ABSTRACT

Title of Thesis: **LIGHT FORMS FUNCTION**

Cristhy Centeno, Master of Architecture, 2023

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School of Architecture, Planning and Preservation

Light is essential for understanding design as well as living and working in structures. Although it cannot be produced, its perception shapes architectural spaces and forms. It creates a mood by lighting surfaces with texture and materials. It also has a significant influence on our biological and mental well-being. This thesis will investigate the programs, different lighting strategies, and typological precedents used by design schools, as well as collect questionnaires and interviews from building users. To enhance and support users' daily lives, it will also examine methods for capturing, rerouting, darkening, and framing natural and artificial light luminosity. The University of Maryland's School of Architecture, Planning, and Preservation Building would eventually be redesigned using the knowledge acquired. Due to the amount of time students spend in schools, it is essential to design primarily for the visual requirements of the users and their expected functions inside a given space. This is because schools may serve as students' second homes.

LIGHT FORMS FUNCTION

by

Cristhy Centeno

Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Master of Architecture
2023

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Introduction

The function of a space cannot be perceived in the absence of light

Figure 1 – Absence of Space

Human perception of space has been influenced and evolved by the daily conditions of natural light. Light manifests as a physical presence that can create or remove boundaries. Our eyes are where most of the information we learn about the world around us originates from. In addition to being a necessary condition, light is also how we may see.

Light produces unique conditions through its characteristics that might affect how we perceive things. Through its strength and how it is dispersed, our visual environment is planned through lighting design. Working efficiently and maintaining our sense of well-being in perceptual environments enable us to an environment that is intended to be created through good lighting design.

The primary source of natural light is the sun, Since the beginning of mankind, we have used the sun. The sun's constantly changing light creates unique and dynamic illumination conditions throughout the day. The sun has been praised by many religions as the source of light, the home of the Gods, or a manifestation of the divine. Within this, the history of architecture can tell the story of how civilizations have adapted to the environment through different solar principles. This happened following their knowledge, philosophical beliefs, and geographical and environmental contexts in which they lived. The interaction humans have with the sun and the natural world has been evident throughout history, either on a mystical or religious level or more visually in-built structures.[1]

Light makes a space livable; it shapes it and guides us throughout it. Light sets the scene for building performance, clarifies the purpose, and shapes the space. The lighting design is integrally a part of the building design. Architectural considerations including building orientation,

[1] Boubekri, Mohamed. *Daylighting, Architecture and Health*, 9

aperture size and placement, interior geometry, and surface properties come together with the sky's constantly changing light to create unique and dynamic illumination conditions.

Our perceptions have been influenced by the daily rhythms, the seasonal cycles of light and darkness, and the unpredictable nature of the weather. Natural light has been also significant to human physical health, it can revitalize the mind, bring happiness, and makes us genuinely appreciate our existence. [2]

[2] Meek, Christopher M., and Kevin van den Wymelenberg. *Daylighting Design in the Pacific Northwest*, 3-4

Chapter 1: Lighting Principles

When lighting architectural spaces, the six visual principles that will be describe in this chapter offers a list of criteria that can be independently verified. Although each concept is unquestionably crucial on its own, they eventually need to work together to produce the intended spatial experience, both with one another and with the surrounding architecture. In this sense, each principle operates as a small piece of a larger puzzle that, when put together, produces a singular image through relative interaction.[3] The six principles of lights that will be discussed in this chapter are illuminance, luminance, color and temperature, height, density, and direction and distribution.

[3] Descottes, Herve, and Cecilia Ramos. *Architectural Lighting: Designing with Light and Space*, 13

Illuminance

Illuminance, which is measured in footcandles or, in the metric system, lux, is a term used to describe the amount of light that a light source emits and that falls on a specific surface area. Illuminance is the element of a nuanced spatial composition in the built environment that gives it structure and clarity. It can regulate visual extremes, crescendos of light and dark that can both reveal and hide layers of a complex space. Given that it enables us to move around a room or carry out tasks within it, this principle is crucial both practically and phenomenologically in the design of architectural lighting.[4]

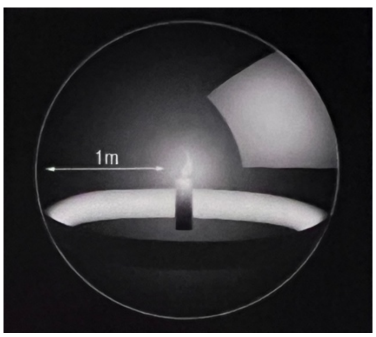

Figure 2 - A lux is defined as the sphere of illumination cast by a one-candela point source on a surface one meter away

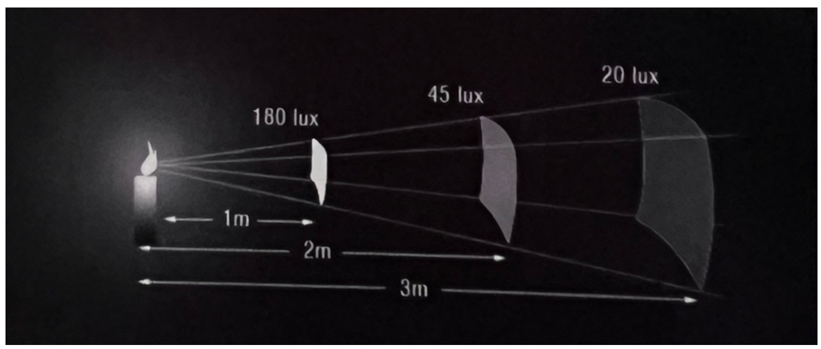

Figure 3 - Illumination as a function of distance: Illumination decreases as the distance between the light source and the illuminated area increases

Visibility

If people only relied on touch or taste, their environment would only extend as far as their arms or legs. But the combination of light and perception produces an interior world of distance and depth, color and contrast, dimension, and texture. Light and vision are the only senses that can effectively describe the incomprehensible size and infinite depth of perceptions.

[4] Descottes, Herve, and Cecilia Ramos. *Architectural Lighting: Designing with Light and Space*, 14.

In the dark, there is a new visual relationship encounter that can alter how to interpret the surroundings. The retina contains photoreceptor cells that convert various light wavelengths and intensities into neural signals, which the brain then interprets into images. Cones function best in bright light, whereas rods are sensitive to changes in light intensity. As light levels fluctuate, so does the activity of rod and cone photoreceptors.

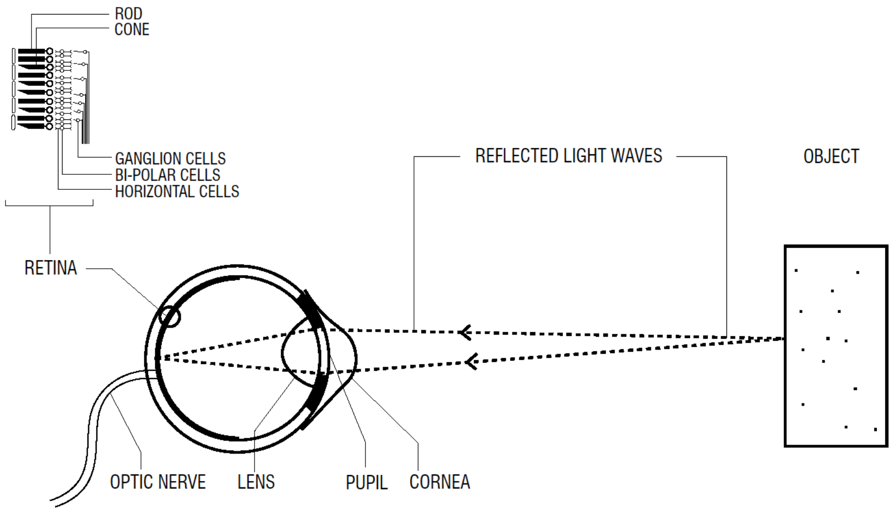

Figure 4 - Anatomy of the human eye

The growth of urban centers and the production of excessive light have challenged the ways in which the nocturnal sky is view. For many people, the stars are most often invisible, overpowered by the mist of artificial light or the glare of streetlamps. Light pollution is of great concern to scientists and people who study the relationships of nature and the urban environment. Likewise, Light can be a welcome source of visibility in architectural environments, but it can also overstimulate or make people blind. The design of such spatial pathways benefits from gradual illumination augmentation.

Figure 5 – Images were taken near Toronto in August 2003 show the night sky during a blackout (left) and on a night with electrical power restored (right)

Since light can represent both physical form and atmospheric space, it can be used in combination with architectural features to establish the limits of a seen space. Light can be made more solid or, conversely, more fading by the presence of dark. Darkness might imply the presence of unending spaces or clear boundaries, clear openings, or opaque enclosures. A powerful palette of light and dark, as well as the gradients between them, can improve the understanding of an architectural space in addition to built form.[5]

Reassurance

The function of public lighting in urban areas today is still based on ideas of visibility, safety, and aesthetics, but the term "safety" involves much more than simply preventing criminal activity. People rely on light to give drivers uniform vision, to allow for the safe coexistence of vehicles and pedestrians on a road, and to provide psychological comfort by assuring vision for individuals who travel through cities at night. However, it is no longer taken for granted that there is a direct correlation between lighting and lower crime rates.

A 1977 and 1997 National Institute of Justice investigation found no significant correlation between illumination and crime because most crimes take place at night in empty lit buildings or during the day in open areas. Further suggesting that nighttime crime may be more likely to occur in areas with high outdoor ambient-light levels, a 2003 study by B. A. J. Clark at the Astronomical

[5] Descottes, Herve, and Cecilia Ramos. *Architectural Lighting: Designing with Light and Space*, 14 – 20.

Society of Victoria Inc. in Australia found that "excessive outdoor lighting appears to facilitate some of the social factors that lead to crime." This study discovered that locations of excessive light and glare frequently produce pockets of great contrast and deep shadows, where criminals can be hiding out unnoticed.

The presence of large amounts of light may also encourage illegal activity in places that would otherwise be uninhabited. None of the studies listed make the case for the elimination of public lighting; rather, they merely advocate for the proper use of the resource. Of course, the presence of public lighting can have radically different consequences in various socioeconomic settings. In the end, it's crucial to illuminate public areas in a way that both looks to and truly keeps people safe.[6]

Conservation

It's essential to keep in mind that light is energy by definition and that it can have negative effects on the materials it encounters. When light hits an object, some of the light waves are reflected, and some are taken in by the material of the object. The light waves that are reflected are the ones that enter the eyes, where they are processed into an image of the object. Although the absorbed light waves cannot be seen, they could be dangerous and harm the object's materiality irreversibly. Studies of how light will interact and be distributed inside a specific space must be addressed by lighting designers. These calculations assure that the lighting levels in the space will be comfortable, visible, and safe for the objects and materials there. For instance, the design of museum exhibitions is an area in which carefully calculated illuminance is essential to the preservation of objects.

[6] Ibid, 22-23.

Uncontrolled or improperly filtered light can harm an object photomechanically and photochemically, leading to fading and disintegration. The proper maintenance and preservation of the objects inside depends on the use of appropriate filters and controlled lighting levels.[7]

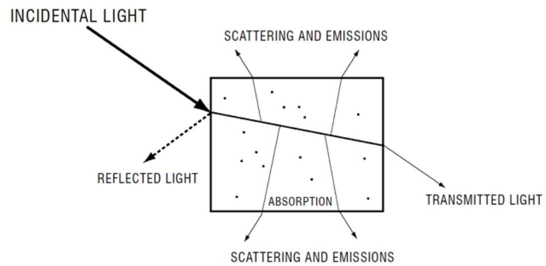

Figure 6 - Light can be reflected, absorbed, or transmitted by a given material. A single object can selectively reflect a wavelength of a given frequency while absorbing or transmitting others. Reflected light is what renders a surface visible. The lighter reflected, the brighter the surface, and the lighter absorbed, the darker it appears. A surface that transmits some light appears transparent.

Light Energy

Conservation is not just a subject concerning the preservation of materials and objects, but a notion equally relevant to the use of light itself. The future conservation of light energy is dependent on both advances in lighting technologies and on our meaningful and responsible use of lighting in the built environment. Recent campaigns encouraging consumers to replace incandescent bulbs with compact fluorescents are one example. Other advances in lighting technology include dimmers, photocells, occupation sensors and time-clock scheduling. The use of such systems can save 20 percent to 50 percent of a building's energy consumption while reducing environmental impacts.

Conservation of light energy can be as simple as turning lights off when a room or building is not in use. IESNA lighting design guide suggests illuminance levels of 300 lux in an office environment. By designing for 100 lux in circulation areas, one can lower energy consumption by approximately 65%.[8]

[7] Ibid, 24-26.
[8] Ibid, 26-29.

Luminance

Luminance, a visual characteristic that measures the intensity of light from a particular surface, attempts to explain the phenomenon. Both footlambert and candela per square meter are units used to express luminance. By light, it is possible to give space a sense of direction and hierarchy.[9]

Light Reflection and Material

Brightness is the viewer's subjective perception of an object or surface, whereas luminance is the objective measurement of light intensity per unit area. Most often, a surface with high luminosity would appear bright, and recurrently, a surface with low luminosity will appear dark. The idea of luminance in lighting design is closely tied to built form, materiality, and color since a surface's material properties influence how light waves are reflected to the eye. For instance, a lamp shining on a white wall will create more brightness than the same lamp shining on a black wall will since the white paint will reflect most incoming light waves while the black paint will absorb them. See Figure 7. When a lamp is shining on a white wall, luminance values are higher, but when the same light is shining on a black wall, visual contrast is higher. See Figure 8.

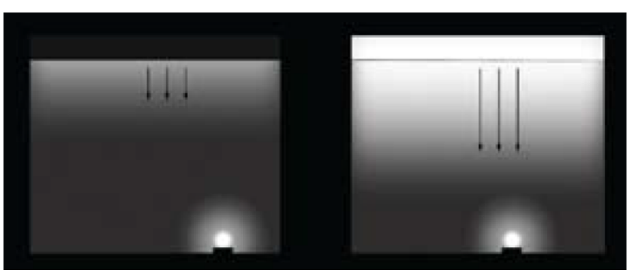

Figure 7 – Luminance comparison of black wall and white wall

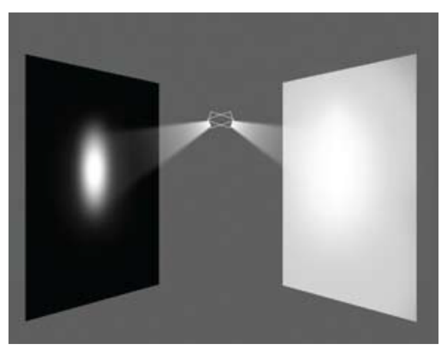

Figure 8 – Luminance versus contrast for a black

[9] Ibid, 30.

wall and a white wall

In both ecclesiastical and secular settings, indirect lighting and luminous surfaces in contemporary architecture continue to evoke a sense of the unexpected. For instance, the chapel designed by Eero Saarinen for the Massachusetts Institute of Technology in Cambridge in 1955 achieves extraordinary results by directing natural light reflected from the building's surrounding moat into the chapel's cylindrical brick border.

On the inner walls, where light waves dance across the wavy surface of brick, the color, direction, and strength of the sunshine as well as the motion, patterns, and clarity of the water are projected.[10]

Figure 10 - Massachusetts Institute of Technology Chapel, the image shows the interior light reflected from the exterior moat and how it illuminates the undulating brick walls of the interior

Figure 11 - Exterior of the Chapel, with moat.

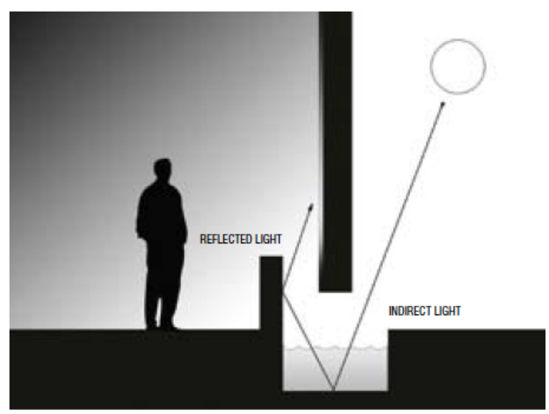

Figure 9 - Diagram of indirect and reflected light in the chapel

[10] Ibid, 30-33

Contrast and hierarchy

The brightness of a surface in relation to its surroundings is measured as a surface's luminance. The brighter object seems closer to the viewer and the less brilliant object appears further away when two identical objects are put side by side. Bright and dark contrasts can be carefully choreographed to direct people's movement around a space while also highlighting significant landmarks and moments of pause in the visual trajectory.

Businesses typically use windows in retail settings where brightness contrasts are carefully managed to entice visitors into a location. To break down the visual barrier of the storefront window, high brightness levels are used in the back of a store to attract the eye into the depths of the retail environment. If the store window had a higher brightness level than the back wall of the store, the reflectivity of the window would instead act as a visual barrier to prevent one from seeing in, compressing the perceived limits of the space. Luminance ratios, a comparison numbering system that describes the brightness of one surface in relation to another, can be used to objectively control the hierarchy of luminance. While a brightness ratio of 10:1 is thought to be dramatic, luminance ratios of 10:9 or 5:4 in normal interior settings indicate consistency in luminance.[11]

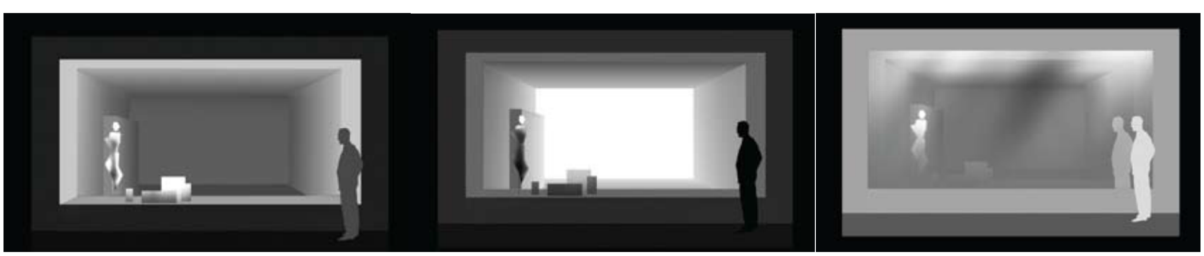

Figure 12 - Effects of luminance in accentuating or negating perceptions of depth through a window

[11] Ibid, 30-35.

Glare and Sparkle

Glare is the sensation of discomfort caused when high levels of luminance are misdirected toward the eye. It is a condition that lighting designers must control in their quest to create a visually tolerable and programmatically functional space. Glare can also limit one's perception of space and sense of depth, acting as a visual barrier. Glare can be a problem when an unshielded light source is in plain view, preventing the viewer from seeing what the light source aims to highlight. For this reason, recessed fixtures, shields, and other disguises are often employed to minimize glare. Sparkle in its multitude of forms can add interest to a space, punctuating areas of darkness or drawing attention to key spatial elements.[12]

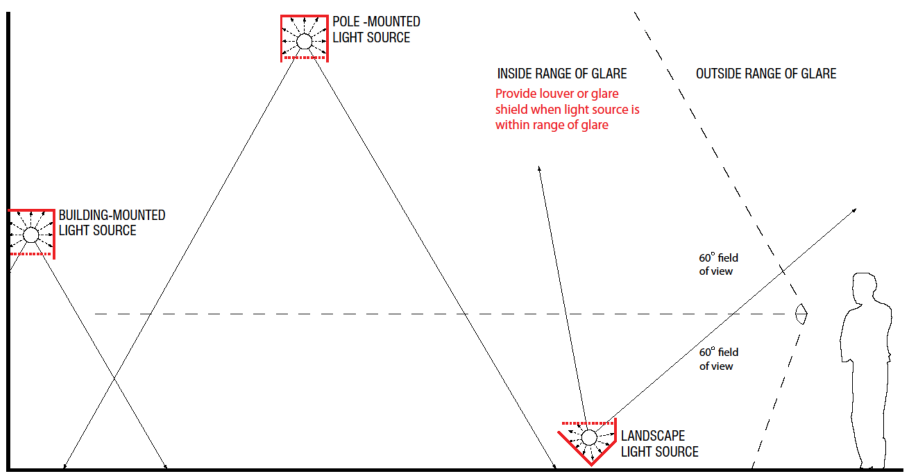

Figure 13 - Glare prevention: Exterior fixtures situated within 60 degrees above eye level generally require shielding to prevent uncomfortable glare

Color Temperature

The impression of space and time is strongly linked to the color of light. The cool blue light of a winter morning or the warm glow of a sunset sun are typically what linger memories, influencing our idea of a space inhabited at a specific time, rather than the architectural

[12] Ibid, 36-38.

characteristics of a space. The way that items are perceived in their environment changes when they are a light color. By creating new relationships and chromatic contrasts between the foreground and background, form, and atmosphere, it can turn the familiar into the strange. Light color can alter how we see an object and its surrounds since every object gets its color from the light it absorbs or reflects. This can lead to the discovery of new chromatic, formal, or spatial correlations.[13]

Visual Impressions

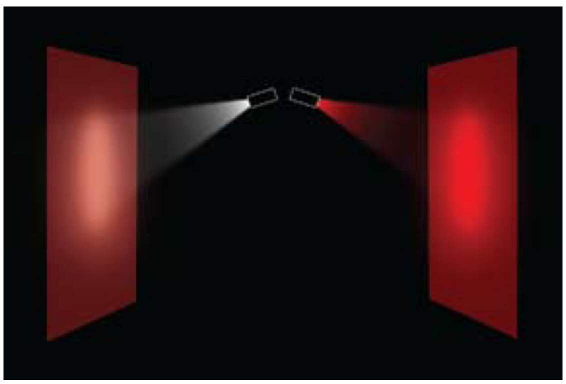

Figure 14 – Illumination of red wall with white light (left) and red light (right)

When describing colors, we primarily speak in a language of hue, lightness, and saturation. Hue is an adjective that describes the trait we commonly recognize as a color (red, yellow, green, blue, and purple). Lightness refers to a color's subjective brightness (light blue versus dark red), while saturation refers to the color's purity or intensity against a counterpoint of grays. Light is a powerful medium in the art of design as it can alter the color and hue of an object or surface through its ability to reflect or transmit light. In this sense, mixing light colors differs from mixing pigment colors because light obeys the rules of additive mixing, while pigments obey the rules of subtractive mixing. [14]

Identity through color

The use of color in lighting design has the unique capacity to add identity and orientation to a place. On a large-scale urban scale, color can be used in master designs as a sort of visual

[13] Ibid, 40-43.
[14] Ibid. 43-46.

compass that orient visitors within the larger site while also emphasizing key locations. Controlled use of light colors can also heighten the sense of place or elicit strong feelings. The careful selection and application of color in an architectural context can influence how people remember and perceive a space while also evoking emotional responses in the observer.

