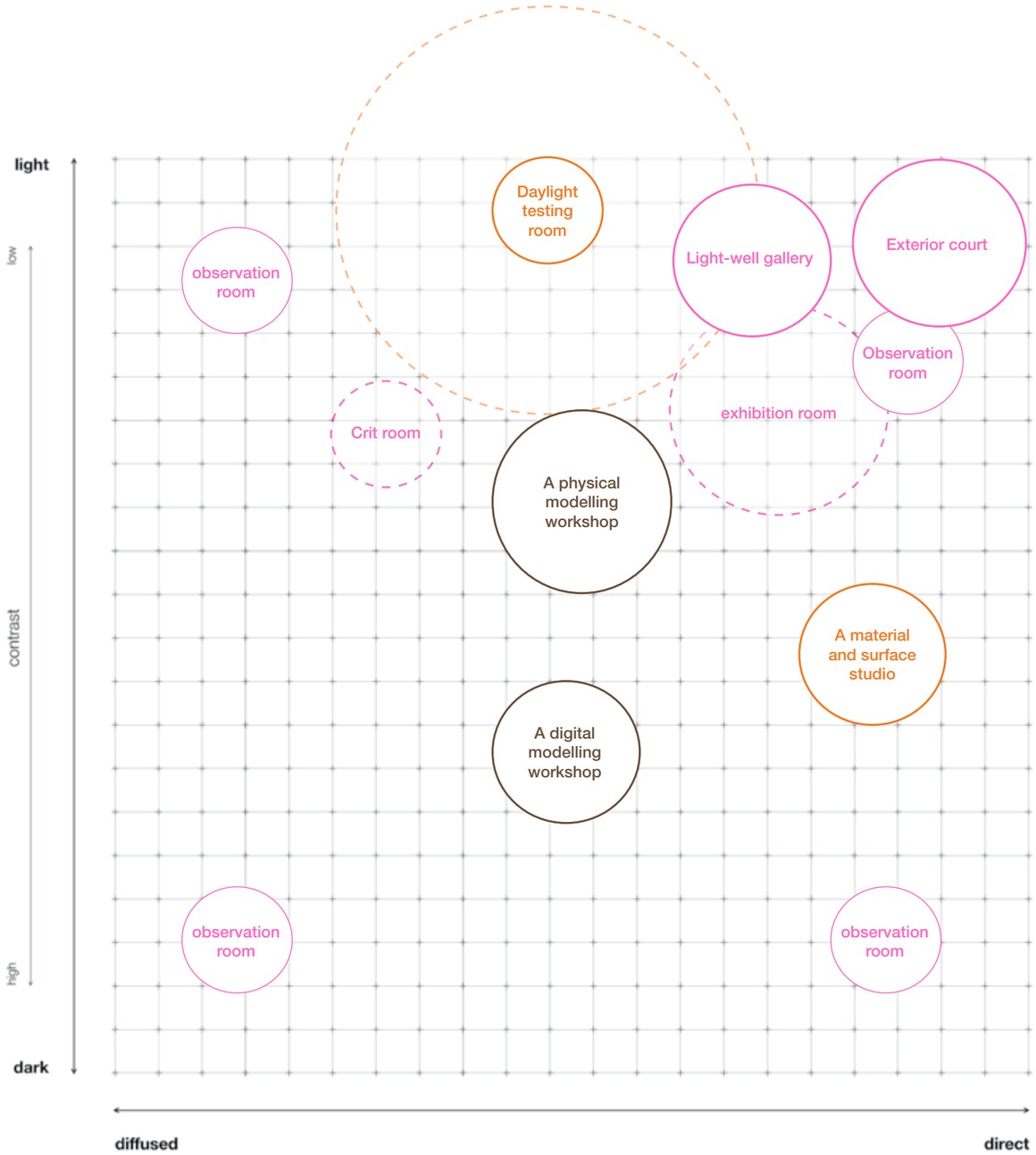
spatial organization

Before I could assign specific illuminance values or glare limits, I first needed a simple way to understand how each space in the lab should feel. To do that, I plotted all the rooms on a chart organized by two basic qualities, direct versus diffused light, and bright versus dark environments. This quick diagram helped reveal the character of each program, which spaces relied on sharp, high-contrast sunlight, which required softer, uniform conditions, and which needed the flexibility to shift between the two.

Observation

Testing

Work



the goals

Once the spatial programs were established, the next step was to give each room a clear set of daylight goals. This phase felt like translating intuition into measurable criteria. Each space in the daylight lab has its own purpose and, because of that, its own requirements for how light should behave inside it. Defining illuminance ranges, determining whether light should arrive as direct sun or soft diffuse glow, and setting acceptable glare limits helped transform the program from a conceptual framework into something that could actually guide design.

These goals are practical, but they also protect the experience I want each room to offer. The observation spaces rely on wide illuminance ranges that can move from dim to intense, allowing seasonal light framing, raw outdoor exposure, and orientation-based effects to unfold without restraint. These spaces do not chase precision. They make room for change, for shifting shadows, and for a level of unpredictability that keeps daylight alive.

The testing spaces demanded more control. The daylight testing room requires calibratable conditions with illuminance goals between 200 and 1000 lux depending on the experiment, and a direct-lighting setup that pushes glare right up to an acceptable threshold. The materials and surface studio sits somewhere in between, balancing direct and diffuse light so that textures, reflectance, and color can be analyzed without distortion.

The work spaces are tuned for comfort. The physical modelling workshop needs a stable diffuse environment between 300 and 500 lux to support focused making, while the digital modelling workshop sits closer to a controlled studio atmosphere with lower diffuse illuminance and very low allowable glare. These rooms are meant to sustain long periods of concentration, so the lighting goals prioritize visual ease over drama.

Setting these goals grounded the project. It clarified what each room is for, and it made the entire daylight lab more intentional. By defining purpose, illuminance levels, light type, and glare criteria, the architecture becomes accountable to the light it hopes to teach.

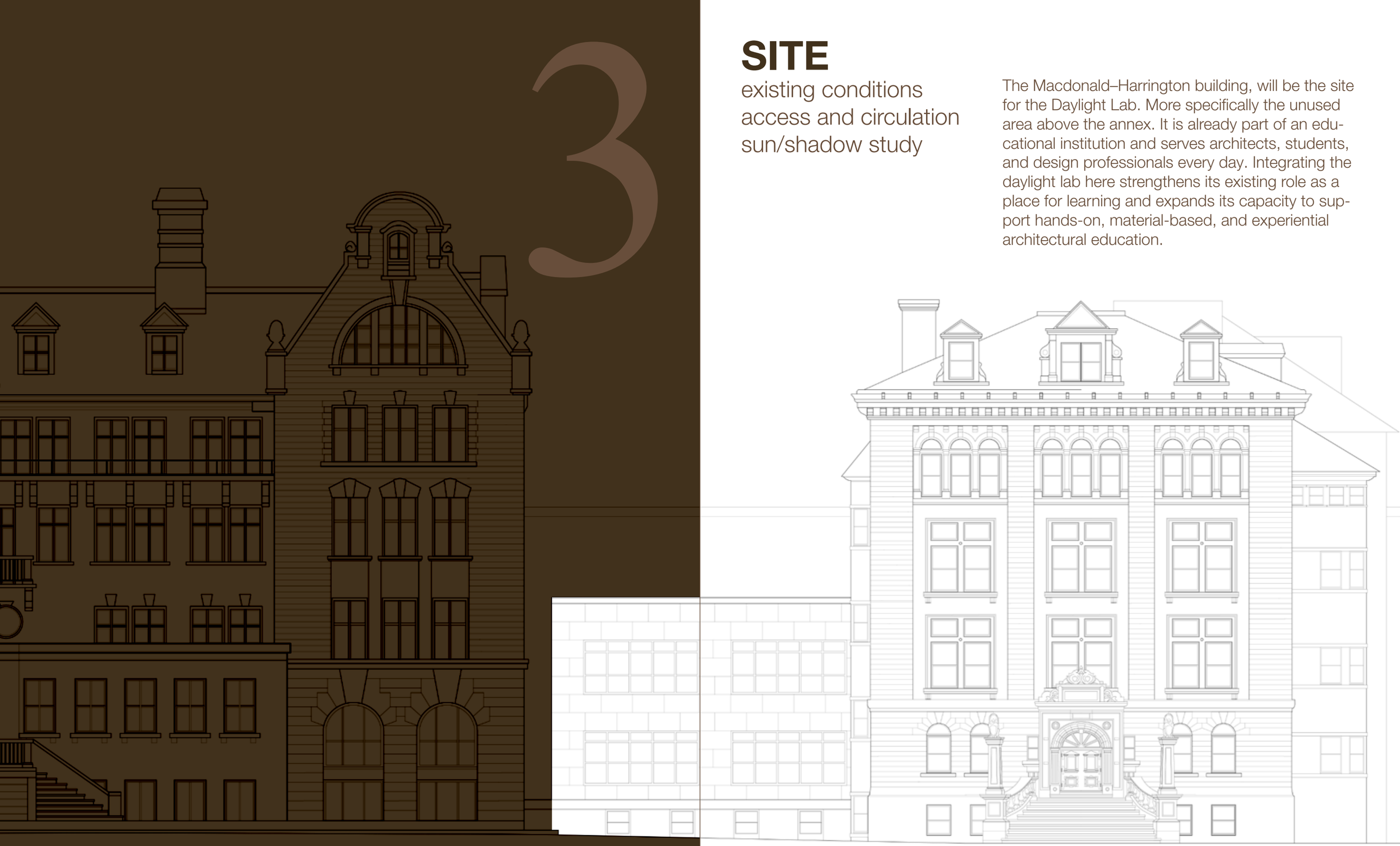
	program	*purpose*	*illuminance goal (lux)*	*type*	*glare (DGP)*
Space for observation	**Observation room**	seasonal light framing	10-1000+	direct/diffuse	-
	Exterior court	uncalibrated exposure	10-1000+	direct	-
	Light-well gallery	orientation based obs.	150-400	direct/diffuse	≤0.35
Space for testing	**Daylight testing room**	configuarble tests	200/500/1000+	direct	≤0.40
	A material and surface studio	material&texture analysis	200/500/1000+	direct/diffuse	≤0.35
Space for work	**A physical modelling workshop**	physical construction	300-500	diffuse	≤0.35
	A digital modelling workshop	rendering&simulations	~ 300	diffuse	≤0.15

3

SITE

existing conditions
access and circulation
sun/shadow study

The Macdonald–Harrington building, will be the site for the Daylight Lab. More specifically the unused area above the annex. It is already part of an educational institution and serves architects, students, and design professionals every day. Integrating the daylight lab here strengthens its existing role as a place for learning and expands its capacity to support hands-on, material-based, and experiential architectural education.



the background

The home of the School of Architecture at McGill is the Macdonald Harrington Building. It was first constructed in 1896-97 as the Macdonald Chemistry Building. The project was commissioned by Sir William Macdonald and designed by Sir Andrew Thomas Taylor with his associates Morley Hogle and Huntley Davis. At this time, the building served as a major center for chemistry and later for mining and metallurgy. As these departments grew the need for more laboratory space became clear.

To support this growth a two storey annex was added on the north side in 1957. It offered additional laboratories and acted as a practical extension of the scientific programs that were rapidly expanding at the time. Records in the local heritage registry show that further work took place in 1966 also on the north flank. This project is described as another two storey addition, credited to M Fleming. Together these mid century interventions created the version of the annex that still stands today.

The building shifted its purpose later in the century. By the 1980s the scientific departments had relocated and the complex was ready for a new life. In 1987 ARCOP Associates completed a major renovation. This project reconfigured both the original nineteenth century structure and the two mid century annex additions so they could support the needs of the School of Architecture and the School of Urban Planning. Studios, workshops, classrooms, and offices were introduced to the buildings and it began to function as the home of architectural education at McGill.

This long history of expansion and renewal shows the way the school has always adapted its spaces to new forms of learning. From the original construction in the 1890s to the 1957 annex the 1966 addition and the 1987 renovation each moment reflects a shift in what the building was asked to support. Today that story continues. The annex has always been a place for hands on work and experimentation so placing a daylight lab here extends that legacy and ties the future of the school to its layered architectural past.

vcirculation and access

pedestrian path

metro station

bixi station

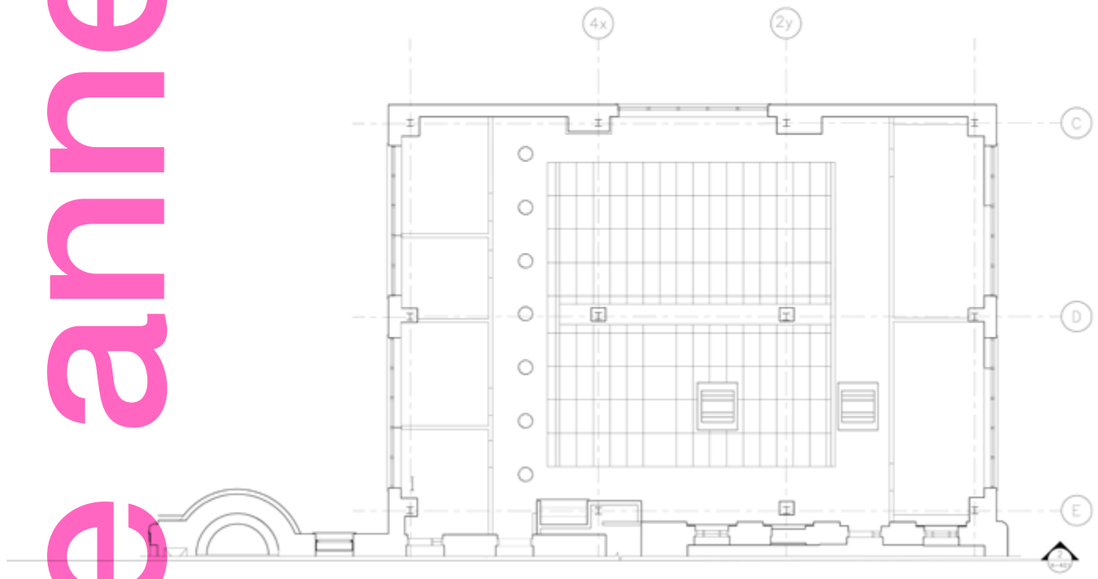
bicycle lane

bicycle rack

0 20 40 120

N

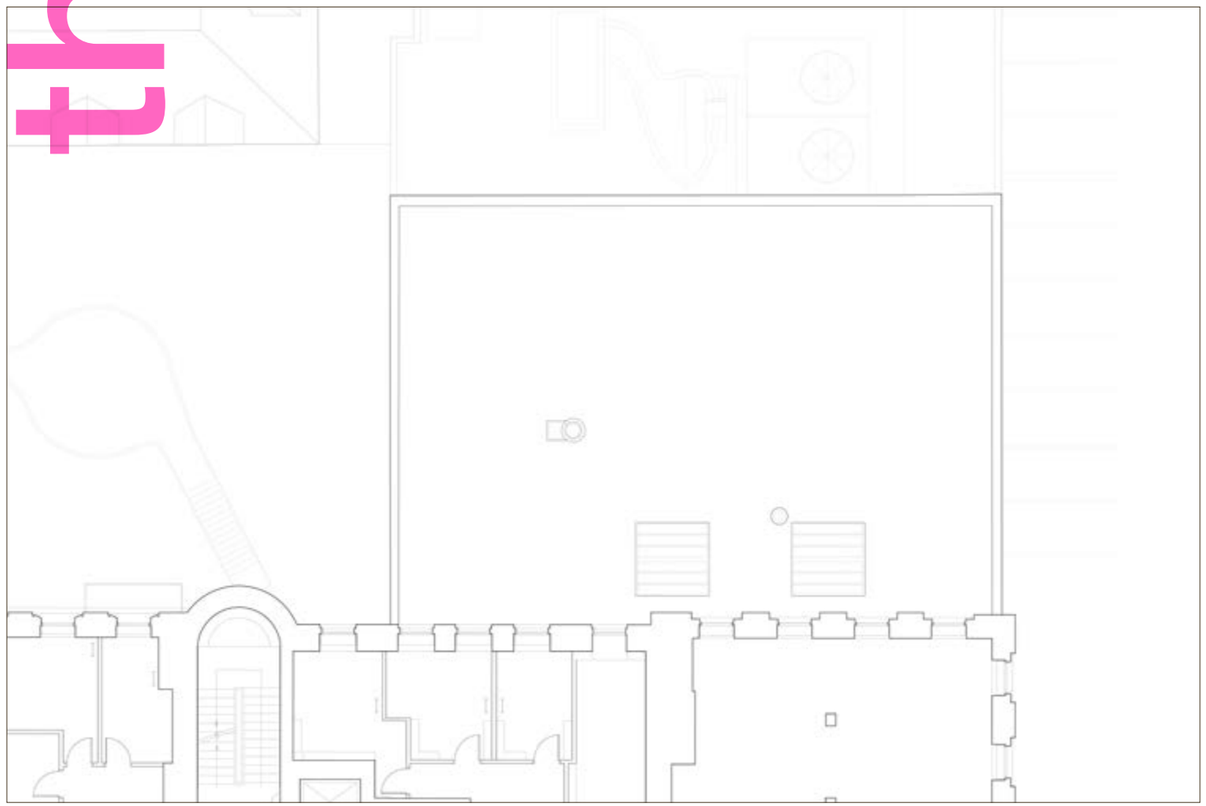
the annex



0 1.5 5 10

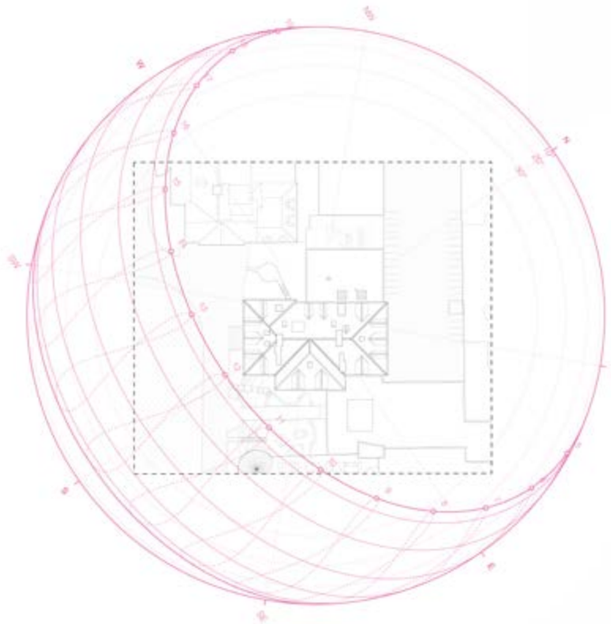
vroof plan

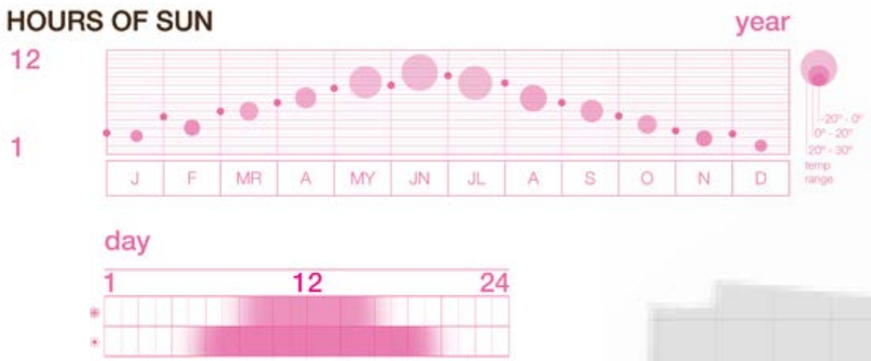
reflected ceiling plan^



sun + shadow

Conducting a thorough sun and shadow analysis is essential for understanding how natural light interacts with a site throughout the day and across seasons. The sun path diagram, combined with local sunlight statistics for Montreal, provides a framework to anticipate patterns of illumination and shading. Our shadow study highlights how surrounding context directly influences sunlight availability. In the morning, shadows cast by the Macdonald-Harrington Building limit sun exposure on certain areas of the site, affecting both visibility and thermal comfort. By mid-afternoon, these constraints are reduced, and the site benefits from unobstructed sunlight, creating opportunities for activity and passive heating. This analysis underscores the importance of considering neighboring structures and their impact on light, informing design decisions that maximize daylight access, enhance spatial quality, and respond intelligently to the site's temporal rhythms.





*all measurements taken on July 21st, outlined at 12:00

4

TESTING

With the program defined and the site established the next step is to begin shaping each room. This phase becomes the moment when the research the design principles and the physical conditions of the annex come together. I move through the project room by room and map out how each space will take form using the rules set out in the daylighting design guide. Each principle becomes a lens for making decisions about orientation openings volume and the quality of light that each space will hold.

The first principle is that solar design is free. This means I begin by placing each room according to the path of the sun. Some spaces need steady northern light while others benefit from eastern morning sun or the long dramatic reach of the western sky. The second principle follows the Goldilocks principle of comfort. I look at which rooms require specific illuminance conditions and then direct windows and apertures so that the light they receive is never too dim or too bright but feels just right for the activity inside. The third principle draws from Aalto. I treat daylight as something that can be guided softened or sharpened. I use form and material to channel both diffuse and direct light so that each space becomes an intentional study of how light behaves.

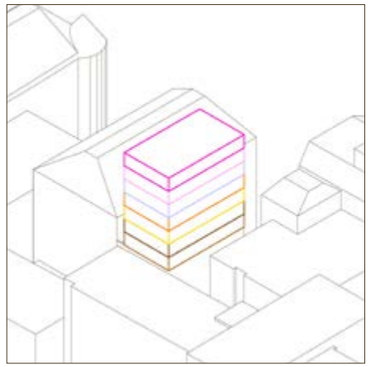
Further principles are in progress and will continue to adjust the design as the project grows. This stage is not about finalizing the architecture. It is about testing possibilities and discovering how each space in the daylight lab can embody the ideas that shaped this project from the beginning.

the base model

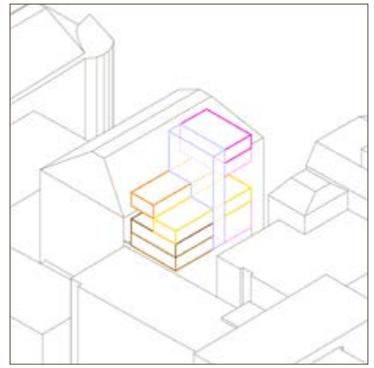
I began the testing phase by building a base model guided entirely by the first design principle that solar design is free. I started by arranging the program according to daylighting requirements. Spaces that do not require direct sunlight were pushed toward the north. Spaces that depend on direct sun were arranged toward the south. Programs that need access to both types of light were placed in positions that allow a balance of sun and shade.

Once the program was organized by orientation I condensed the forms to reduce overall height. (This was done to avoid casting new shadows on surrounding buildings) These base forms will then be used to perform metric evaluations that will later be used to influence their form.

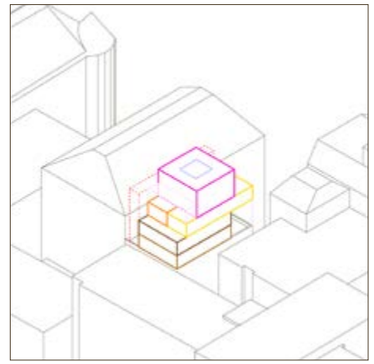
*NOTE: I keep in mind that this extension will block existing windows on the macdonald-harrington building facade. This will be addressed directly in the next stages of design. A buffer zone corridor has been introduced to acknowledge this condition and to ensure that the addition does not simply obstruct but works to mediate light for both the existing building and the new lab.



solar access



orientation



height

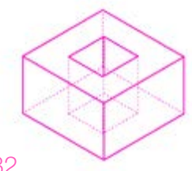
observation room

Location: High as possible

Exposure: Enclosed, Direct

Goal: Continuous, unmediated daylight observation

*minimal reliance on quantitative metrics



exterior court

Location: Varies

Exposure: Exposed, Direct

Goal: Immerse users in open natural light.

*no reliance on quantitative metrics

light well gallery

Location: Determined by form

Exposure: Enclosed, Direct

Goal: Moment-to-moment observations of changing daylight conditions

*will affect other quantitative metrics greatly

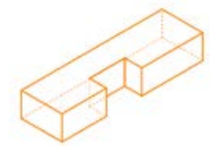
daylight testing room

Location: mid-building

Exposure: Enclosed, Direct, Diffuse

Goal: A range of intensities to be manipulated by user.

*minimal reliance on quantitative metrics



material and surface studio

Location: mid-building

Exposure: Enclosed, Direct, Diffuse

Goal: A range of intensities to be manipulated by architecture.

*minimal reliance on quantitative metrics

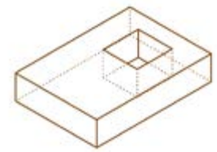
physical modelling workshop

Location: low in building

Exposure: Enclosed, Diffused

Goal: Soft, diffused daylight

*small reliance on quantitative metrics



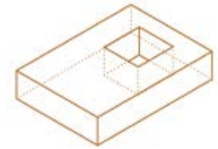
digital modelling workshop

Location: low in building

Exposure: Enclosed, Diffused

Goal: Soft, diffused daylight

*high reliance on quantitative metrics



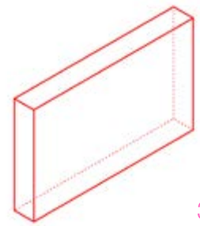
buffer zone

Location: /

Exposure: Enclosed, Direct, Diffuse

Goal: Moderate daylight between transition spaces.

*varies

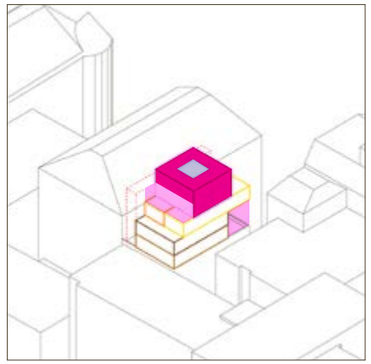


**All base models are subject to change, these objects are starting points.

BASE TEST

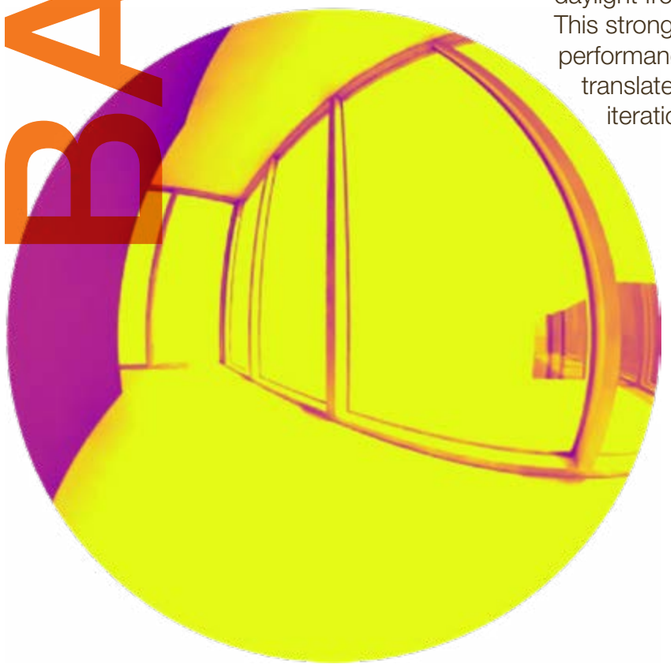
observation spaces

The observation spaces were tested as a confirmation of influx at this stage. Assuming all exposed walls are fully windowed, how much light would the alloted space aquire? These rooms have very few restrictions in terms of daylighting because their purpose is simply to receive and observe natural light. Observation spaces are expected to push values to the extreme. They show very high glare, ASE, and sDA because they are fully exposed to direct sunlight. These metrics do not necessarily reflect comfort but rather confirm the obvious: outdoor light is uncontrolled and intense. As the project evolves I predict that these observation spaces will become crucial drivers of form and section.



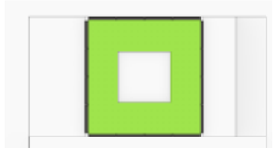
observation room

The observation room receives abundant daylight from its windows. This strong baseline performance should translate well into future iterations of the form.



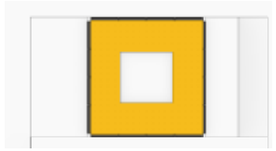
$sDA_{300/50\%}$

100.00%



$ASE_{300/50\%}$

100.00%



$GLARE_{\%>5\% \text{ of time}}$

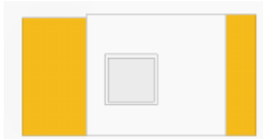
99.7%

$sDA_{300/50\%}$

100.00%

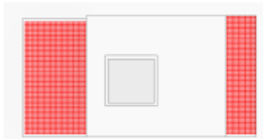
$ASE_{300/50\%}$

100.00%



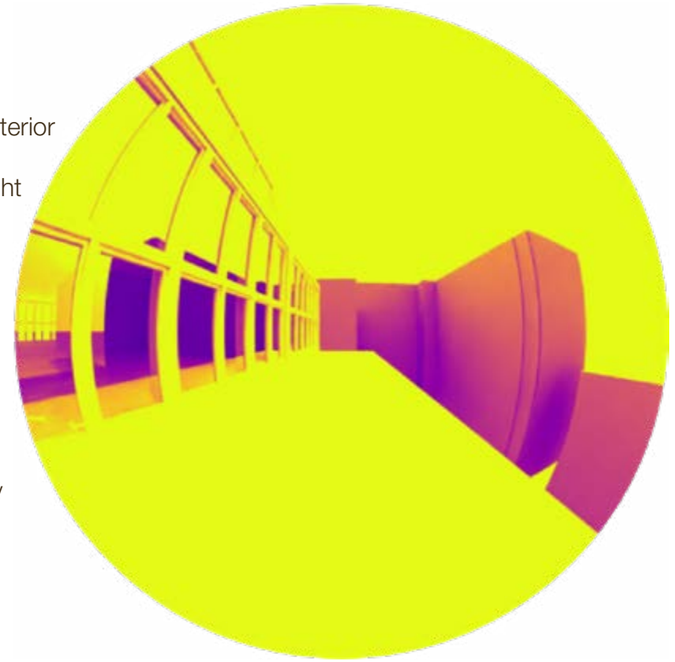
$GLARE_{\%>5\% \text{ of time}}$

100.00%



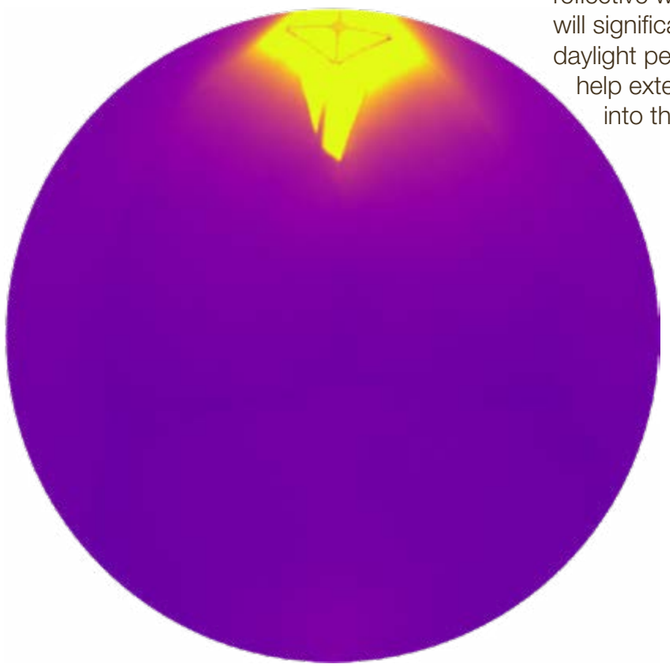
exterior courts

As expected, exterior courts reach maximum daylight metrics across all categories. However, comfort varies seasonally, with northern light feeling cold in winter and southern light becoming overly hot in summer.



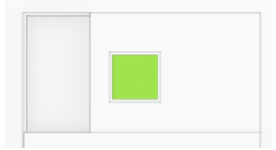
light well gallery

The gallery reads dark in its current form, but reflective wall treatments will significantly increase daylight penetration and help extend light deeper into the vertical shaft.



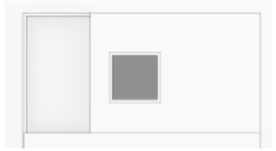
$sDA_{300/50\%}$

100.00%



$ASE_{300/50\%}$

0.00%



$GLARE_{\%>5\% \text{ of time}}$

0.00%

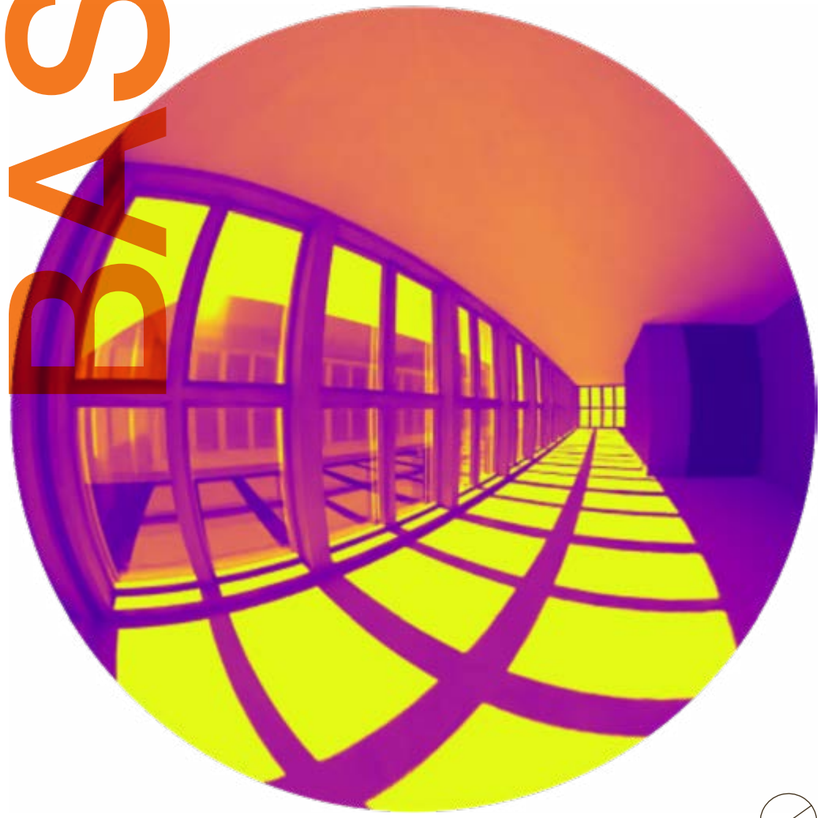
BASE TEST

testing spaces

The testing spaces have less freedom than the observation spaces. Comfort matters more but the priority here is variety. These rooms are meant to expose users to different daylighting conditions so they need to hold a wider range of illuminance qualities. Some tests demand sharp direct sun. Others require soft diffuse light. The goal is not to make the space perfectly balanced but to tune each room so it supports the kind of daylight experiments that will take place inside.

material and surface studio

The materials and surface studio shows a clear daylight split. One side receives higher levels of daylight while the opposite side holds much softer diffused light. The uniform sDA tells me that the overall daylight autonomy is steady across the room even if the character of the light shifts from side to side. This is a strong baseline for a space that will be used to test material reflectance absorption and texture. The massing will change as I continue to refine the form but the current distribution gives me something promising to build from. It offers both intensity and subtlety which are essential for studying how materials react to light.



$sDA_{300/50\%}$

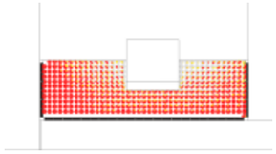
100.00%

$ASE_{300/50\%}$

53.8%

$GLARE_{\%>5\% \text{ of time}}$

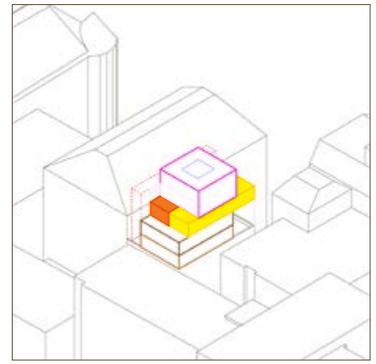
64.7%



BASE TEST

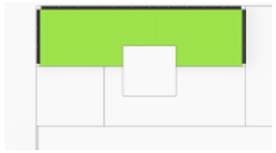
daylight testing studio

The daylight testing studio receives strong daylight penetration. The southern edge is bright while the interior settles into a smoother and more diffused distribution. This gradient will become incredibly useful as the project develops. It gives students and designers a place to test how light behaves across form depth and material. The current massing already provides a generous variety of conditions which means later iterations can refine and exaggerate these qualities rather than trying to invent them from scratch, though the final form of observation spaces may vary these outcomes.



$sDA_{300/50\%}$

100.00%

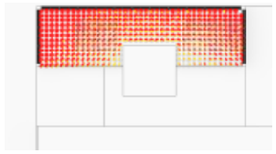


$ASE_{300/50\%}$

13.2%

$GLARE_{\%>5\% \text{ of time}}$

63.1%



BASE TEST

work spaces

The work spaces are the most restrictive and delicate rooms in the entire program because users spend long uninterrupted periods in one position. This is where glare and ASE become critical. Sustained exposure to bright patches of sunlight or uncontrolled reflections would make the spaces uncomfortable and unusable for focused design work. Before shaping any openings or adjusting any form, my first step is to understand how much daylight enters the space in its current state and where that light is concentrated. Only once I see the baseline distribution can I begin to tune the room toward comfort and productivity.

digital modelling workshop

In the digital modelling workshop the main priorities are ASE and glare. Fortunately the ASE is naturally low because this room sits low in the overall massing and only one façade receives significant light. Glare is the real concern. Even with limited exposure a single bright patch can severely impact screen based work. The challenge is to reduce glare and avoid increasing ASE while still keeping the sDA at an acceptable level. This means the space needs careful refinement rather than simply closing down the opening. Moving forward I will focus on diffusing the western light that strikes this façade and finding ways to soften the high angle sun while preserving long term daylight autonomy.

$sDA_{300/50\%}$

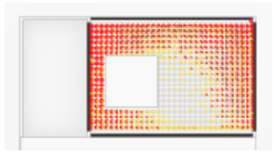
100.00%

$ASE_{300/50\%}$

1.4%

$GLARE_{\%>5\% \text{ of time}}$

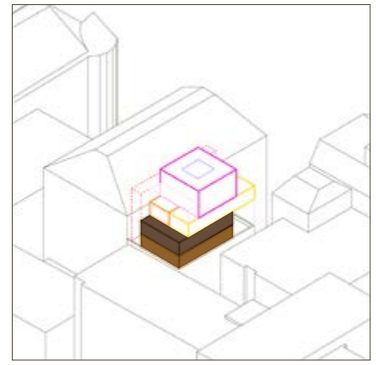
34.9%



BASE TEST

physical modelling workshop

The physical modelling workshop behaves very similarly to the digital modelling space. It shares a comparable form for the moment and only sits one level higher so the baseline daylight pattern is almost the same, though the ASE is noticeably higher, but due to change as the buffer zone shifts. The difference is how users occupy the room. In physical modelling people move around handle materials and shift positions often. Because of this mobility the tolerance for contrast and brightness is slightly more flexible. There is more room to let the space express daylight rather than suppress it. Still any glare from the south-east and any potential increase in ASE must be managed with care. Moving forward I plan to be more expressive with the form of this room using shape and depth to sculpt the incoming light while remaining attentive to comfort on that south-east edge.

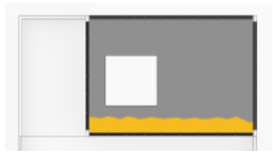


$sDA_{300/50\%}$

100.00%

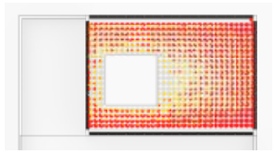
$ASE_{300/50\%}$

13.3%



$GLARE_{\%>5\% \text{ of time}}$

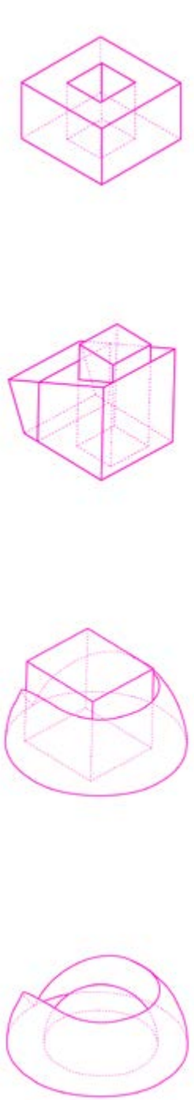
45.5%



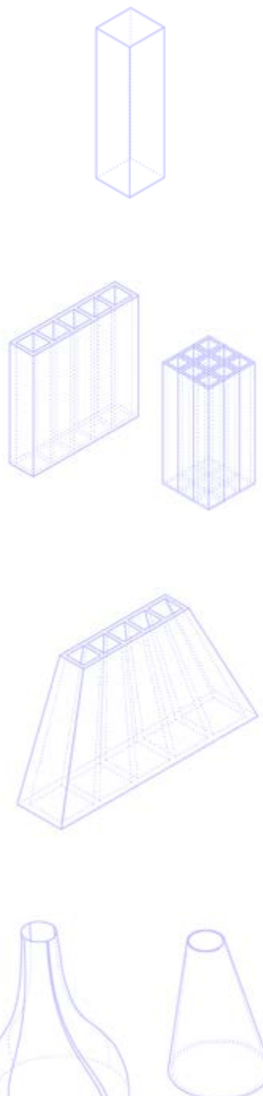
defining forms

There are many potential formal strategies that can meet the daylighting goals established in earlier phases. These models are intentionally provisional. Redefining forms through continuous testing is at the core of designing with daylight. Program sets the initial boundaries, but daylight ultimately determines which forms succeed.

observation room



light well gallery



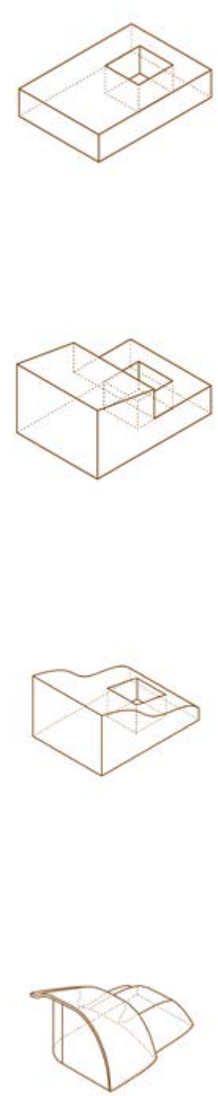
daylight testing room

Moving forward, I will continue to refine and adapt these geometries within their programmatic context. Through iterative evaluation, the daylight performance of each space will guide the evolution of the architecture until the most appropriate form becomes unavoidable.

*buffer zone and exterior court removed for future consideration

material and surface studio

physical modelling workshop

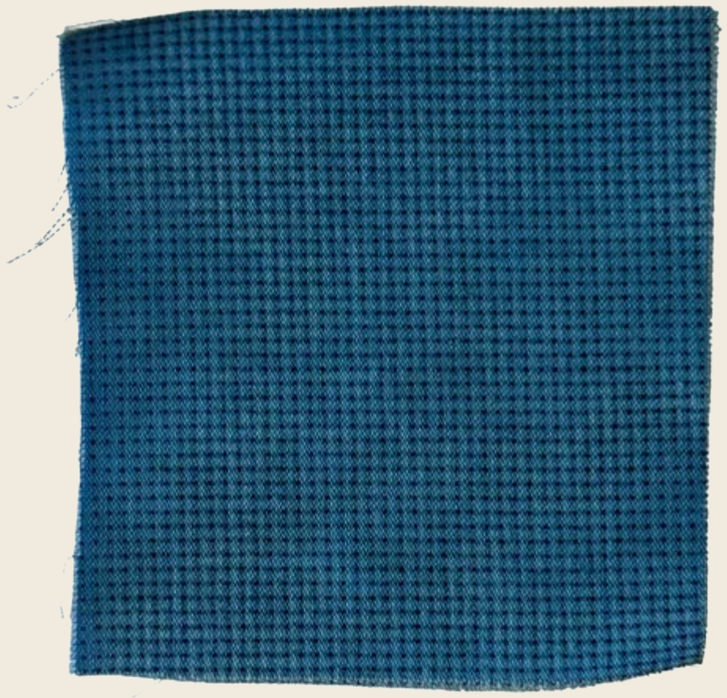


digital modelling workshop

5

DEVELOPMENT

sunlight as generator



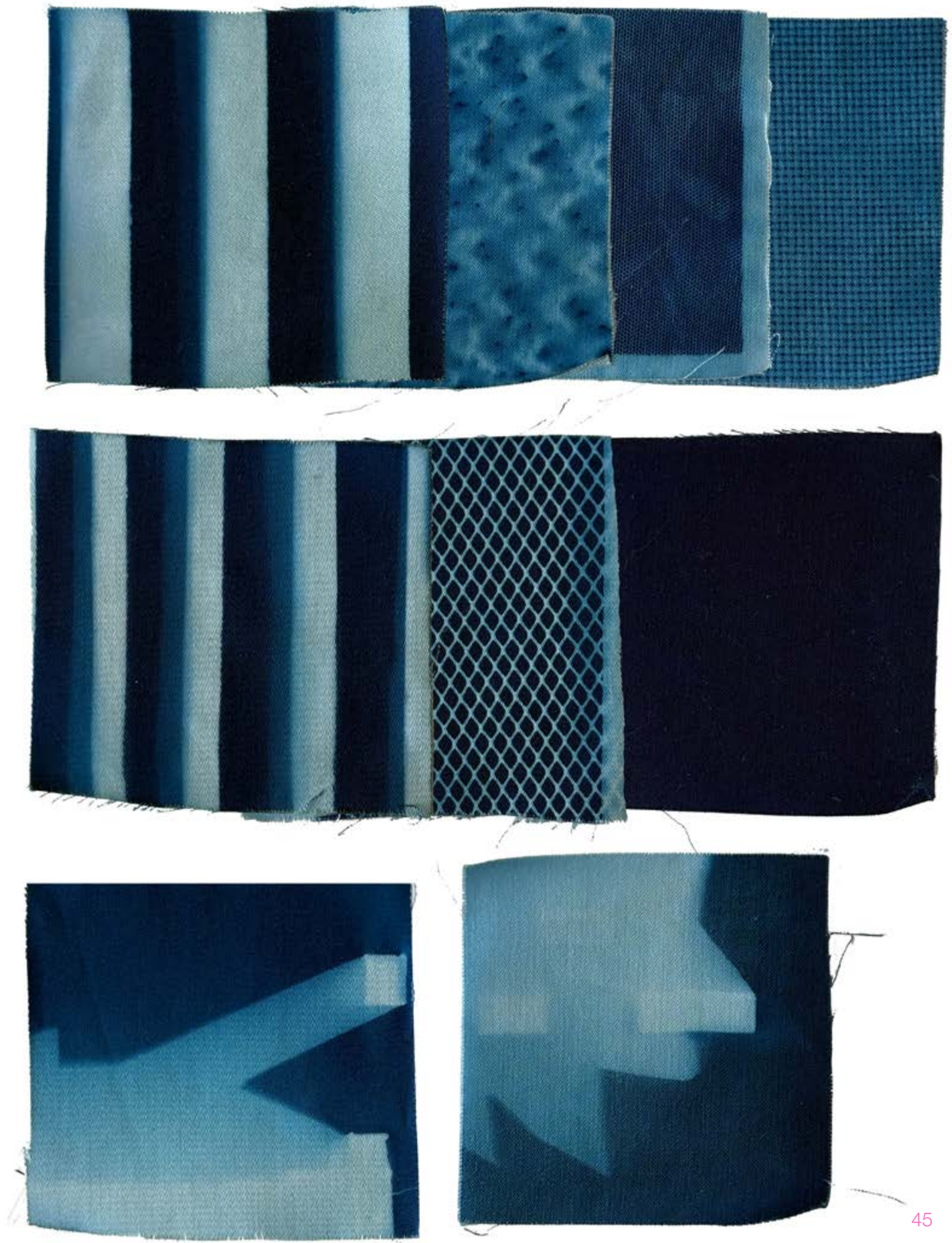
If Volume 1 asked what daylight is and how we might begin to design with it, this next volume asks what it becomes when given space, structure, and time. Building on the observations, principles, and early studies established previously, Volume 2 follows the translation of daylight from an idea into architecture, from models and metrics into inhabitable form.

Here, the Daylight Lab is no longer a proposal in principle, but a project under continuous development. The focus turns to iteration: testing spatial configurations, refining geometries, and negotiating between qualitative experience and quantitative performance. Each room becomes a case study in itself, shaped by its program, orientation, and desired luminous condition. Metrics are reintroduced not as prescriptions, but as tools in dialogue with perception, guiding adjustments without overriding intuition.

Ultimately, Volume 2 is less about defining daylight and more about working with it. It positions design as an ongoing negotiation between control and unpredictability, where architecture does not fix light in place, but frames the conditions for it to unfold.

sunlight as generator

I first turned to cyanotype processing as a generative tool for exploring form. The technique allowed me to work directly with light, testing transparency, layering, and exposure, to produce spatial ideas grounded in the behavior of daylight itself. Through these experiments, I began to understand how varying intensities, durations, and filters of light could shape form and atmosphere.



sheer fabric, polyester, 5 min. exposure

crochet cloth, cotton, 5 min. exposure

wire mesh, 20 min. exposure

wire mesh, 7 min. exposure

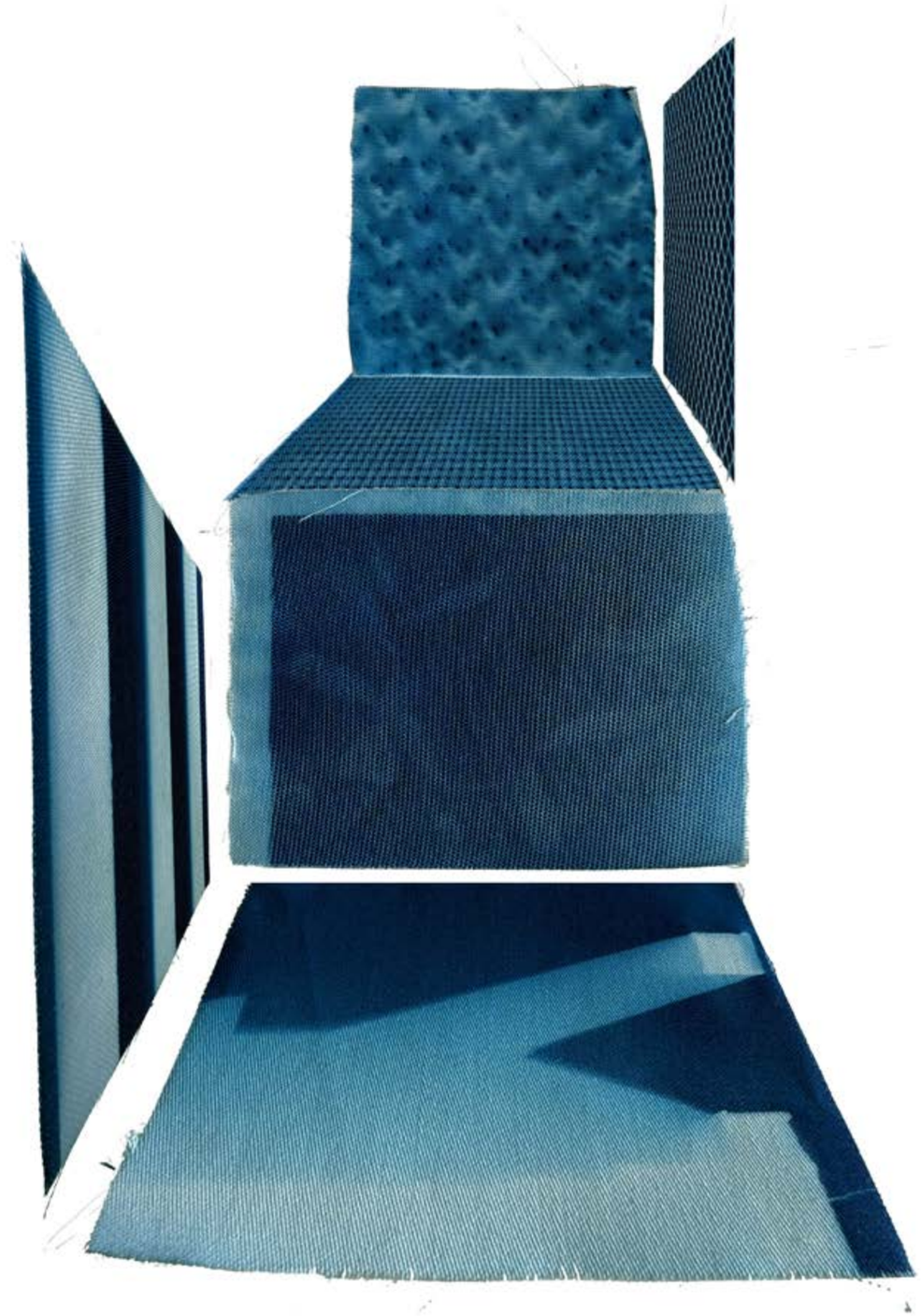
canvas, 7 min. exposure

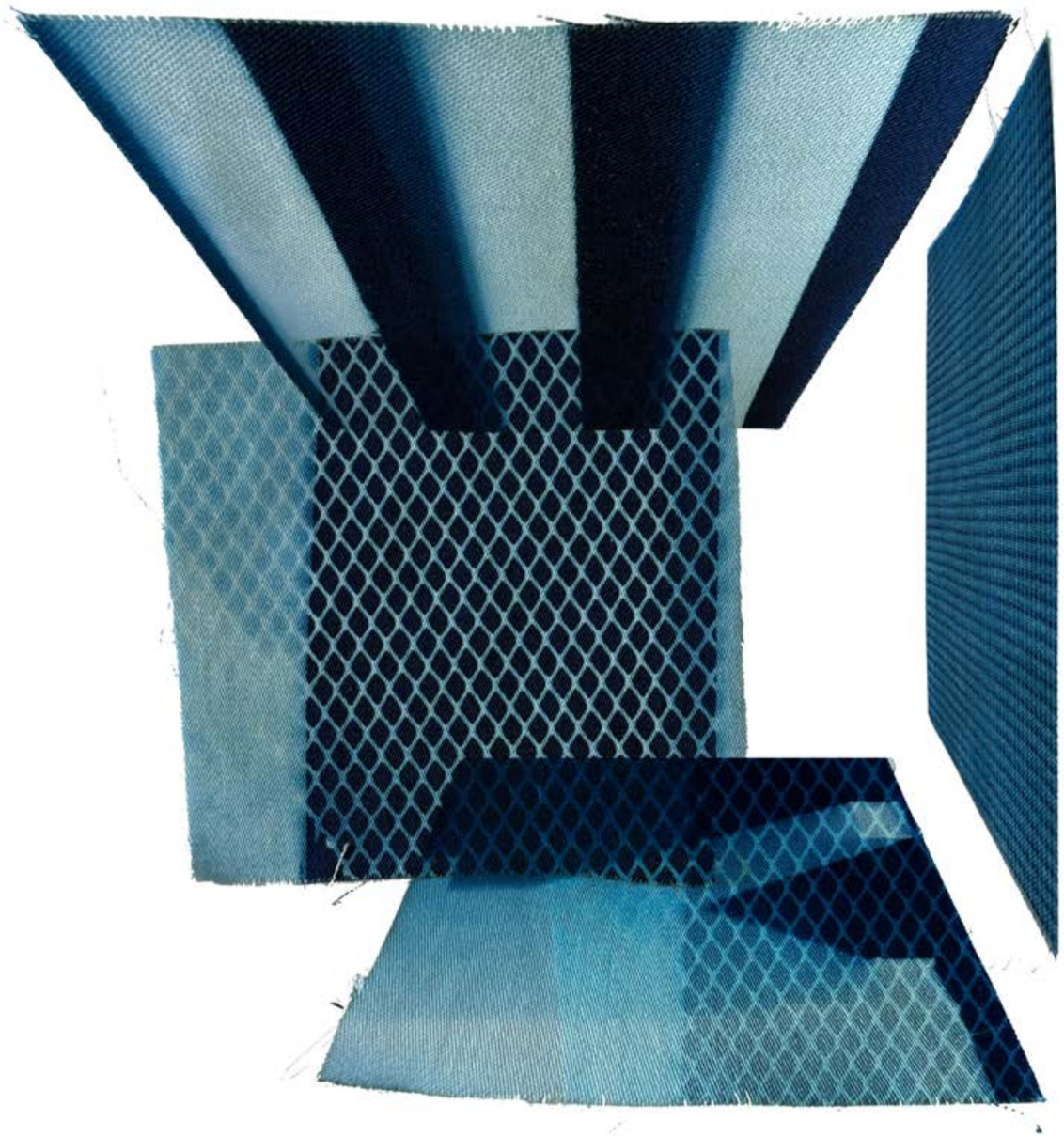
reflective louvres, carstock, 7 min. exposure