However, despite extensive research into the psychological impacts of colors and the development of correlations between color and induced emotion, choosing a color is frequently a highly subjective process. One must give the brain a visual opportunity to adjust for the color's full intensity to be really recognized. In other words, you must ultimately look outside of a color-saturated space to fully appreciate its impact.[15]

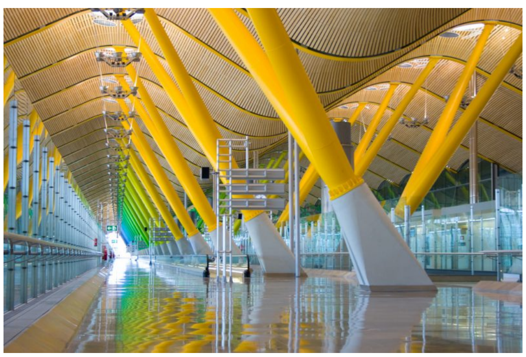

Figure 15 - Interior corridor of Madrid Barajas Airport.

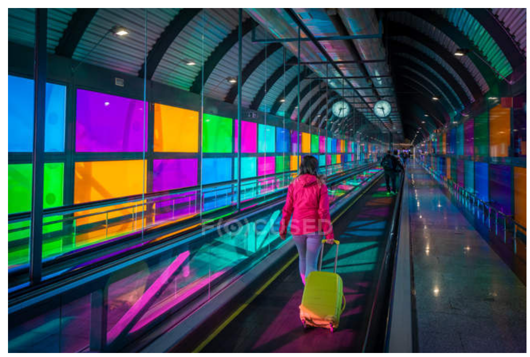

Figure 16 - moving walkway near colorful panels inside Madrid Barajas Airport in Spain

Natural and artificial light

In interior lighting, it is often effective to vary the color, hue, and saturation of light throughout the course of a night. Incandescent lights, whose low color temperatures are concentrated in the red-yellow range of the spectrum, produce a warm glow that recalls the light of the sun. A daily cycle of light and dark, whose complex colors change with the passage of time, controls circadian rhythms. The sun will make a 180-degree arc in the sky throughout the course of the day, bathing the landscape in shades of red, orange, white, blue, pink, purple, deep red, and

[15] Ibid, 48-50

Figure 17 - Perimeter up lighting behind bench seating gives a sense of intimacy evocative of the setting sun.

colors in between. People may infer the day of the week and the month of the year from the brightness of the ambient light because the colors and patterns of natural daylight have become so engrained in their perception.

The cycle of colors can be altered, and new types of time and duration can be introduced, using both electric light and artificial sunlight. To create a sense of atmospheric movement and the passage of time, it is frequently effective to change the color, hue, and saturation of light over the course of a night in interior lighting. Behind a row of benches, for instance, an emitted light might rapidly go from a delicate gold to a vibrant scarlet to a deep red.[16]

Height

An essential aspect of architectural lighting design is the height at which light sources are installed. Height is a powerful variable, capable of provoking a sense of expanded space or visual intimacy.

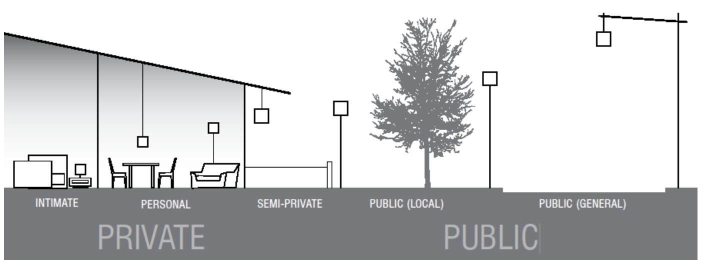

Figure 18 – Height of light relative to degree of intimacy

The height of a light source can also be used to control luminance levels or evoke new concepts and unrations of time. Every space that we inhabit has a height equivalent to the height of a light source, as measured by how close our bodies are to it. A candle held in one's hand becomes a physical extension of one's body; the light it casts is personal and envelops its holder in a curtain of light.[17] Single beam of light that exhibits the following qualities:

[16] Ibid, 50-51.
[17] Ibid, 52.

- The area illuminated will be a function of height: the higher the fixture, the larger the area illuminated.
- The luminaire will become the focal point of a space, as our eyes are drawn to the brightest spot around.
- The light emitted by the luminaire will blanket the surroundings in an unequivocally even glow, eliminating all sense of hierarchy or patches of darkness within the space.

Multiple luminaires installed at lower heights will cast multiple beams of light that exhibit the following qualities:

- The area illuminated will be a function of height and density: several low-height luminaires can illuminate a comparable area to that of a high-height luminaire.
- No single luminaire will become the focal point of the space. Rather, one's eyes will shift around the space to the various areas of brightness.
- The light emitted by the luminaires will overlap or remain separate to create areas of greater or lesser brightness. Variety in lighting effect and hierarchy is perceived.[18]

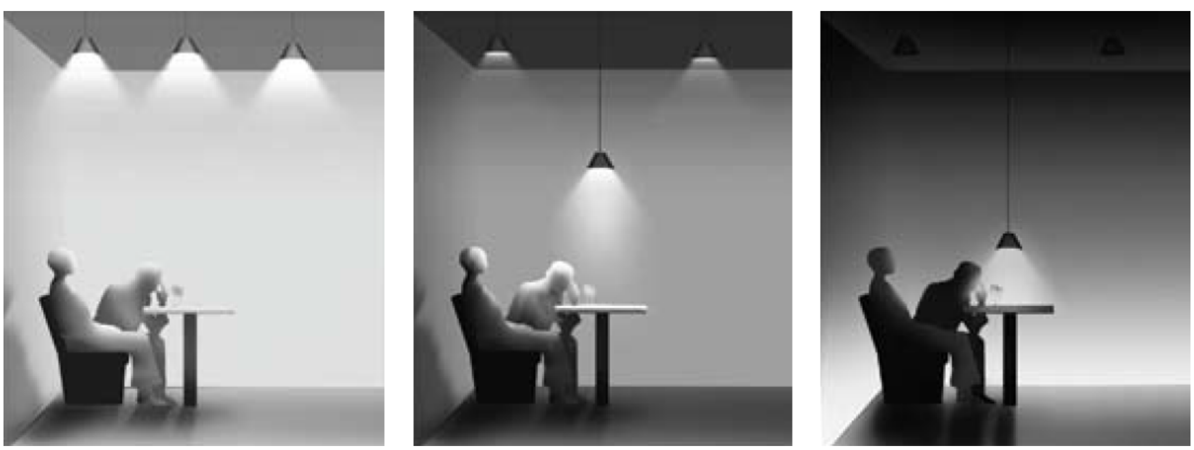

Figure 19 - Varying conditions are created with light height, signaling time and intimacy: High-output downlight and three raised pendant fixtures illuminated for daytime conditions (left), two raised and one lowered pendant fixture illuminated for day to evening transition (middle), and medium-output up lights and single low pendant fixture over dining table illuminated for nighttime condition (right).

[18] Ibid, 58-59.

Density

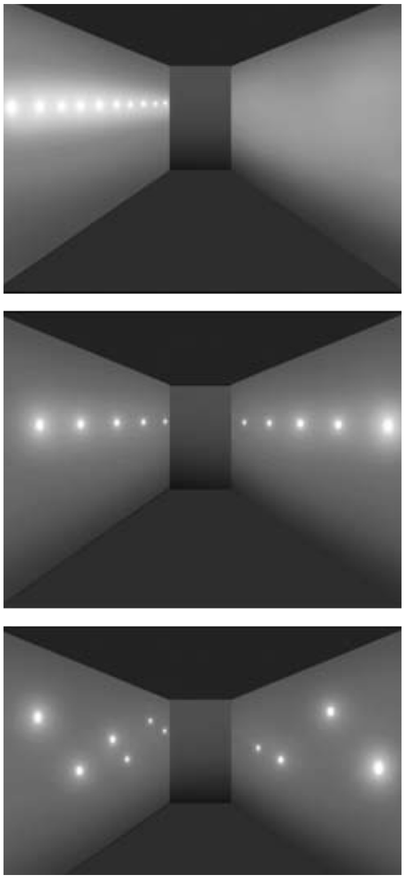

Figure 20 - Varied densities of light in a corridor affect perception

The density of lighting fixtures, along with their organizational characteristics, plays an important role in controlling the way we perceive space. Changes in density can quicken the tempo and heighten the energy of a space, or slow down the pace or evoke a sense of stasis. The spatial organization of fixtures into different patterns of density can a augment or negate the ways in which numeric densities affect our perception of time and depth. The visual principle of density can be defined by the number of fixtures in each space, and the organizational character of a grouping of fixtures.

Our perception of space is significantly influenced by the density of lighting fixtures as well as their organizational characteristics. The energy of a space can be accelerated and amplified by changes in density, or it can be slowed down or evoke a sense of stasis. The ways that numerical densities affect our impression of time and depth can be augmented or negated by the spatial organizing of fixtures into various patterns of density.

If the fixtures are arranged alternately on both walls, one meter apart, the staggered effect prevents the exaggerated optical reading of a decreased perspective, making the corridor appear shorter. The perspectival tunnel effect is nearly destroyed, and the random constellation of lights takes over the visual field if the ten fixtures are distributed randomly throughout the length of the hallway. Density, like the other five visual principles of light, has components of both scientific and subjective judgment. There is no definitive formula that can be implemented to suit all conditions.[19]

Direction and Distribution

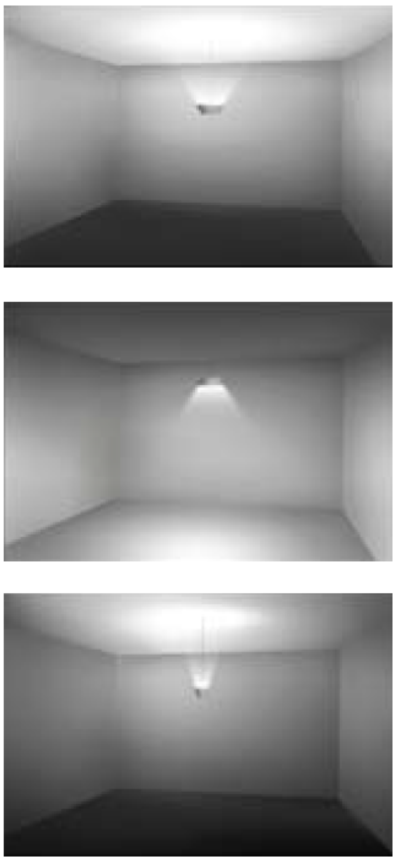

Figure 21 - Different direction and distribution of light withing a room can create varied spatial effects. Top (21.1), middle image (21.2), bottom image (21.3)

Light can be regarded as having one of three directions—up, down, or multidirectional—and can be applied to an area or object in one of two ways: directly or indirectly. Light is typically either concentrated, where it is focused on a small region, or diffuse, where it is spread out across a large area. A lighting designer has several options when combining different directionalities and distributions to represent an object or place to achieve a variety of effects[20]. Consider a room's lighting as an example. The lighting possibilities presented by the following seven possible combinations of direction and distribution allow for a variety of spatial readings:[21]

- The room's ceiling will be illuminated by an indirect-diffuse up light, directing our attention to the ceiling's highest limits. In this situation, the ceiling can start to appear like a light source. See Figure 21.1

[19] Ibid, 60-69.
[20] Ibid, 70-81
[21] Ibid, 71.

- The floor or intermediate plane in the space will be illuminated by a direct-diffuse downlight, making it the dominant surface. An illuminated floor will help the visitor feel more at home in the space. See Figure 21.2
- An area of high luminance will be produced on the ceiling by an indirect concentrated up light. See Figure 21.3
- A direct-concentrated downlight will provide significant contrasts in the room and an area of high luminance on the floor. See Figure 22.1
- A multidirectional concentrated light source will produce uneven brightness in the space, calling the viewer's focus to specific areas of the room that are highlighted. See Figure 22.2
- A multidirectional-diffuse light will reduce contrasts and the presence of shadows by uniformly illuminating different surfaces in a room See Figure 22.3

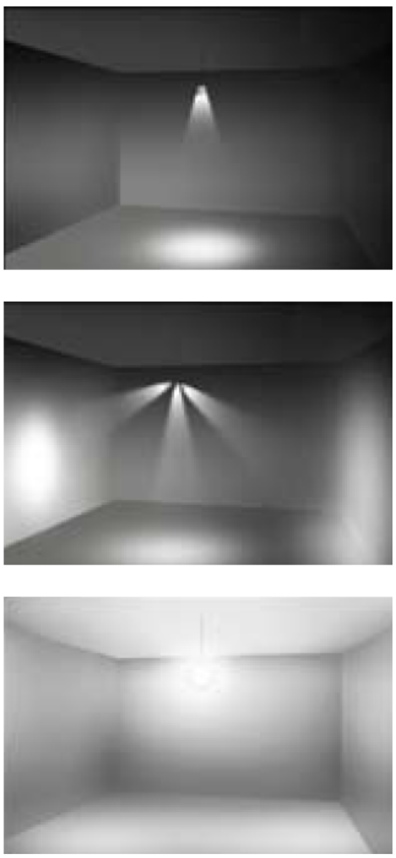

Figure 22 - Different direction and distribution of light withing a room can create varied spatial effects. Top (22.1), middle image (22.2), bottom image (22.3)

The most successful collaborations between lighting designer and architect are those where integration of light and built form is totally seamless. A skilled lighting designer can successfully work with an existing material and formal palette, transforming architecture into a metaphorical lantern for light. Ultimately, the best lighting in architecture simply evokes an atmosphere, emotion, and a memory of a space in time.[22]

[22] Ibid,80-81.

Chapter 2: Psychological Principles of Lighting

Lighting modes & subjective impressions

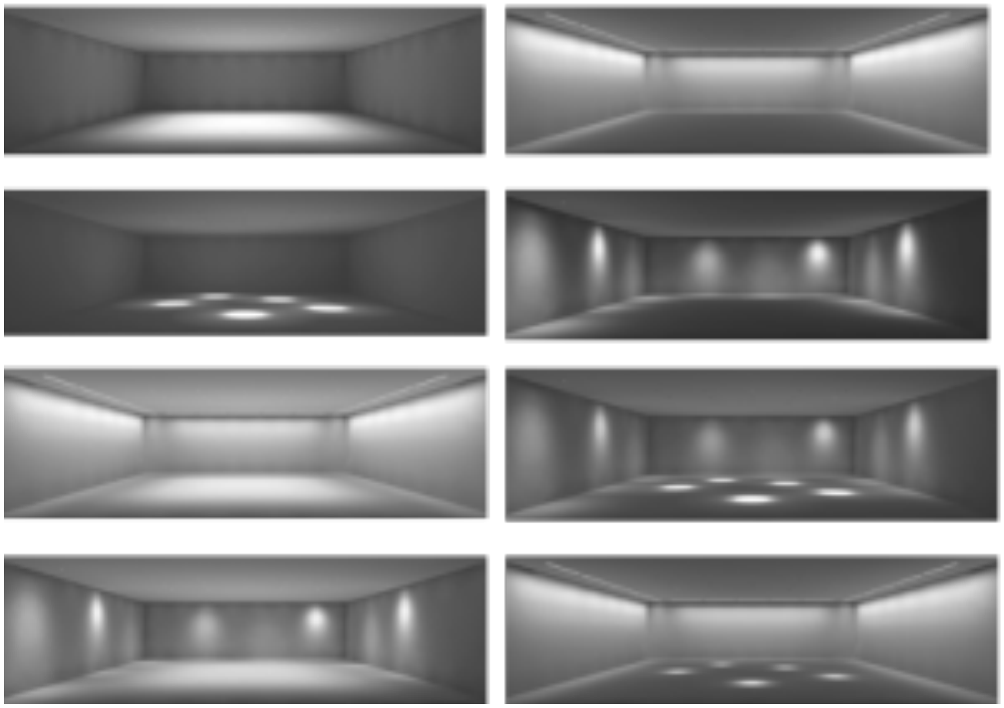

Figure 23 - Lighting modes. Image by Dr. Robert Davis

Architectural lighting plays a much more significant role in the human experience than simply as an enabler of task performance, according to John Flynn. Flynn examined the human response to lighting by studying an array of subjective impressions related to architectural settings. For some impressions, changes in lighting produced significant changes in the response – such as spaciousness, visual clarity, privacy, pleasantness, relaxation, complexity.

Flynn studied how people react to light to comprehend the nature of the stimulus. He identified four attributes of lighting in a space, which he called the "lighting modes". The modes are central/peripheral, uniform/non-uniform, bright/dim, and warm/cool. Each mode represents a range of variations in lighting between two extremes. The message from Flynn's research was that altering certain aspects of the lighting stimulus would alter how people would react.

A designer may concentrate on various elements of the lighting mode descriptors while creating the lighting system to strengthen a specific impression in the environment. The designer could, for instance, use warm-toned, non-uniform lighting on the surfaces around the perimeter of the space to further the relaxing effect. A uniform lighting pattern on the room's surfaces around the perimeter enhances the feeling of openness. A helpful way to characterize the stimulus and responses to lighting that go beyond task performance, according to many practitioners, is through the connections between the lighting modes and the subjective sensations.[23]

Environmental Cognition

The study of Kaplan and Kaplan offers significant insights from the field of environmental cognition that are essential for lighting practice. The goal of these academics was to comprehend the variables that influence environmental preferences in people. One factor that emerged from their research is the desire to make sense of our surroundings. The Kaplans claim that when we are introduced to a new environment, one of our main goals is to discover a cognitive match for that environment in our memory. This will aid us in interpreting and comprehending the new environment.

We frequently enter a new setting that is very similar to other places we have been. Due to our rapid ability to understand the environment, the high level of familiarity prompts a pleasant, comfortable emotion. Sometimes we encounter a strange location that offers a brand-new

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23 "Lighting Psychology: Cognitive and Emotional Responses to Lighting." Ledinside.com. Accessed January 20, 2023. https://www.ledinside.com/knowledge/2013/12/lighting_psychology_cognitive_and_emotional_responses_to_lighting.

experience, and we find it unsettling as we try to make sense of the setting. The Kaplans' research explains both contrasting perceptions by the basic human drive to make sense of our surroundings.

Low preference may also result from high familiarity. Clearly, our preference is influenced by a second element that works in conjunction with our need to understand our environment. According to the Kaplans, a desire for environmental involvement is a factor that supports our motivation to make sense of our surroundings. We want the environment to be interesting, we want it to invite us to explore and engage, and we want a sense of complexity and mystery. This purpose of involvement makes some novel environments seem exciting rather than just plain weird or overwhelming. It also makes some very familiar environments seem just too uninteresting to us.[24]

	LOW Preference	**HIGH Preference**
LOW Familiarity	That's weird	I've never seen anything like that before! Wow! That's neat!
HIGH Familiarity	That old stuff again	No place like home

Figure 24 – Cognition familiarity and preferences

Emotional Response

In Russell's model, human sensory systems process the environment and characterize the relationships between various aspects of the stimulus. This sensory input combines with personality characteristics to produce primary emotional responses. These responses are determined by the pleasure that a person finds in an environment and the amount of arousal or stimulation that the environment provides.

[24] Ibid.

The dominance response has some fascinating implications for lighting, as it depends on how much control we feel we have over the environment. the connections to automatic vs. manual lighting controls are intriguing. Studies have shown that consumers save more energy when they have human control, compare to automatic controls

Russell identified what he called the pleasure and arousal emotions as the two primary ways we experience our environments. These emotions are defined by the four quadrants that are placed under each of four different axes. Figure 25.

Russell argues that our emotional response to a stimulus along the two dimensions of pleasure and arousal is a single, integrated response rather than two distinct responses. This type of comprehensive response is reflected in the language we use to describe spaces. A "stimulating" environment is one that is both arousing and pleasant, whereas a "tense" environment is one that is somewhat arousing but unpleasant. While a "dreary" environment is also arousing but low on pleasure, a "relaxing" space ranks low on arousal but relatively high on pleasure.[25]

[25] Ibid.