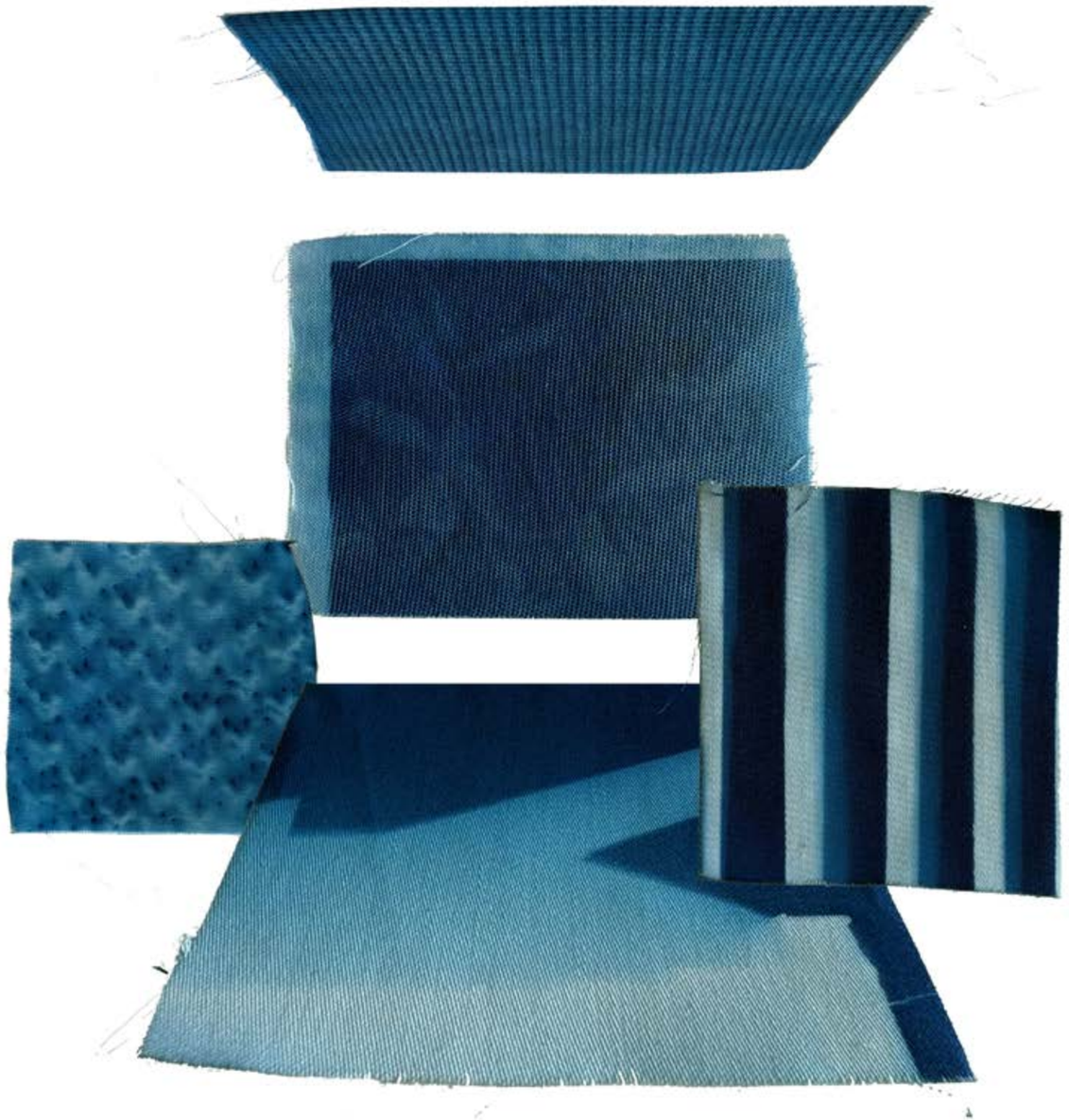
The following cyanotype-generated spaces represent a deeper exploration of form, an attempt to translate the behavior of light directly into spatial conditions. These studies pushed the project beyond initial concepts, using exposure, transparency, and layering to imagine how daylight might actively shape architecture.

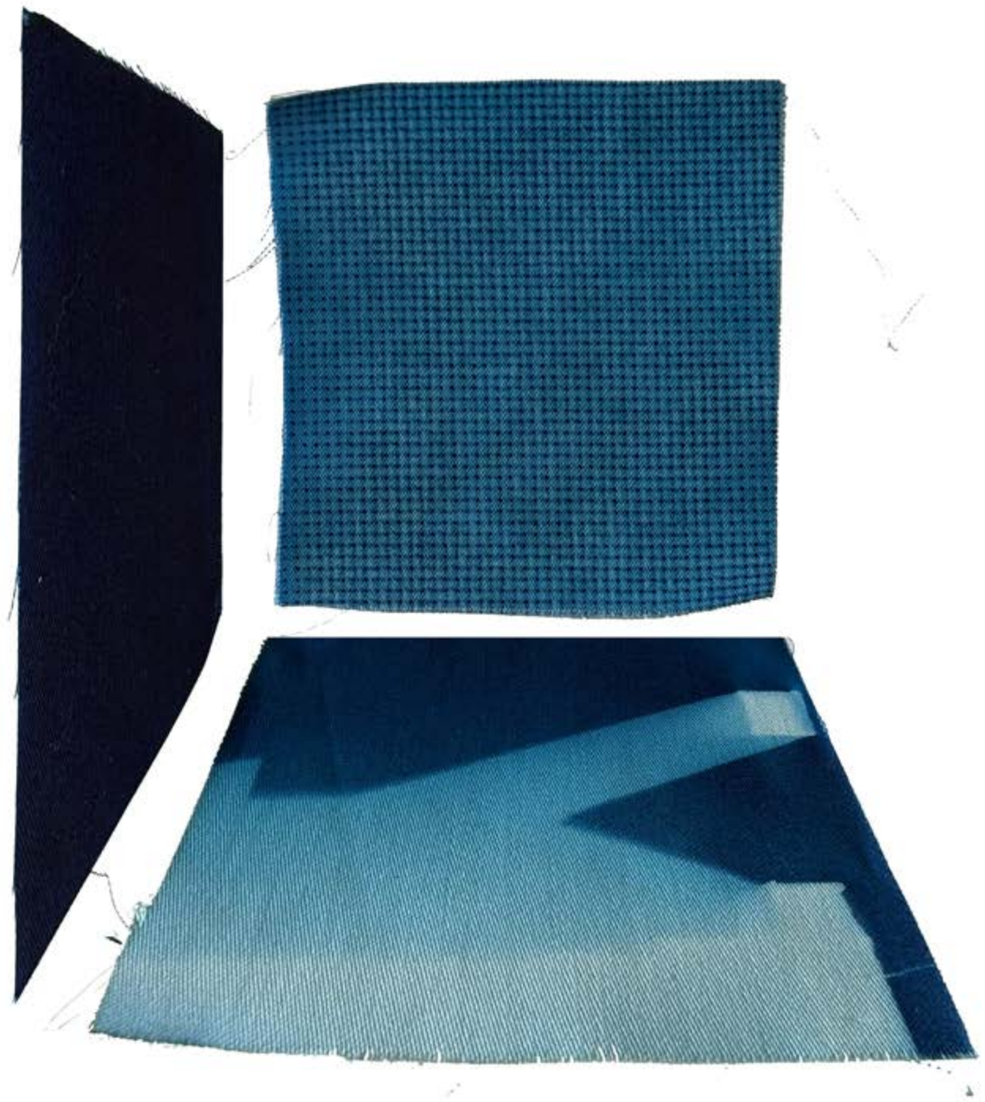
However, this exploration also clarified the limits of cyanotype as a design method. While it proved valuable for generating ideas, the process relies on highly specific and often uncontrolled lighting conditions. In contrast, the Daylight Lab requires a wider range of calibrated environments to support observation, testing, and work.

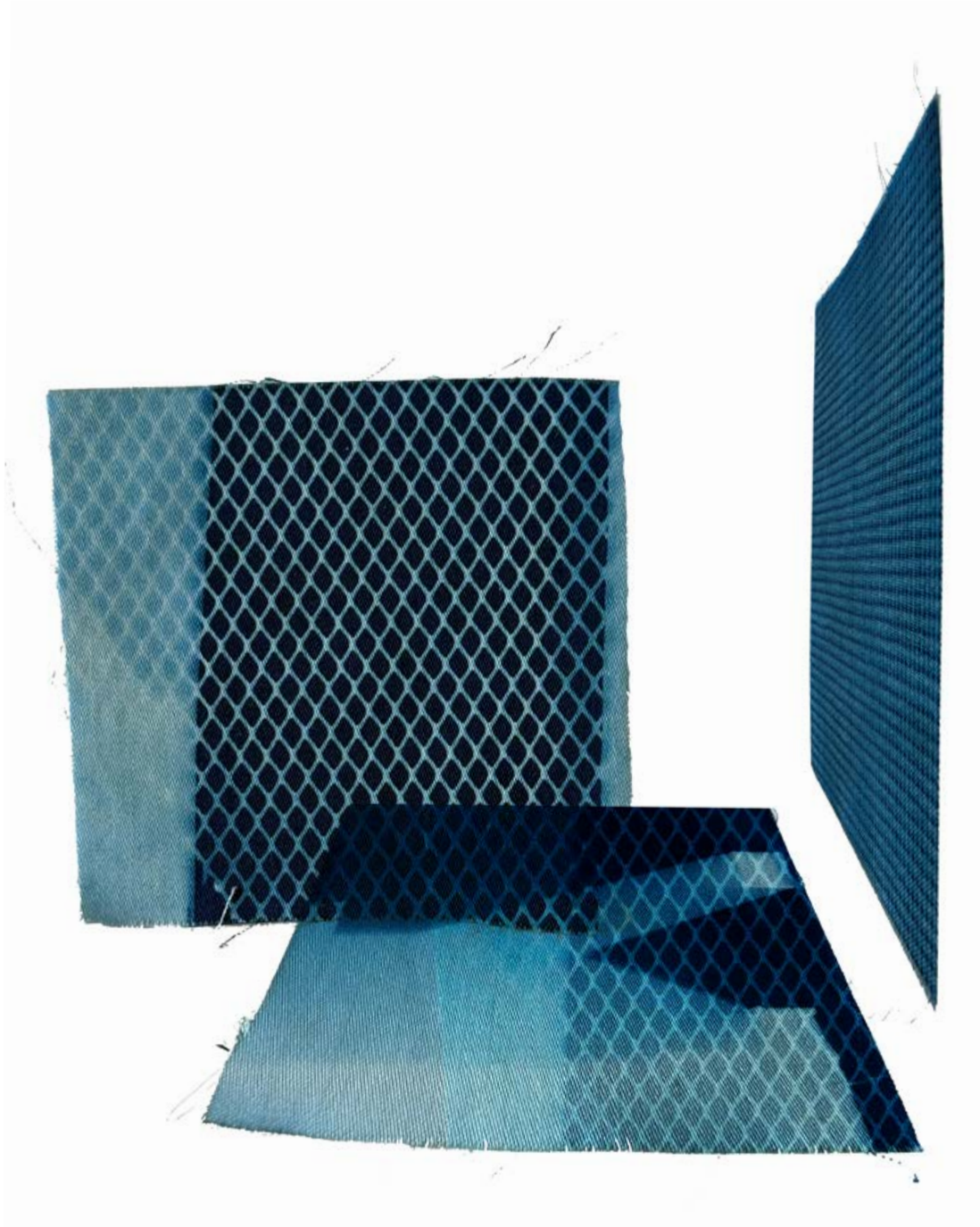
As a result, cyanotype shifted from being a driver of design to becoming a programmatic component, an activity housed within the Lab rather than a method for defining it. It remains a productive exploratory tool, one that ultimately reinforces the need for more controlled and diverse daylight conditions within the architectural framework.

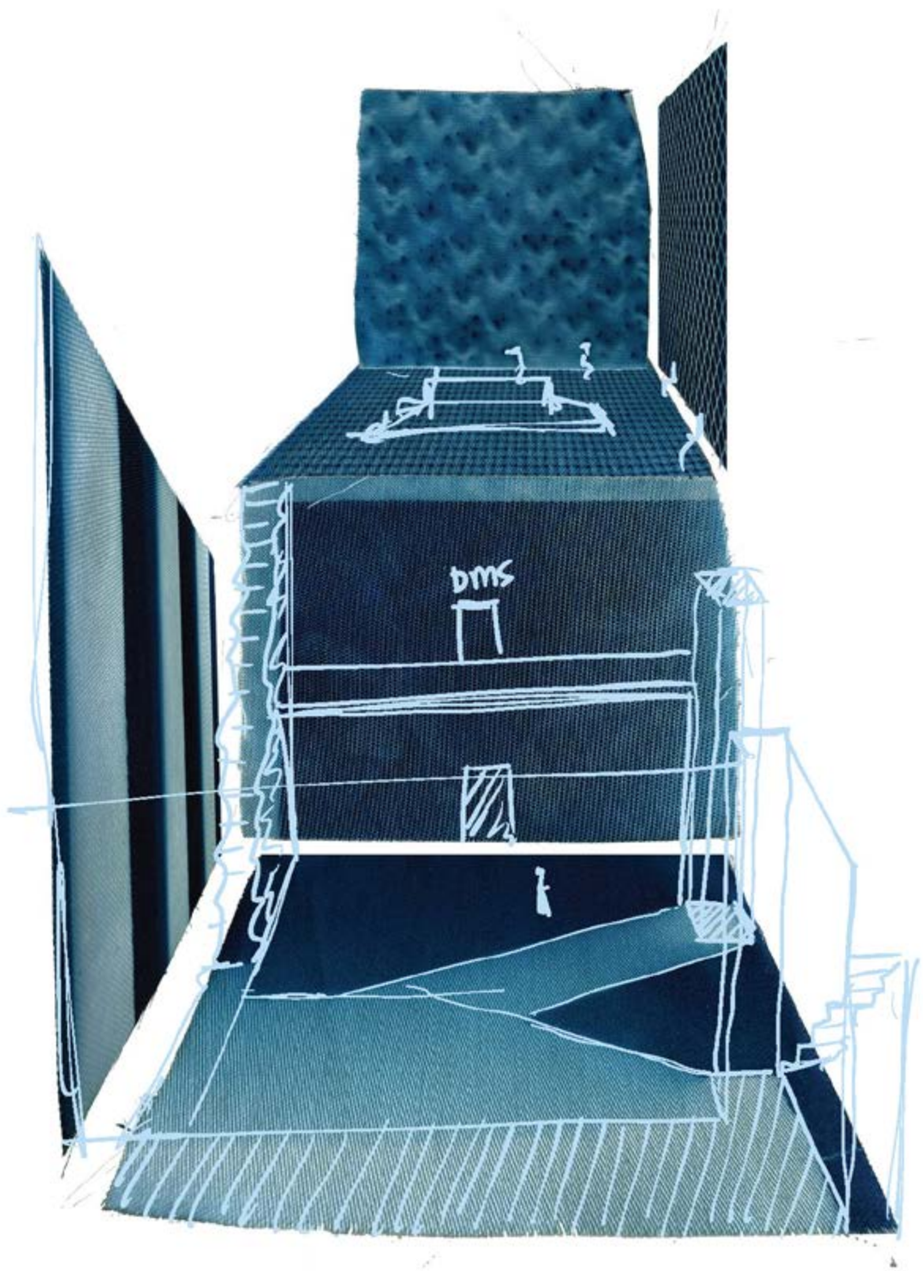


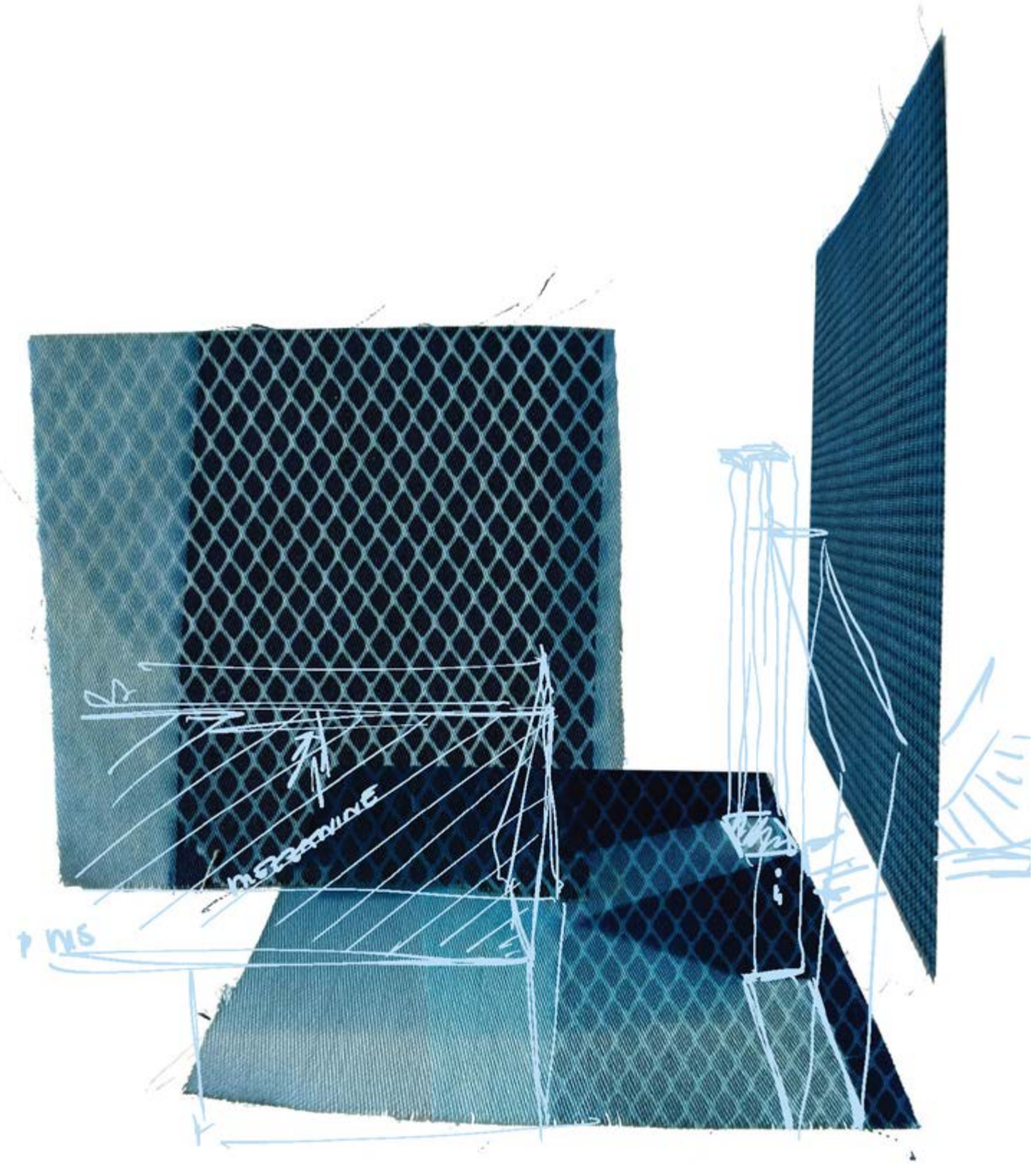












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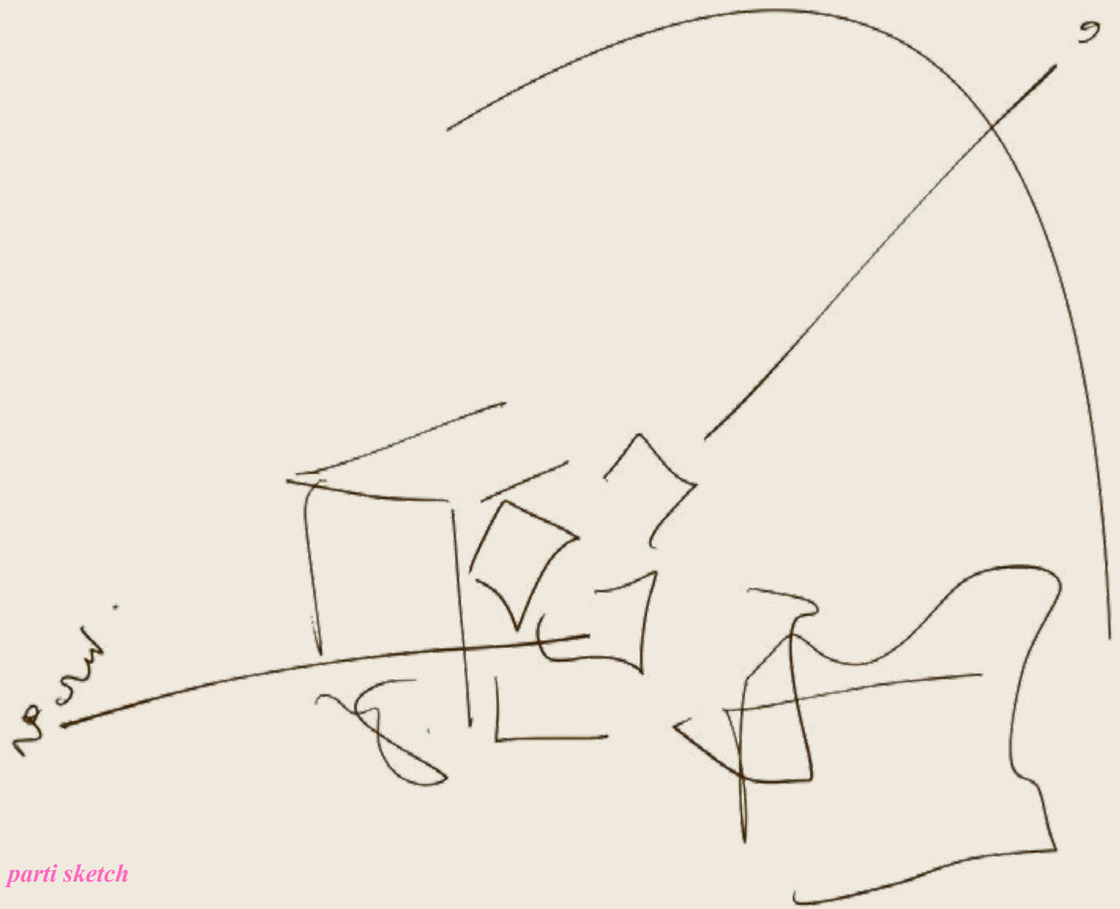


parti sketch

THE DAYLIGHT LAB

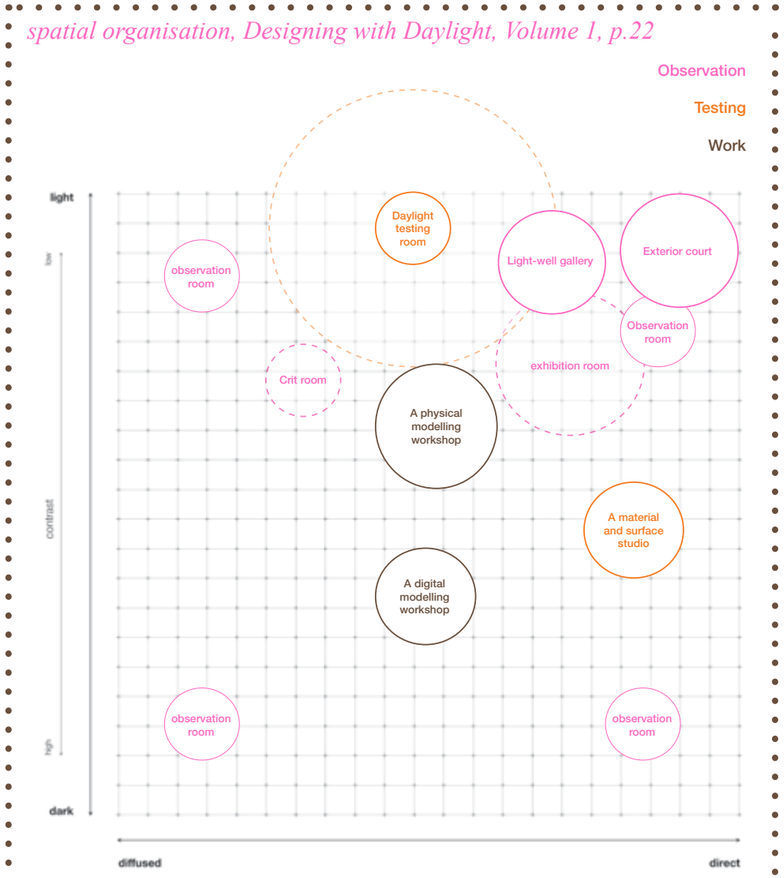
concept
program requirements
the core
the north wing
the south wing
perspectives
when the sun sets

Through the daylight design process outlined above, the following building emerges. It is important to note that this project is not intended as a repeatable model, but as a site-specific response shaped by its climate, context, and program.

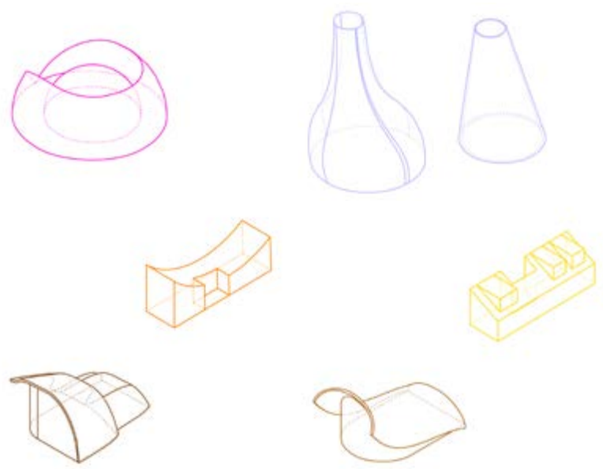
Rather than a fixed prototype, the Daylight Lab is conceived as a framework for variation. Each iteration would differ, adapting to its location and evolving through the very processes it is meant to support. While they share common principles and programmatic intentions, no two labs would be identical. Instead, each becomes a unique manifestation of daylight, informed by place, use, and ongoing experimentation.

concept

spatial organisation, Designing with Daylight, Volume 1, p.22



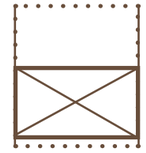
defining forms, Designing with Daylight, Volume 1, p.22



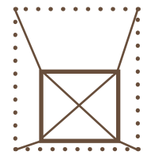
Through my cyanotype explorations, I realized the lab was not meant to simply “play” with sunlight, but to act as a neutral framework for studying it, a kind of blank canvas. The design of the Daylight Lab was therefore driven by the spatial organization diagram and the formal investigations from Volume 1. I also recognized that designing purely from daylight requirements risked over-optimizing a single sun path condition. Instead, glazing and orientation were carefully calibrated to the sun, positioning the building to receive optimal daylight for the given program.

step 1 Create a plane that will act as the main source of daylight for a given program or space

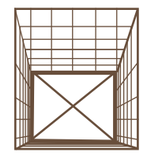
step 2 Direct this plane toward the idealized sunlight/daylight for that program requirement (direct/diffused)



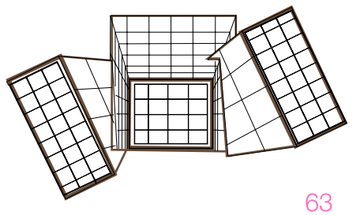
step 3 Adjust the plane size, shape, and form to optimize influx of daylight according to the program requirement (light/dark)



step 4 Allow surrounding walls to compliment the daylight requirement and plane that will act as boundary for the program.



step 5 Repeat for all programmatic requirements.



concept model 01

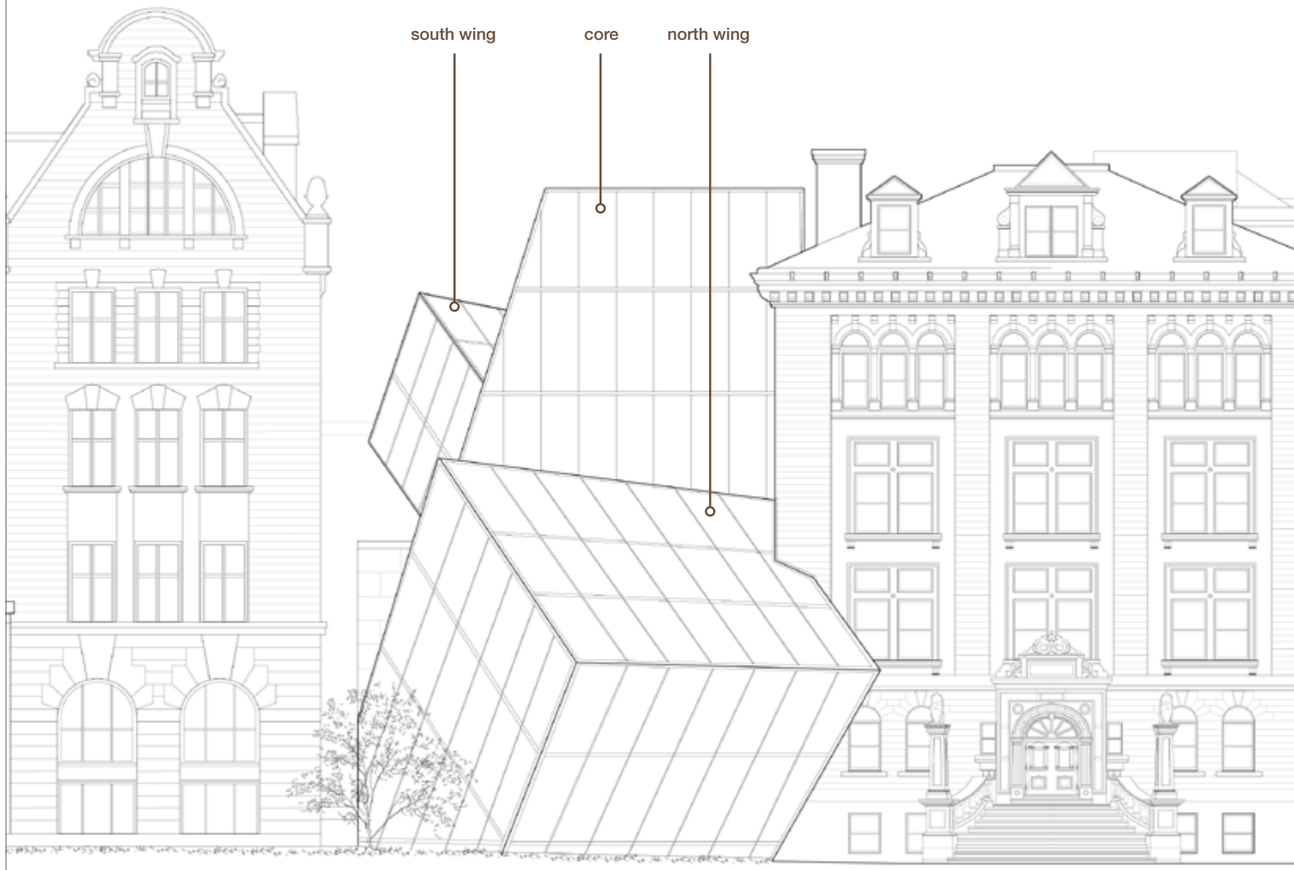
concept model 02

concept model 03

program requirements

Three primary daylighting requirements translate into three distinct spatial conditions: one oriented southward to maximize direct solar exposure, another oriented northward to capture consistent, diffuse light, and a third positioned between these extremes, calibrated to support user agency across testing, observation, and work.

The conceptual models were instrumental in informing the development of the plans and sections, ultimately shaping the Daylight Lab in its resolved architectural form.

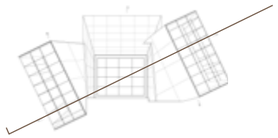


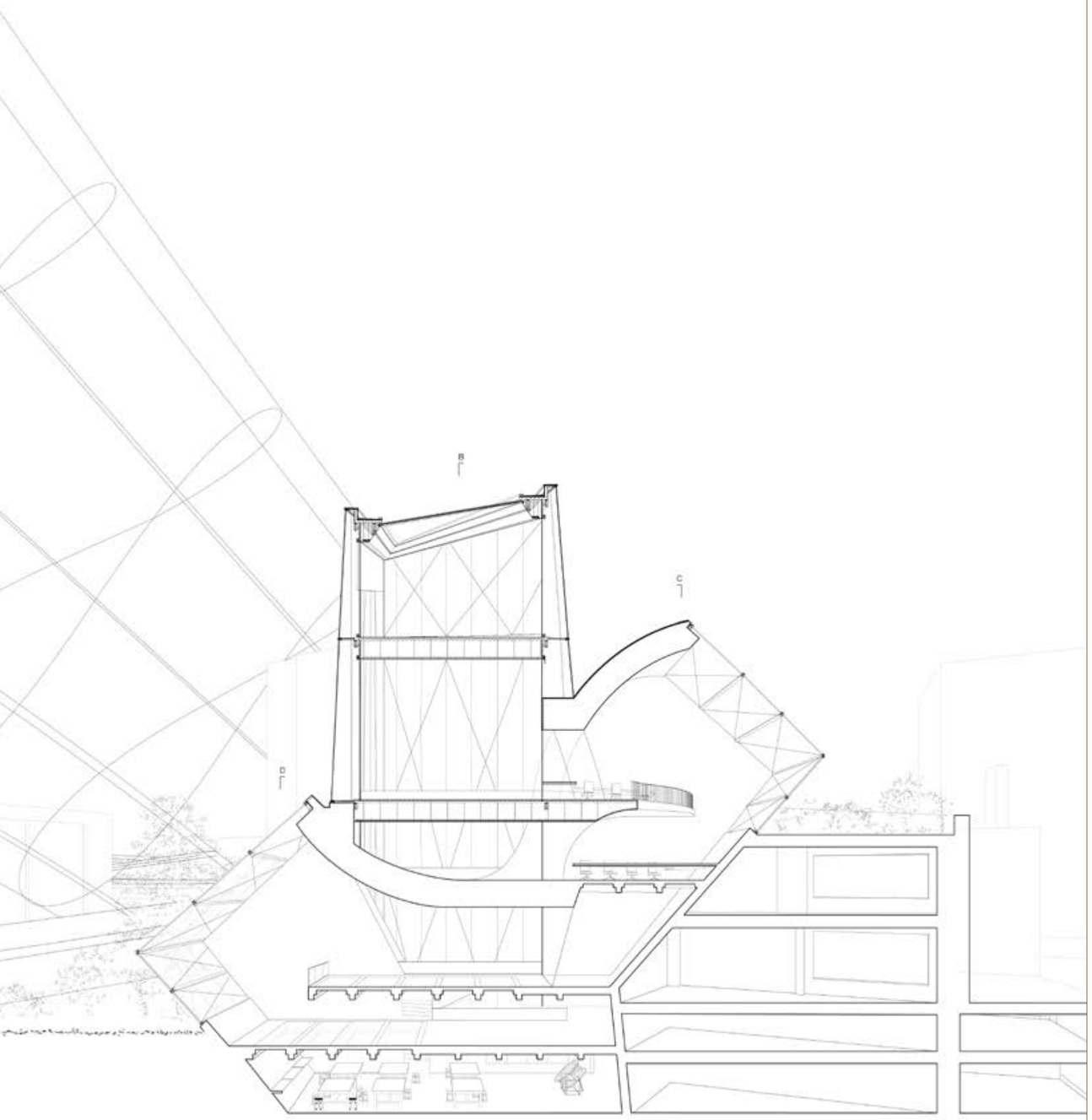
macdonald-stewart building

macdonald-harrington building

0m 2.5 5 10

elevation





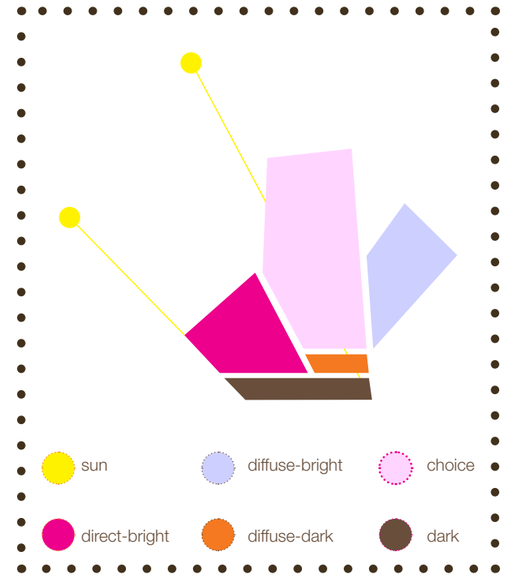
*see complete drawing in 04-documentation

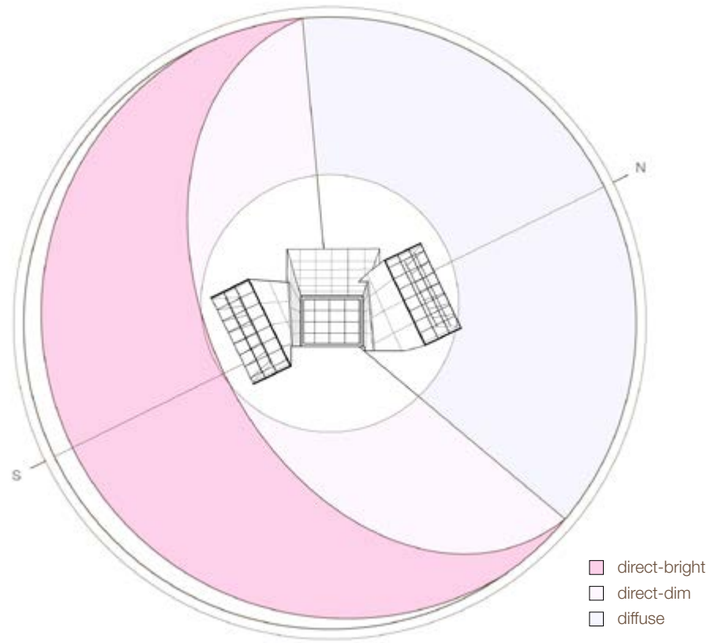
the core, the north wing & the south wing

Derived from the spatial organization diagram in Volume 1, the three primary programs are further articulated into four light-based conditions: diffuse, direct, bright, and dark. Rather than treating program and light as separate systems, they are understood as interdependent, where spatial use is directly shaped by the quality and intensity of daylight.

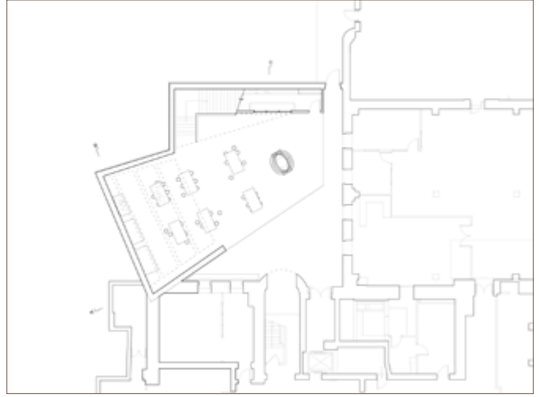
Diffuse and direct conditions are explicitly tied to orientation, corresponding to the north and south wings respectively, and calibrated according to the inherent solar characteristics of each façade. In contrast, bright and dark are defined by exposure and proximity to daylight, establishing a vertical and sectional gradient within the building.

As a result, the building is organized not only by programmatic function, but by a continuous spectrum of light conditions. Each space is positioned to align with a specific daylight logic, allowing the architecture to operate as a spatial translation of light intensity, direction, and depth.

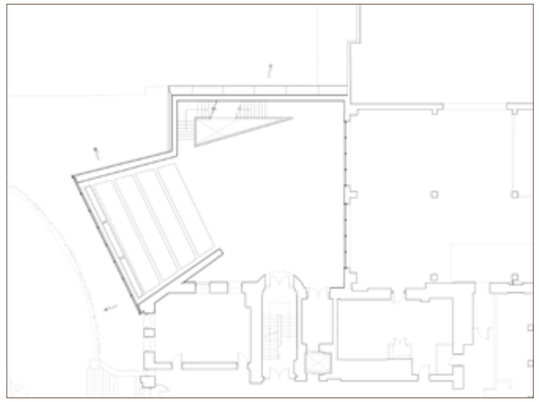




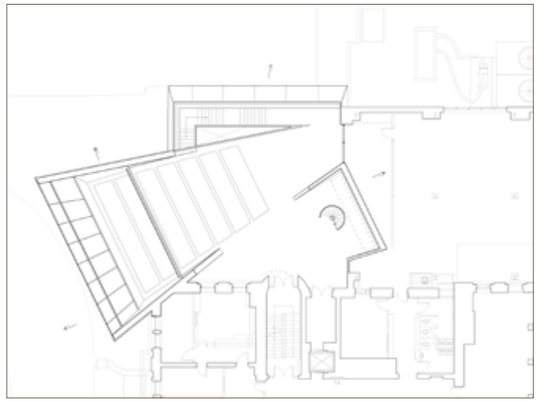
plan 01



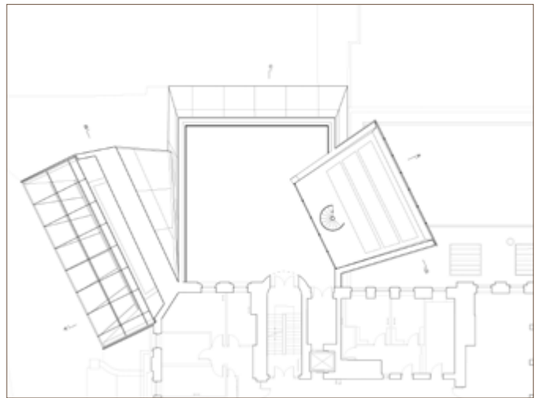
plan 02



plan 03



plan 04

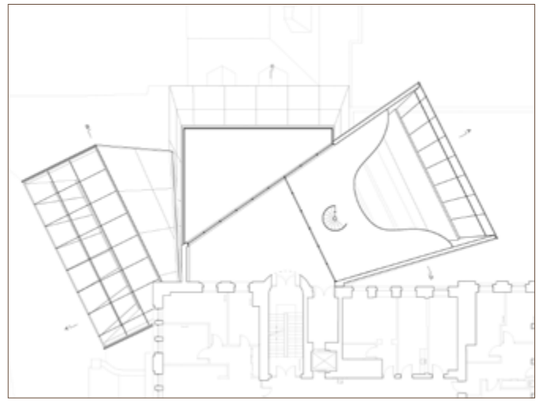


the core

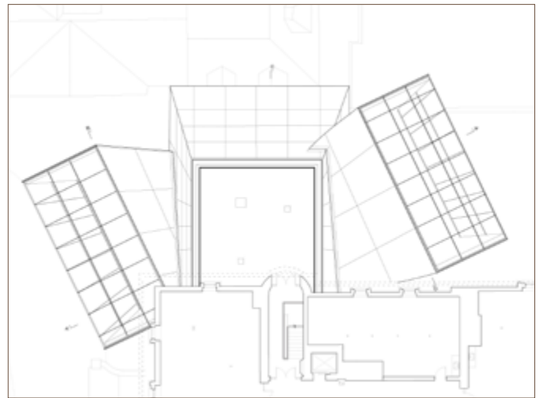
The core is the only element that spans the full height of the building, rising vertically to engage the complete range of solar angles and maximize light capture. It is conceived as a predominantly glazed volume, equipped with operable shading systems on every level to modulate exposure and control interior conditions.

Functionally, the core serves as the connective spine, linking all wings of the project. Primary circulation is anchored through the existing Macdonald-Harrington building, while secondary circulation is introduced at lower levels to facilitate more direct movement between testing, fabrication, and observation spaces for students and designers. Interspersed mezzanine levels accommodate taller and more intensive models, allowing vertical continuity within the working environments.

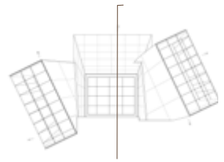
plan 05



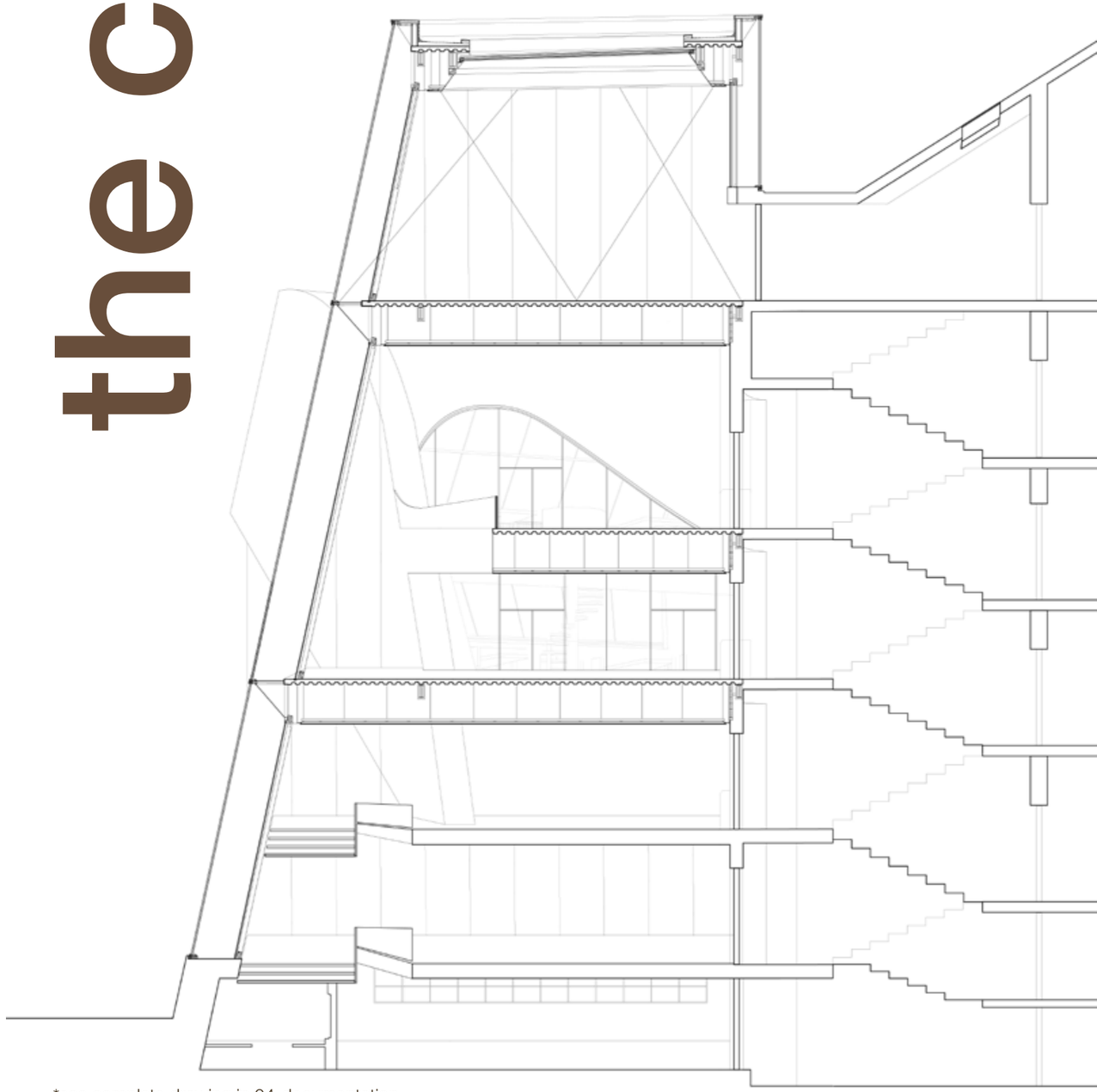
plan 06



the core



section B

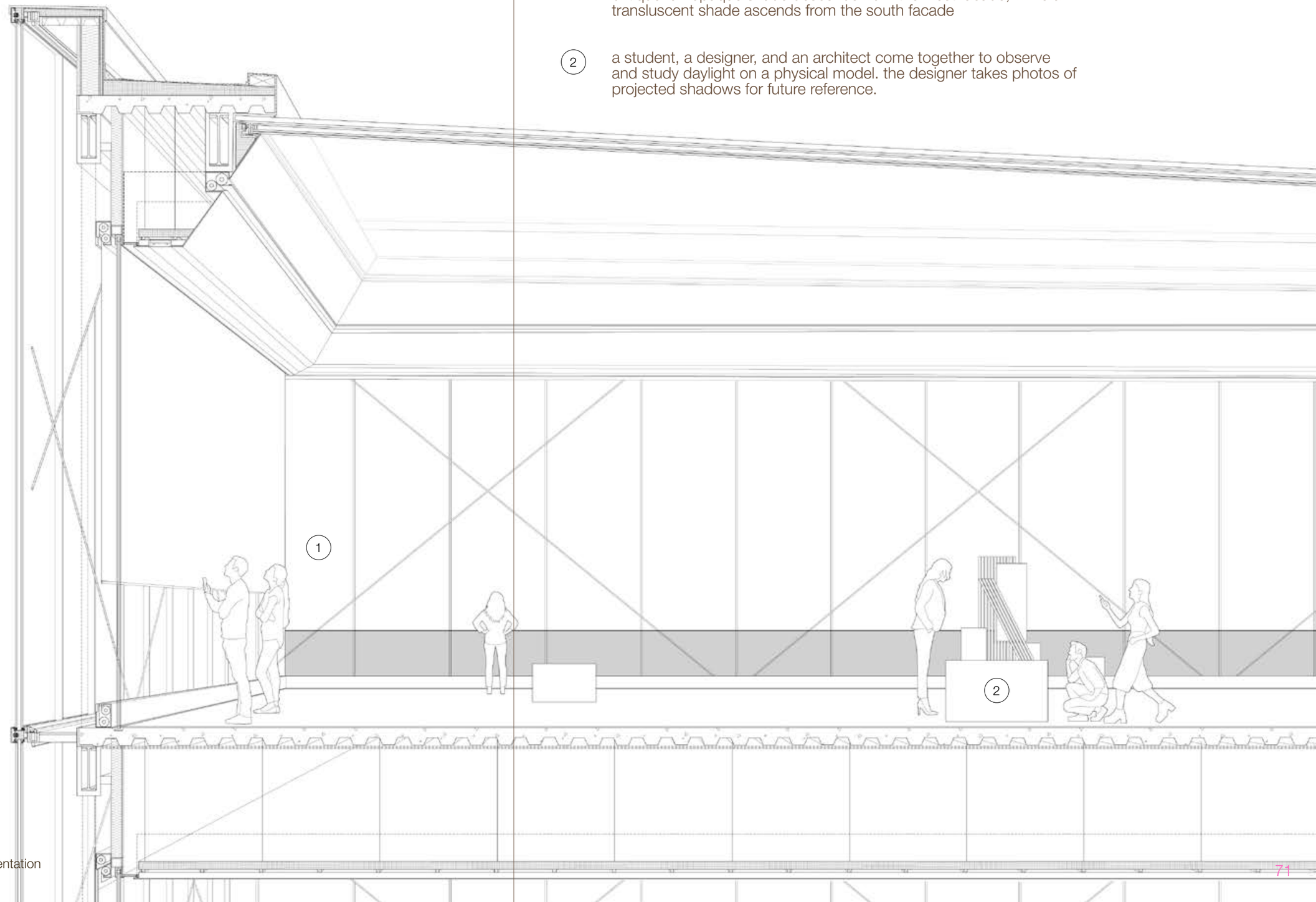


*see complete drawing in 04-documentation

detailed wall assembly

The observation deck at the top floor is designed to maximize user agency in testing, observing, and working conditions. Positioned above surrounding obstructions, it allows for optimal solar observation throughout the day. Mechanized shading systems, located both overhead and on all vertical surfaces, give users precise control over light conditions. Shades can rise from below and descend from above, offering four levels of opacity. Users can also introduce their own shading devices, making the space a flexible environment for testing light in their designs.