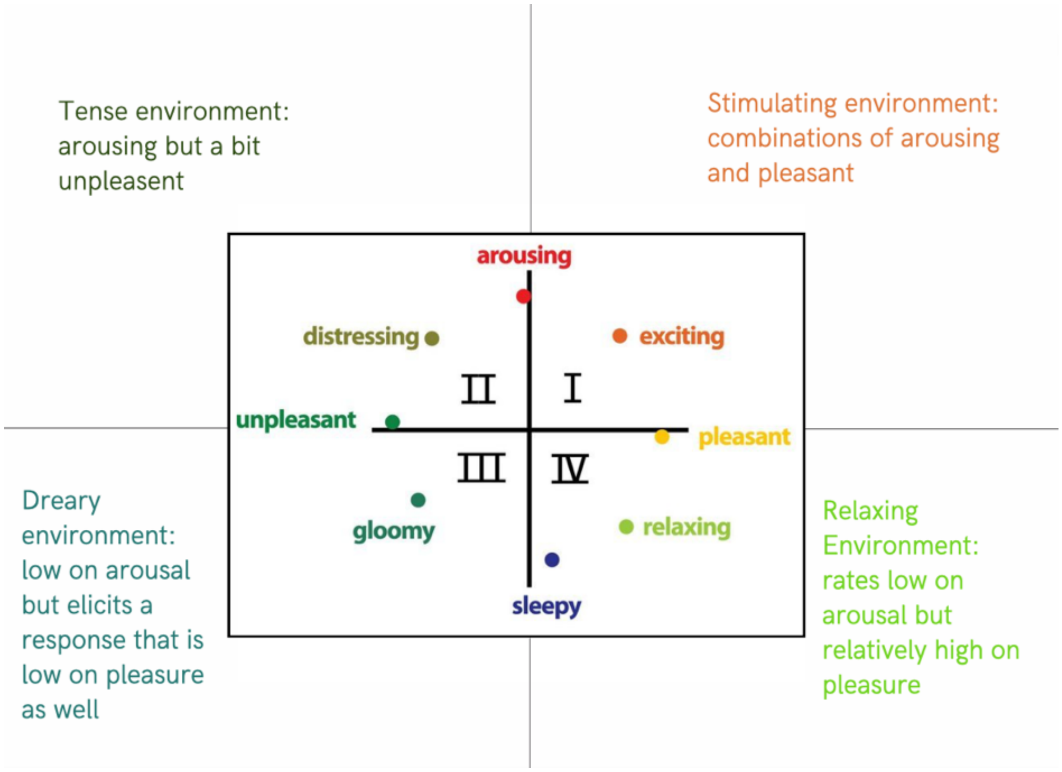

Figure 25 -The four quadrants of emotions and environments

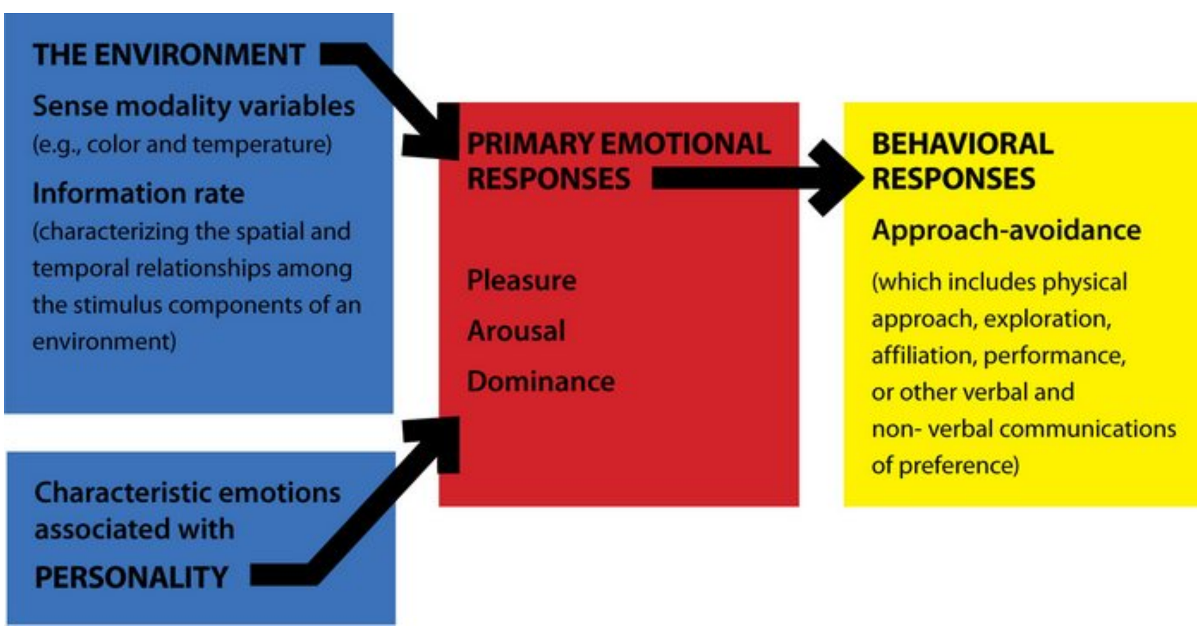

Figure 26 - Primary emotional responses table

Chapter 3: Precedent Analysis

To support the basic concepts of this thesis, the following precedents will be studied at. These precedents will be examined by their programs, their usage, and my observations of their spatial and ambience design. Then, describe the kind of light strategies being employed and whether they are considered physiology and psychology successful. Finally, provide user experiences, either from alumni who attended the institution or via a survey that was sent to students and faculty.

Case Study: School of Architecture, Planning and Preservation, University of Maryland

Figure 27 – School of Architecture, Planning and Preservation building frontage

When designing a new educational facility, there should be a focus on students and teachers since they are the users that experience the facility most frequently. "The environment users must be drawn into the design process if the resulting design is expected to meet their needs."[26] The facility must satisfy its functional needs while also stimulating creativity and promoting teamwork.

During its early years, the school established a reputation for having an exemplary culture of collegiality and community among its faculty and student body. W. Hill, the founding dean and

[26] Hill, John W. *The Foundation Years*. College Park, MD: University of Maryland, School of Architecture, Planning and Preservation, 2011., 14

professor emeritus, notes that the school's aim has been to work in a socially meaningful manner and engage students in current environmental design problems and difficulties facing the community and nation. As the program was being developed, the goals were to involve students in some of the current design issues facing the neighborhood and to collaborate with the school to be socially relevant[27]. According to John W. Hill, the layout design of the school fosters a collaborative learning atmosphere where students can share and critique each other's work in the hall, mezzanines, or great room. [28]

In the 1970s, students developed the annual Beaux Arts Ball to showcase their identities as designers and artists. The event involved picking a theme, designing, and building a set, creating costumes, and sometimes producing a show centered around the subject or costumes. Back then, the "great space" advertised itself as a location for a series of balls. Decadent Elegance served as the theme for the 1977 ball.[29] The school started giving its spaces significance and a purpose to promote community.

Figure 28 - Elegant Decadence poster, 1977

Figure 29 - The Beaux Arts Ball in the Great Space

[27] Hill, John W. *The Foundation Years*, 19.
[28] Ibid, 85-87.
[29] Ibid, 65.

The structure's design incorporated several improvements. One was the design of the great space, which guided everyone to use the facility daily with the perception of the larger school. Another was the addition of the architecture library, which served as the building's equivalent of a "chapel" to allowed people to renew their minds and spirits. Third, though it didn't last long, was the coffee shop. It was in a room at the far end of the great space from the library. It became somewhat out of control due to its extreme popularity, and the university closed it after a short time. Although it was short-lived, its spirit has endured. The school gained a reputation for having a faculty and student population that exhibits a great sense of connection and community among other schools.[30]

Figure 30 - Coffee Shop, New Building, photo ca. 1976

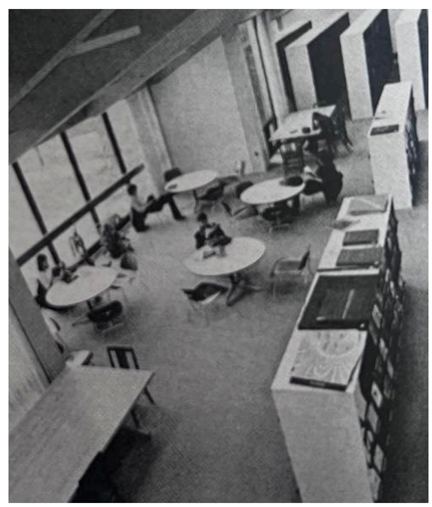

Figure 31 - Library, ca 1972

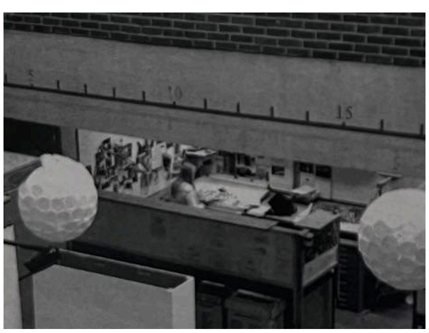

Figure 32 - Looking down into the Great Space, ca 2004

[30] Ibid, 66-67.

Program

Figure 33 - Architecture Building Program

The school's current program includes a great space, studio areas, classrooms, offices, a library, an auditorium, and fabrication labs. The Great Space promotes an overall view of the school since it offers adaptable space that may be used for various activities. The great space is surrounded by the studio space with student workstations. The upper-level classrooms are organized by the circulation of the halls/mezzanines, which also provide pin-up areas for students' work and overlook the great space. As mentioned earlier the library was viewed as a "chapel" where one may renew their spirits and minds.[31] John W. Hill mentioned that the locations of faculty offices were intended to be near the classrooms to promote casual student-faculty contact. [32]

[31] Ibid, 66.
[32] Ibid, 71-72.

This demonstrates that enhancing educational opportunities and creating interactive spaces for students and faculty were the key design considerations in the school. However, as shown in the following floor plans (Figure 1) the intent of the design, as mentioned, is not clearly defined on the floor plans' layout. The encouragement of casual interaction between students and faculty can barely happen. On the floor plans, we can see highlighted in blue color the locations of the classrooms and studio are placed in the building at the north. Almost most of the administration offices, highlighted in pink color, are in the south building in an enclosed area. The connection and opportunity for casual interaction can mostly happen in the long narrow hall that connects both buildings. The possibility of such interaction and encounter can happen if only the students choose to take the farthest stairs to lead them to their classrooms. From the ground floor, you would need to go upstairs to approach the offices.

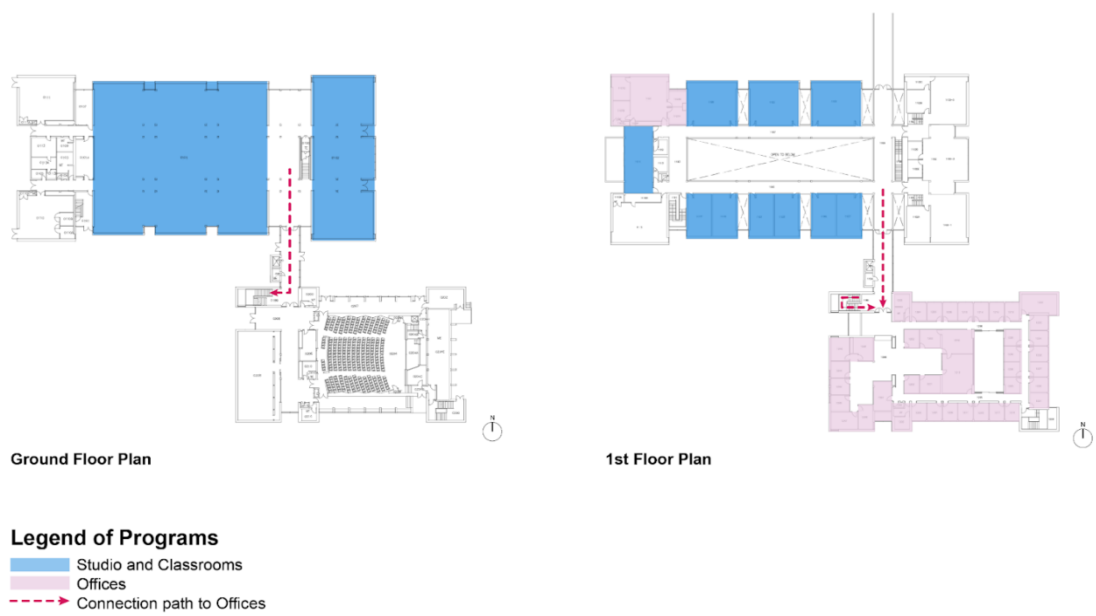

Figure 34 - Floor plans of the School of Architecture, Planning & Preservation Building

Additionally, the Library is located on the First Floor and has a level above that overlooks the ground below. See Figure 2. The extensive collections of books, magazines, and journals available in the library entice students to learn more. The school currently has expanded to four programs, this includes, architecture, historic preservation, real estate development, and urban and community planning. Although Hill noted that the library works as a chapel[33] to uplift our hearts and minds, the number of students has grown along with the program's expansion.

The upper floor currently features two seating areas. The first floor has a larger open floor plan that offers plenty of natural light creating collaboration and interaction spaces. However, lectures do occasionally take place on the first floor, which makes it harder for other students to find a seat. Just as Hill envisioned in his design mission, expanding, or adjusting the seating arrangement might inspire and encourage students to utilize the library more regularly, find inner peace, recharge, and focus on their studies[34].

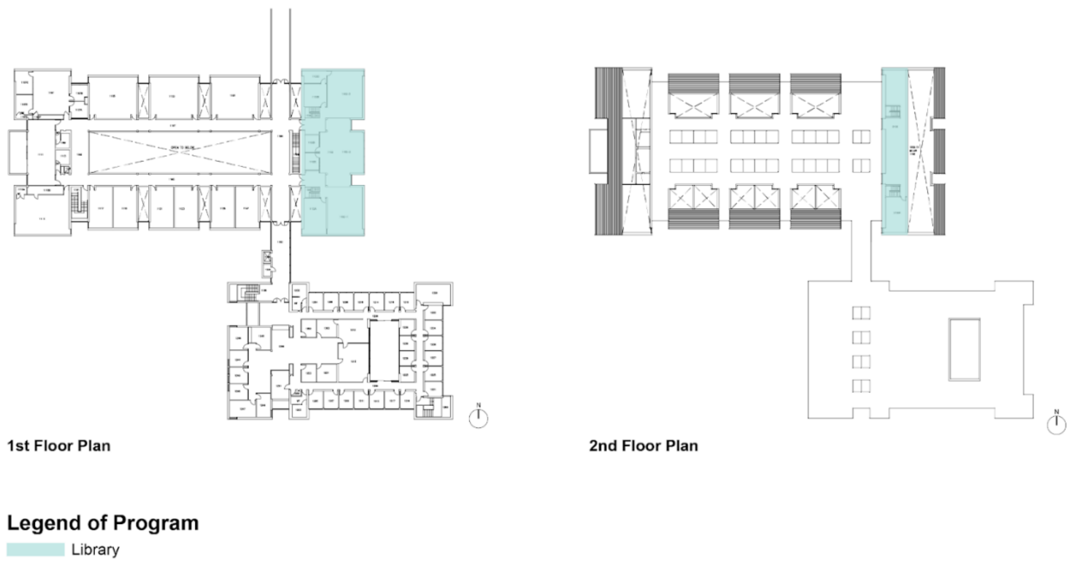

Figure 35 - Library Diagram of School of Architecture, Planning & Preservation

[33] Ibid, 66.
[34] Ibid, 11-24

Figure 36 - View to the library at the lower level

Figure 37 - View to the library from the top level

Reverse Engineering

The following diagrams shows the reverse engineering programs of the architecture school.

Figure 38 - Reverse Engineering Programs, diagram made by author, 2022

Lighting Approaches

Track Mounted Light

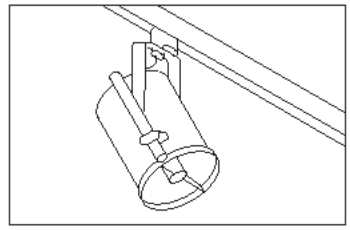

Figure 39 - Track mounted light

Gallery lighting can be positioned anywhere on the gallery's soffit to suit different exhibitions, giving the object and ambient light an excellent contrast. Ultimate lighting flexibility are ideal for galleries concerned with picking out small objects from the background, allowing them to be clearly seen.[35] Kibel gallery uses movable spotlights mounted on track systems offering flexibility, which it is necessary for the illumination of the exhibitions and display lighting. This implies that the illumination can be change using a lighting control system, entirely reconfigured, provide opportunities to realigned them, be dimmed individually, or switched in groups. (Figure 40)[36]

Figure 40 - Kibel Library

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[35] Innes, Malcolm. *Lighting for Interior Design*, Laurence King Publishing, 2012., 44.

[36] Rüdiger Ganslandt, Harald Hofmann. *Handbook of Lighting Design*. Germany: Bertelsmann International Group company., 1992., 8-12.

Tandem Skylights

The tandem skylights are located on the main area of the South building, it illuminates down to the Great Space. This type of illumination provides natural daylight within the structure, that permits. Tandem units' skylights are typically used for flat roofs with low pitches. The domes are separated by a structural purlin and are available single or double glazed with dome or pyramid shapes. The school uses the dome shape.[37] The skylights are built within the concrete beams at the second level. However, the light falls directly onto the great space, it does not diffuse through the studio/drafting room areas.

Figure 41 - Tandem skylight

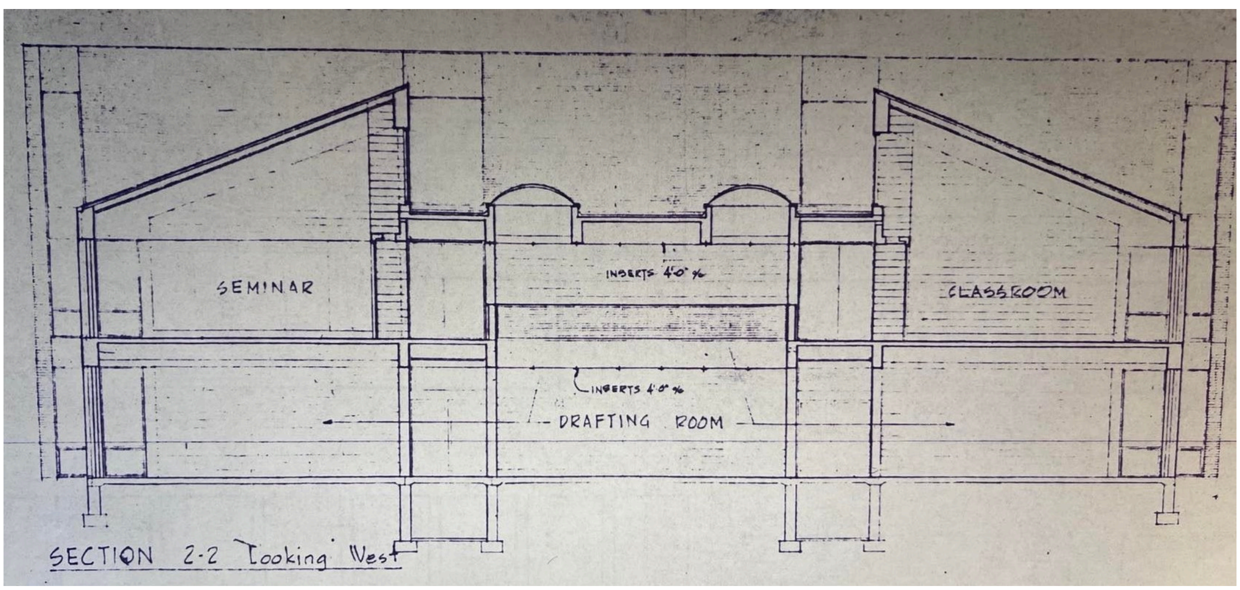


Figure 42 - Section through tandem skylights looking west

[37] "Wasco's Tandem Unit System - Acrylic Dome Unit Skylight System." n.d. Wasco Part of VELUX Commercial. Accessed December 14, 2022. https://www.wascoskylights.com/product/tandem-unit-system/.

Lighting's Condition Survey

The survey was sent to the students and faculties of the Architecture School in the University of Maryland. There were 111 respondents in all, of whom 38.7% were graduate students, 40.5% were undergraduates, and 20.7% were faculty. The study investigated how students and faculty felt about the school's lighting environment and program design.

Most of their work is done at their desk or own workspace, according to 65.8% of respondents (73 replies). Having a realization and considering why other areas do not offer a focus space that enables people to prefer their own personal space to prevent spatial invasion. Surprisingly, the school's primary program, such as, the library and the great space received a lesser rating. The great space is considered as a focused environment by 13.5% (15 respondents), whereas the library is regarded as such by 21.6%. (24 responders). The lab was a frequent response in "If other" responses. See Figure 43.

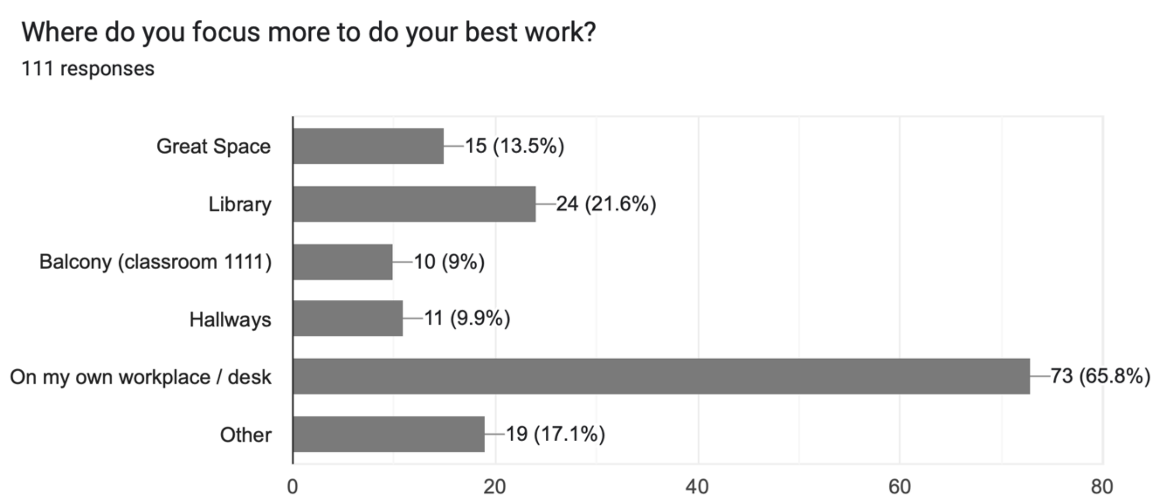


Figure 43 – Workplace preferences

The survey also highlighted that a combination of natural and artificial light is preferable. According to their personal preferences, the great space had an "about appropriate" amount of natural light. Together with the studio spaces, the classrooms provide "too little" natural light. The answers indicate that the offices and Galleries are primarily "unfamiliar." concluding that they might not be as accessible or open to people as they ought to be. See Figure 44

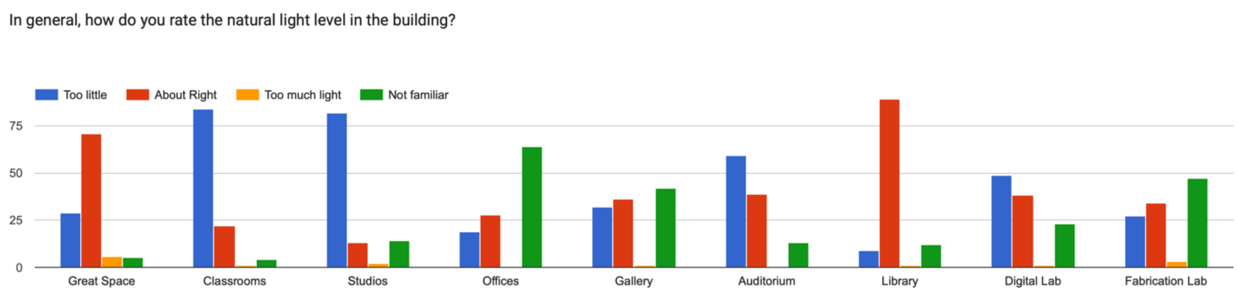


Figure 44 – Natural light ratings

The artificial light experienced at the school went as follows: (Figure 45)

- the great space was competing with being “too little” and being “about right” artificial light, with the difference of 10 responders
- The classrooms highly scored on “about right” artificial light
- The studios had the difference of 7.2% (8 responders) with being “too little” higher than “too much light”. However, “about right” made it to be the highest, 43.2% (48 responders)
- The offices again ranked as “not familiar” together with “about too right”
- The gallery again competed with being “not familiar” and “about right” artificial light

It concludes that the experience students and faculty have in the school with the artificial light is adequate for them.