The core is conceived as a highly adaptable space that can accommodate a wide range of programs, as long as appropriate lighting conditions are met. Through responsive shading systems, the environment can be adjusted quickly, allowing spatial conditions to be modified at the touch of a button.



1 three students test the mechanical shading system for an upcoming critique. an opaque shade descends from the west facade, while a transluscent shade ascends from the south facade

2 a student, a designer, and an architect come together to observe and study daylight on a physical model. the designer takes photos of projected shadows for future reference.

*see complete drawing in 04-documentation

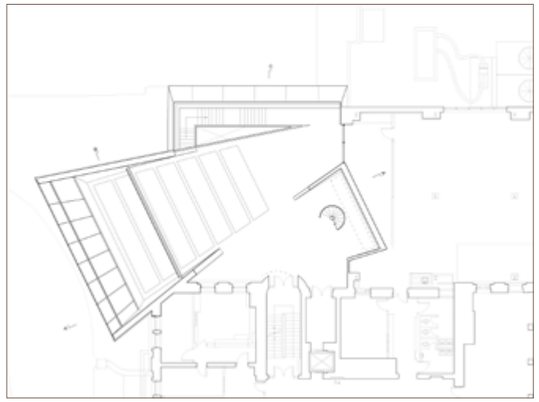
the north wing

concept model 02

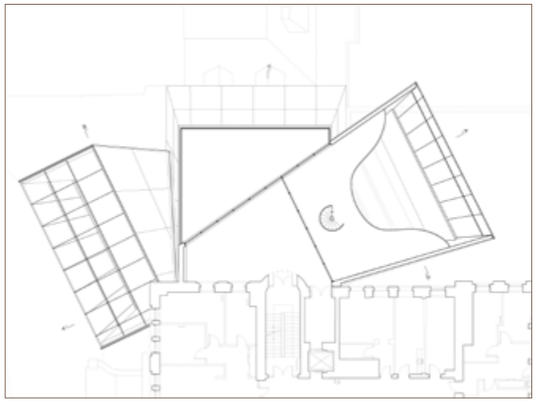
The north wing is dedicated to diffuse daylight conditions, making it an ideal environment for the digital modelling studio. By excluding direct solar exposure, the space minimizes glare and reduces eye strain, supporting prolonged screen-based work. Only the cooler, consistent quality of northern light is admitted, establishing a stable and controlled visual environment.

Circulation within the studio is primarily vertical, allowing users to move between varying quantities of diffuse brightness. As one ascends, proximity to the façade increases, resulting in a gradual shift from lower to higher light levels while maintaining the same soft, indirect quality. Workstations are arranged perpendicular to the windows to optimize screen visibility and minimize glare, reinforcing both ergonomic comfort and spatial clarity.

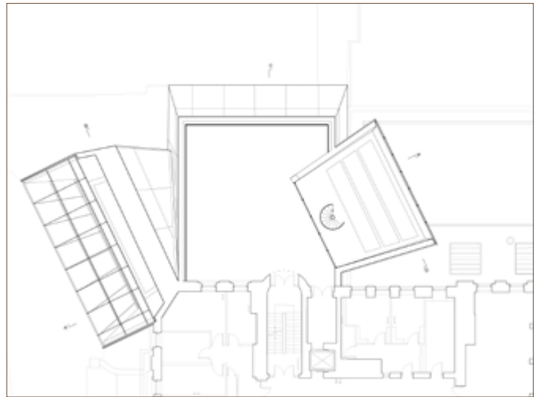
plan 03



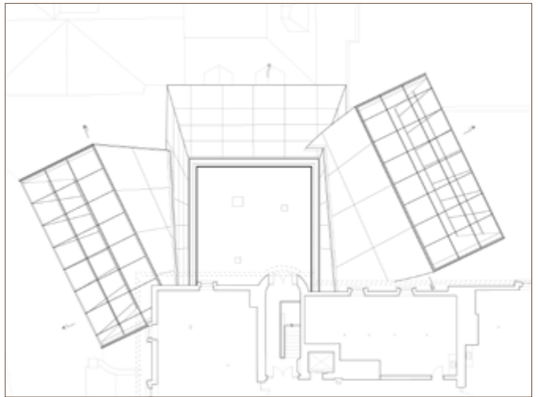
plan 05



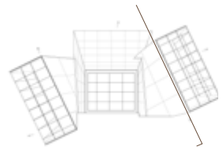
plan 04

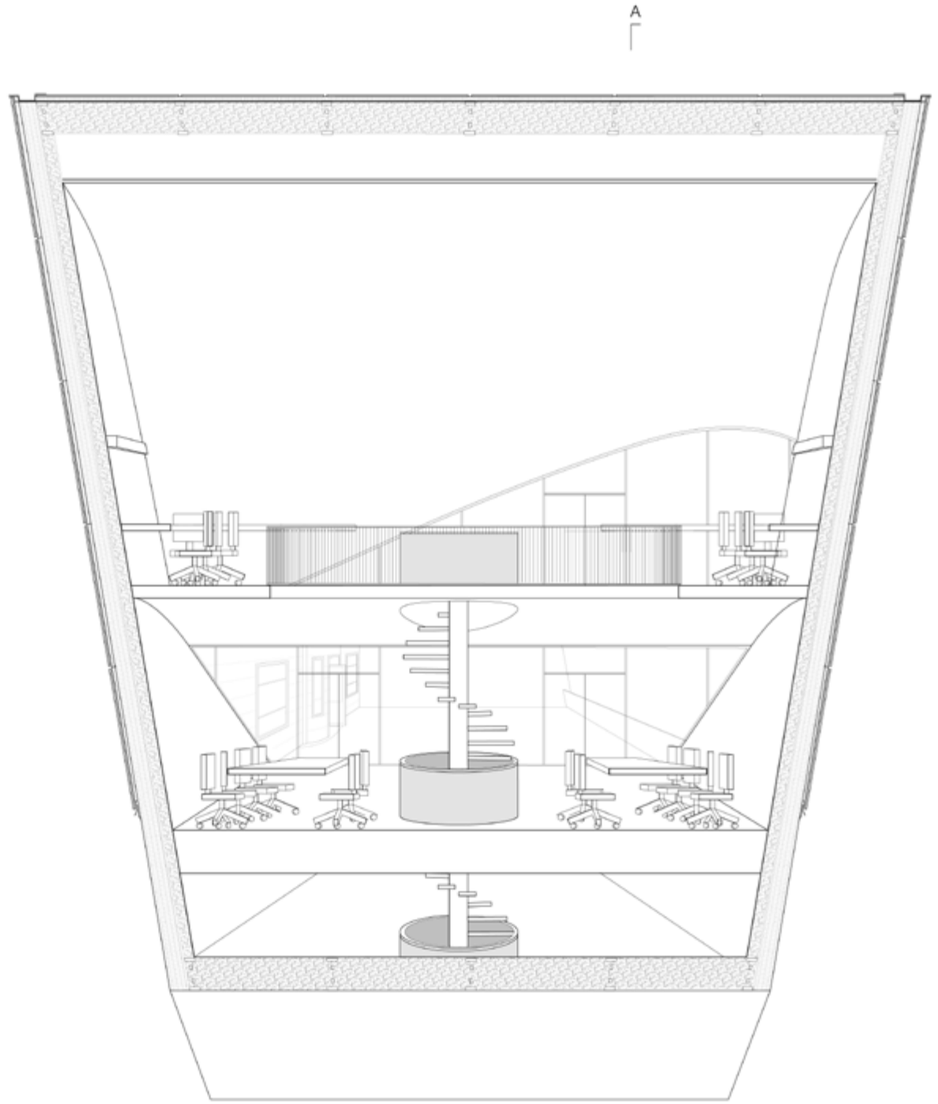


plan 06



the north wing

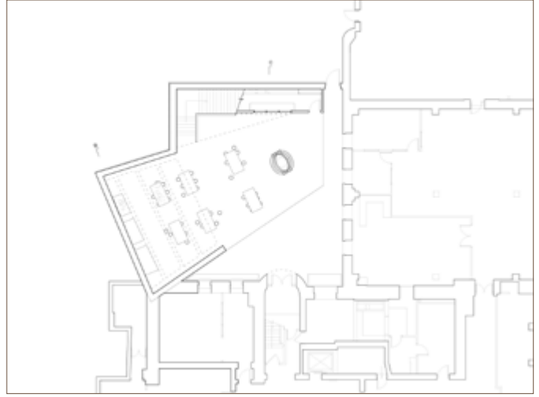




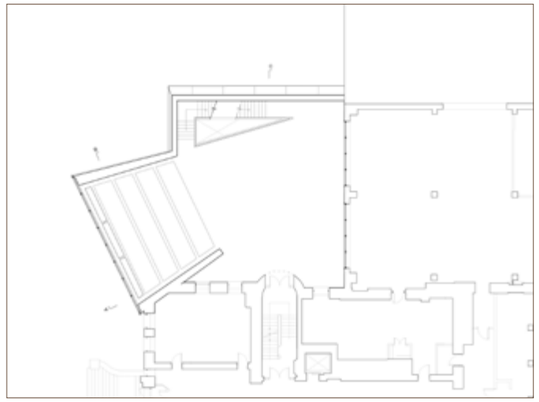
*see complete drawing in 04-documentation

section C

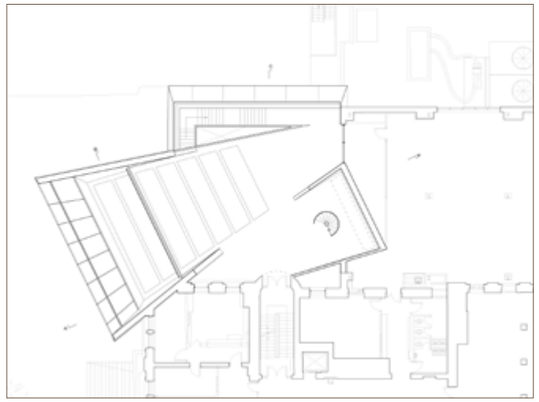
plan 01



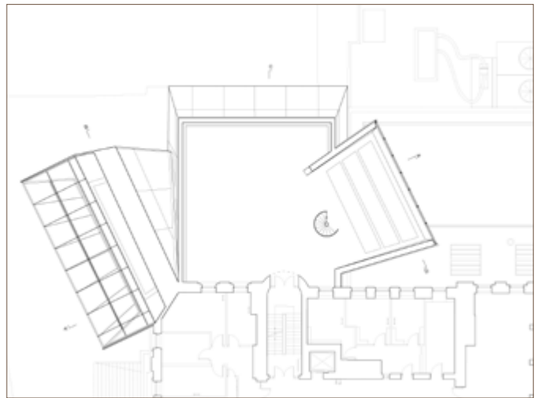
plan 02



plan 03



plan 04



the south wing

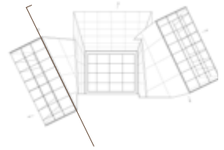
The south wing is dedicated to the direct experience of sunlight, operating as the project's primary interface with solar exposure. Both the main floor and mezzanine are carefully oriented to capture the sun at its peak intensity throughout the day and across all seasons, allowing light to penetrate deeply into the space. As a result, sunlight becomes an active and visible element, its movement, intensity, and angle shaping how the space is perceived and used.

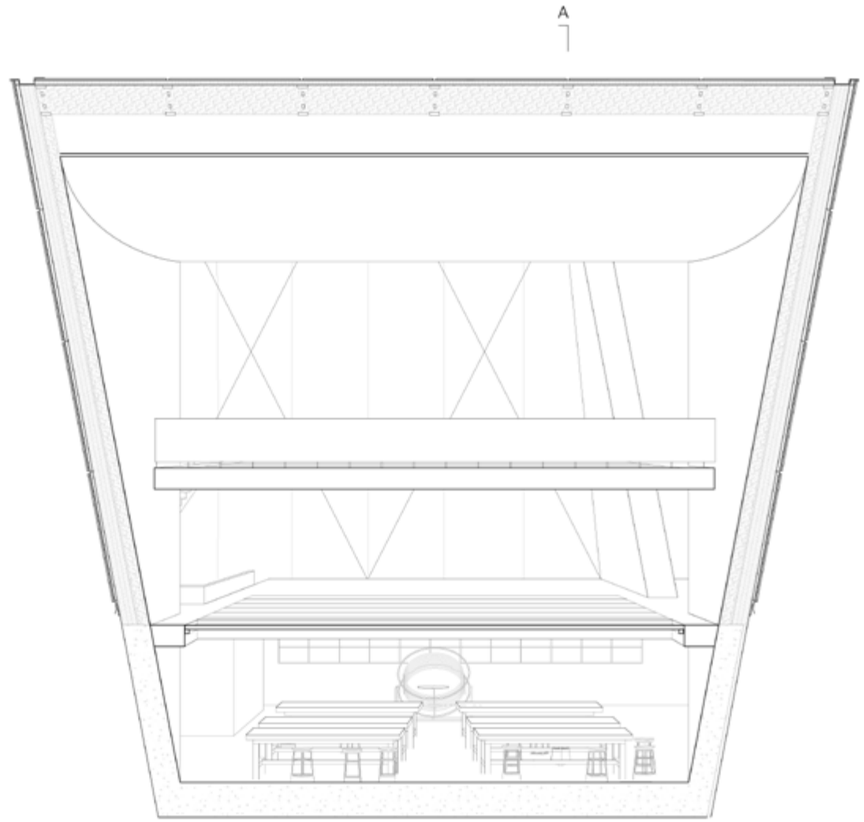
Programmatically, these upper levels are designed for observation, where users can study how direct sunlight interacts with materials, surfaces, and spatial configurations. The space also supports experimental testing of solar angles, enabling designers to evaluate different strategies for controlling or incorporating direct light into their work. In this sense, the south wing functions both as an observational platform and a testing environment.

In contrast, the basement level houses a more controlled laboratory setting, where precision and consistency are prioritized. A series of workstations are arranged for hands-on experimentation, receiving softened daylight through diffused skylights that filter the intense southern exposure above. This creates stable working conditions while maintaining a connection to the source of light. The south wing also includes a darkroom and a dedicated cyanotype production room, supporting analogue processes that depend on controlled light exposure.

concept model 03

the south wing





*see complete drawing in 04-documentation

section D

observation

The highest level of the core is conceived as a flexible environment for testing and observation, though its use is intentionally not limited to these functions. It operates as a hybrid space capable of accommodating exhibitions, design critiques, and informal reviews, while also serving as a setting where students can test, document, and photograph their models under controlled lighting conditions.

Through a remote-controlled system, users can precisely adjust the operable shading devices to suit their specific needs, calibrating light intensity, direction, and diffusion in real time. This capacity for immediate environmental control transforms the space into an active instrument, allowing it to shift seamlessly between modes of display and experimentation. As such, the uppermost level of the core becomes both a representational space and a performative one, where light is continuously manipulated as part of the design process.

testing

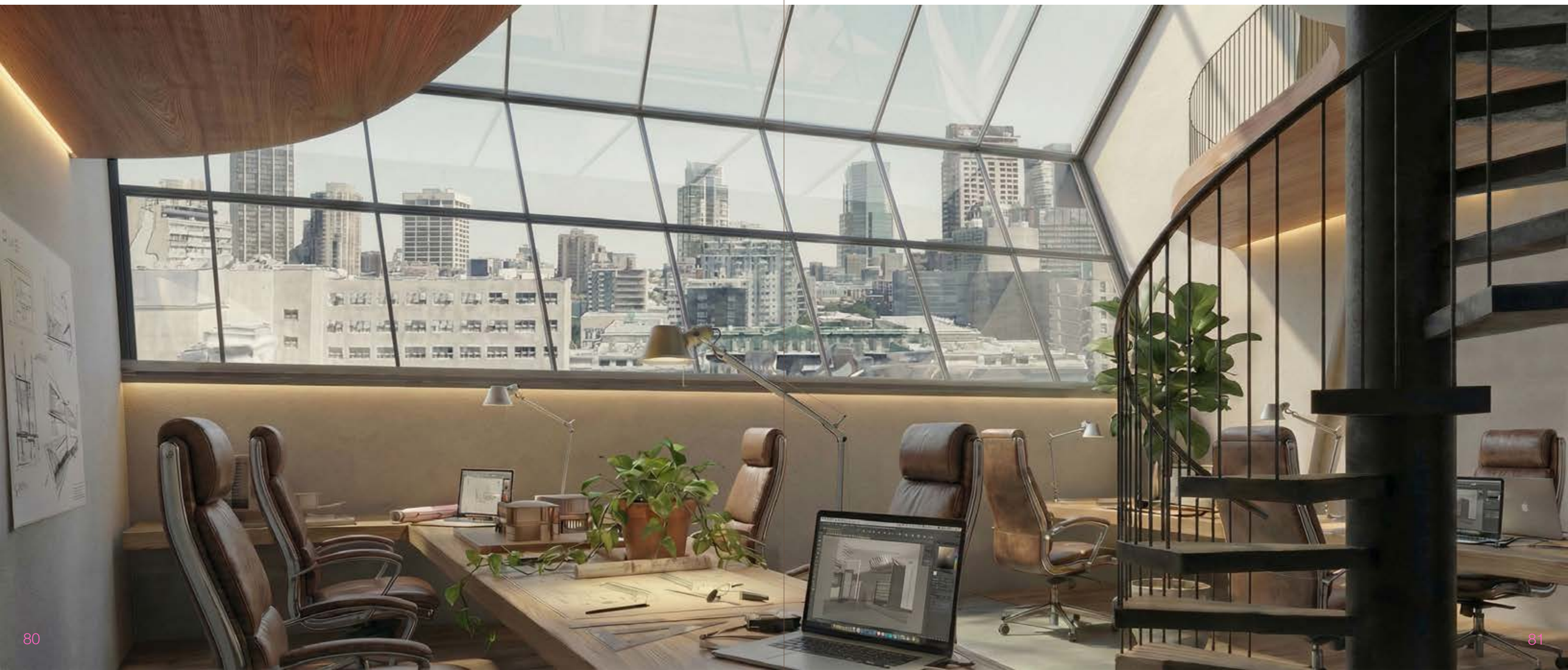
The testing lab is conceived as a space of controlled lighting, located in the basement of the south wing where precision and experimentation take priority over exposure. Here, daylight is no longer simply experienced but deliberately constructed, manipulated, and studied. The lab supports a range of methods for designing with light, allowing users to test, iterate, and refine their approaches under calibrated conditions.

Workstations are equipped for model-making and hands-on experimentation, while adjacent spaces support analogue processes such as cyanotype production, where controlled exposure to light becomes part of the design inquiry. In the absence of natural sunlight, a heliodon is used to simulate solar conditions, enabling the study of sun angles, shadows, and seasonal variations independent of time or weather. Together, these tools position the lab as a critical counterpart to the observational spaces above transforming daylight from a variable condition into a measurable and reproducible design medium.

work

Finally, the digital modelling studio is designed as a comfortable and stable working environment, calibrated to support prolonged screen-based work while maintaining a strong connection to natural light. Large windows are lifted and carefully proportioned to maximize the admission of diffuse daylight, ensuring the space is evenly illuminated without introducing glare or visual discomfort.

Workstations are oriented perpendicular to the façade, positioning screens away from direct light sources and reducing eye strain while preserving ambient brightness throughout the room. The result is a workspace that remains visually calm and ergonomically efficient, allowing users to engage digital tools without interruption from harsh solar conditions.



when the sun sets

It goes without saying, but it is important to acknowledge that the sun is not constant. Its qualities shift continuously over the course of a day and across seasons. Morning light tends to be warmer and lower in intensity, while afternoon light becomes cooler, sharper, and more direct. Cloud cover can transform the entire building condition into a field of diffuse illumination for extended periods, whereas clear skies can produce intense solar gain and uncomfortable heat until sunset. Even beyond this, the question remains: what kind of light exists when the sun disappears entirely?

This variability is integral to the design of the building and its interiors. Rather than treating daylight as a fixed resource, the project is structured around its instability and cyclical nature. The architecture responds not only to presence of light, but also to its absence.

At night, the shading system within the core transitions into a dedicated night mode. All shading elements descend, and artificial lighting activates across the building, transforming the core into an illuminated vertical mass within the structure. The building becomes legible as a glowing infrastructural presence, reversing its daytime relationship to the sun.

Despite this shift, work continues within the Daylight Lab. Electric lighting takes over the role of the sun, providing a subdued and strictly functional level of illumination that preserves continuity of use without replicating daytime conditions. The space remains operational, but intentionally restrained, sustaining activity until natural light returns and reactivates the building's full environmental system.

7

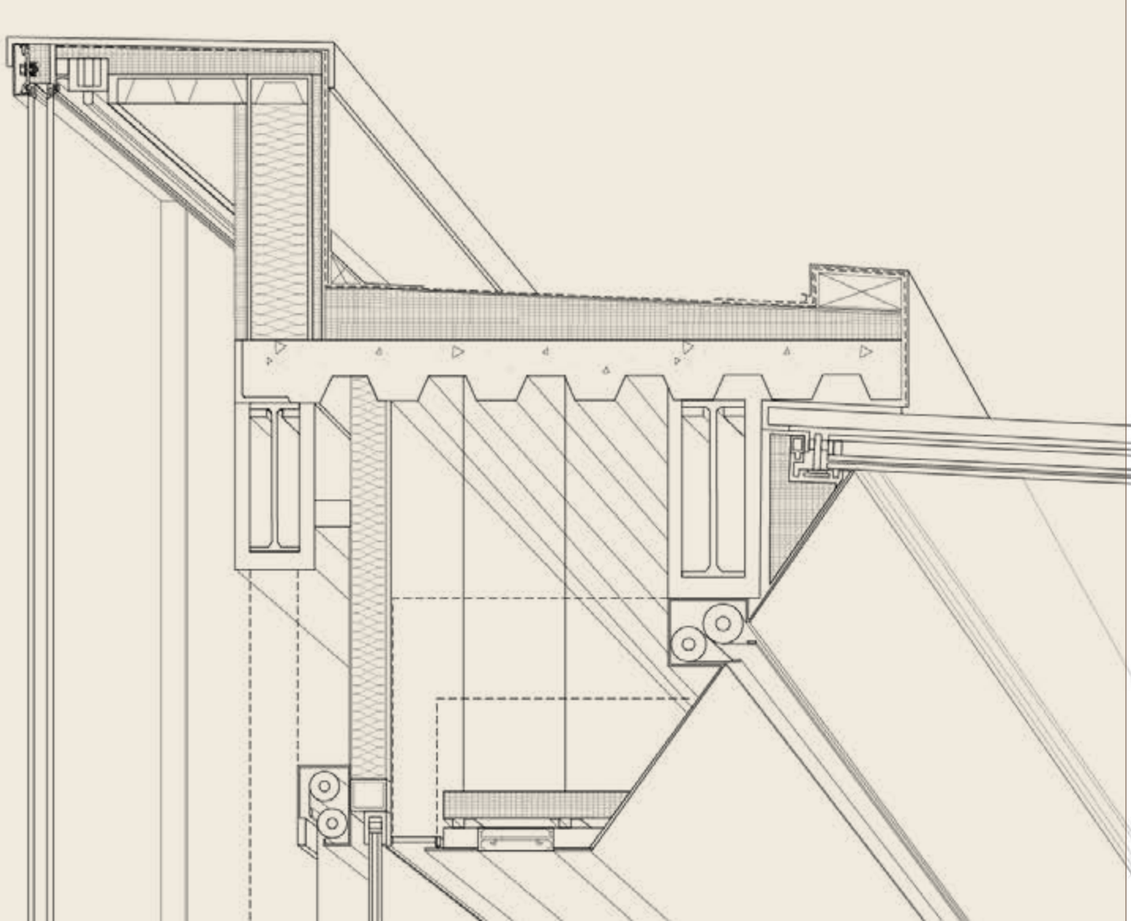
DOCUMENTATION

elevation

plans
- plan 01
- plan 02
- plan 03
- plan 04
- plan 05
- plan 06
- plan 07

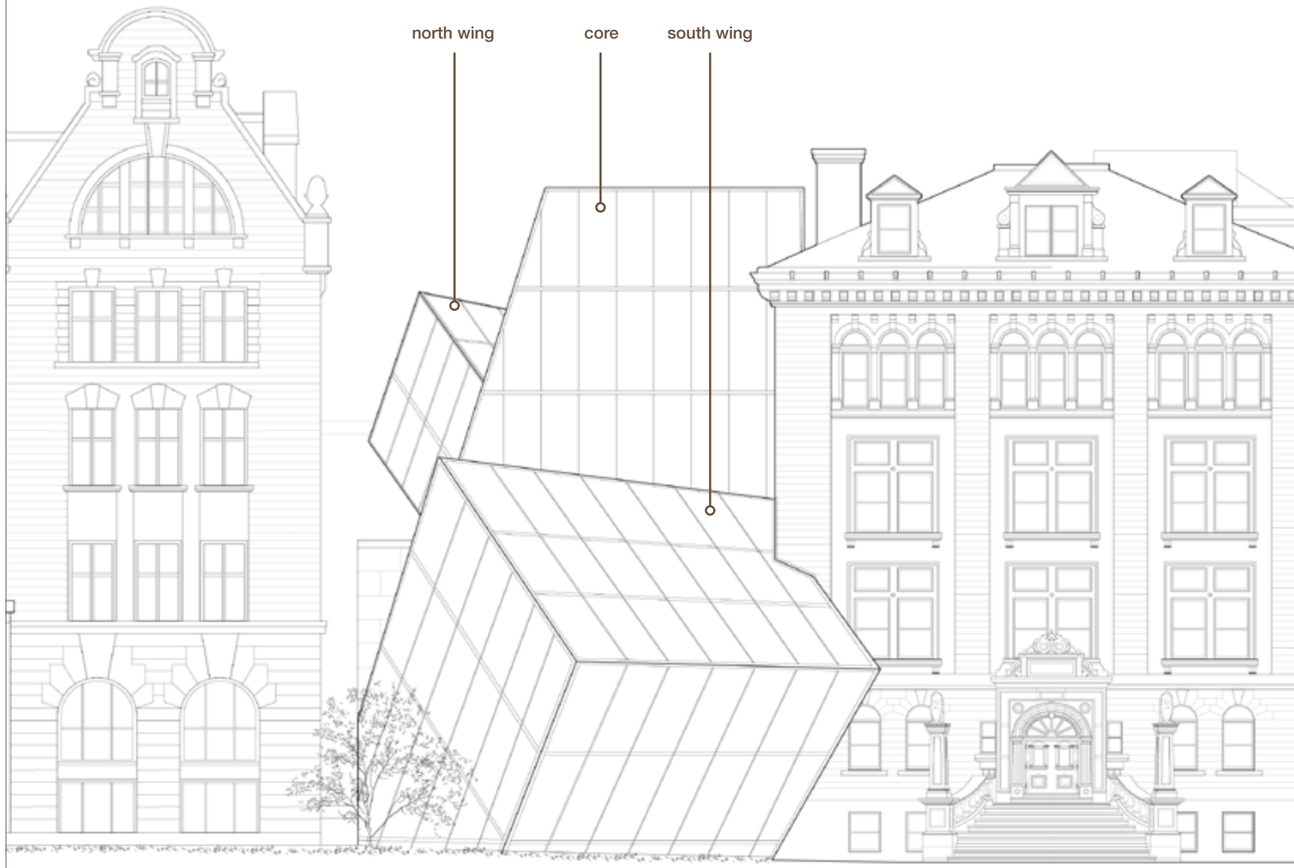
sections
- section A
- section B
- section C
- section D