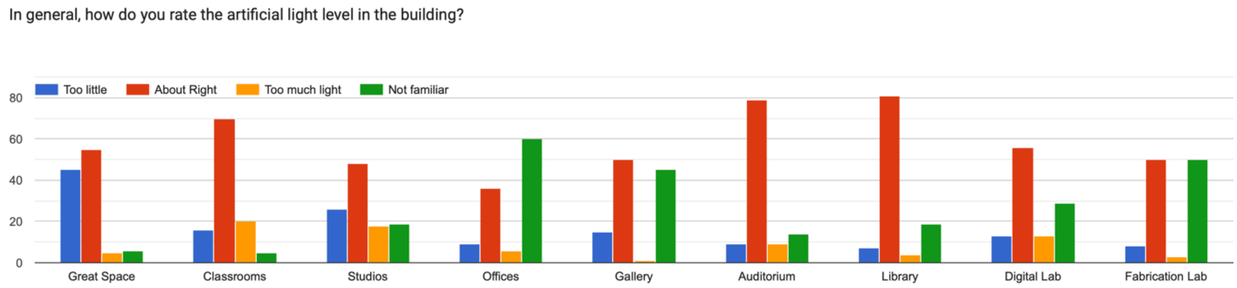


Figure 45 – Artificial light ratings

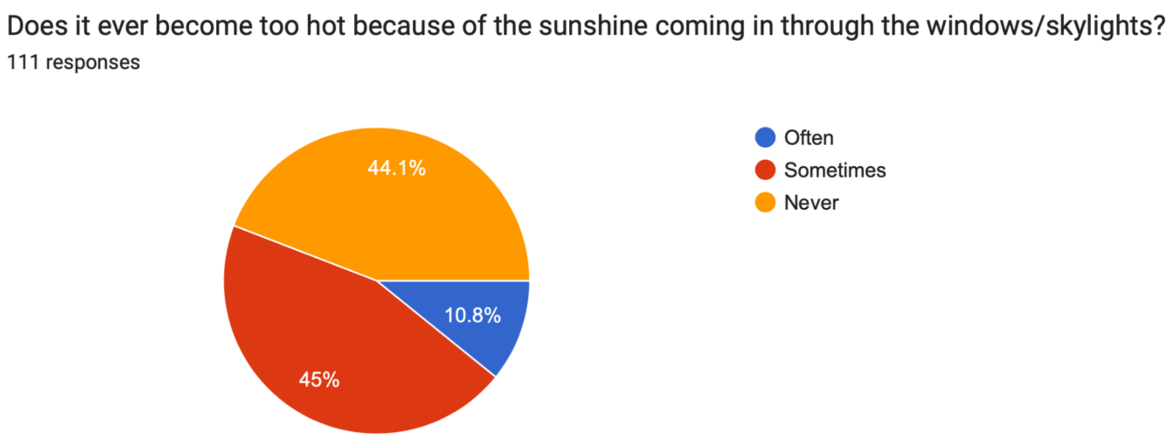


Figure 46 – Solar heat levels experience

In addition, 45% of respondents claim that "sometimes" they feel that the heat from the sun that comes through the windows or skylights becomes too intense. Whereas 44.1% think it "never" becomes too intense. While 10.8% claim to be "often" affected by it (Figure 46). These close results might come from the building's widespread utilitarian lighting use. For instance, in the studio spaces or classrooms, the sun is either entirely blocked out or not present. See Figure 47 and Figure 48.

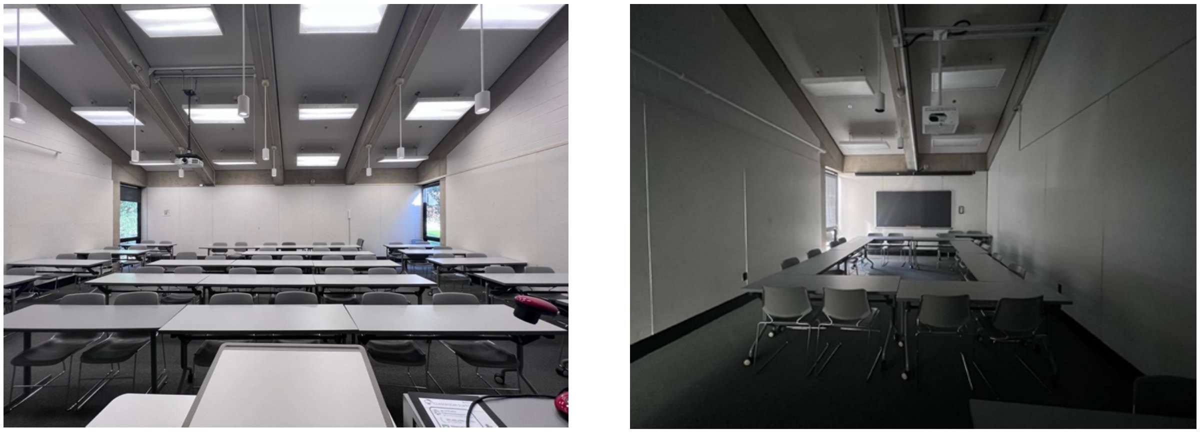


Figure 47 - Classroom lighting conditions, images by Author, 2022

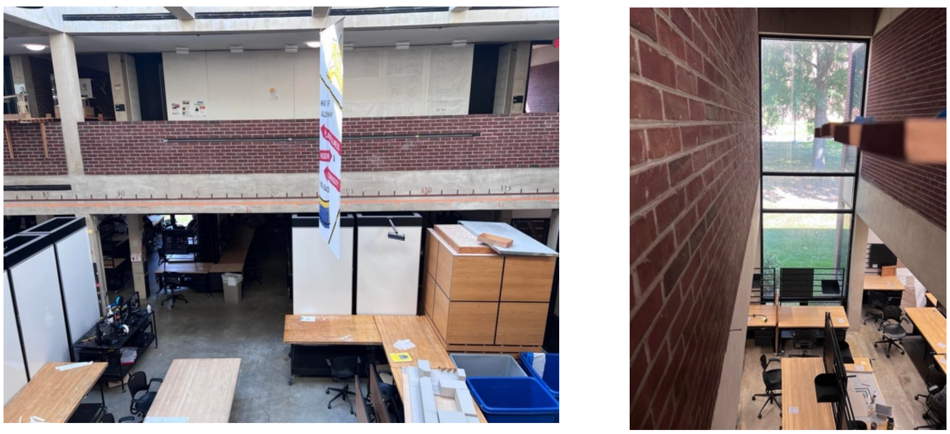


Figure 48 - Studio utilitarian lighting conditions, images by Author, 2022

The respondents add that windows and skylights do not reflect light in a way that interferes with their work. Figure 49. The fact that the building doesn't receive enough natural light may also be a contributing factor as shown in Figure 50. The following question, "How important is it to you to have a window in your workstation/desk," further supports this. Figure 51. The requirement for access to natural light is felt by the users, who consider it "very important" in 69.4% of cases.

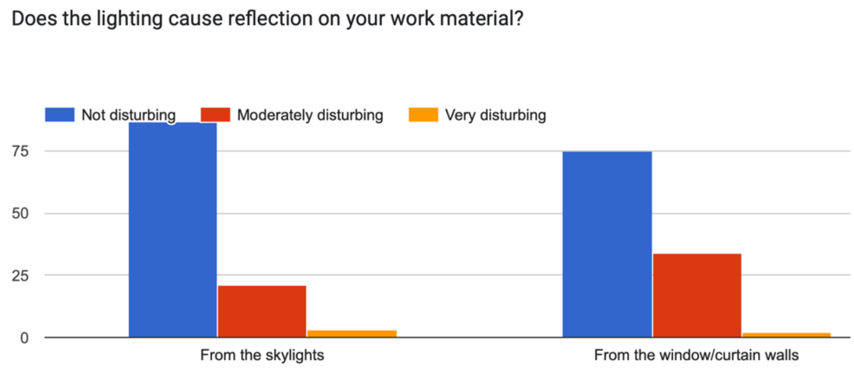


Figure 49 – Reflection interference with work

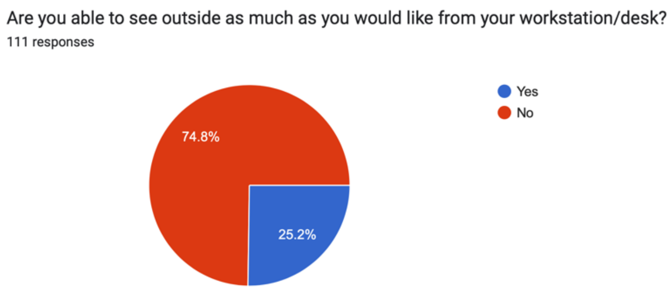


Figure 50 – Access to natural light

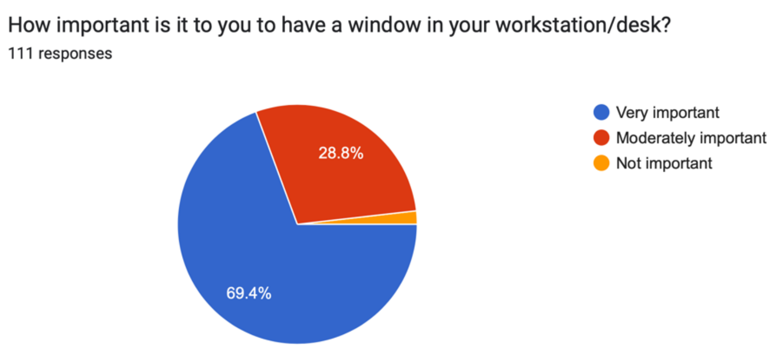


Figure 51 – Importance of windows

The two responses that were most frequently picked for "how much time do you spend at your workstation desk" were "most of the time," which is equivalent to 4-6 hours per day, and "all the time," which is equivalent to 7–8 hours per day. Figure 52. This reveals that despite getting eight hours of sleep, faculty and students spend half of their day at school. This can be taken as an assumption that they are considering the school as their second home because of the number of hours they spend in the school. As per the “other” responses, they highlighted that they don’t have studio yet, so they don’t have a desk assigned. Or that they are moving around because they teach different classes.

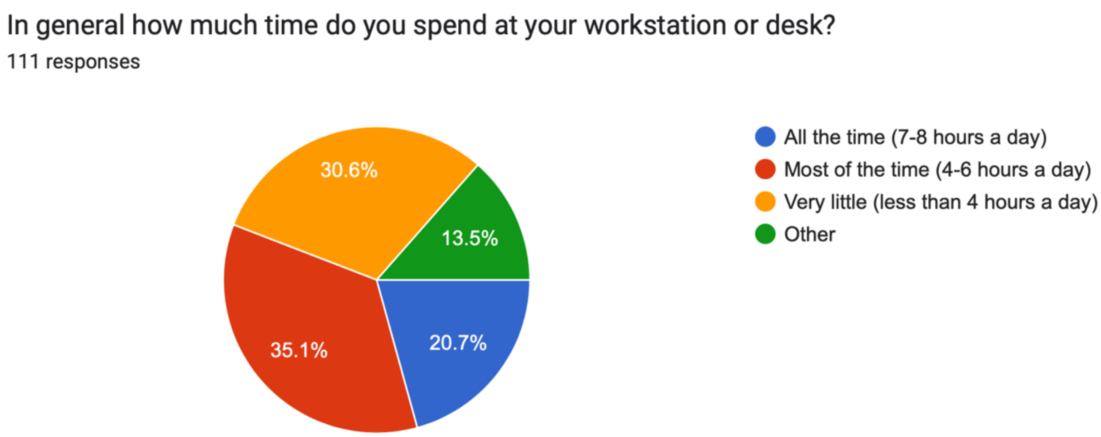


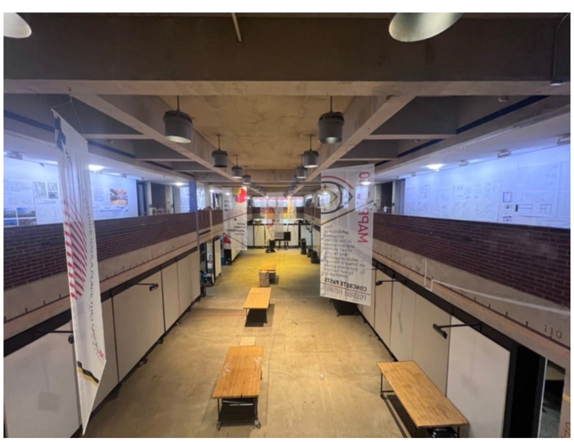
Figure 52 – Time spent in the school

Images Captured in Winter Solstice, 2022

Great Space

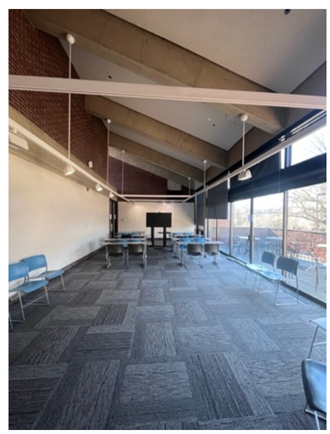

9am

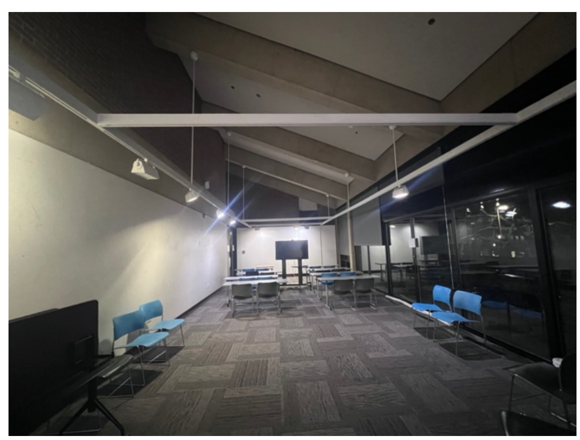

12pm


6pm

Classroom


9am

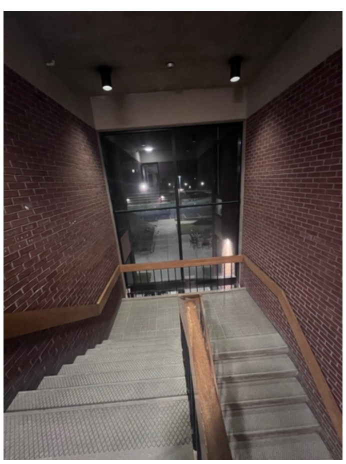

12pm


6pm

Stairs

6am

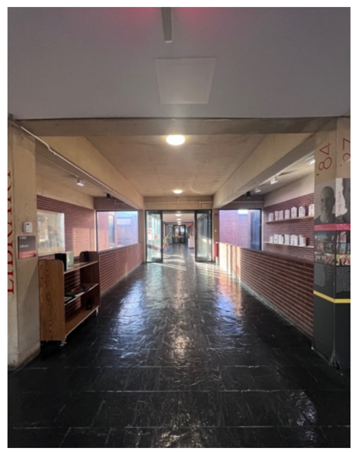
12pm



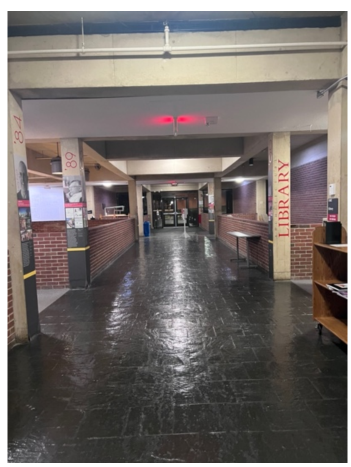
6pm

Hallway

6am



12pm



6pm

Figure 53 - Views to different interior spaces of the Architecture School, images by Author, 2022

Case Study: Brown Center, Maryland Institute College of Art (MICA)

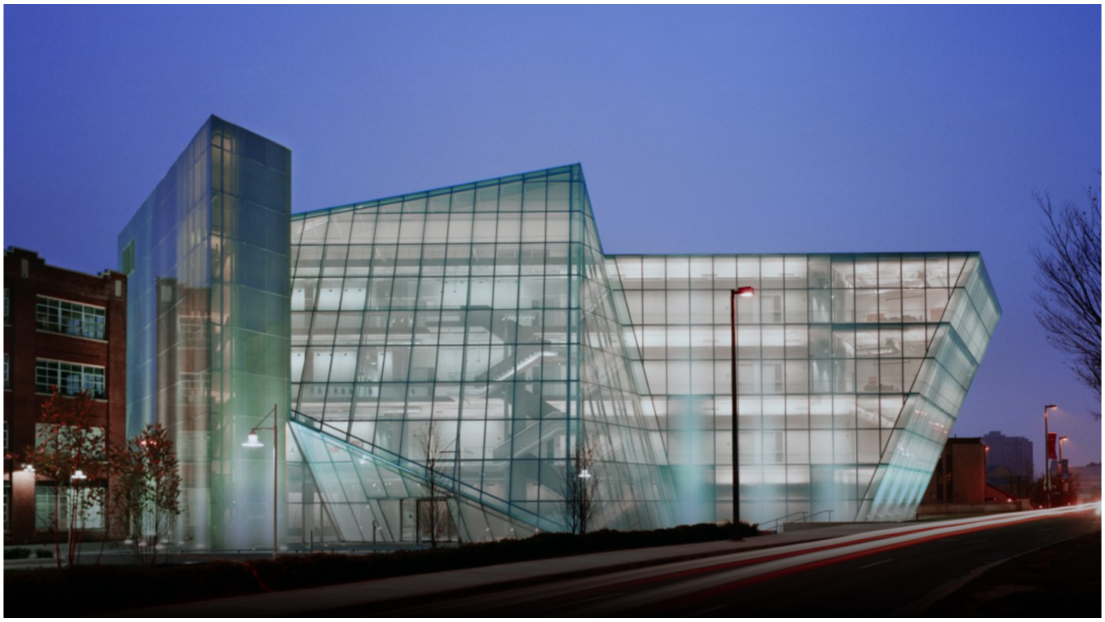


Figure 54 - Brown Center Building

Program

The Brown Center was the first new building to be constructed on the campus in nearly a century. Prior to the Brown Center, the digital arts department was housed in several locations across campus. The four-story concrete structure is next to a full-height steel-framed atrium area that serves as the facility's social heart. The building's distinctive design drew quick attention from local, regional, and national media. The pace of public programming on campus has accelerated by more than 50%, while event attendance has grown by more than 30%. The design has contributed to MICA's national recognition as a progressive leader in arts education.[38]

This main lobby leads to the freshly built lawn and the historic neighborhood beyond. The building's angular exterior is clad in translucent white glass to provide solar shading and create a

[38] Etoh, Katelin. "MICA Brown Center." Architect. Accessed October 31, 2022. https://www.architectmagazine.com/project-gallery/mica-brown-center.

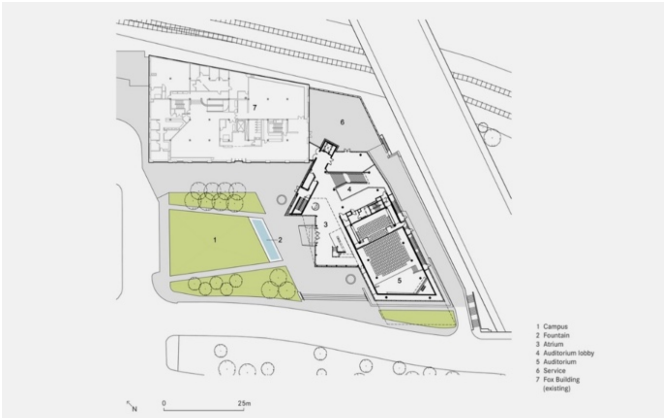


Figure 55 – Brown Center Ground Floor

provocative counterpoint to the college's Renaissance Revival main building which stands across Mount Royal Ave. The angular geometries of the plan were generated by site constraints and translated to the building's elevations.

The Brown Center's geometry and size seek to unite the different surrounding structures into a cohesive urban environment. It was designed to turn a parking lot into a dynamic campus center. The structure is meant to stimulate a dialogue between contemporary and traditional forms, technologies, and materials. From the outside, it appears complex, but on the inside, it is a simple plan with programmatic space surrounded by light-filled halls that serve as exhibition and critique halls for students' work.[39]

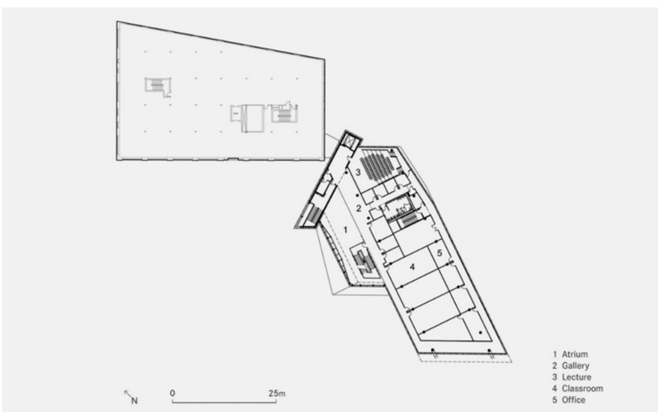


Figure 56 – Brown Center First Floor

The Facility houses classroom and studio space for Graphic Design and Animation programs at the graduate and undergraduate levels. Falvey Hall, a 525-seat theater, the Leidy

[39] Ibid.

Atrium, and the Rosenberg Gallery are also located there. Among these are the Atrium, auditorium, services, gallery, lecture spaces, and offices.[40]

The facility's combined programs have produced a dynamic learning environment with a strong sense of cohesion, pride, and devotion. The architects reacted to the problem of building a new generation of visual and performing artists by encouraging students to collaborate across disciplines. The auditorium is suitable for both traditional film and video and digital art shows. The corridors, a continually revolving gallery, provide a fertile setting for students to share ideas and assess one another's work.[41]

Figure 57 - Leydi Atrium, at the entrance to Brown Center, is the focal point of installation and performance art.

Figure 58 - Rosenberg Gallery can be found on the second floor of Brown Center

Figure 59 - Work from an Interdisciplinary Sculpture student in hung above Leidy Atrium

[40] Brown Center." MICA. Accessed October 31, 2022. https://www.mica.edu/buildings/brown-center/.
[41] Ziger, Steve. "Projects · Ziger/Snead Architects." Zigersnead.com. Accessed January 21, 2023. https://www.zigersnead.com/projects/details/maryland-institute-college-of-art-brown-center/.

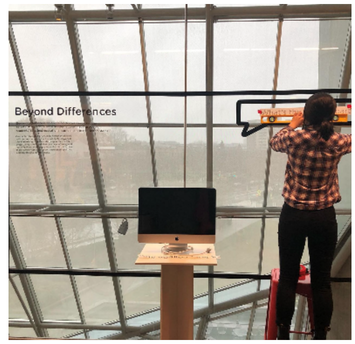


Figure 60 - Students' Art Exhibitions on the hallways

Lighting Strategies

The Atrium

Figure 61 – View to the Atrium from the outdoors

The building's dot matrix fritting-covered exterior, which is entirely made of glass, allows for a variety of lighting effects. The glass is designed by The Lighting Practice to be either opaque or transparent. TLP illuminated the construction site, glass facades, interior atrium, and galleries while collaborating closely with the architects and their in-house lighting designer. They also created architectural and performance lighting systems for the 550-seat auditorium. The Brown Center, a structure that has become a well-known emblem, is visible from a great distance above the city at night.[42]

The Hall

Figure 62 – The Hall

To preventing audience members' faces from being cast in shadow, The Hall uses both diffuse and directional lighting. The system control offers dimming zones and scenes to customize the

[42] "Maryland Institute College of Art - Brown Center." 2016. The Lighting Practice. December 14, 2022. https://www.thelightingpractice.com/project/brown-center-maryland-institute-college-of-art/.

lighting levels for every use of the room. The Hall is a special area in the Brown Center because, once inside, there is no longer any indication of the luminous glass skin. The auditorium is in the center of the structure and has no access to the exterior. The theater requires the glass' translucent properties to counteract the heavy materials that are there. Through the impact of the lighting system, this gloomy space transforms into a glittering retreat.

The Hall is illuminated in two unique lighting modes: lecture and performance. Bright surfaces and high brightness levels are characteristics of the lecture mode. The performance mode is intended to emit a gentle glow that will create the right ambiance for the upcoming performance. [43]

Graduate Student Experience Interview

Dayanna Centeno is a Graphic Designer Alumnus of MICA. When she graduated from Montgomery College, MICA is highly recommended for students seeking a career in Graphic Design. The school is known for its variety of programs that also offer networking opportunities for the students. MICA was a great choice for Dayanna. The tuition was a great obstacle, but it did not discourage her from applying. It was a dream come true when she was accepted. Her experience in the school felt like a second home, she felt that everybody spoke the same language. The school was a competitive, welcoming, and challenging environment that encourage her to go the extra mile. Her experience increased her appreciation for the school and her career.

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[43] Baltimore, Keenan Dae. n.d. "MICA: BROWN CENTER." Psu.edu. Accessed December 14, 2022. https://www.engr.psu.edu/ae/thesis/portfolios/2004/kdo110/Auditorium.pdf.

She mentioned that the resources, tools, and spaces in the school helped her expand her ideas and lead her to become more visionary. She enjoyed walking by the main hallways located in the Atrium because that was where most of the student’s artwork was exhibited. It made her feel motivated and inspired by looking at other students’ work. And she also had the opportunity to use it herself by exhibiting her work. But sometimes the hallways could get too crowded with visitors which made it hard to walk through without interrupting conversations.

Most of her classrooms had the same seating arrangement, a long rectangular table where the students could seat around making it a more collaborative learning environment. She enjoyed the light coming from the curtain walls but sometimes felt overstimulated because of the heat received in the summers. Overall, the school opened opportunities to continue her career and now she is working as a graphic designer.

Figure 63 - Interactive Art Exhibition. The drawers contained the students' artwork, enticing the audience to open each one and discover the artwork that was inside. The artwork by Dayanna was in one of the drawers.

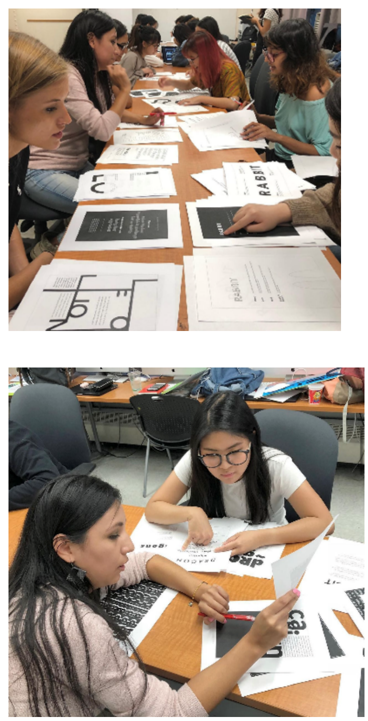

Figure 64 - Dayanna experiencing classroom interactions.

Reviewing the Brown Center's design features, the architect's mission, and the alumni experiences found throughout the building, it appears that the building's design can influence the students to have a dynamic learning environment that promotes pride, inspiration, and collaboration. Students can pursue their ambitions and be creative thanks to the school's program, which frees them from restrictions on resources or available space. The hallways were utilized solely for the art exhibits, but as Figure 8 illustrates, they appear to be too narrow to accommodate visitors, presentations, and walk-by traffic. It can result in a physical invasion of the students' space (Figure 16)

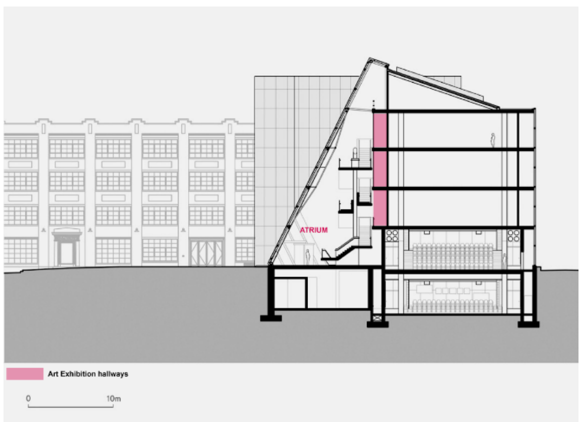

Figure 65 - Background Building Section from ZigersNead website and diagrams made by the Author

Figure 66 - Student presenting her Artwork in the Atrium hallways

Case Study: The Center for the Built Environment and Infrastructure Studies, Morgan State University (CBEIS)

The Center for the Built Environment and Infrastructure Studies (CBEIS) houses the Civil Engineering, Transportation Studies, and National Transportation Center research and teaching programs for the School of Architecture and Planning. It is a 126,000 GSF shared facility for academic engineering and design departments at Morgan State University. The building, which completed in July 2012, adds to the university's overall institutional environment by increasing the quantity of shared facilities. CBEIS features 32 classrooms, labs, and seminar rooms, as well as 88 offices and three department offices. CBEIS fosters engagement among students and teachers by housing several design and engineering professions under one roof.[44]

[44] "Hord Coplan Macht - CBEIS, Morgan State University." 2018. Hord Coplan Macht. May 12, 2018. https://www.hcm2.com/projects/center-built-environment-infrastructure-studies-cbeis-morgan-state-university/.

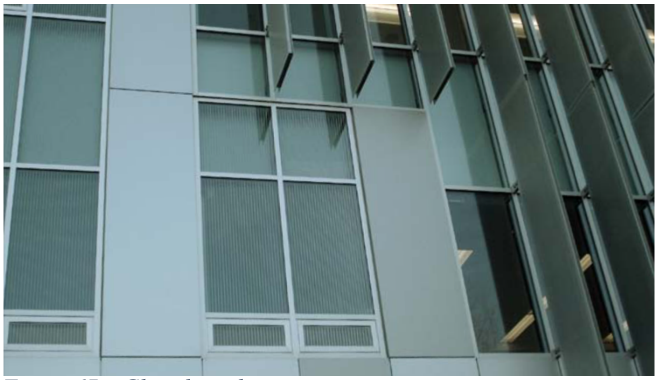
Figure 67 – Glazed windows

Program

The CBEIS have research and instructional programs for Civil Engineering, Transportation, Architecture and Planning in a highly collaborative environment. It is designed as a gateway building on the northern-most edge of the Morgan State campus, and includes four levels of classrooms, offices, group study rooms, conference rooms, atriums, a green roof and more. Two horizontal bars link a sky-lit atrium that runs the length of the building, creating an internal street with a café, lounges, information kiosk, departmental "store fronts", views to academic studio spaces, and a gallery-like space for displays and social interaction. [45]

Lighting Strategies

The CBEIS serves as a testing ground for sustainable design and engineering. In July 2014, CBIES was certified with LEED Gold. The American Institute of Architects Baltimore Chapter awarded it with the first Design Award for Excellence in Environmentally Sustainable Design in recognition of its achievements. With high performance, integrated, and inventive design mindful of distinctive cultural heritage and affordability, this award is meant to reward

[45] "LEEDing by Example Morgan State University: CBEIS." n.d. Unicelarchitectural.com. Accessed December 14, 2022. https://unicelarchitectural.com/wp-content/uploads/2020/11/Unicel_ALUMINUM-CBEIS-CaseStudy.pdf.

excellence in sustainable design in projects that conserve resources, maintain ecosystems, maximize comfort, and reduce environmental effect.[46]

In addition to being used to achieve sustainability goals, day-lighting techniques, resource conservation, and energy efficiency systems are deployed in diverse ways to visually disclose the possibilities and act as instructional reference points. To demonstrate the range of technologies available, many types of natural daylight are used, two green roof systems are included, and conventional rooftop photo voltaic (PV) panels are mixed with curtain wall integrated PV collectors. Atrium displays visually monitor performance in relation to climate and occupancy variances to help show the dynamic and integrated nature of the building systems.[47]

Figure 68 - Vertical louvers at West elevation

Figure 69 – Green Roof

46 "Hord Coplan Macht - CBEIS, Morgan State University." Hord Coplan Macht. Last modified May 12, 2018. Accessed January 22, 2023. https://www.hcm2.com/projects/center-built-environment-infrastructure-studies-cbeis-morgan-state-university/.

47 Marich, Anna. "Morgan State University Center for the Built Environment and Infrastructure Studies (CBEIS)." Architect. Accessed January 21, 2023. https://www.architectmagazine.com/project-gallery/morgan-state-university-center-for-the-built-environment-and-infrastructure-studies-cbeis-1138.

Figure 70 - Fabrication Lab

Figure 73 - View to Classrooms

Figure 71 - A sky-lit atrium runs the length of the building

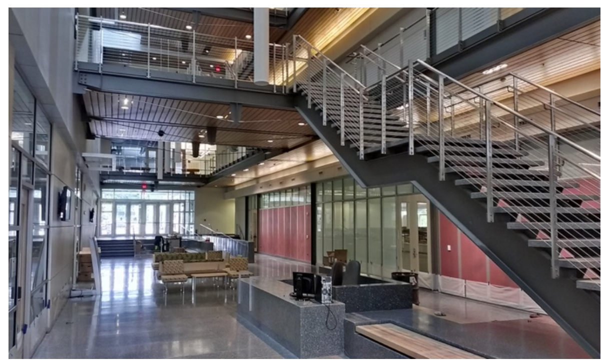

Figure 74 – Atrium stairs

Figure 72 – Studio collaboration

Figure 75 – Natural light studio space

Undergrad Student Interview

Daryl, a graduate student at the University of Maryland, had attended Morgan State University for his undergraduate studies before transferring. I had the opportunity to speak with him and learn more about his experience at CBEIS.

While telling me about his experience with the interior spaces of the building, I saw that he valued the openness of the floor plans; he felt it provided a collaborative and engaging environment. It gave him a sense of safety and comfort. He remarked that there was no reason for him to leave the facility because the building program covered practically everything he needed. When he needed something, there was a Food Kiosk and a coffee shop within the building. There were comfortable seating places that could be used for various purposes such as seating or sleeping, giving it a relaxing retreat from stress. In addition, the building concept features an accessible green roof with seating places to encourage social interactions and relaxation. He also stated how much he appreciated the building's parking lot, which meant he didn't have to go far to get to his car.

The classrooms and studios would interact with one another, he said. When needed, the open studio space allowed moveable walls to enclose one section and create a small, enclosed classroom. The pin-ups partitions were a proximally about seven feet height, making them accessible and usable to everybody. Almost every wall in the building is used for the student’s artworks exhibits. He also remarked that most of the classrooms featured natural light, with views to the outside and/or the halls. His nighttime light encounters were limited due to the safety of the neighborhood, but when he did stay late, he stated that the illumination from the exterior of the building was bright enough to feel secure stepping out of the building.

Overall, the building program and aesthetic design soothed him and inspired him to go to school and learn. Faculty members were just as enthusiastic as he was, encouraging him to study more. He saw the architectural school as a community where everyone looked out for one another. It was his second home.

Figure 76 – Open Hallways

Figure 78 - View to classroom

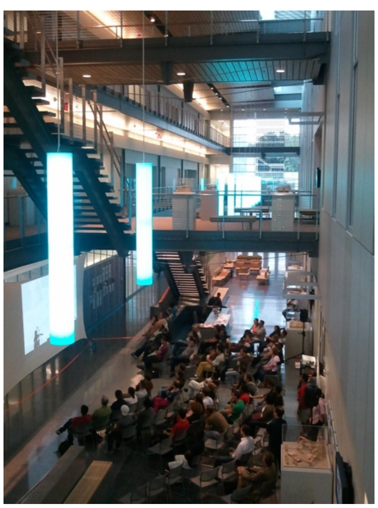

Figure 77 - Atrium gathering

Case Study: Notre-Dame de Haut by Le Corbusier

Figure 79 - Entry view of Notre-Dame de Haut

"Architecture is the clever and magnificent assembly of volumes under the light" - Le Corbusier

The Ron champ chapel, which was finished in 1954, was constructed on a historic pilgrimage destination for a Catholic church. The previous church located on the hill was destroyed during World War II. This makes it possible to claim that the chapel is in a spiritual area.

The main structure is made of curving, thick masonry walls that promote stability and serve as structural support. The massive, arching concrete roof is supported by walls that have columns that aren't visible. The curving walls, in addition to serving as structural and decorative components, also serve as acoustic amplifiers, particularly in the case of the eastern outer wall, which reflects the sound from the outdoor altar out across the field. A sliver of light can enter the interior through a gap underneath the concrete roof. Although its outside suggests a complex layout, the inside is rather a straightforward program in design: there are two entrances, an altar, and three chapels.

The arrangement of the windows on the walls is one of the design's most intriguing features. By tapering the window well in the wall hollow, Le Corbusier's puncturing apertures on the exterior enhanced the light within the church. These different window frames highlight each wall, which when combined with the stark whitewashed walls provides the walls brilliant qualities accented by a stronger direct light. A powerful religious image and transformative experience are created on the wall behind the altar in the chapel by the lighting effects, which produce a speckled pattern of sparse openings that resembles a starry night. And it is complemented by a larger opening above the cross that emits a flood of light.

Le Corbusier envisioned the area as a place for reflection and meditation. The chapel's pure white walls contribute to this purist mindset by giving the space a washed-out, otherworldly feel when light enters. The way the light affected people's expressive and emotional attributes led to intensified feelings that were in line with religious practices. Ronchamp is more of an irregular sculptural form where the walls, the ceiling, and the floor slope, in contrast to most of Corbusier's other works, are composed of boxy, practical, and sterile volumes. It is sophisticated both stylistically and formally.[48]

Rhythms of lights

There are 27 splayed rectangular window bays with relatively modest glass units piercing the massive south wall. These windows are highlighted by their almost random sparse distribution in this relatively dark place. These windows have various sizes and internal or external embrasures. The contrasts between glass and surrounding wall surfaces are diminished by the intermediary zones of luminance created by their

[48] Winston, Anna. "Le Corbusier's Ronchamp Chapel Is One of the 20th Century's Most Important Buildings." Dezeen. Last modified July 24, 2016. Accessed January 22, 2023. https://www.dezeen.com/2016/07/24/le-corbusier-notre-dame-du-haut-ronchamp-chapel-france-unesco-world-heritage-list/.

internal embrasures. Additionally, they prevent direct sunlight from entering the south wall for at least half of the year; observations made around the spring equinox reveal that sunlight is either projected onto the surface of the embrasures or on the roof overhang. Metal oxides were used by Le Corbusier to "color glaze" some windows while leaving the others colorless. Cobalt blue, vibrant yellow and red, emerald, green, deep violet, and grey were the same colors he used for the door, and he finished this colorful composition with patterns and praises to Mary: a moon with a human face, birds, butterflies, flowers, leaves, the sun, stars, and clouds.[49]

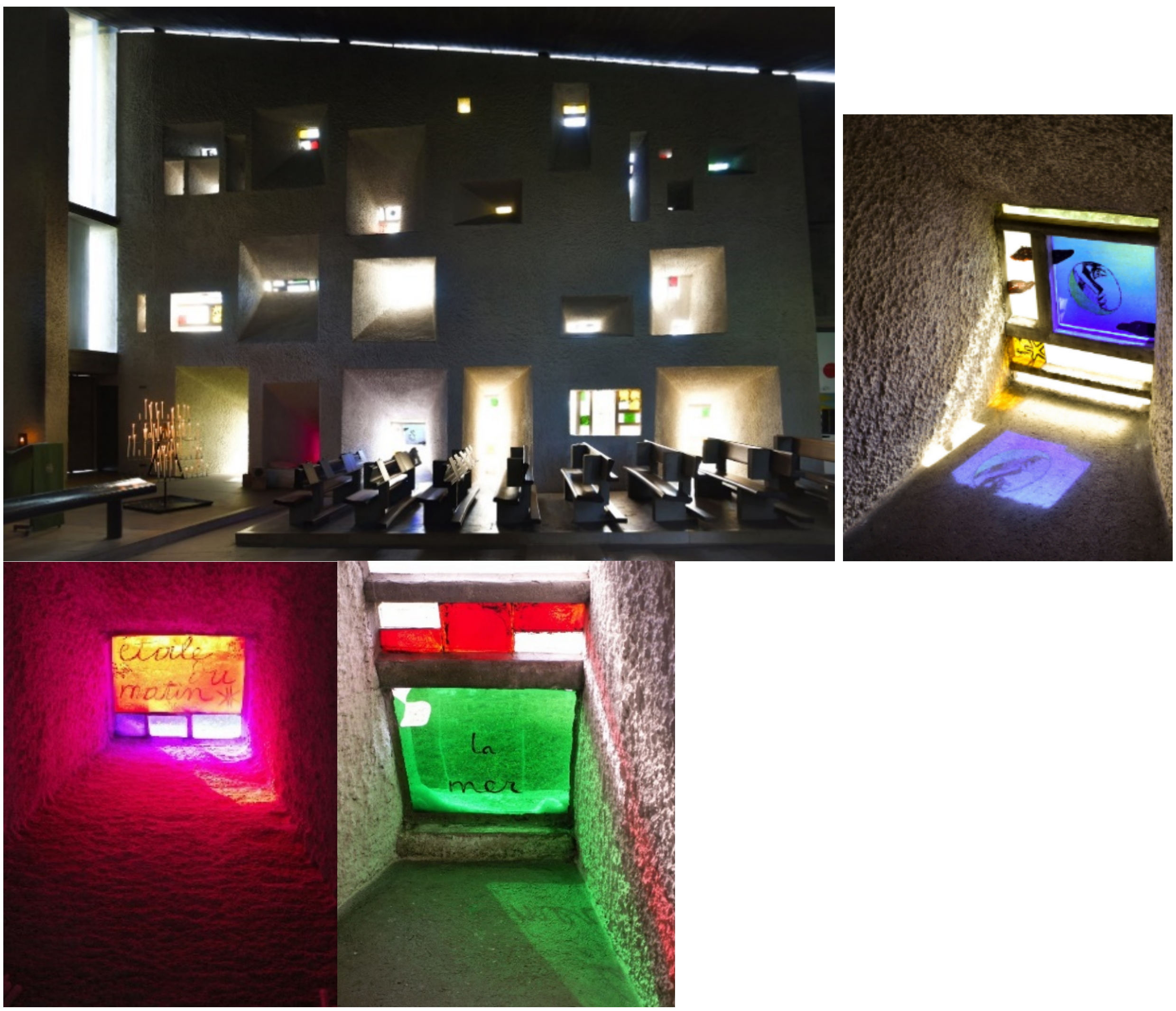

Figure 80 - Window bays

[49] Fontoynont, Marc. *Daylight Performance of Buildings*. London, England: James & James (Science Publishers), 1999, 55-56.

Statue of Virgin Mary

The name Notre Dame-du-Haut translates to "Our Lady of the Heights.". The Virgin and Child figure, which was taken from the previous chapel, is a multicolored wooden sculpture that is thought to date from the end of the 17th century. The east wall, which opens to the exterior, is where the statue is placed. The statue is set in a window whose embrasure is painted green, yellow, and red. Small gaps left by the scaffolding beams have formed star-like light spots all around it. The statue was carefully enclosed in a glass case by Le Corbusier so that it could be seen from both inside and outside the chapel. One may say that she presided over the chapels on the inside and outside. The statue is illuminated by the morning light that passes through it. Worshipers refer to her as "The Morning Star."[50]

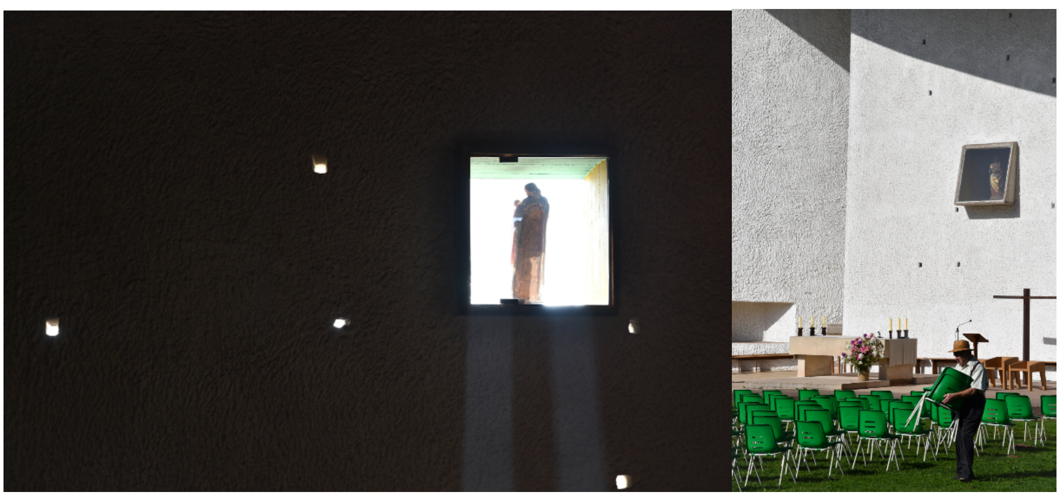

Figure 81 - Views from the inside and outside of Virgen Mary

[50] Ibid, 56.