core detail



elevation

south-west facade



macdonald-stewart building

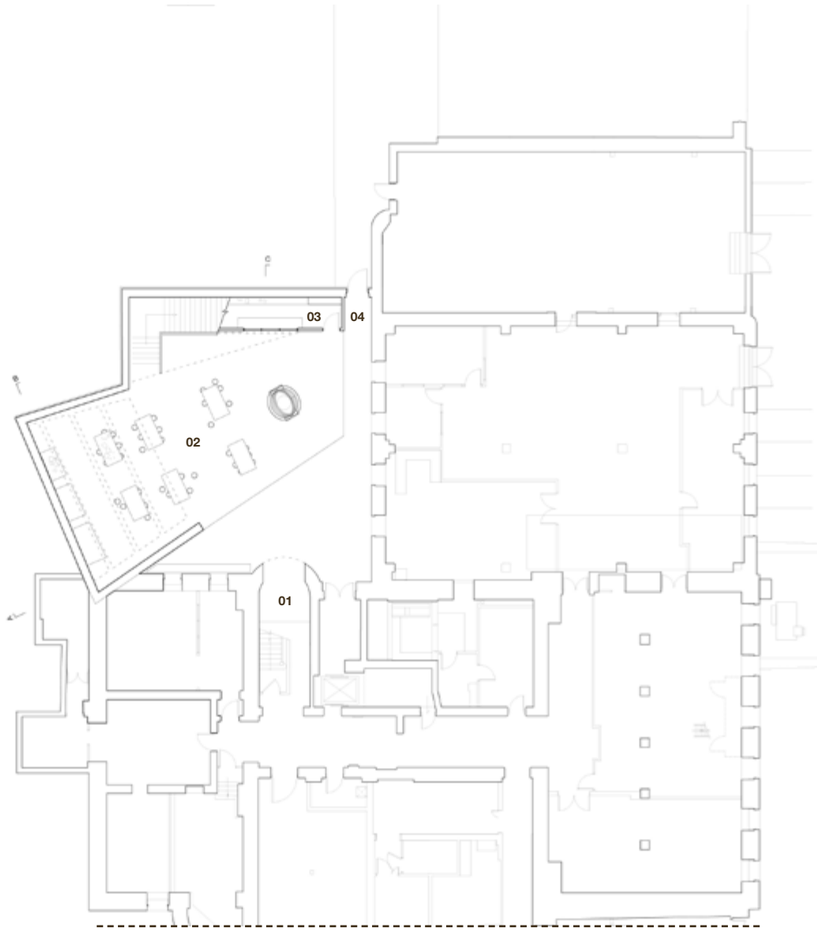
macdonald-harrington building

0m 2.5 5 10

plan 01

MDH_LEVEL 00

0m 2.5 5 10



01 entrance
02 testing laboratory
03 dark room
04 emergency exit

plan 02

MDH_LEVEL 0.5

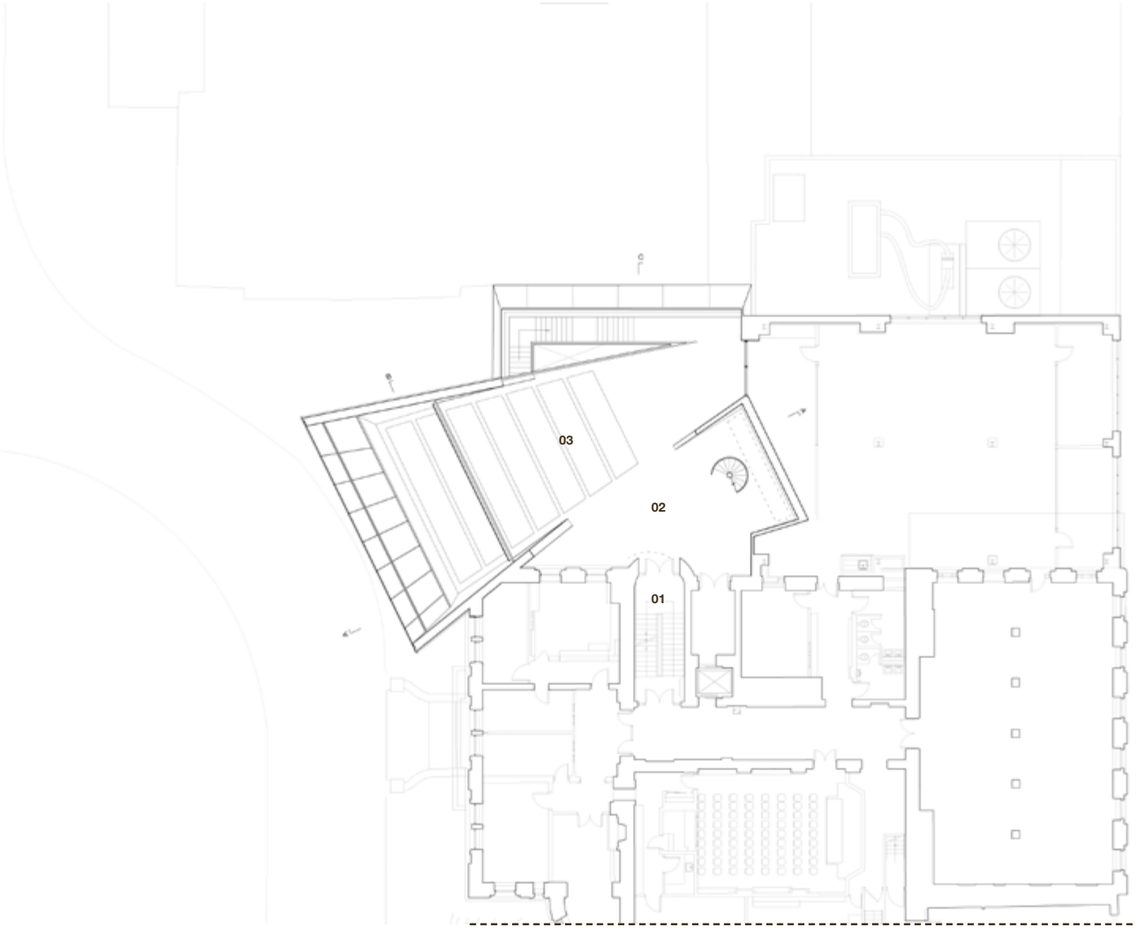
0m 2.5 5 10

01 entrance
02 south observation/testing room

plan 03

MDH_LEVEL 1.5

0m 2.5 5 10

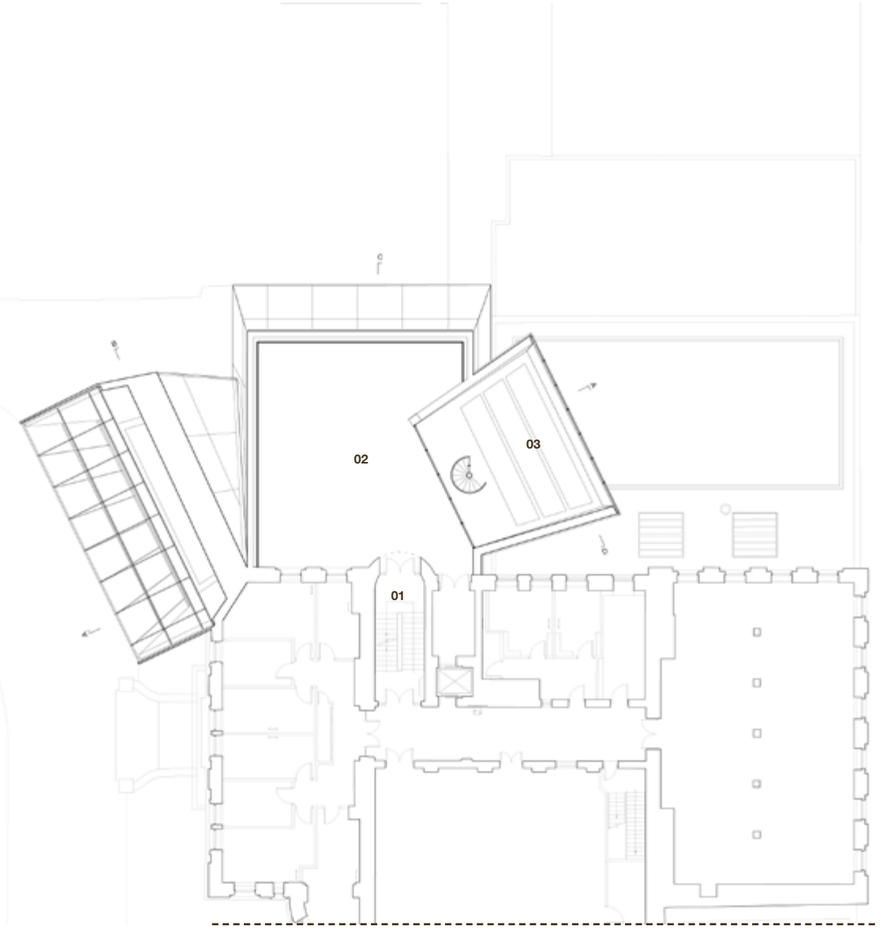


01 entrance
02 lobby
03 south observation/testing room

plan 04

MDH_LEVEL 2.5

0m 2.5 5 10

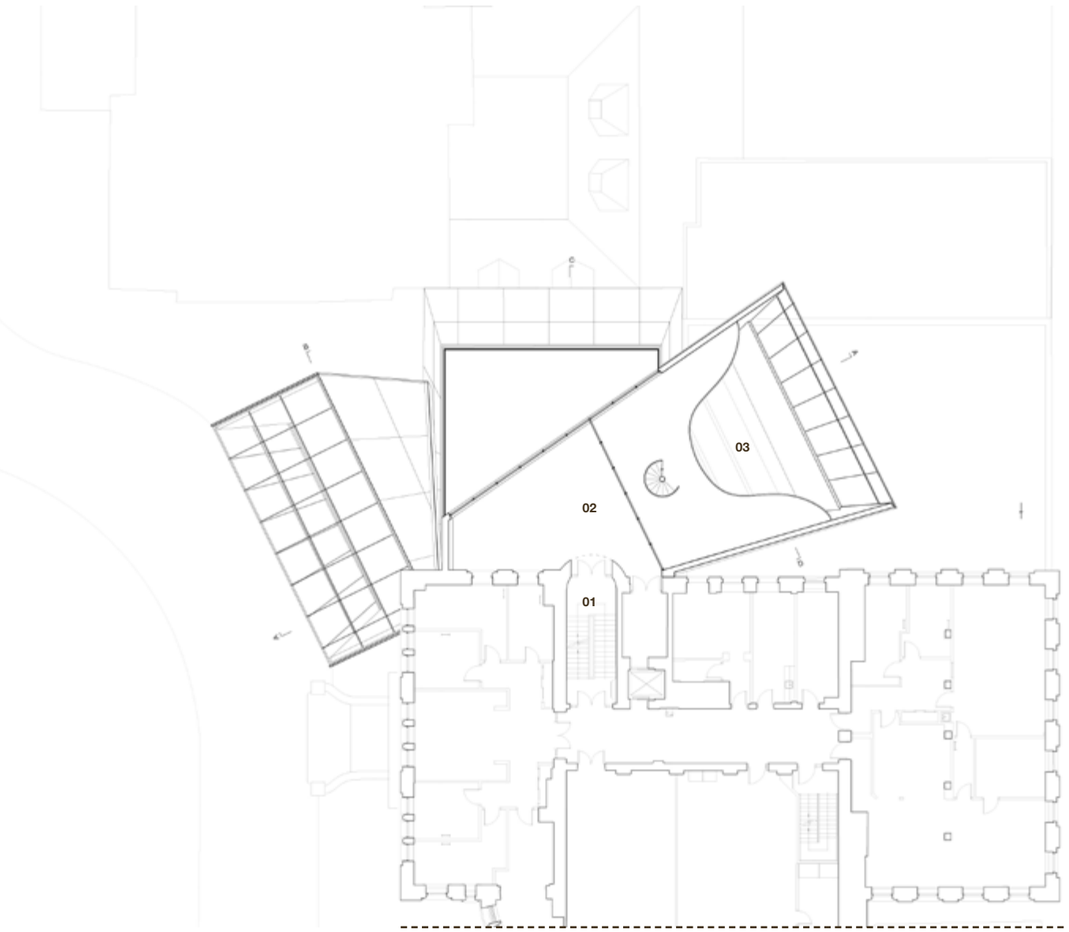


01 entrance
02 lobby
03 digital modelling studio

plan 05

MDH_LEVEL 3.5

0m 2.5 5 10

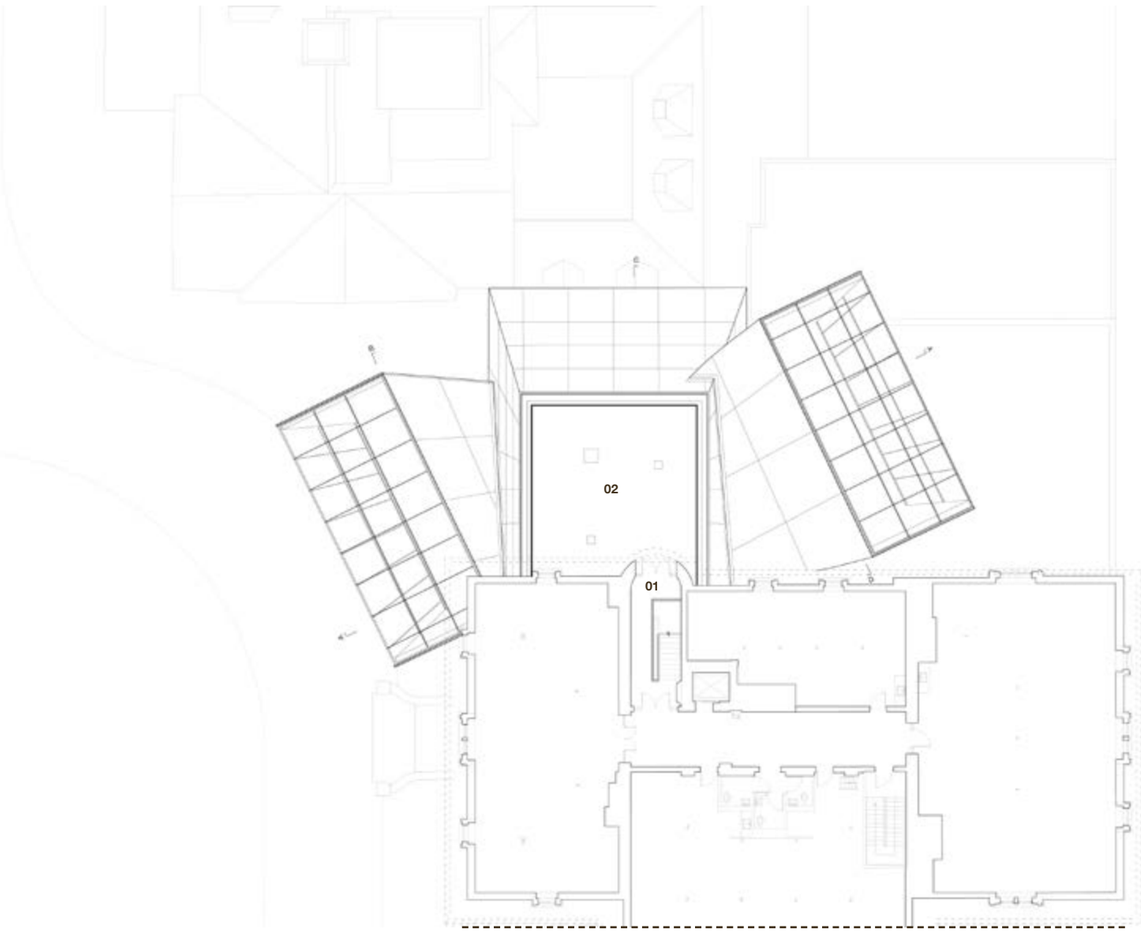


01 entrance
02 observation/testing room
03 digital modelling studio

plan 06

MDH_LEVEL 5.5

0m 2.5 5 10

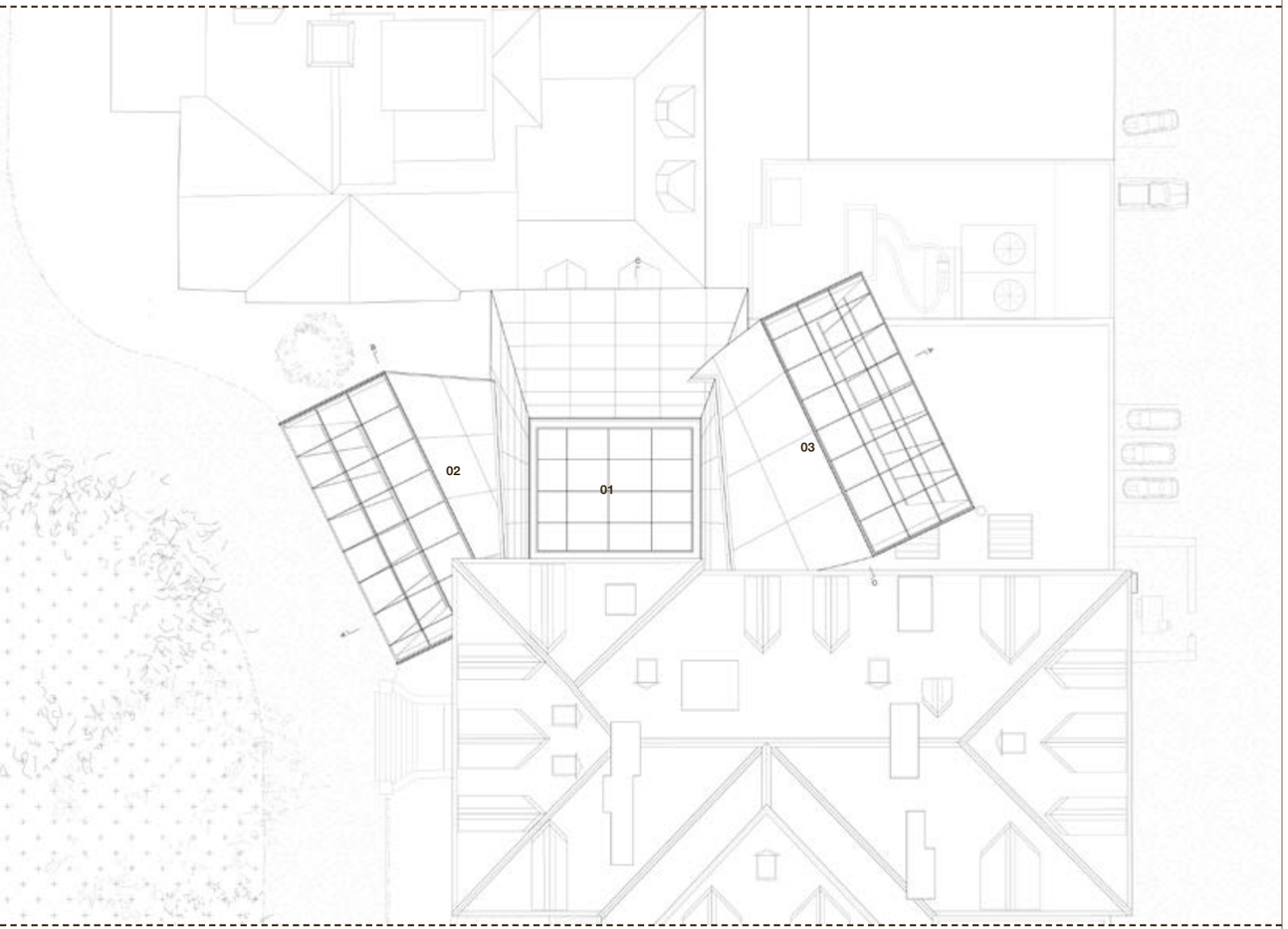


01 entrance
02 observation/testing room

plan 07

SITE PLAN

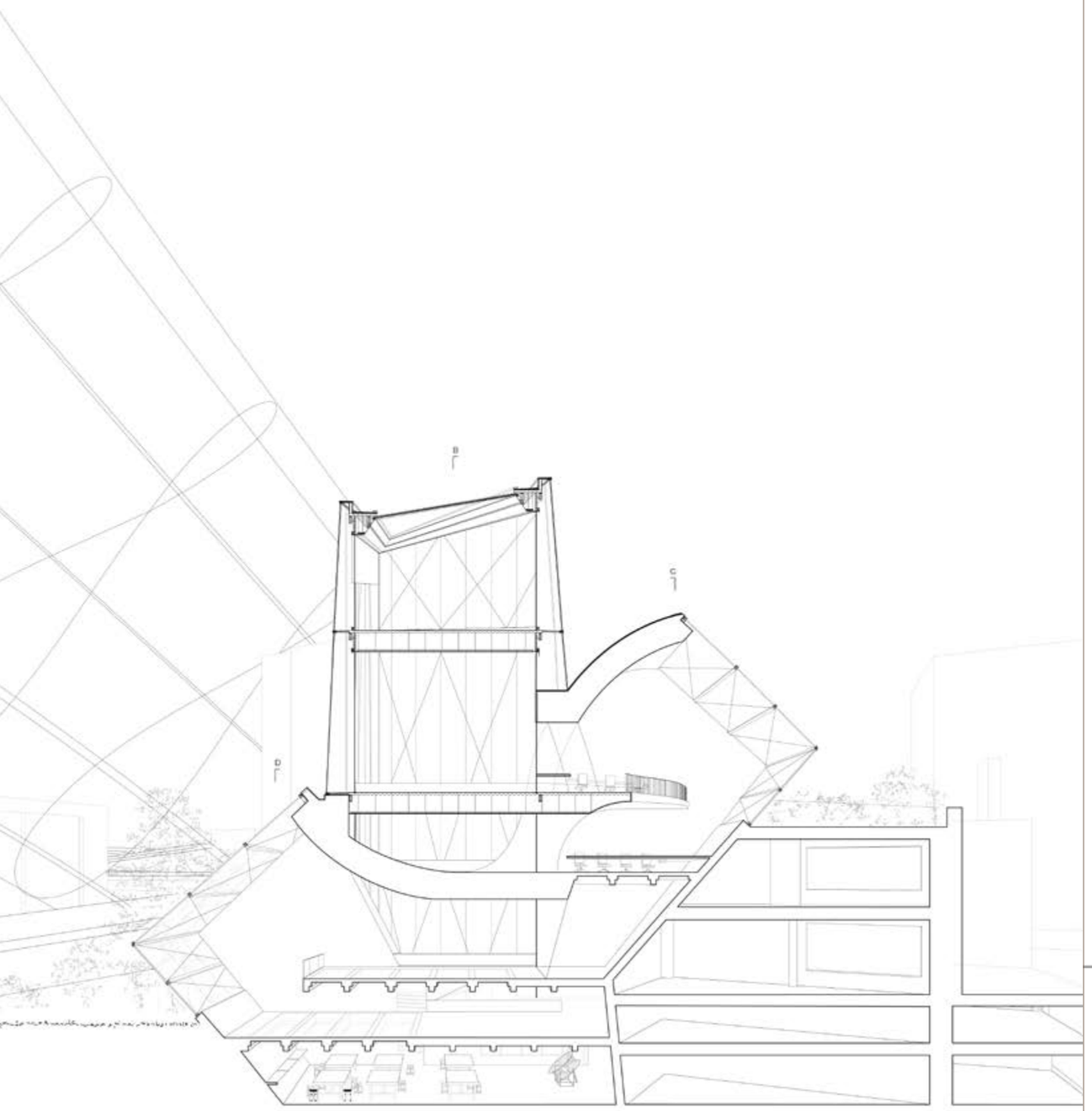
0m 2.5 5 10



01 the core
02 south wing
03 north wing

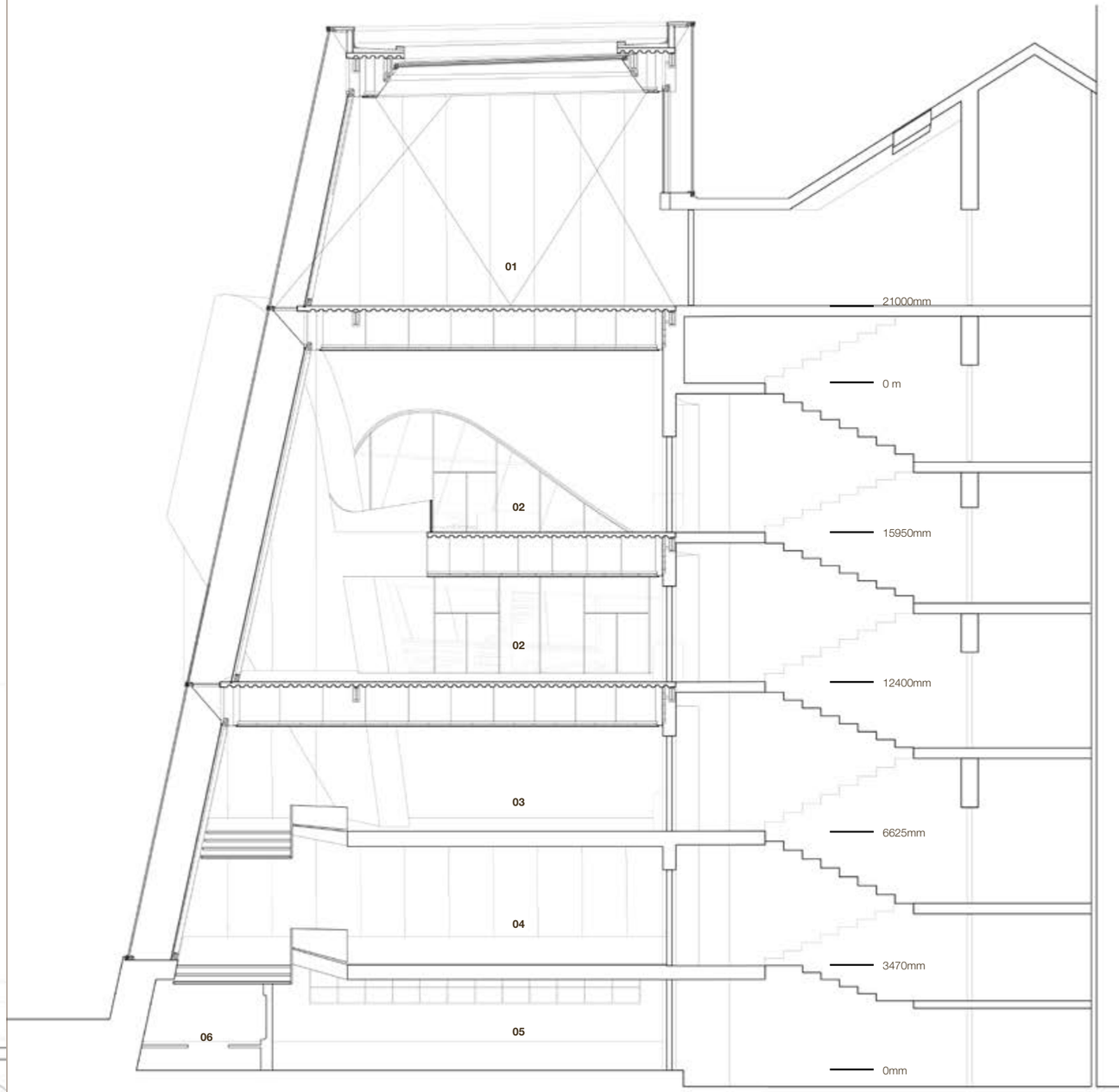
section A

the core, the north wing & the south wing



section B

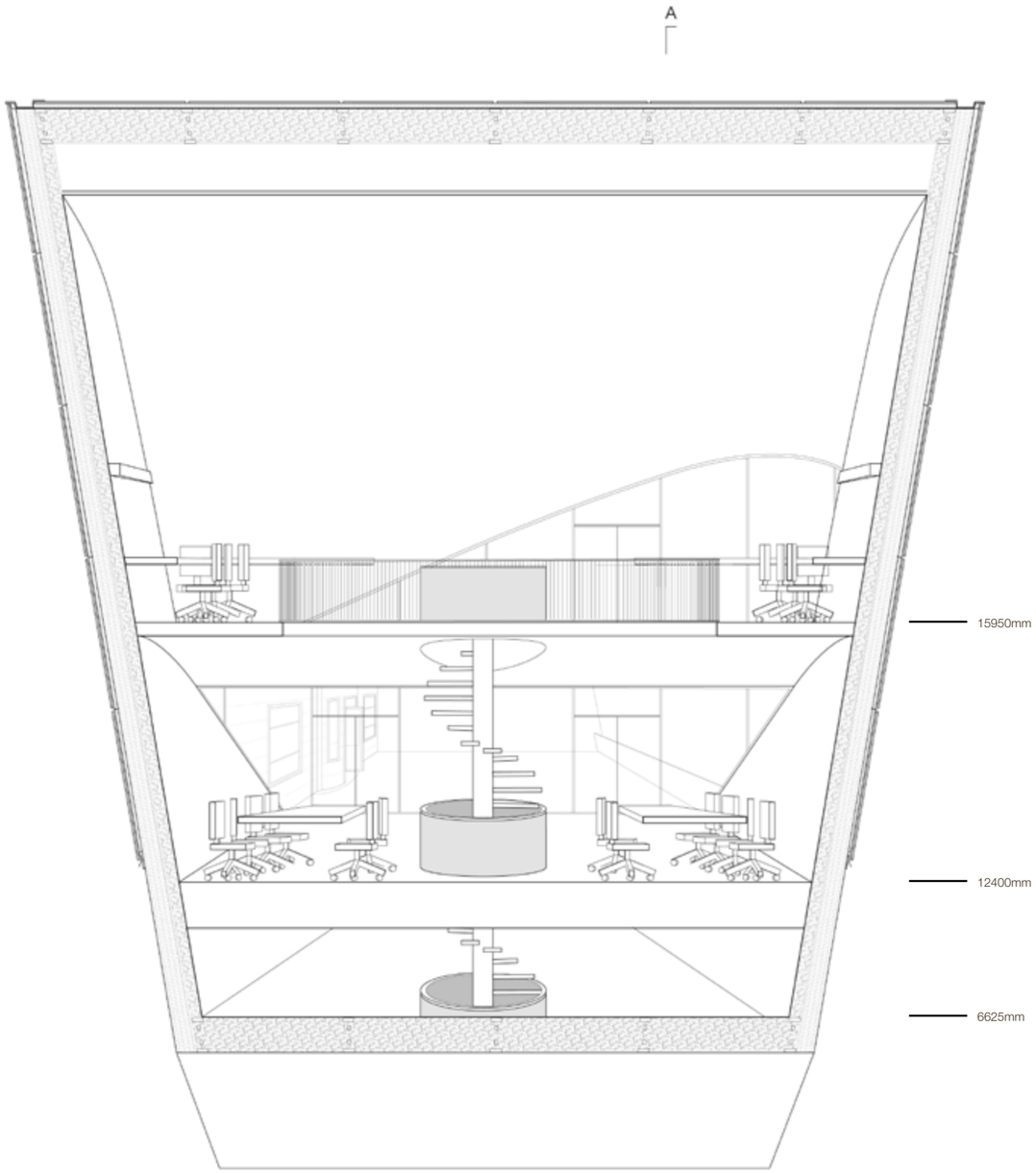
the core



01 observation/testing room
02 entrance to north wing
03 lobby
04 observation/testing room
05 testing laboratory
06 dark room

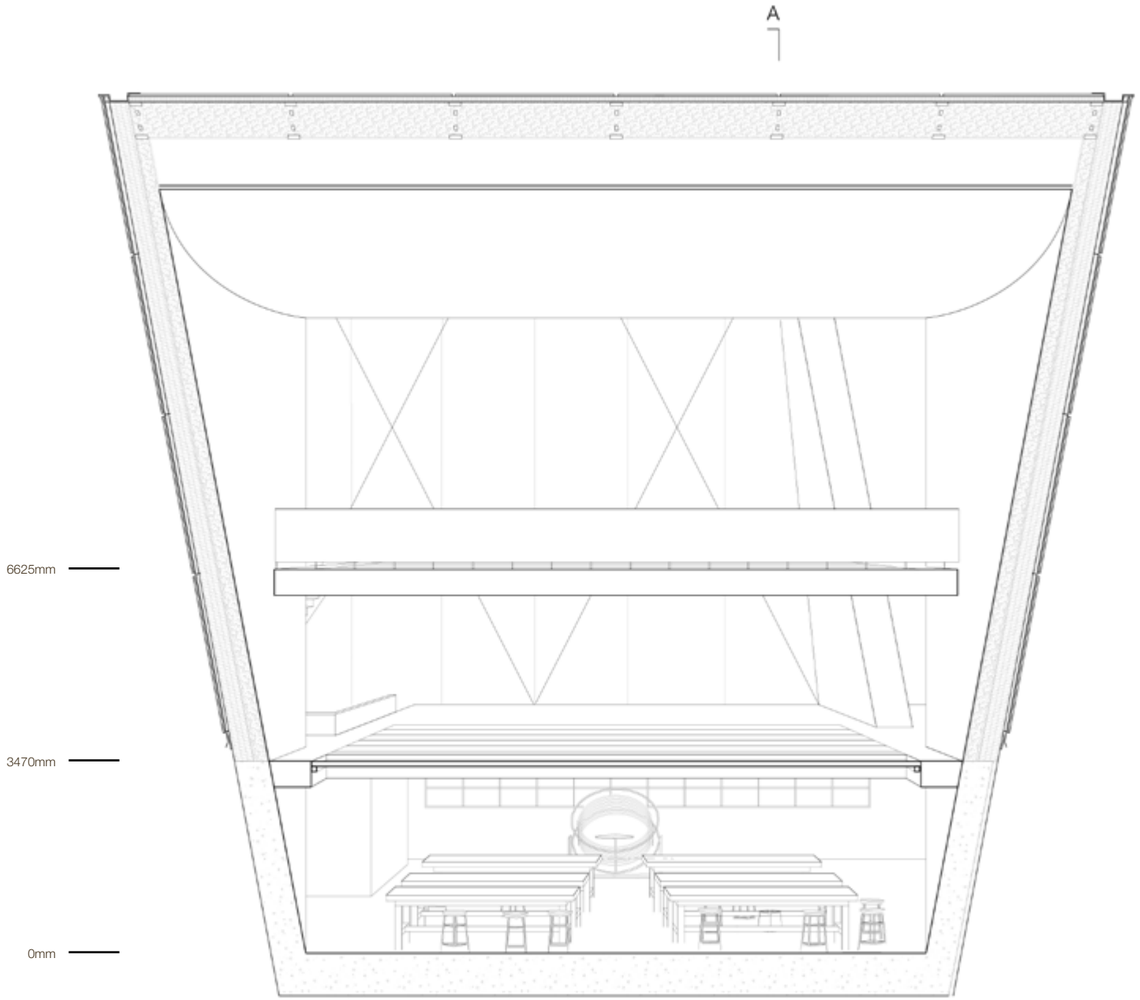
section C

north wing



section D

south wing



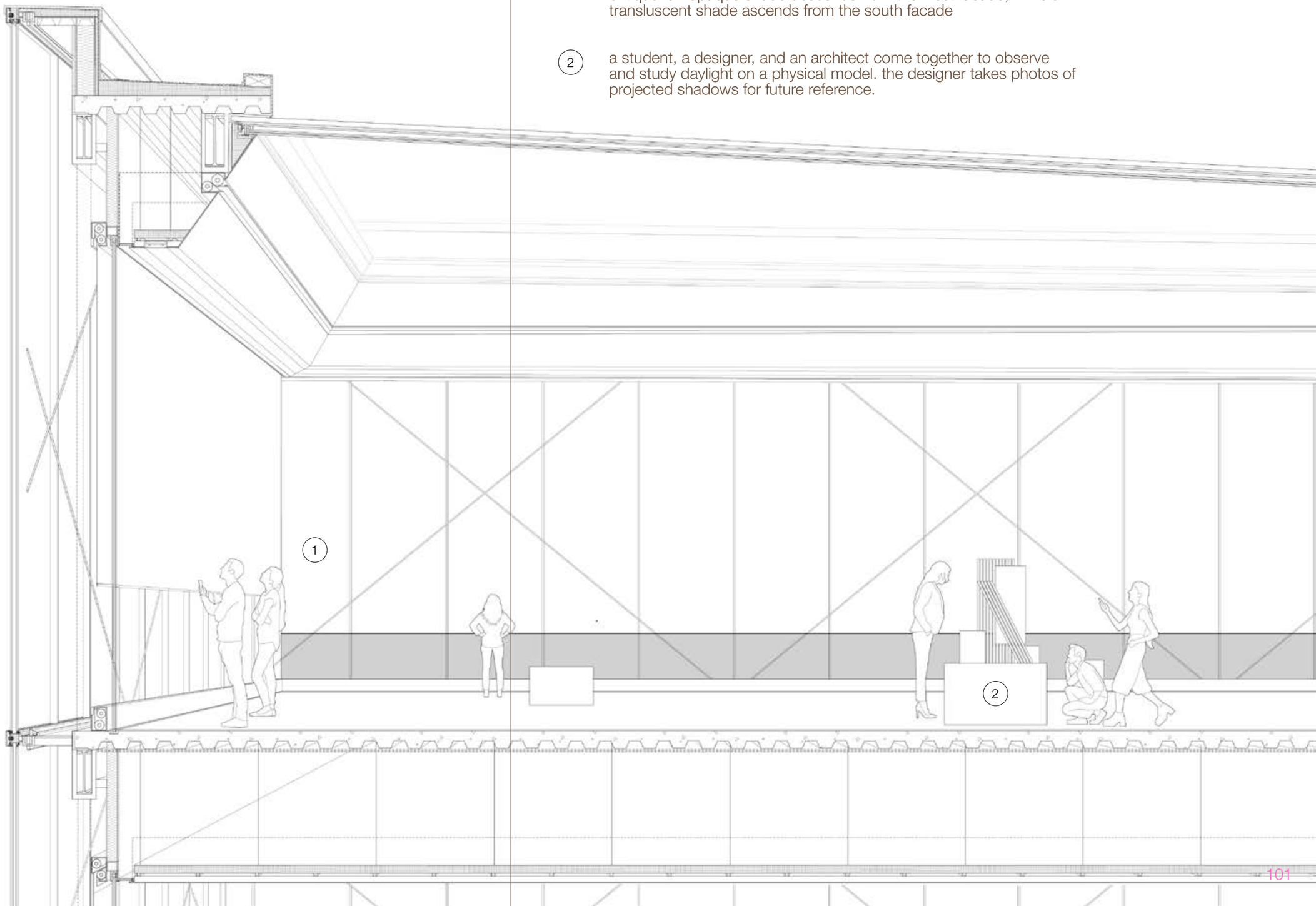
core section

roof composition
EPDM roofing membrane
Protection board
Tapered rigid insulation
Vapor barrier / air barrier membrane
Plywood or roof sheathing
Lightweight concrete
Steel decking
Structural steel framing
Integrated motorized solar shading system (mounted below structure)
Suspended ceiling system
Mechanical plenum
Linear LED lighting

curtain wall composition
Exterior double-glazed low-iron U-profile glass
Thermal break system within framing
Air and vapor barrier continuity at slab edge
Suspension rods
Fireproofed steel framing
Insulated aluminum back-pan / painted panel system
Rigid insulation
Interior single-layer laminated glass wall system
Perimeter sealants and gaskets
Anchoring system to slab edge (with thermal isolation)

floor composition

Finished floor surface (polished concrete)
Leveling compound
Lightweight concrete
Acoustic insulation layer
Steel decking
Structural steel framing
Suspended acoustic ceiling
Mechanical / electrical plenum
Integrated services (lighting, sprinklers, HVAC diffusers)



1 three students test the mechanical shading system for an upcoming critique. an opaque shade descends from the west facade, while a transluscent shade ascends from the south facade

2 a student, a designer, and an architect come together to observe and study daylight on a physical model. the designer takes photos of projected shadows for future reference.

0

ANNEX

APPENDIX A:
“Standardizing Daylight?”

APPENDIX B:
“5 Observations and 5 Design Principles for:
Designing With Daylight”

APPENDIX C:
“How Much Light Is Too Much? An Architectural
Perspective on Daylighting”

APPENDIX A

FULL PAPER

Standardizing Daylight? The Practice of Standardization in Healing Spaces

Keywords: daylighting standards, architectural daylighting, evidence-based design, environmental performance metrics.

This paper examines the long history, contemporary application, and fundamental limitations of daylighting standards in healing environments. Drawing on historical precedents from ancient Asclepieia and Roman Valetudinaria through Nightingale-era pavilion hospitals and modernist institutions, it traces how natural light has been repeatedly recognized as a therapeutic force yet increasingly constrained by standardized frameworks such as LEED and the WELL Building Standard. Through personal professional experience and critical analysis of current metrics, the paper argues that contemporary daylighting guidelines reduce a complex, sensory, and context-dependent phenomenon to rigid numerical thresholds that inadequately represent the needs of diverse geographies, cultures, and patient populations. The study highlights key shortcomings in these systems, including geographic insensitivity, oversimplification through quantitative metrics, and neglect of the experiential and psychological dimensions of daylight in patient care. By synthesizing historical research, building performance literature, and critiques of evidence-based design, the paper calls for more adaptive, regionally calibrated, and human-centered approaches to daylighting in hospitals, emphasizing that meaningful design must balance the benefits of standardization with the spatial, climatic, and cultural specificities of healing environments.

INTRODUCTION

Daylighting, the strategic use of natural light in buildings, has been central to the design of healing spaces for centuries. From Ancient Greek Asclepieia and Roman Valetudinaria to modern sanatoria and contemporary design, natural light has been associated with improved patient recovery, reduced stress, and enhanced staff performance.[1] While standardization efforts such as Leadership in Energy and Environmental Design (LEED) and WELL Building Standard® ((WELL) aim to regulate daylighting, these frameworks prioritize energy conservation, overlooking the effects on human health.

I have what I like to call a deep fascination with daylighting. This fascination was only amplified in my studies in sciences and architecture school, and then in practice working as an intern learning to calculate daylighting levels for schools in and around Montreal, Quebec.

It was there that I discovered the strict standardization of daylighting that classrooms, much like hospital patient rooms, are required to meet. The MEQ (Ministère de l'Éducation du Québec) has rules for the design of schools, a set of standards. To be precise, it has to meet the LEED gold standard in order to ensure the well being of students in the classroom. It was in this work that I realized the nature of building within these guidelines, the political context it exists within, and how ignorant this standard is.

CAN DAYLIGHTING BE STANDARDIZED?

By examining daylighting standards, particularly within the WELL framework, I investigate whether current guidelines for healing spaces adequately reflect the benefits of natural light.

Historical research proves the importance of daylighting in medical architecture and traces the shift from open-air environments to enclosed, electrically lit hospitals. Contemporary research underscores the psychological, physiological, and environmental impacts of standardization on daylighting.

My findings suggest a need for further investigation into the impacts of daylighting on human well-being in healing environments and a refinement of daylighting criteria to better align with health and patient-focused design principles. It is important to acknowledge however, that such narratives risk oversimplifying the complex evolution of hospital design for the sake of studying the standardization of daylighting. While my research incorporates a global ambition, it primarily focuses on Western hospital design and standardization systems which do not universally apply to all healing spaces. Nevertheless, my study aims to contribute to broader discussions on hospital architecture by highlighting the lack of qualitative assessment, climate responsiveness, and adaptability of daylighting standards.

A STANDARD FOR DAYLIGHTING – THE HISTORY OF

STANDARDIZATION

I'd like to clarify that standardization is in no way new to hospital design. Hospital architecture has undergone extensive standardization over time, shaped by evolving medical practices, theories on hygiene, technological advancements, and regulatory frameworks throughout history. While standardization has arguably improved hospital functionality, it has also introduced challenges related to flexibility, cultural adaptation, environmental and economic constraints.

ANCIENT AND PRE-INDUSTRIAL HOSPITAL STANDARDIZATION

Early healthcare structures such as Asclepia in ancient Greece and the Valetudinaria in the Roman Empire followed health-focused design principles.[2] These healing temples and military hospitals emphasized ventilation, access to natural light, and modular courtyard arrangements to promote healing. Roman military hospitals, for example, had repetitive ward structures with uniform dimensions, an early form of modular hospital planning.[3]

Medieval hospitals in Europe, often associated with monasteries, followed religiously inspired design patterns. Large Nave-style hospitals like the Hôtel-Dieu in Paris, founded in the 7th century, housed patients in open halls, reflecting a standardized approach to mass patient care.[4] These designs however were criticized for poor ventilation and cross-infection risks.[5]

INDUSTRIAL REVOLUTION AND EARLY MEDICAL STANDARDIZATION:

Advances in germ theory and sanitary science during the Industrial Revolution brought major refinements in hospital design. The Public Health Act (1848) in Britain mandated sanitary improvements, influencing hospital designs to include proper drainage, standardized plumbing, and isolated fever wards.[6] Florence Nightingale's Notes on Hospitals (1859) highlights the emergence of the pavilion plan, emphasizing standardized ward layouts, natural light, improved ventilation, and patient separation to reduce contagion.[7] The Nightingale Ward, characterized by long, narrow wards with high ceilings and large windows, became the dominant hospital standard in Europe and North America.[8]

While not a formal code, Nightingale's design principles heavily influenced hospital architecture in America. By the early twentieth century, local and state governments began to implement formal regulations; New York State, in particular, led early efforts to standardize hospital construction following the Flexner Report's 1910 call for modernization of medical infrastructure.[9] The most significant example of standardization in the Americas occurred with the passage of the Hill-Burton Act in 1946, which tied federal hospital funding to specific design and construction standards that prioritized sanitation, accessibility, and spatial adequacy.[10] Subsequent publications by professional organizations, such as the American Institute of Architects (AIA) and the American Hospital Association (AHA), helped to solidify these guidelines into nationally recognized code

20TH CENTURY: MODERNISM AND THE RISE OF INSTITUTIONAL STANDARDIZATION

From the 1950s to the 1970s, zoning principles became central to hospital planning. Spatial divisions between sterile and non-sterile areas, staff-only and patient-accessible zones, and diagnostic and treatment spaces were codified into design standards. This led to the proliferation of the block hospital typology, characterized by compartmentalized floor plans and strict departmental segregation. While efficient, these layouts often prioritized operational logic over patient-centered care.[11]