Light Periscopes

Each of the three secondary chapels includes a periscope that serves as lighting and ventilation, evoking the light and ventilation towers. These periscopes let in natural light through a single, long vertical slit, and then project lights onto chapel altars.[51]

The low daylight factors (about 1%) and a concentration of daylight near south wall windows define the nave. Treatment of the three secondary chapels varies greatly. The largest one, which is in the southwest and is lit by a periscope looking north, receives a great deal lighter than the others (maximum 10 percent). It is the chapel's brightest area. The east-facing secondary chapel, which is painted red, is the darkest area of the structure (daylight factors are about 0.1%), which favors candlelight. The chapel facing west, which is comparable to the chapel facing east but has white surfaces, has an average daylight factor of 2 percent (which is closer to the light levels measured in the nave).[52]

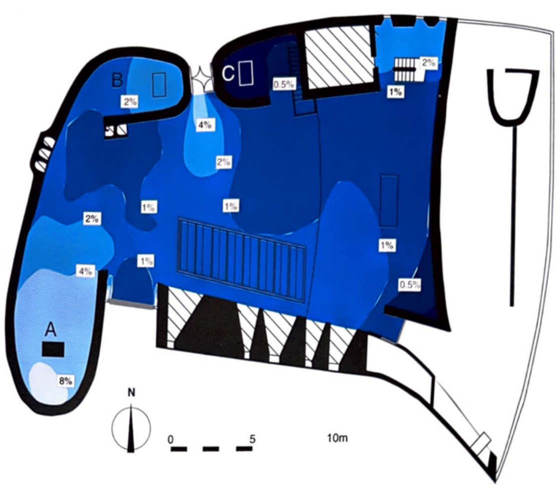

Figure 82 - Light performance of Notre-Dame de Haut

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[51] Ibid, 57.

[52] Ibid, 57-58.

Case Study: Glenstone Museum

Figure 83 – Glenstone's pavilion Water Court

Glenstone is a museum of modern and contemporary art that provides visitors with a perfectly integrated experience of works from its collection, architecture, and landscape. It is situated in Potomac, Maryland, not far from Washington, DC. It is renowned for being situated in a vast natural landscape and is the largest private modern art museum in the United States.

The 230-acre wooded campus at Glenstone is recognized for its peaceful natural environment, which includes a collection of galleries and other structures. Glenstone incorporates major works of outdoor sculpture within rolling meadows and woodlands. Around 33 acres of existing pastureland have been converted into sustainable meadows with a variety of natural flora, and more than 9,000 trees of 55 native species have been planted across the grounds. Water lilies, irises, and rushes are just a few of the plants used in the Pavilions' Water Court to create diverse landscaping that changes throughout the seasons.

The museum buildings are located closer to the campus's center, and visitors can access the galleries from gravel parking areas through an about one-third mile-long property path. The founders of Glenstone tried to create a peaceful environment when planning the site. On the short path that leads to the Pavilions, one of the outdoor sculptures, a large meadow, and a timber bridge can all be seen. Visitors get a glimpse of the structure when the walkway curves through a forested verge of honey locust, oak, and tulip trees, emerging with a full view of the Pavilions' entrance. [53]

Light Design

The Pavilions' structure and design depend heavily on natural lighting. Large clerestories or laylights give balanced natural light from above in most rooms. One room has a skylight. The daytime variations in light and shadow, as well as the seasonal variations, highlight subtle aspects of the artworks and make for a more natural, nuanced viewing experience.[54]

Material

The Pavilions' architectural focus is on using materials that evoke a direct, primal, and enduring relationship with the surroundings. The building's façade is constructed of 26,000 cast concrete blocks that are individually poured to have dimensions of six feet long, one foot high, and one foot deep. The light gray hue and texture were slightly altered by the pouring technique

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[53] "Glenstone." n.d. Glenstone.org. Accessed December 14, 2022. https://www.glenstone.org.

[54] Expansion Description. "Glenstone Architectural Fact Sheet." Glenstone.org. Accessed January 22, 2023. https://www.glenstone.org/wp-content/uploads/2021/11/Glenstone-Architectural-Fact-Sheet.pdf.

and cement and sand mixture, despite the absence of color-changing pigment. The flawless accuracy of the windows, which have been particularly constructed utilizing glass panels as large as nine feet wide by thirty feet tall, and are placed flush into stainless steel mullions, is purposefully contrasted with this surface. The indoor and exterior sections of the building are connected by a continuous skin made of glass surfaces and concrete blocks.[55]

Figure 84 - Glass panels

Figure 85 - View to the landscape from the library

[55] Ibid.

Case Study: Seinajoki, Finland by Alvar Aalto

Figure 86 – Aerial view of Seinajoki Library

Aalto designed a civic complex in Seinajoki that comprises a church, a municipal theater, public offices, and a town hall between the early 1950s and the late 1980s. The 1965 public library is one of its components. The library appears at first to be little more than a simple, single-story block, facing an urban square to the north and backing onto a small grove of trees to the south. The linear form, white walls, and heavily screened windows conceal nothing about the carefully tuned sequence of space and light inside. It is not until entering the building and approaching the main information desk that begins to make sense how the natural light has shaped the building's layout[56]

At Seinajoki Library, there is no connection to the outside environment, and the interior only offers a partial view of the sky. Instead, a cloud of light floats above the books, an exuberant feature that helps in creating the impression of an introverted environment buoyed by light, where readers are drawn to look up when not immersed in reading. Here, a quiet retreat from the outer world is contrasted by a complex play of light and shadow at a high level. Seinajoki was intended to have mostly daylighting. [57]

[56] Ann, Mary. The Architecture of Light. New York, NY: Routledge Member of the Taylor and Francis Group, 2011, 93.
[57] Ann, Mary. The Architecture of Light., 77.

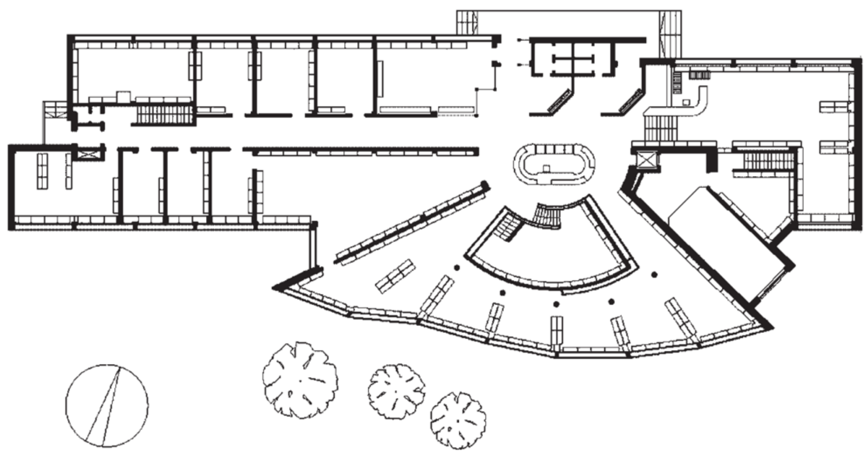

Figure 87 - Ground plan of Seinajoki Library

In this library, you'll find several standard rectangular rooms with standard side lighting alongside a taller, more inward-looking theater of books. whose intricate ceiling adjusts the light coming in from the high clerestory windows facing north and south. The main lending library is located in this considerably bigger fan-shaped space that extends south from the entrance hall. Readers are accommodated among the books in an easily supervised arrangement. Library staff members can look over the reading well, which is encircled by books, into the bays of the radial bookstack beyond. The primary objective of Aalto was to remove the glare from the windows and other surfaces near the readers. He made sure that the primary browsing areas, the auxiliary bays, and the center well were well-lit regardless of the weather to make this happen. [58]

At Seinajoki, Aalto considered how the quality of cool, shadowless daylight may be used to provide reading circumstances as well as how it might pace and structure interior navigation. Along with its pattern of distribution, the color and warmth of the light were crucial. In this plan, cool daylight predominates, but it also depends on the careful application of warmer artificial light for a specific function. He considered

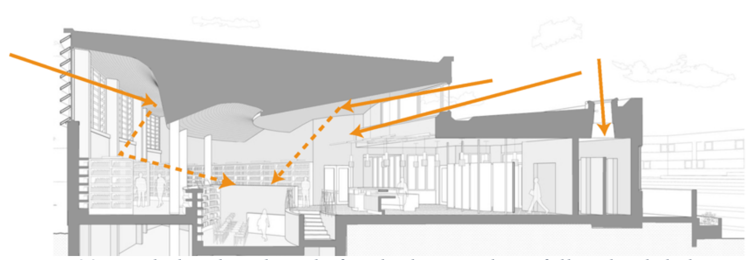

Figure 88 - Light bends indirectly for shadows to don't fall on bookshelves

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[58] Ibid, 94.

how the spatial hierarchy in which a complex ceiling is both an indirect source of daylight and a source of aesthetic interest is determined by how building surfaces scatter light to provide generally even daylight levels across the reading area.

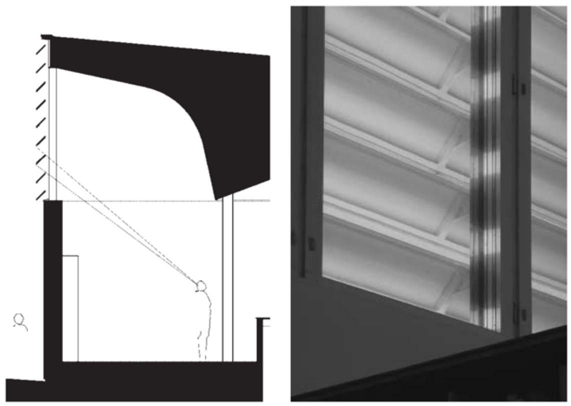

Figure 89 - A veiled light-scoop formed by the southern clerestory and the curved ceiling gives bookshelves below good diffuse daylight while protecting readers from the glare of an overcast sky

Windows can become potentially a bigger source of heat loss, which would create thermal discomfort to the readers. Aalto understood the significance of blending enclosure, warmth, light, and warmth in this setting. He used most of the available daylight to provide intimate shelter, a strategy which thermal benefits do not prevent him from responding to the difficulties caused by the local light climate. For instance, the frequency of overcast skies, solar geometry at this latitude which meant low-level sunlight shining deep into buildings but also potentially straight into the eyes. While ensuring they still have sufficient access to skylight and are not blinded by sunshine, he provides readers a stronger sense of refuge from what may be a bleakly uninviting, snow-covered landscape in winter by positioning them below the center of the area. Aalto sees daylight as a valuable resource that should not be wasted, sunlight as a valued source of brightness that should be managed carefully, and a public library as a setting where quiet study is supported by a mainly diffuse sea of light.[59]

[59] Ibid, 94-95.

Figure 90 - Reading bays adjacent to south wall of the main space in overcast conditions

Case Study: Barajas International Airport Madrid by Richard Rogers

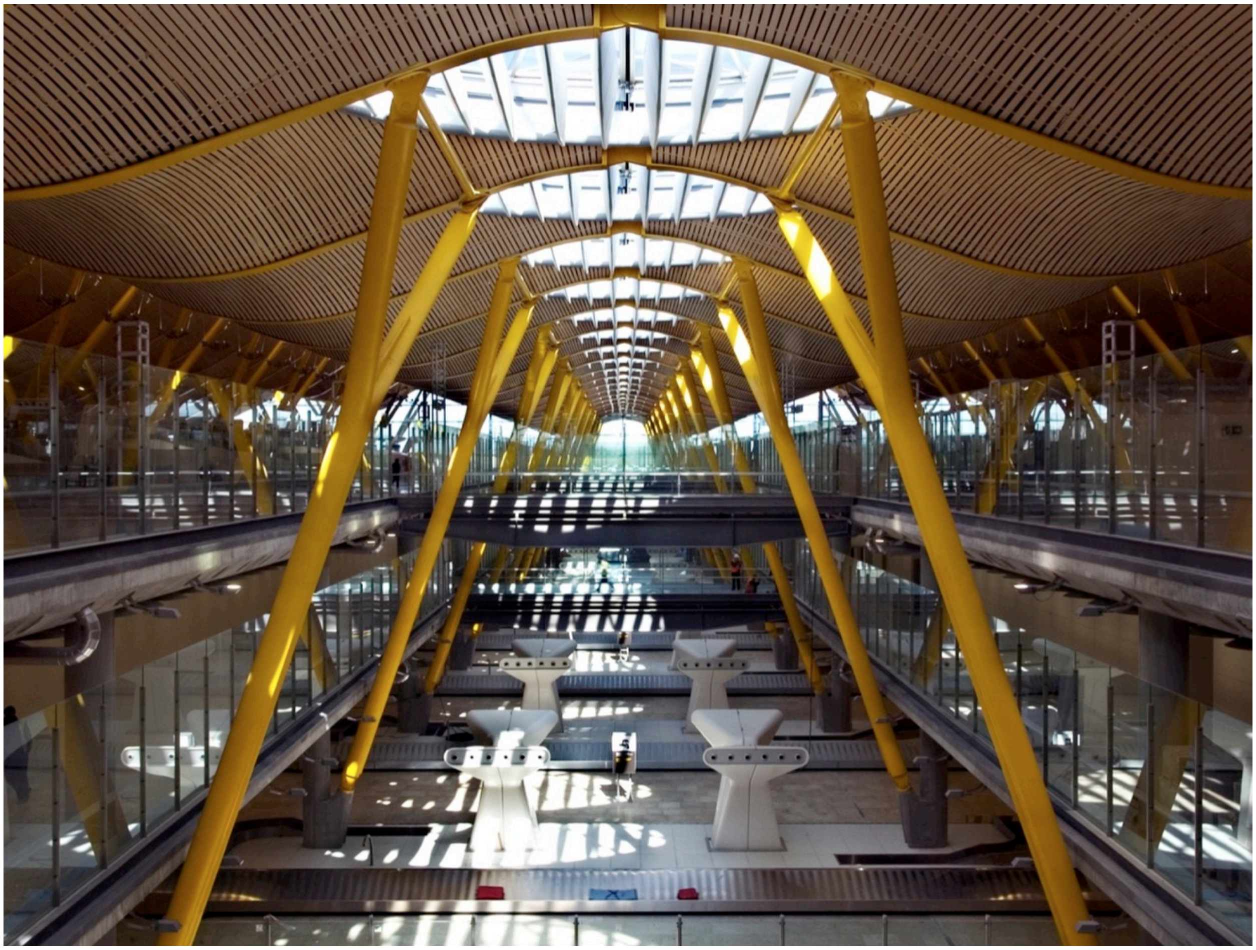

Figure 91 – View to the Baggage area

The international Madrid-Barajas Airport is located to the north of the old Baraja terminals. The lighting design aims to highlight the distinctive architecture and complement the intuitive wayfinding that the architectural planning offers, while it creates a calm experience for travelers. The architect created a special suspended mirror reflector system that allowed to both illuminate the floor plane and to provide a rhythmical glow to the lower portions of the roof's dynamic, undulating form. A special wide circular ceiling luminaire known as "the work" was developed, drawing the eye away from the concrete soffit and services above, preventing the need for a suspended ceiling and yielding significant financial savings.[60]

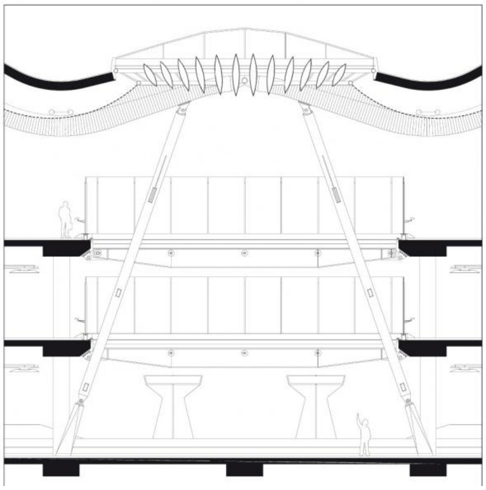
Figure 92 – Light-filled canyon and walkway, cross section

The new terminal has a clear progression of areas for arriving and departing travelers. The building's modular layout arranges its massive, prefabricated steel wings into a series of waves. The enormous ceiling, which is supported by central "trees," is broken up by roof lights that provide natural light across the upper level. Parallel levels that house the various stages of passenger processing, from the point of arrival, through check-in and passport and security procedures, departure lounges, and finally the aircraft, are divided by light-filled "canyons."

The airport, which has a total size of 1,200,000 square meters and is thought to be the largest structure in Europe, will have a significant urban, economic, and social influence on Madrid and Spain. The building's integration of the terminal's functional elements to improve its aesthetic quality is one of its successes.[61]

One factor in the design was how the structure could enhance the traveling experience by creating a pleasant, calm environment. As a result, materials and finishes that would evoke a sense

[60] Smlightarchitecture.com. Accessed December 14, 2022. https://www.smlightarchitecture.com/projects/534/terminal-4-barajas-airport/download/SMLA%20-%20Terminal%204%20%20Barajas%20Airport.pdf.

[61] "Barajas International Airport Madrid." Archello. Accessed December 14, 2022. https://archello.com/project/barajas-international-airport-madrid.

of tranquility were used. The straightforward simplicity of the architectural concept is reinforced using a kit-of-parts detailing strategy and a limited material palette.

Passengers are connected to the outside world by the exterior's flowing curves, which mimic the surroundings and the horizontal lines of the Madrid environment. Despite the building's scale, the numerous visual cues nonetheless make it possible for visitors to quickly get around. The terminal is easier to read and use for both staff and passengers due to a simple linear pattern and a clear progression of spaces for outgoing and incoming travelers. [62]

Design Approach

The four fundamental principles of the chosen design go as follow.

1) The incorporation into the environment comes first. Airport terminals are typically surrounded by secondary features like parking lots, power stations, etc., which makes it difficult to navigate the airport with ease. Such structures are incorporated into the main structure in this design, which takes the local topography into account and expresses the area's local and uniform character. The canyons—large, light-filled courtyards—create a pattern that merges the landscape with the interior.
2) The design team made the most of transparency and views towards the aircraft and the mountains beyond despite the intense summer heat. To convey natural light down into the lower levels, a series of brightly lit "canyons" have been built. A mix of deep roof overhangs and external shade protects the facades.
3) The airport offers a spatial clarity with a clear progression of spaces making it a great example of legibility. Six floors make up the lodging; three are used for check-in, security,

[62] Ibid.

boarding, and baggage reclaim; the other three are used by maintenance, processing bags, and transferring travelers between buildings.

4) Flexibility, the airport's layout is adaptable to accommodate all airport operations while keeping a distinctive architectural identity throughout all stages of the project, considering the necessity for future building extensions.[63]

According to the flow of passengers, the Terminal Building's three linear modules—the check-in spine, processing spine, and pier—serve various purposes (arrivals or departures).

The building's lower levels are naturally lit by light-filled canyons that divide these modules from one another. This supports the environment strategy of cutting down on energy use. Additionally, this lowers the expenditures associated with maintenance. Travelers can move vertically in these areas using lifts, ramps, or steps. These are a crucial component of the passenger's orientation since they define the sequence of actions the travelers must take to arrive or depart.[64]

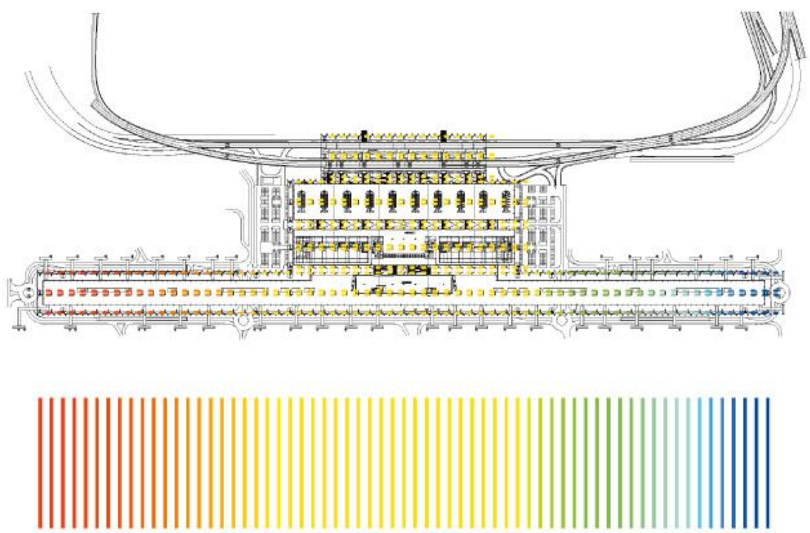

Figure 93 - Archade color scheme

[63] Ibid.
[64] Ibid.

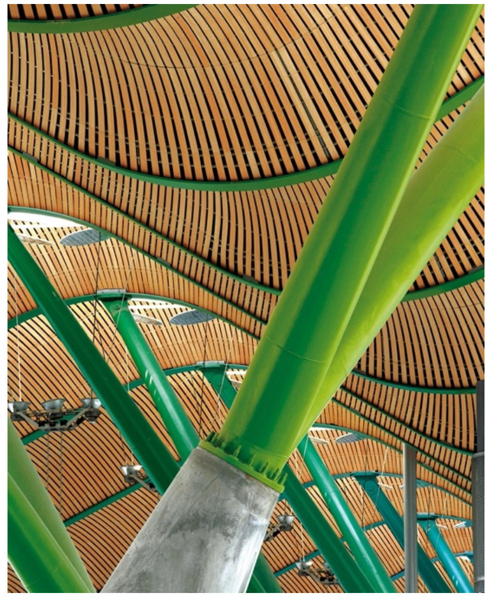

Figure 94 - The structural trees are painted in imitation of the gradation of shades in the rainbow (so helping with user orientation), and the warped surface of the roof's interior is clad in bamboo strips, giving this continuous space a warm, smooth appearance.

Program Purpose

By dividing the many functional volumes or modules, the main building incorporates the sequential nature of the traveler processing. Light-filled canyons serve as a visual representation of the separation between the different options in the processing of travelers, guiding them and letting light into the interior of the structure. The goal of the project is to show how an airport can serve as more than just a place for air navigation; it can also serve as a vital center for services, employment, and commerce while also enhancing the comfort and experience of air travel.

The building's interior has a calm and sunny ambience that mirrors the neighborhood. The bamboo roof's wavy shape follows the traveler as they traverse through the interior of the structure. Because of the exterior's lightness and transparency, the inside and outside are clearly visible to one another. The airport development is easily accessible, and there are adequate internal connections with the parking lots for cars and public transportation.[65]

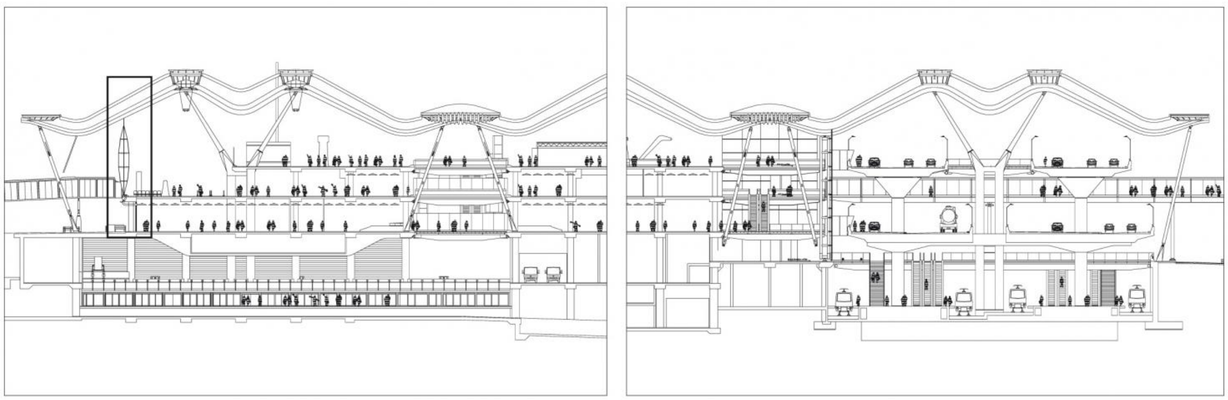

Figure 95 - Travelers cross the linear bands transversally following an itinerary that is stratified in height to avoid interfering with the passenger flows: level 0 is for arrivals, level 1 for boarding, and level 2 for departures

[65] Viva, Arquitectura. "Airport Extension Barajas, Madrid - Estudio Lamela Richard Rogers." Arquitectura Viva. Last modified August 29, 2018. Accessed December 14, 2022. https://arquitecturaviva.com/works/ampliacion-del-aeropuerto-barajas-10.

Chapter 4: Site Analysis

To continue studying the University of Maryland's School of Architecture, Planning, and Preservation Building in further detail. The evaluation of the current conditions is therefore the next step. This chapter will provide a thorough overview of the school's current location and examine potential future developments that are currently underway. This will make it easier to comprehend the school's architecture, identify its weaknesses and strengths, and determine the lighting conditions throughout the interiors of the building.

Given the amount of time students spend in school, it is essential to design primarily for the needs of building’s users and the tasks they are expected to do in an instructional environment. This is because it's possible for schools to turn into second homes for students and faculty. To redesign the School of Architecture, Planning, and Preservation Building at the University of Maryland, a proposed program for the school will therefore be study as well.

Site Analysis

Campus Map of the University of Maryland

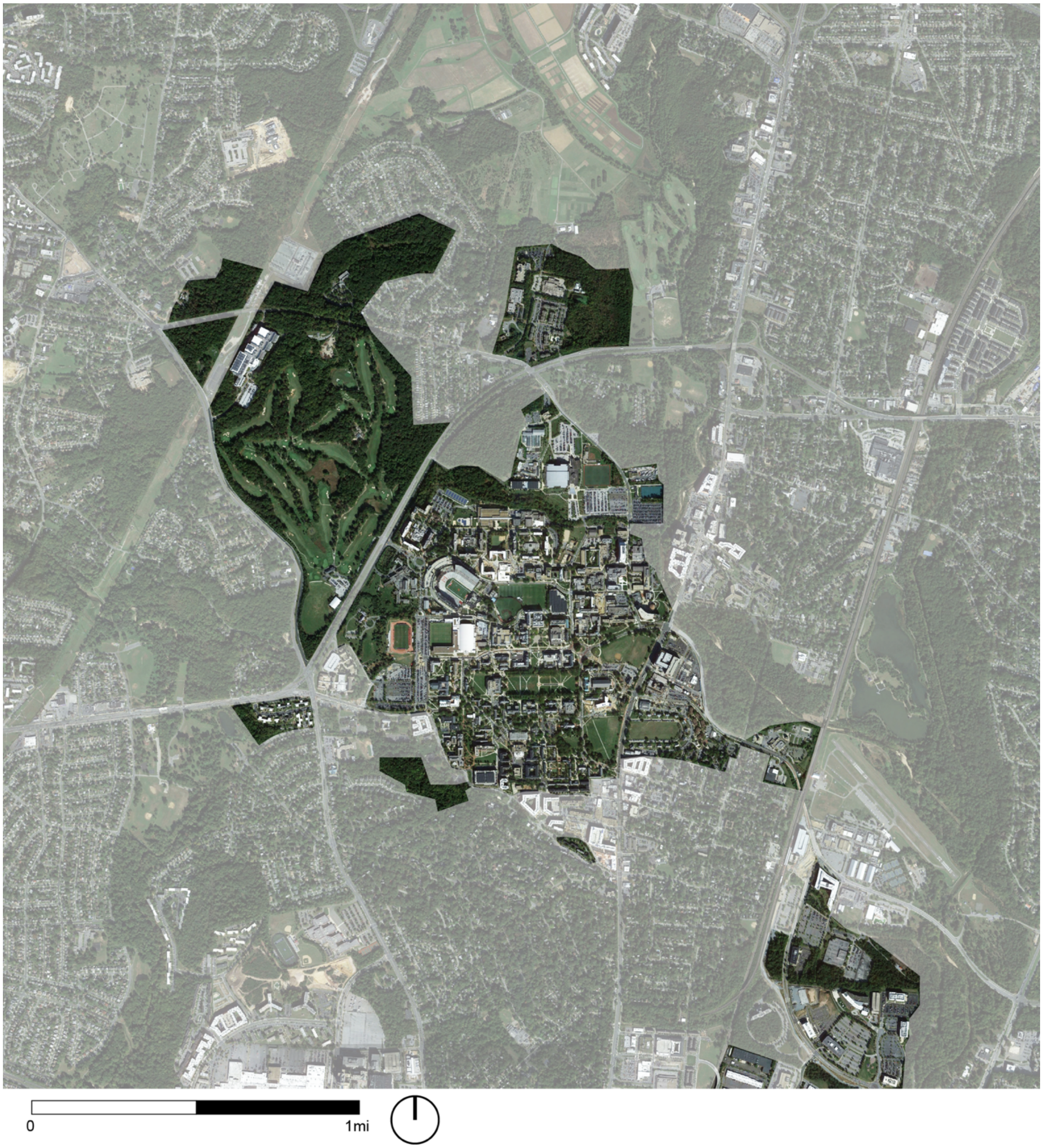

Figure 96 - Map outline of the University of Maryland Campus, image by author. January 2023

University of Maryland’s Campus districts

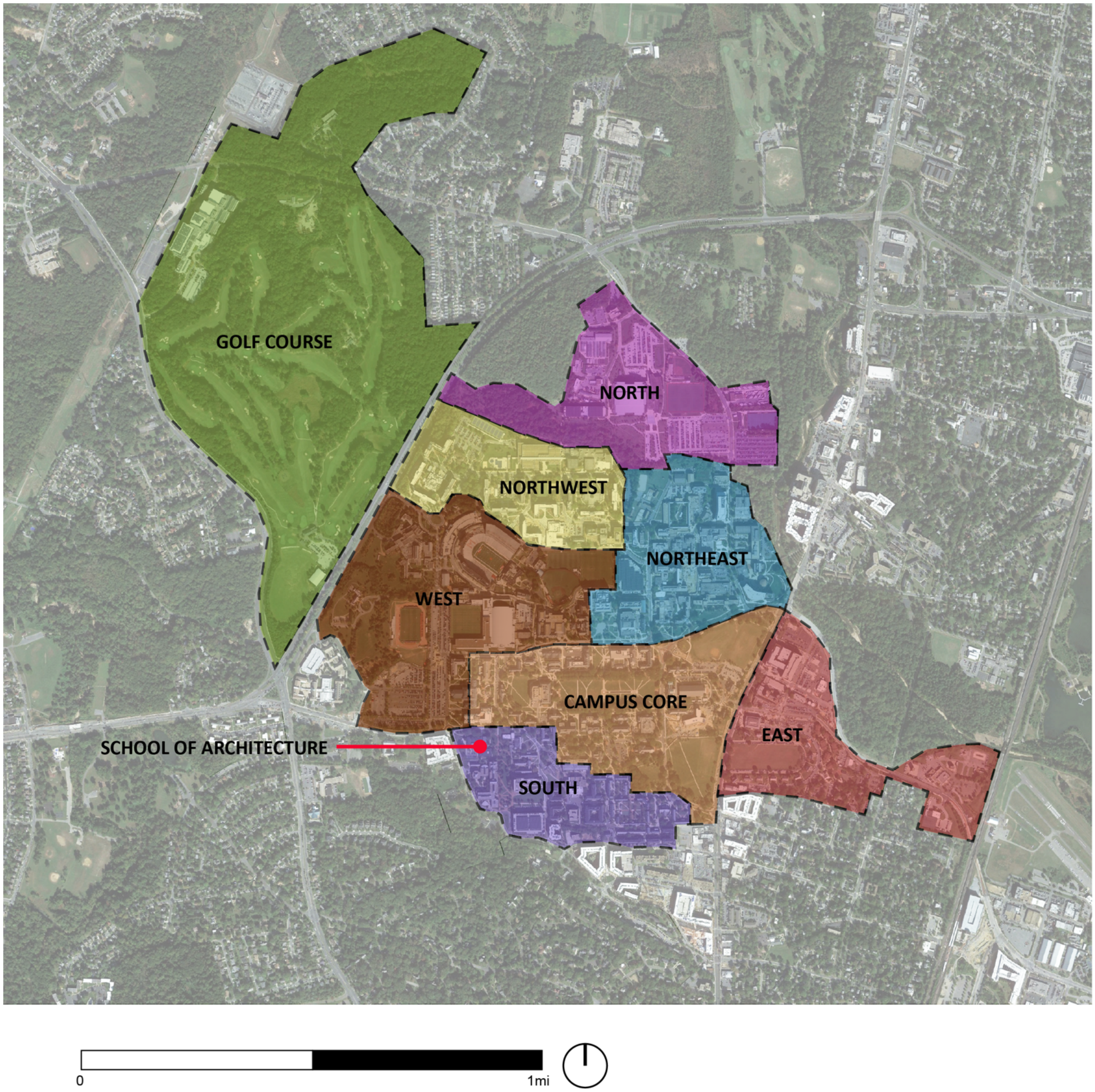

Figure 97 - Map outline of University of Maryland's Campus districts, image by author. January 2023

Facilities Master Plan 2011-2030

The Facilities Master Plan 2011-2030 proposed the concept of an open space/building network made up of buildings bordering quadrangles that are both academic and residential. This continues to be the basis for proposals for the Facilities Master Plan 2011–2030. Mayer Mall and the East-West Pedestrian Corridor, which connects Washington Quad and Mayer Mall, have both seen substantial construction progress since 2001.[66]

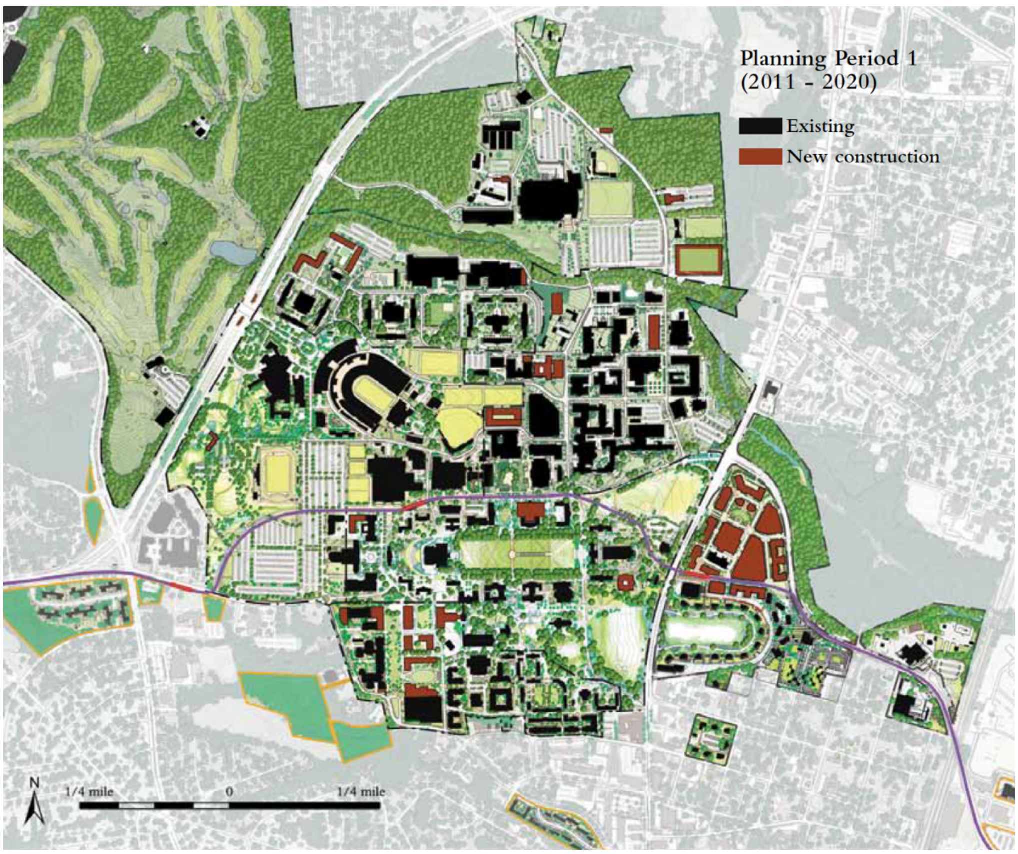

Figure 98 - Planning Period 1 (2011 - 2020) plan

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66 First Class Campus, A. n.d. "Facilities Master Plan 2011-2030." Umd.edu. Accessed January 16, 2023. https://facilities.umd.edu/sites/default/files/publications/2011-2030FMP.pdf.

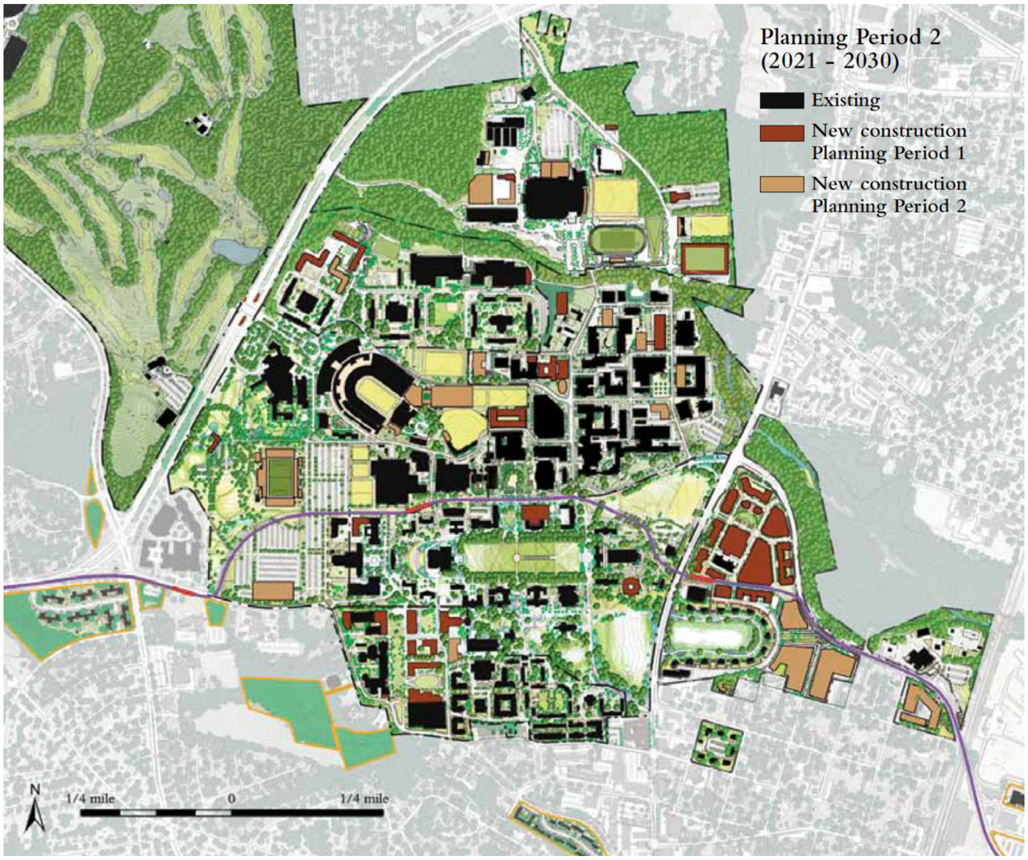

Figure 99 – Planning Period 2 (2021-2030)

In the Facilities Master Plan suggests that the South District will also be part of this new construction planning periods and the Architecture Building is included in the plan as well. The proposals that involve the Architecture Building are as follows:[67]

- Locate the proposed student housing and recreation buildings to form a quadrangle-shaped open spaces north of Mowat Lane Parking Garage.
- Create academic quadrangles by using academic building expansion, which will improve the relationship with a continuation of Morrill Quad terracing down to Mayer Mall.

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[67] First Class Campus, A. n.d. "Facilities Master Plan 2011-2030." Umd.edu. Accessed January 16, 2023. https://facilities.umd.edu/sites/default/files/publications/2011-2030FMP.pdf.

- Reconfigure pedestrian circulation through the East-West Pedestrian Corridor and up the slopes from Mayer Mall to the Campus Core District to make it accessible to people with mobility issues.

This information reveals potential construction areas that could be considered for additional expansion options to redesign the Architecture Building in this thesis. [68]

SOUTH DISTRICT ● planning period 1

Figure 100 - South District, planning period 1

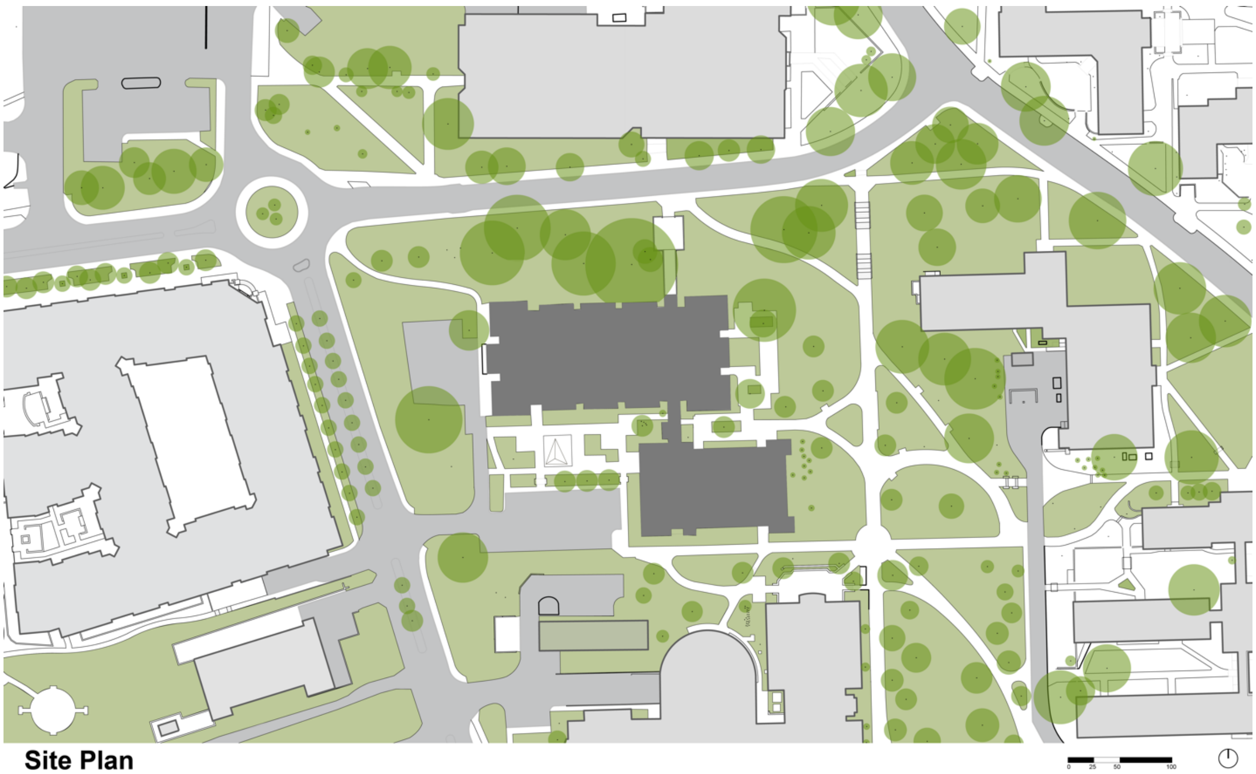
[68] Ibid.

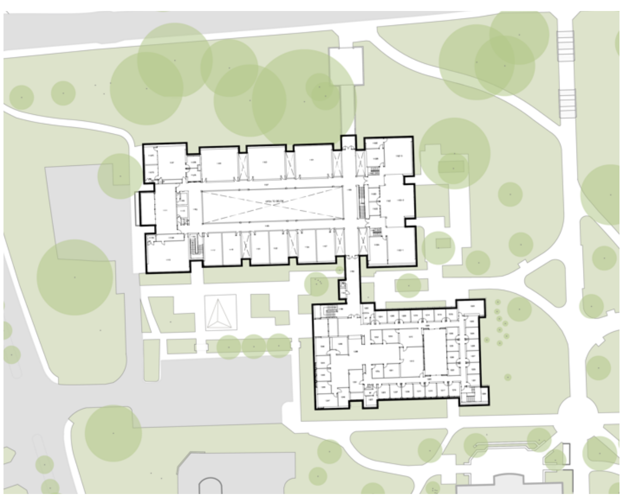
SOUTH DISTRICT ● planning period 2

Figure 101 - South District, planning period 2

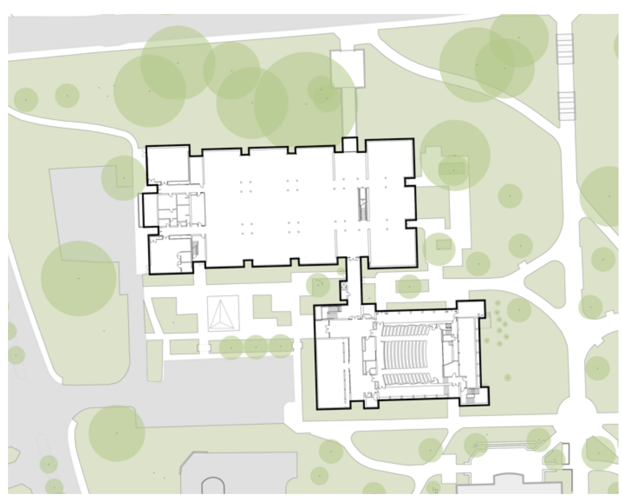
Site Plan of the Architecture Building

This site plan illustrates the Architecture Building in greater detail and is followed by the building's floor layouts.