The mid-20th century witnessed a turn toward modernism with scientific and technological management in healthcare environments. Influenced by principles of efficiency, order, and functionality, postwar hospitals increasingly adopted modular construction and standardized layouts. Patient rooms, operating theatres, and service corridors were sized and configured according to pre-established templates, enabling mass production and systematized construction processes. Notable examples of technologically driven, modernist hospital architecture during this period include Louis Kahn's Salk Institute of Biological Studies (1966) and institutional healthcare complexes like Tufts Medical Center in Boston and the McMaster University Health Sciences Centre in Hamilton, Ontario (1972).[12] These projects reflected a broader architectural shift toward rational, systematized forms that mirrored the bureaucratic and clinical structures of modern medicine.

LATE 20TH AND 21ST CENTURY: FLEXIBLE STANDARDIZATION AND SUSTAINABILITY

By the late 20th century, criticisms of excessive standardization emerged. Scholars and architects argued that rigid, efficiency-driven hospitals often ignored patient comfort and adaptability to different cultural and climatic conditions. The advance of evidence-based design (EBD) and healing environments led to new standards emphasizing daylighting, biophilic design, and patient-centered care. Hospitals began incorporating standardized design elements such as single-patient rooms, access to nature, and flexible modular units to accommodate evolving medical technologies.[13]

Initiatives, such as the U.S. Green Building Council (USGBC) founded in April 1993, emphasized sustainable practices in the entire building and construction industry, later developing the LEED green building rating system in 1998, and LEED for Healthcare in 2011.[14] It was only until 2013 that The International WELL Building Institute™ (IWBI™) launched the WELL Building Standard®, as the first set of formal design standards whose "primary" focus was on health and wellness.[15] This standard introduced strict new requirements for the design of hospital buildings based on the energy efficiency and sustainable practices of its predecessors like indoor air quality control, and responsible material sourcing

that claims an assurance of adequate "wellbeing" for patients.[16] LEED and WELL among many other of these initiatives however, are not exempt from criticism as they are based on geographic bias, and make remarkable generalizations on the requirements of all people in healing spaces.[17]

A DISCUSSION ON STANDARDIZATION IN HEALING SPACES

Despite its well-intentioned goals, LEED and WELL standards have been criticized as a money-driven system that lacks meaningful results in sustainable design. This critique extends to daylighting standards, which, despite their well-documented therapeutic and health benefits, are often reduced to a quantifiable metric rather than a fundamental design principle.[18]

My own personal experience working within LEED guidelines, a school in Northern Quebec was my most difficult and confusing project. The MEQ requires all schools in Quebec to reach a minimum of 300 lux spatial daylight autonomy (sDA) and no more than 10% annual sunlight exposure (ASE), as LEED suggests. Only the MEQ enforces an even stricter policy that requires this achievement not yearly, but during only the months that children are in school September-June (excluding summers, when the sun is at its strongest and longest, which allows most buildings to reach those LEED values). In some Northern cities, for the majority of winter only 5 hours of sunlight is seen per day. Thus, schools in Northern Quebec do not meet MEQ regulations, and will never be approved unless the standards change.

While I agree that standardization remains essential for medical safety, infection control, and efficiency, contemporary hospital design must also balance uniformity with cultural sensitivity, environmental adaptability, and patient-centered care especially in regard to their regulations on daylighting. WELL building standards are designed to focus on the wellbeing of its users, but almost ironically have the exact same standards for daylighting as its predecessors for sustainability. This begs the question where these thresholds originate from and how accurate they prove to be. This thought is only further provoked by the severe lack of available information on the origin of the standards.

SHORTCOMINGS OF DAYLIGHTING STANDARDS

The influence of daylight on human health is well-documented. Studies have shown that exposure to daylight naturally increases vitamin D levels, which are linked to reduced hypertension, improved mood, and faster recovery times.[19]

Recognizing these benefits, LEED and WELL Building Standards have introduced specific daylighting metrics. However, these standards fail to consider the complexity of human sensory experiences and the diversity of daylighting needs.[20] Despite their apparent good intentions, their quantitative, standardized metrics oversimplify the complex, contextual, and sensory nature of daylight. The notion of measuring daylighting, with the intention of increasing well-being, through rigid numerical thresholds is inherently flawed, as people require different levels of daylight exposure based on their individual health conditions, geographic location, and cultural expectations.[21] In hospital architecture, where human-centered design should be paramount, these limitations are particularly consequential.

1. OVERSIMPLIFICATION THROUGH QUANTITATIVE METRICS

The most fundamental shortcoming of daylighting standards in systems like LEED is their reliance on fixed numerical thresholds to define quality daylighting. LEED v4, for example, promotes a target of 300 lux spatial daylight autonomy (sDA) for 50% or more of regularly occupied spaces and penalizes spaces where annual sunlight exposure (ASE) exceeds 10%.[22] These metrics are intended to balance daylight access with visual comfort and glare reduction. However, this approach treats daylight as a static quantity rather than a dynamic, atmospheric experience. The overemphasis on lux values, percentages, and simulations reduces daylight to a performance indicator rather than a phenomenological element that interacts with time, weather, and human perception.

This instrumentalized view of light sidelines the architectural role of daylight in shaping spatial experience, producing environments that may meet technical requirements without delivering the therapeutic benefits associated with natural illumination. As Roger Ulrich's foundational research has shown, even a view of nature filtered through daylight can significantly influence patient outcomes, a nuance lost in purely quantitative models.[23]

2. GEOGRAPHIC AND CLIMATIC INSENSITIVITY

One of the most egregious oversights in current daylighting standards is their lack of geographic adaptability. Originating in Southern California, LEED's default solar models and climate assumptions are aligned with sun-rich environments like Los Angeles.[24] These conditions are not representative of many parts of the world, especially regions with long winters, low solar angles, or high cloud cover.

In northern climates such as Quaqtaq, the seasonal availability of daylight is significantly reduced. Achieving a year-round sDA of 300 lux in these contexts is often unfeasible without extensive artificial supplementation, undermining both energy goals and the integrity of natural lighting as a health-promoting force. Conversely, in equatorial or arid regions, excessive solar exposure can result in overheating, glare, and discomfort. While LEED attempts to mitigate this through ASE thresholds, the solution is mechanical and reactive, rather than preemptively responsive to climate-specific needs.

This geographic insensitivity encourages a one-size-fits-all model of daylighting that disregards the architectural traditions and site-specific knowledge developed to address diverse climatic conditions.

3. CHALLENGES IN DENSE URBAN CONTEXTS

Urban hospital design presents further challenges to achieving daylight compliance under current standards. In dense metropolitan areas, where hospitals are often built vertically due to space constraints, access to unobstructed daylight is limited by adjacent buildings, narrow lot sizes, and zoning restrictions. The rigid benchmarks of daylighting standards fail to accommodate the constraints imposed by such built environments.

This is particularly troubling given that urban populations are growing reliant on high-density healthcare infrastructure. When architects are forced to prioritize daylight metrics over contextual responsiveness, they may resort to artificial solutions or window placement strategies that reduce privacy, overlook street-level activity, or sacrifice programmatic logic. In some cases, excessive standardization may even hinder community resilience by discouraging context-sensitive architectural responses to local urban conditions.

4. NEGLECT OF SENSORY AND EXPERIENTIAL DIMENSIONS

Perhaps the most critical shortcoming of current daylighting standards lies in their failure to account for the full sensory and experiential qualities of light in healing environments. Daylight is not merely a functional element; it contributes to spatial atmosphere, perceptual orientation, and emotional comfort. In hospitals, where patients often spend prolonged periods indoors, isolated from familiar rhythms of day and night, natural light can serve as a vital connector to the outside world.

Yet standardized hospital layouts, often guided by mechanical efficiency and cost-effectiveness, subordinate these experiential aspects to artificial lighting and HVAC systems. As Sara Jensen Carr and Annmarie Adams have argued, the pursuit of medical modernity in the 20th century prioritized sterile, technologically driven environments over embodied and ecological experiences.[25] By standardizing light into performance thresholds, daylighting standards continue this legacy of reductionism.

Verderber and Fine have similarly critiqued the dominance of metrics in healthcare design, arguing for more holistic approaches that integrate materiality, spatial openness, and patient dignity.[26] Unfortunately, architects working within the confines of LEED and similar frameworks are often incentivized to meet minimum criteria rather than innovate with light as an expressive and healing medium.

A CALL FOR ADAPTATION AND RESEARCH

While critiques of LEED and similar frameworks highlight significant limitations, these should not be mistaken for rejections of their value. LEED has played a pivotal role in legitimizing the importance of daylighting within mainstream architectural discourse, particularly in healthcare settings where the stakes of design are high. By translating evidence-based design into widely applicable certification systems, LEED has increased awareness of the role natural light plays in promoting recovery, well-being, and energy efficiency.[27] However, as with any standardization system, the tension between universality and context must be carefully negotiated. As Boyce notes, the attempt to quantify daylighting on a global scale is ambitious and necessary, yet inherently limited by the variability of geography, culture, and building type.[28]

REGIONAL ADJUSTMENTS: RECOGNIZING SOLAR DIVERSITY

One of the most urgent areas for refinement in daylighting standards is the need for regional calibration. Fixed daylighting targets, such as the spatial daylight autonomy (sDA) of 300 lux, implicitly assume solar conditions that are only achievable in certain latitudes or climates. Eleanor S. Lee, et al. have argued that meaningful daylight performance must be assessed relative to the local solar context.[29] For example, hospitals in Nordic countries or Arctic regions experience vast discrepancies in daylight hours between seasons, making it impractical to evaluate them by the same criteria used for hospitals in Southern California or the Mediterranean.

Designing for latitude-specific conditions would involve establishing variable daylighting benchmarks that reflect regional daylight availability. These adaptive metrics could prevent underperforming scores in buildings that are otherwise exemplary in their context and encourage innovation in façade design, site orientation, and seasonal shading tailored to specific climates. Such regional adjustments would also reintroduce local architectural knowledge into a conversation often dominated by standardized, technologically driven solutions.

FLEXIBLE PERFORMANCE METRICS: EMBRACING DYNAMIC MODELING

In tandem with geographic adjustments, there is a growing need for flexible performance metrics that account for the temporal variability of daylight. Static numerical thresholds fail to reflect how daylight changes across hours, days, and seasons. Dynamic daylight modeling, already in use by advanced architectural firms and research centers, offers a more accurate representation of daylight behavior over time, using climate-based data simulations and real-time performance monitoring.[30]

Konis, in his work on daylight design and building performance, advocates for dynamic metrics that not only consider illuminance levels but also incorporate thermal performance, glare potential, and occupant satisfaction.[31] By shifting from prescriptive metrics to performative models, architects and engineers could better assess how light operates throughout the life of a building, improving both energy outcomes and spatial quality. Hospitals, which are operational 24/7 and subject to changing occupancy patterns, stand to benefit significantly from such a responsive approach.

CULTURAL AND CLIMATIC EXPECTATIONS: DESIGNING FOR HUMAN DIVERSITY

Daylighting is not solely a technical variable, it is deeply intertwined with cultural expectations, social practices, and climatic comfort norms. Research by Veitch and Galasiu underscores how visual and thermal preferences vary widely across regions and populations.[32] For instance, patients in warmer climates may associate sunlight with discomfort or illness, preferring diffused or shaded light, while others might equate bright sunlight with vitality and openness. These cultural differences must be acknowledged in the development of daylighting strategies, particularly in hospitals that serve diverse populations or are located in multicultural urban centers.

Incorporating cultural considerations into daylighting standards would require greater interdisciplinary collaboration between architects, anthropologists, and environmental psychologists. It would also demand new forms of user-centered evaluation, including post-occupancy studies and participatory design methods, to ensure that lighting environments reflect not only physiological needs but also emotional and cultural comfort.

TOWARD A MORE ADAPTIVE STANDARDIZATION

Standardization in healthcare design has historically sought to ensure safety, hygiene, and operational efficiency. In this context, LEED has provided valuable guidelines for integrating environmental sustainability into hospital construction. Yet the very mechanisms that support consistency and accountability can become obstacles when they fail to accommodate the nuanced realities of the site, climate, and culture. As this discussion has argued, daylighting standards, while foundational, must evolve toward a more adaptive, responsive, and human-centered paradigm.

Such a shift would not abandon the pursuit of standardization, but would refine it to better serve the complexities of healing environments. It would promote a layered approach to daylight design: one that retains rigorous benchmarks where appropriate, but that allows for regional specificity, dynamic simulation, and cultural variation. As healthcare architecture continues to adapt to the challenges of urbanization, climate change, and shifting patient demographics, the demand for more contextually intelligent design strategies will only increase.

Synthesizing findings from historical precedents, contemporary research, and critiques of standardization, it becomes clear that the next phase of daylighting innovation must balance technical precision with spatial empathy. Rather than treating daylight as a measurable quantity alone, architects and standard-setting bodies alike must embrace its full potential as a material of care, one that shapes not just how hospitals function, but how they affect people using them.

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APPENDIX B

DESIGNING *with* DAYLIGHT

THE POCKET GUIDE

“Architects in planning rooms today have forgotten their faith in natural light. Depending on the touch of a finger to a switch, they are satisfied with static light and forget the endlessly changing qualities of natural light, in which a room is a different room every second of the day.”

Louis Khan

Written&Documented by
Nicolea Apostolidis
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OBSERVATIONS

Daylight's core architectural affordance is its variability, which shapes spatial rhythm, supports human circadian health, and offers an economical source of ornament rooted in changing conditions. This chapter reframes daylighting practice by emphasizing design for variability, aligning daylight with chronobiology, treating it as an ornamental and experiential medium, centering user agency and comfort, and bridging the gap between simulation and lived experience through post occupancy evaluation.

1 Material as Spent Light

Louis Kahn's notion of material as "spent light" reminds us that architecture is animated by the daily performance of sunlight and its changing qualities that reveal the character of materials. Designing with daylight is therefore not about maximizing brightness but about tuning variability so each space receives the kind of light its function and atmosphere require. When we design this way, buildings feel alive as they mark time, respond to climate, and become luminous compositions shaped by the continual passing of light.

2 Biological Wi-Fi

Daylight is the body's primary regulator, synchronizing biological clocks and maintaining sleep, focus, and overall wellbeing, so buildings that limit access to it disrupt more than visibility. Architects can support this connection by orienting key spaces for morning light, modeling daylight for timing as well as quantity, and ensuring that different programs receive the light they physiologically need. When daylight is treated as a biological signal, architecture becomes an active contributor to cognitive, emotional, and physical health.

3

Light as Ornament

Daylight embodies the ornament Venturi and Scott Brown described, creating patterns, reflections, and shadows that give spaces rhythm and depth without added material. Designing with light as ornament means using time, orientation, and surface to let sunlight animate architecture and shape its aesthetic from moment to moment. The result is a building enriched by variation, a living surface that marks the hours and connects occupants to daily and seasonal cycles.

4

The Banham Clause

Reyner Banham's principle that buildings should serve people before systems applies equally to daylight: the most advanced glazing means little if users feel glare, exposure, or a lack of control. Human-centered daylighting recognizes that comfort varies widely, so design must offer choices, from dimness to brightness, and allow users to adjust or move between light conditions. The goal is adaptability rather than uniformity, creating environments that support changing tasks, moods, and needs.

5

Alphabet Soup

Daylighting metrics like sDA, ASE, UDI, and DF are useful, but they can reduce light to data and push design discussions too late in the process. Simulation tools should guide intuition, followed by observation, sketching, and assessing how a space actually feels throughout the day and in different weather. The best daylighting comes from balancing analysis with experiential judgment, using numbers to support design rather than define it.

DESIGN PRINCIPLES

Daylight is the architect's raw material, and these principles act as guides that translate its experiential qualities into actionable design strategies. Beginning with orientation, they use the sun's predictable path, balance luminous and thermal comfort, and rely on diffusion, reflection, and adaptive systems to shape inhabitable light. Taken together, they serve as a framework for decision making, uniting daylight and electric light into a coherent luminous identity that supports design from concept to completion.

1

Solar Design is Free

Respond to Local Climate and Latitude

Goal: Use solar geometry as the foundation of design. Orientation costs nothing and gives everything.

Directive: design with the sun, not against it.

2

The Goldilocks Principle

Consider Thermal and Visual Comfort Together

Goal: Balance brightness and warmth; tune light for comfort, not abundance.

Directive: tune daylight as a dual performer, visible and thermal, sensual and sustainable.

3

Channel-ing Aalto

Diffuse and Reflect Light Strategically

Goal: Design surfaces as instruments of light, not backdrops to it.

Directive: design for reflection and scattering before resorting to glazing ratios. In daylighting, gentleness is power.

4

A Fashion Statement

Embracing Adaptive Systems

Goal: Make daylight adjustable. Treat movement as both performance and expression.

Directive: design adaptability as architecture. Shading should be worn proudly.

5

Daylight After Dark

Integrate Daylight with Electric Lighting Design

Goal: Extend the life of daylight through artificial light; maintain atmosphere after sunset.

Directive: design electric lighting as a temporal continuum. Let the building glow with consistency, evolving (not disappearing) after dark.

OBSERVATION	QUICK NOTE	DIRECTIVE
Material as Light	**Design for Variability.** Daylight is a mood, not a metric. Vary conditions across a building.	Light should change through the day, animating space with cycles of brilliance, shadow, and glow. Variability creates depth and character.
Biological Wifi	**Prioritize Circadian Health.** Connect users to natural rhythms. Morning light is critical.	Daylight entrains our biological clocks. Orient spaces and tune light quality to support human health, productivity, and wellbeing.
Light as Ornament	**Daylight as Decoration.** Daylight itself as decoration; changing patterns & shadows create rhythm.	Treat daylight as the building's ornament. Patterns, shadows, and reflections give rhythm, atmosphere, and temporal richness without excess.
The Banham Clause	**Center the User Experience.** People first, technology second; comfort > gadgets.	Technology and metrics mean little if users feel uncomfortable. Design for diversity, provide options, and respect occupant agency.
Alphabet Soup	**Simulation + Evaluation.** Metrics matter only if translated into experience; verify with real users.	Metrics (sDA, UDI, ASE) guide design, but must be paired with post-occupancy feedback to confirm real human experience.

DESIGN PRINCIPLE	QUICK NOTE	DIRECTIVE
Solar Design is Free	**Work with the Sun.** Use predictable sun paths to guide form; free, low-tech strategy.	Begin with solar geometry. Orientation, overhangs, and section cuts aligned to latitude and climate deliver free, effective daylighting.
The Goldilocks Principle	**Balance Light + Heat.** Not too bright, not too dim, not too hot. Balance is key.	Design daylight for both visual and thermal comfort—avoid glare, control solar gain, and tune for seasonal balance.
Channeling Aalto	**Diffuse + Reflect.** Soft, bounced, warm light; surfaces as collaborators.	Use surfaces, shelves, and membranes to soften, scatter, and balance light, creating atmospheres that feel humane and alive.
A Fashion Statement	**Adaptive Systems.** Shading is both functional and expressive. Let users control it.	Integrate shading, blinds, or smart glazing as core design elements. Give buildings and users the ability to adapt with the sun.
Daylight After Dark	**Unify with Artificial Light.** Electric lighting extends daylight drama; do not replace it.	Treat electric lighting as a continuation of daylight, extending atmosphere and rhythm seamlessly into the evening.

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APPENDIX C

FULL PAPER

How Much Light Is Too Much? An Architectural Perspective on Daylighting

Keywords: Daylighting, Human-centric design, Standards (LEED/WELL).

This paper asks how architects can determine what amount of daylight is too much, when illumination is both a technical variable and a lived, spatial phenomenon? Sustainability frameworks such as LEED and WELL have elevated the role of daylight, yet they rely on metrics like lux thresholds, daylight autonomy, and glare indices that often separate light from experience. Drawing on historical work to more contemporary findings, the paper argues that the limits of daylight cannot be captured through measurement alone. "Too much light" is shaped by physiology, perception, materiality, and cultural expectation.

Situated between professional lighting practice and graduate architectural research, the project uses reflective narrative, precedent analysis, and critical readings of daylighting standards to examine the gap between measured performance and lived reality. It describes how overexposure becomes a design problem, whether through glare, flattened surfaces, or thermal discomfort, and shows how designers often rely on intuition to resolve these tensions. The discussion draws attention to the limitations of data-driven design cultures that prioritize optimization at the expense of sensory understanding.

Building on phenomenological perspectives, the paper proposes an experiential framework for daylighting that integrates scientific rigor with architectural judgment. This approach positions light as an ethical and aesthetic concern shaping comfort, privacy, visibility, and wellbeing. The paper concludes by presenting the Daylight Lab as a dedicated environment where architects can study daylight directly and bridge the divide between simulation and sensation. Through this reframing, the project argues for a renewed architectural vocabulary capable of addressing the full complexity of daylight in contemporary design practice.

THE PROBLEM OF TOO MUCH LIGHT

In her research on daylighting, Marilyne Andersen poses a question that seems at once practical and philosophical, how can we better integrate the complexity of human needs in buildings into effective design strategies for daylit spaces?[1] This deceptively simple inquiry exposes a central tension in architectural practice between the quantifiable and the experiential, between the science of illumination and the art of inhabitation. Daylight is rarely neutral. It is both a physiological necessity and a cultural construct, capable of shaping mood, spatial perception, and the rhythms of daily life. Yet contemporary architectural discourse often treats light as a technical parameter, reduced to performance metrics, simulation outputs, and compliance with sustainability standards such as LEED or WELL.[2] These frameworks, though essential for environmental accountability, risk flattening light into a numerical abstraction, detaching it from the sensory and symbolic dimensions that have long defined architectural experience.

How can we then reclaim daylight as an architectural question? By examining the relationship between measurable and lived light, it argues that "too much" or "too little" illumination cannot be determined by lux levels alone. Instead, light must be understood as a dynamic, relational medium, one that situates the human body within space, time, and atmosphere.[3] The inquiry is thus both technical and phenomenological, bridging the empirical rigor of daylighting research with the reflective, interpretive mode of design thinking.

Historically, the relationship between light and wellbeing has been framed as both a scientific and moral concern. Richard Hobday, in The Light Revolution, traces how early modernist architects and medical reformers celebrated sunlight as an agent of hygiene and health.[4] Similarly, Roger Ulrich's landmark 1984 study demonstrated that hospital patients with window views recovered faster than those facing a blank wall, establishing an empirical link between light, vision, and healing.[5] More recently, Andersen's human-centric framework for daylighting has sought to "unweave" the physiological and emotional aspects of luminous experience, advocating for virtual design methods that align environmental performance with human comfort.[6] Together, these studies reveal that light cannot be reduced to a measurable commodity, it is biological, psychological, and aesthetic at once.

In the context of contemporary sustainable design, this multidimensional understanding of light remains largely underdeveloped. Architects often navigate a terrain defined by digital simulations and standardized daylight credits, which translate complex spatial experiences into simplified metrics.[7] While such tools are invaluable for quantifying energy efficiency and glare risk, they also risk excluding the atmospheric and affective qualities that make light a vital architectural medium. To ask "how much light is too much?" is therefore to challenge the dominance of data-driven reasoning in design culture. It invites a reconsideration of light as lived experience, shifting the discourse from compliance to care, from control to interpretation.

WHAT IS "TOO MUCH LIGHT"

To define "too much light" is to confront the paradox of illumination itself. Light is essential to vision, yet excessive brightness can obscure rather than reveal. It can flatten surfaces, distort color, and overwhelm perception. In architectural design, the question of "too much" is often treated as a technical problem, a matter of glare indices, luminance ratios, or solar heat gain coefficients.[8] These metrics, while indispensable, tend to isolate light from its spatial and temporal context. A threshold of discomfort identified in a laboratory setting cannot easily account for the subtleties of architectural experience, the glint on polished stone, the shifting reflection on a façade, or the soft burn of afternoon sun in a west-facing room. The excess of light is therefore not a purely optical issue but a spatial and phenomenological one, defined through interaction between material, orientation, and inhabitation.

From a physiological standpoint, "too much light" typically manifests as visual or thermal discomfort. Excessive luminance contrast can cause glare and eyestrain, while high solar radiation leads to overheating or fading of materials.[9] Yet these conditions are also cultural constructs, what one occupant perceives as oppressive, another might experience as sublime. Architectural modernism, for example, celebrated luminous transparency as an aesthetic of progress. Le Corbusier's "white light" interiors and Mies van der Rohe's glass pavilions sought to dissolve boundaries between inside and out, equating illumination with purity, rationality, and truth.[10] Conversely, contemporary architects such as Peter Zumthor or Tadao Ando have embraced shadow, opacity, and filtered light as essential to spatial intimacy.[11] These shifting sensibilities reveal that the threshold of "too much" is historically contingent, shaped by evolving notions of comfort, beauty, and environmental ethics.

In contemporary sustainable design, the concept of "too much light" takes on new significance. High-performance buildings often maximize glazing to achieve daylight autonomy targets, assuming that more daylight equates to better environmental performance. However, this logic can produce paradoxical outcomes, deep-plan spaces flooded with glare, overheated interiors requiring mechanical cooling, or users drawing blinds to block the very light intended to enhance wellbeing.[12] The overproduction of daylight, in this sense, mirrors broader contradictions within data-driven design, where optimization replaces judgment, and metrics displace experience. As Andersen observes, "daylighting design today must move beyond the false opposition between performance and perception."[13] It is not enough to meet a standard; light must be orchestrated, not simply quantified.

Thus, defining "too much light" demands an integrative understanding that encompasses technical, cultural, and experiential dimensions. It is an excess not only of illumination but of control. An overexposure that renders space legible yet lifeless. To resist this excess, architects must cultivate sensitivity to the thresholds where light ceases to serve and begins to dominate. This sensitivity, I will argue, lies at the heart of an ethical and aesthetic practice of daylighting, one that values nuance, variability, and restraint as much as efficiency or performance.

STANDARDS, METRICS, AND THE LIMITS OF QUANTIFICATION

Daylighting standards, such as those embedded in LEED and WELL certification systems, have profoundly shaped architectural practice over the past two decades. By translating light into measurable data (lux levels, daylight autonomy, spatial daylight availability), these frameworks offer a seemingly objective means of evaluating performance.[14] They promise quantifiable sustainability. A design can be "daylit" not by experience but by compliance. Yet in practice, such systems risk narrowing the field of architectural imagination. When daylight is reduced to a checklist, its complexity as a spatial and emotional phenomenon is diminished. Light becomes a means to an end, a point toward certification, rather than a medium through which architecture communicates atmosphere, temporality, and care.

LEED's daylighting credit, for instance, awards points when a certain percentage of regularly occupied floor area achieves specified illumination thresholds under simulation.[15] Similarly, WELL focuses on metrics related to visual comfort and circadian stimulus.[16] These standards undoubtedly advance awareness of daylight's importance, but their reliance on static modeling tools often disregards the lived experience of occupants. A simulation might indicate "adequate daylight" across a grid of points, yet fail to account for glare reflected off glossy surfaces, the distracting shimmer of direct sun on a workstation, or the subtle rhythm of light that animates a corridor over the day. In this sense, performance-based frameworks risk producing spaces that meet numerical goals but neglect sensory and temporal richness.

Moreover, the emphasis on quantification introduces ethical and epistemological tensions. What kind of knowledge about light is privileged when its value is expressed numerically? As Kiel Moe argues, environmental metrics often obscure the very ecological relationships they aim to reveal.[17] By abstracting light from its embodied effects, these standards transform design judgment into statistical optimization. Architects, trained to think

materially and perceptually, are compelled to design through spreadsheets, mediating between software outputs and spatial intuition. The result can be a disjunction between the architecture that is modeled and the architecture that is felt.

Andersen calls for an approach that "weaves together performance and perception," insisting that the human response to light (emotional, biological, and spatial) must inform design as much as photometric efficiency.[18] Her research exposes the inadequacy of metrics that claim universality but ignore context, the cultural practices of shading, the pleasure of dappled light, or the thermal expectations of different climates. In this sense, "too much light" becomes not a measurable threshold but a relational condition, too much for whom, where, and when? The pursuit of universal performance benchmarks obscures these nuances, replacing interpretive judgment with standardized thresholds that may not correspond to lived realities.

This paper therefore situates daylighting standards within a broader critique of architectural quantification. The problem is not measurement itself, but the conflation of measurement with meaning. Standards offer necessary tools, but they cannot substitute for the architect's sensory and ethical engagement with light as material. To design well-lit architecture is to interpret, not merely to calculate. The challenge lies in re-integrating the experiential into the procedural, ensuring that the pursuit of energy efficiency and occupant comfort does not eclipse the poetic, affective, and symbolic dimensions that make light architecturally profound.

TOWARD AN EXPERIENTIAL FRAMEWORK FOR DAYLIGHTING

Between the precision of photometric data and the ambiguity of lived experience lies a critical gap that architects must learn to navigate. Daylighting design occupies this threshold space: it is both a science of measurement and an art of perception. To rely solely on one at the expense of the other produces imbalance, either an overdetermined rationalism that drains space of its sensual vitality, or a purely intuitive poetics detached from environmental reality. The challenge, then, is to bridge these modes of knowing, to develop an architectural language of light that integrates sensibility with scientific rigor.

As both a researcher and a practitioner in lighting design, I have often encountered this gap firsthand. In professional contexts, daylighting simulations are celebrated as proof of performance, yet they often fail to capture the subtleties that define the experience of a space. A rendered image might display uniform luminance across a plan, but it cannot express how light shifts through the day, how reflections alter surface depth, or how brightness affects mood and attention.[19] In contrast, the architect's embodied knowledge, how one senses light while sketching a section or walking through a building, is dismissed as subjective and therefore unmeasurable. Yet it is precisely this subjectivity that allows architecture to address the human dimension of light.

Juhani Pallasmaa argues that "the quality of light is not only a matter of seeing, but of being."[20] His phenomenological perspective reframes light as a medium that shapes both perception and emotion, linking vision to memory and material presence. This aligns with Andersen's human-centric research, which emphasizes the need to "reinsert the occupant" into daylighting discourse.[21] Together, these frameworks suggest that a new epistemology of light is emerging, one that values the sensory and temporal variability of daylight as essential to wellbeing, rather than a problem to be mitigated.

I thus propose what might be called an experiential framework for daylighting, one that situates light within the overlapping domains of physiology, perception, and ethics. Such a framework does not reject quantitative tools but repositions them within a broader spectrum of design intelligence. For instance, Ulrich's (1984) physiological studies demonstrate that access to natural light and views can accelerate healing and reduce stress responses.[22] These findings offer empirical validation of what architects have long intuited, light nourishes both body and mind. Similarly, Hobday historicizes this intuition, tracing how sunlight was once understood as a form of architectural therapy, before modern technologies replaced it with artificial illumination.[23] The experiential framework also calls for a renewed ethics of attention. To design with light is to recognize its capacity to include or exclude, to reveal or to expose. It demands sensitivity to cultural and climatic differences, and to the psychological boundaries between comfort and discomfort.[24] "Too much light" is not an absolute but a negotiation between glare and glow, openness and privacy, performance and poetics. By cultivating this attunement, architects can transform daylighting from a technical variable into a site of critical and aesthetic inquiry, where the measure of success lies not only in lux but in the lived intensity of space.

This shift in thinking requires more than theoretical recalibration, it requires new spatial tools for learning from light itself. Daylight is profoundly situational, it varies by climate, latitude, materiality, season, and hour. It cannot be fully understood through simulation or precedent alone. To bridge the persistent gap between what daylight is measured to be and what it is experienced to be, architects need a dedicated environment where both forms of knowledge can be tested, aligned, and challenged in real time. What follows, then, is a proposition for such an environment, a purpose-built Daylight Lab designed to study light through direct exposure, controlled experimentation, and embodied observation.

THE DAYLIGHT LAB

The study of daylight ultimately demands built space. No model, digital or analog, can reproduce daylight's full behavioral range. Its temporal drift, its chromatic shifts, its capacity to soothe or

overwhelm, reveal or obscure. A dedicated Daylight Lab provides the architectural and methodological infrastructure necessary to understand these dynamics in situ. This is not an office retrofitted with skylights or a conventional laboratory equipped with photometric instruments. It is a building conceived explicitly by daylight and for the study of daylight as a material of architecture. The Lab functions simultaneously as instrument, environment, and pedagogical tool. It houses light, manipulates it, and renders its variations legible through spatial form.

The design supports both analytical precision and experiential inquiry. Adjustable apertures, dynamic louvers, interchangeable materials, and reconfigurable geometries enable controlled experimentation across seasons and solar angles. Vertical light wells capture zenithal illumination, east–west corridors register diurnal extremes, north-oriented chambers cultivate diffuse conditions, south-facing terraces test the limits of solar exposure. The building becomes an ecology of illumination, where atmospheres can be crafted, compared, and measured.

Metrics in the design of The Daylight Lab remain essential. The Lab is calibrated to meet standards for daylight autonomy, glare control, spatial uniformity, and thermal performance. These quantitative benchmarks establish the project's technical rigor. Yet qualitative goals are treated with equal importance. Rooms are designed to sense gradient shifts, thresholds to reveal the fine line between glare and glow, courts to make seasonal and directional light visibly and experientially legible. By integrating measurement with lived perception, the Daylight Lab situates daylighting within a broader architectural discourse, one that values accuracy without sacrificing atmosphere, and that recognizes the ethical, cultural, and psychological stakes of light. It becomes a bridge between what regulations demand and what spaces require, offering a platform through which a genuinely holistic daylighting practice can emerge.

RETHINKING DAYLIGHT AS ARCHITECTURAL ETHICS

To ask "how much light is too much" is ultimately to ask how architecture mediates between necessity and excess, between environmental performance and lived experience. Daylight is both a technical problem and a moral question, it concerns how we care for the spaces we design and for those who inhabit them. As this paper has argued, the contemporary fixation on quantification has narrowed our understanding of light to measurable indices, often at the expense of atmosphere, emotion, and ethical awareness.[25] To design with daylight responsibly is not simply to meet prescribed illumination thresholds, but to cultivate an awareness of its cultural, sensory, and ecological dimensions.

Ethics enters this discussion not as an abstract principle but as an embodied practice. The architect, in orchestrating light, makes decisions that shape patterns of visibility and concealment, comfort and exposure.[26] These choices have profound implications, who is seen, who is protected, and how space mediates human vulnerability. In healthcare, education, or domestic design, the ethics of light becomes inseparable from the politics of wellbeing. Ulrich's demonstration that a window view can accelerate healing,[27] and Hobday's historical account of sunlight as therapy, remind us that light is not neutral, it can heal or harm, empower or overwhelm.[28] In this sense, the question of "too much light" transcends aesthetics or efficiency, it becomes an ethical calibration between sensitivity and control.

The architectural task, then, is to reframe daylight not as a quantity to be optimized but as a relation to be composed. This requires a pedagogy of attentiveness, training architects to read the atmosphere of a space with the same rigor that they read its technical data.[29] Through such attunement, the profession can reclaim light as a medium of meaning. One that communicates care, temporality, and environmental consciousness. The Daylight Laboratory proposed here invites architects to engage daylight as both science and sensibility, measurement and meditation.

In a time defined by environmental urgency and technological abstraction, daylighting offers an opportunity for re-grounding architectural ethics in perception and presence. To design for light is to design for human experience in its most elemental form, to acknowledge the fragile balance between illumination and shadow, exposure and shelter, life and its luminous limits. In this balance lies architecture's enduring responsibility, not to control the sun, but to interpret it.[30]

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