First Floor Plan



Second Floor Plan

Figure 102 - Site Plan and Floor plans of the Architecture School showing site context, rendered by Author, January 2023

Building heights

The diagram below illustrates the surrounding buildings' heights in relation to the Architecture building.

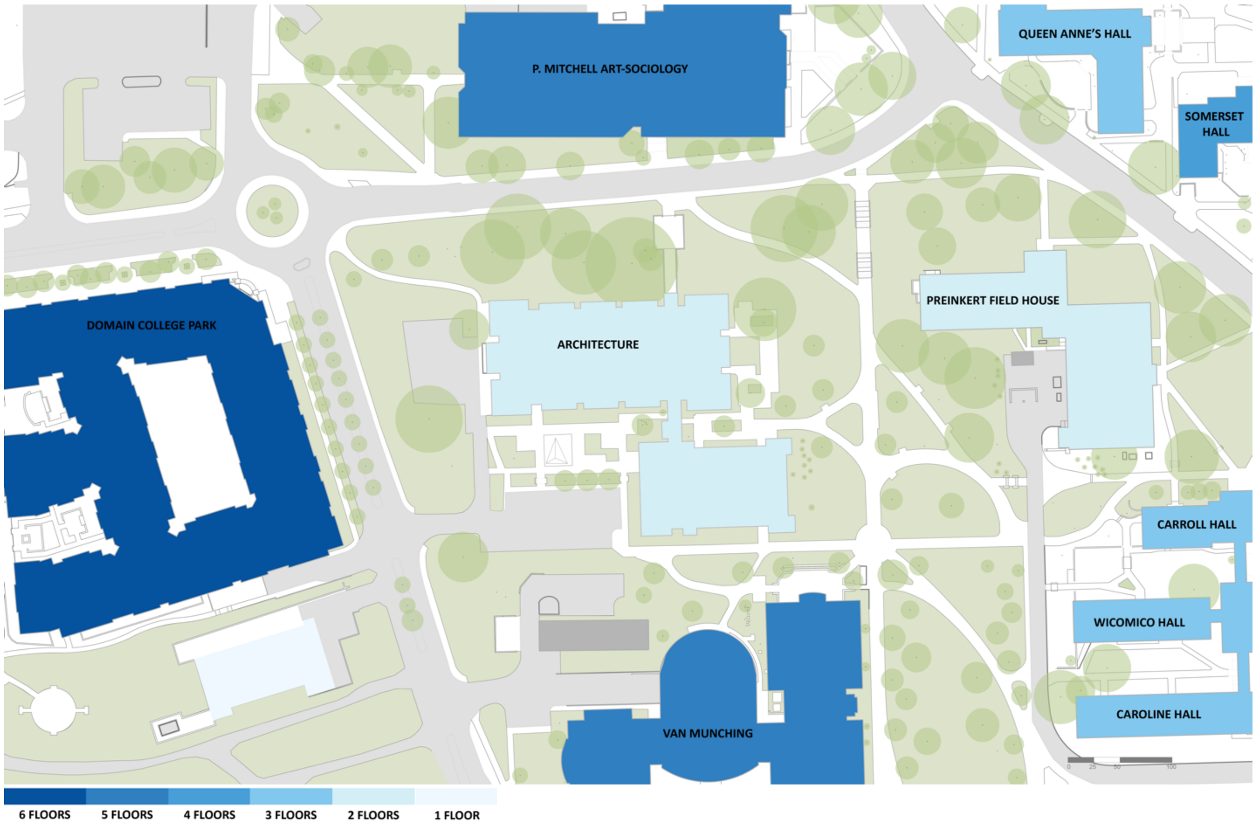


Figure 103 - Building Heights showing site context, rendered by Author, January 2023

Landscape

The landscape plan for the Architecture Building is shown in this diagram.

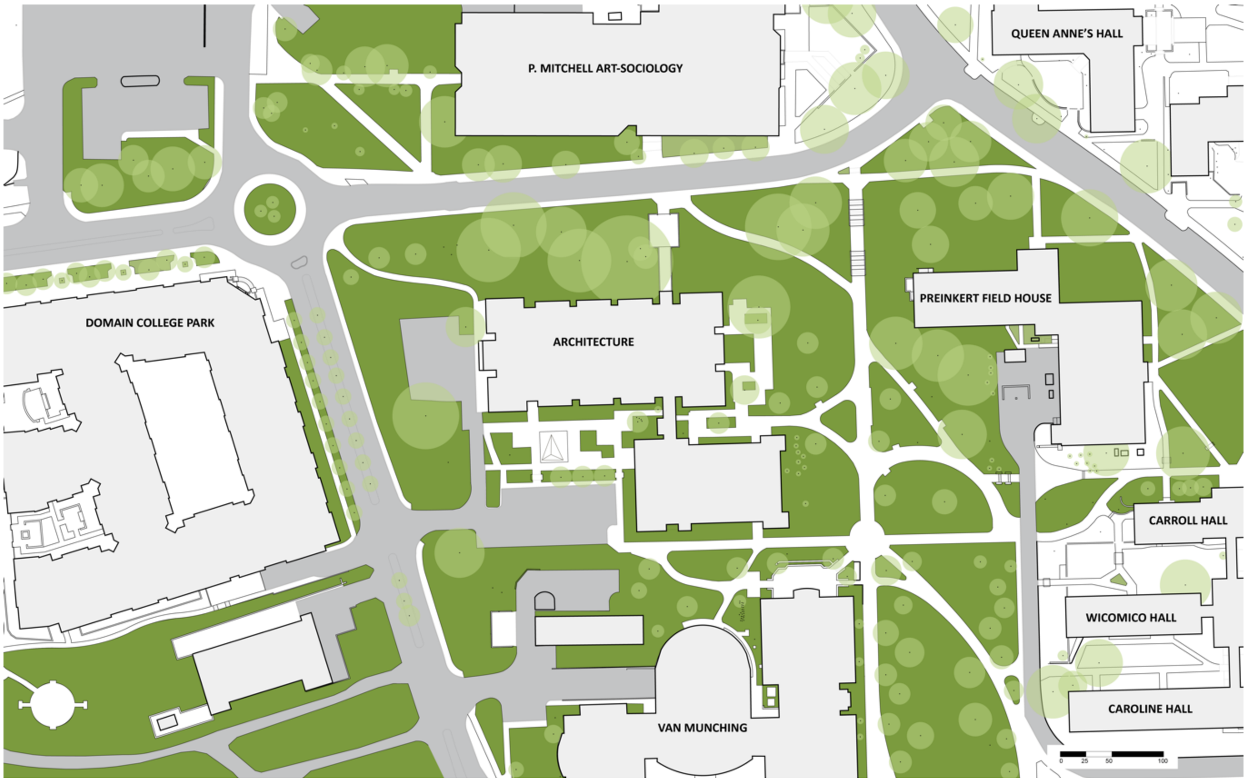


Figure 104 - Landscape plan of the Architecture School showing site context, rendered by Author, January 2023

Topography Map

The contour lines of the architecture building site plan are shown in this diagram.

Figure 105 - Topography Map of the Architecture School showing site context, rendered by Author, January 2023

Solar exposure

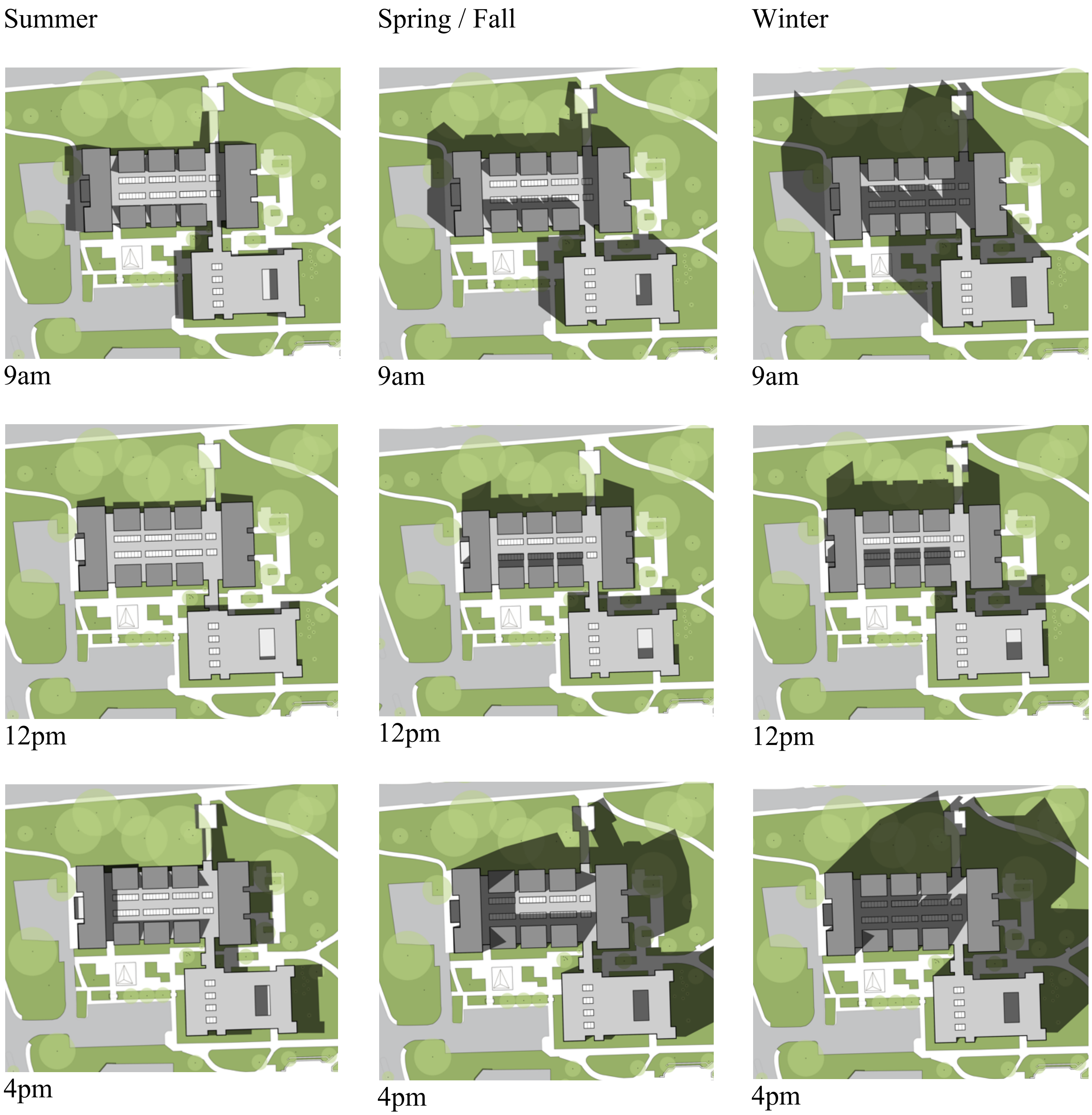


Figure 106 – Solar exposure diagrams of the Architecture School, rendered by Author, January 2023

Interior Environments of the Architecture Building

The reliance on artificial light is evident in the following images, as well as the unequal promenade lighting throughout the architecture building's interior.

Classrooms

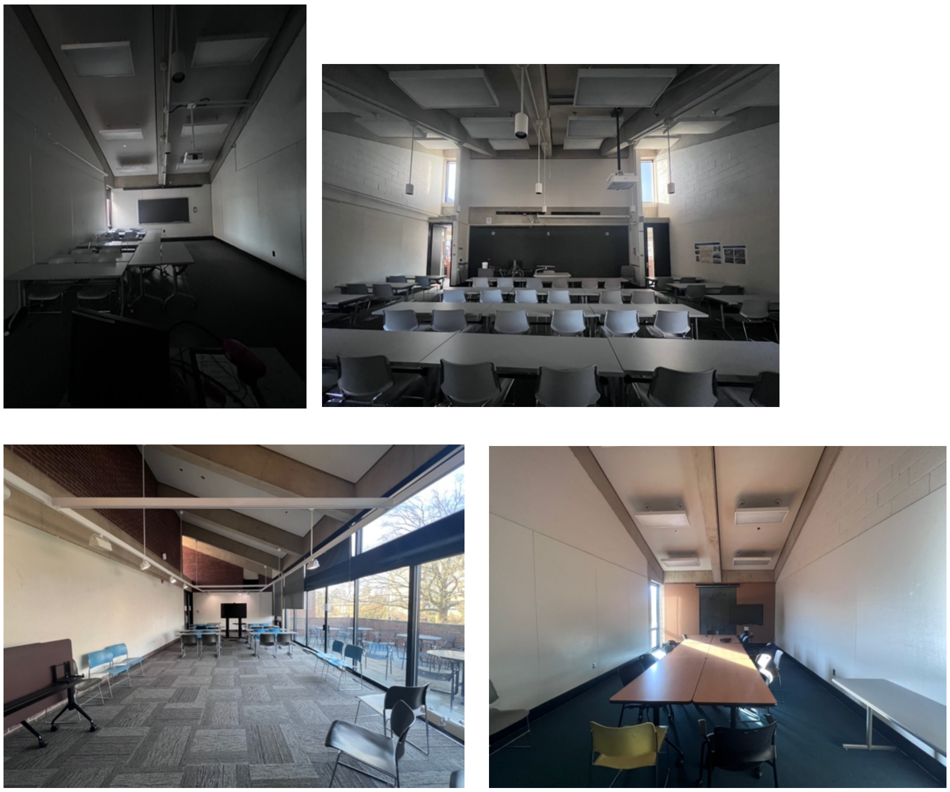


Figure 107 - Views to different classrooms, images by author, January 2023

Library

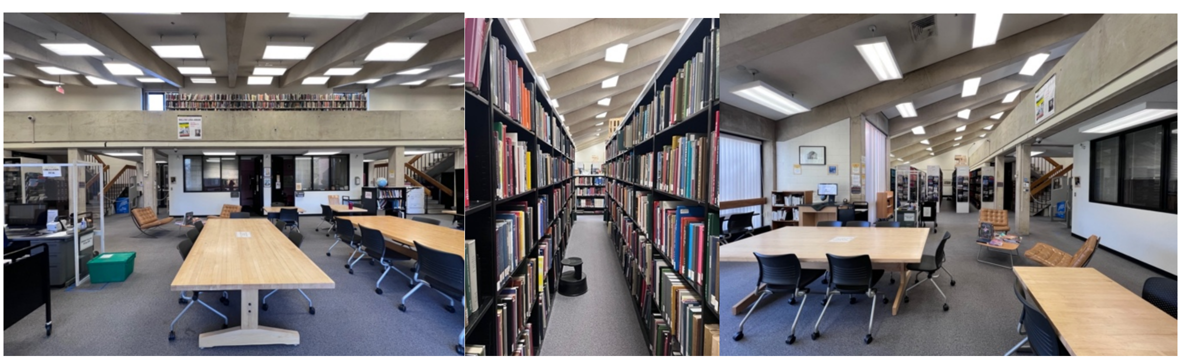


Figure 108 - Views of the interior space of the library, images by author, January 2023

Hallways

Figure 109 – Views of the Architecture School hallways, images by Author, December 2022

Great Space

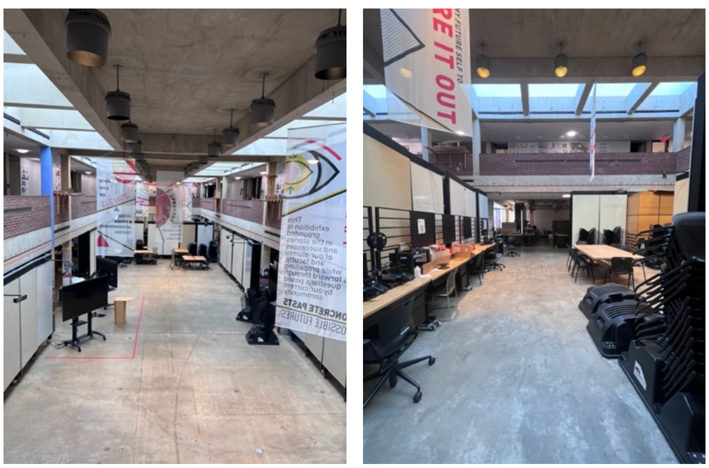


Figure 110 – Views of the Great Space, images by Author, December 2022

Auditorium

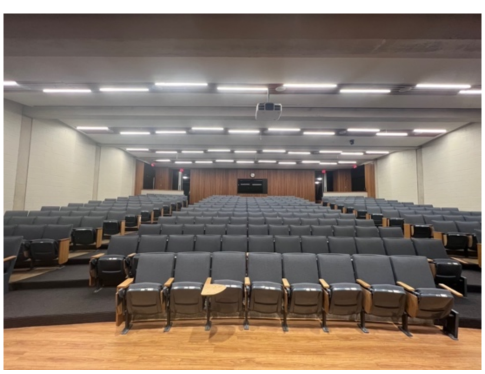


Figure 111 - Auditorium View

Kibel Art Gallery

Figure 112 - View to the Kibel Art Gallery

Digital Research Lab

Figure 113 - View to the Digital Research Lab, image by Author, December 2022

Digital Output Center

Figure 114 – View to the hallways of the Digital Output Center, Image by Author, December 2022

Digital Fabrication Labs

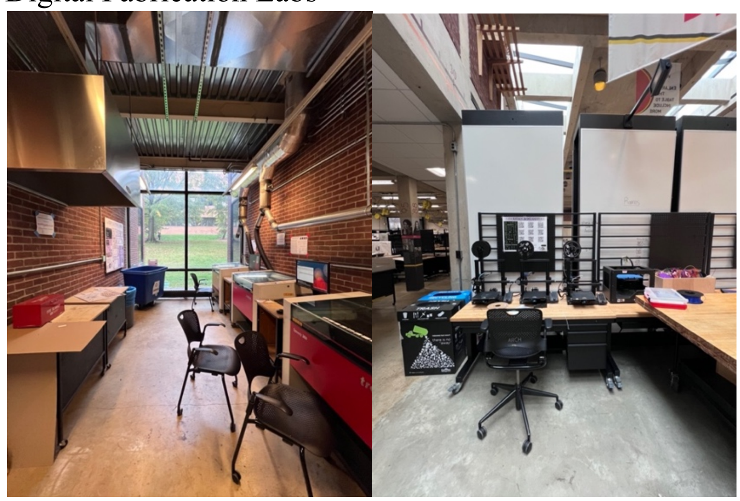


Figure 115 – View to the Laser Cut and 3D printing station, Image by Author, December 2022

Fabrication Lab

Figure 116 – View of the Fabrication Lab, image by Author, December 2022

Chapter 5: Program

The School of Architecture, Planning, and Preservation is a perfect architectural environment for putting the theories of lighting design into practice. Architecture schools foster the development of creative leaders and critical thinkers. It is a platform to encourage the growth of the knowledge and skills needed to address challenging and growing obstacles in a distinctively adaptable and innovative manner. The goal of the school is to prepare students for each discipline so that they can lead meaningful lives in it both now and in the future.

To accomplish this, it is essential to create a spatially lighted environment. Lighting modes, as mentioned in Chapter 2, are related to the human response of subjective impression of environments (John Flynn study), a coherent and complex environmental stimulus interesting enough to elicit involvement (Kaplan and Kaplan study), and finally, integrate emotional responses along the dimensions of pleasantness and motivations (Russell study).

The focus of this project is to create shared living spaces for both faculty and students while also offering a program that will suit the demands of the users. Additionally, it will provide a defined hierarchy of spaces using various lighting types. The goal of the program is to enhance the learning environments and activities at the school benefitting the building's growing demand for additional space.

Program zones

The program will be divided into two zones for different functions connected by the Atrium

- **The learning zone.**
  - An auditorium, a space for inspirational lectures, films, or other events to allure and expand the passion in architecture. It will be accessible from both indoors and outdoors to welcome and introduce all the U.M.D. campus to the culture of Architecture.
  - An art gallery that is prominently displayed on the ground floor to draw more people and serve as a source of inspiration for students and faculty.
  - Library, a place that students can go to seek inspiration and learn from the past located adjacent to the studios for a close interaction.
  - Faculty and Administrative offices, a shared well-lighted workspace where they may collaborate and learn from one another, as well as private, inspiring spaces where they can prepare lessons to instruct students.
  - Green roof, an accessible outdoor area that can be utilized to participate directly in sustainability initiatives, serve as a learning environment, provide a release for stress, and provide access to fresh air. A café, an open space with seating arrangements that offers staff and students a place to reconnect.
  - Terraces proving opportunities for outdoor studio presentation.

- **The creative zone**
  - Design Studios, a collaborative space that is spatially lighted to create an environment that is stimulating enough to encourage interaction and collaboration.

- Classrooms, a lighted spatial environment dedicated to nurture future architects, Real Estate Developers, Urban planners, Historians and Dual Degrees
- Digital Research Labs, Digital Output Center, Digital Fabrication Lab and Fabrication Lab spaces to enable the students enhance their creative thinking and build architectural designs that mix creative and practical thinking.

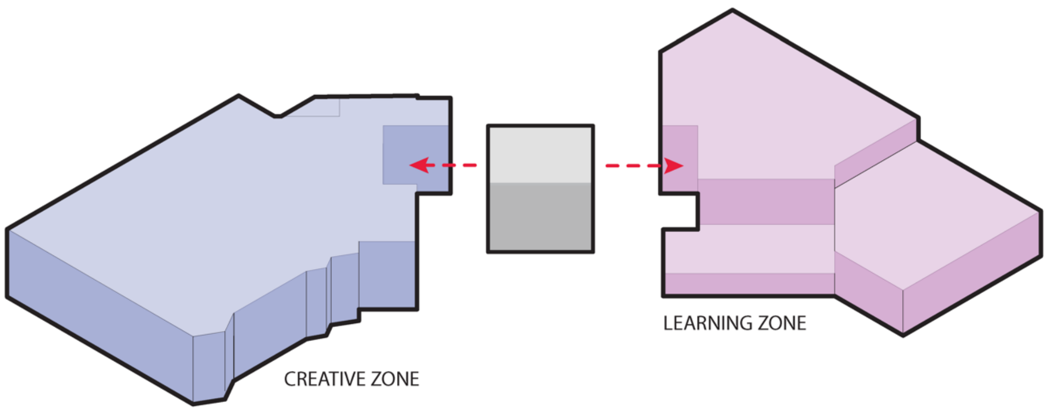


Figure 117 - Massing connection zones, diagram made by Author, May 2023

Proposed Site Plan

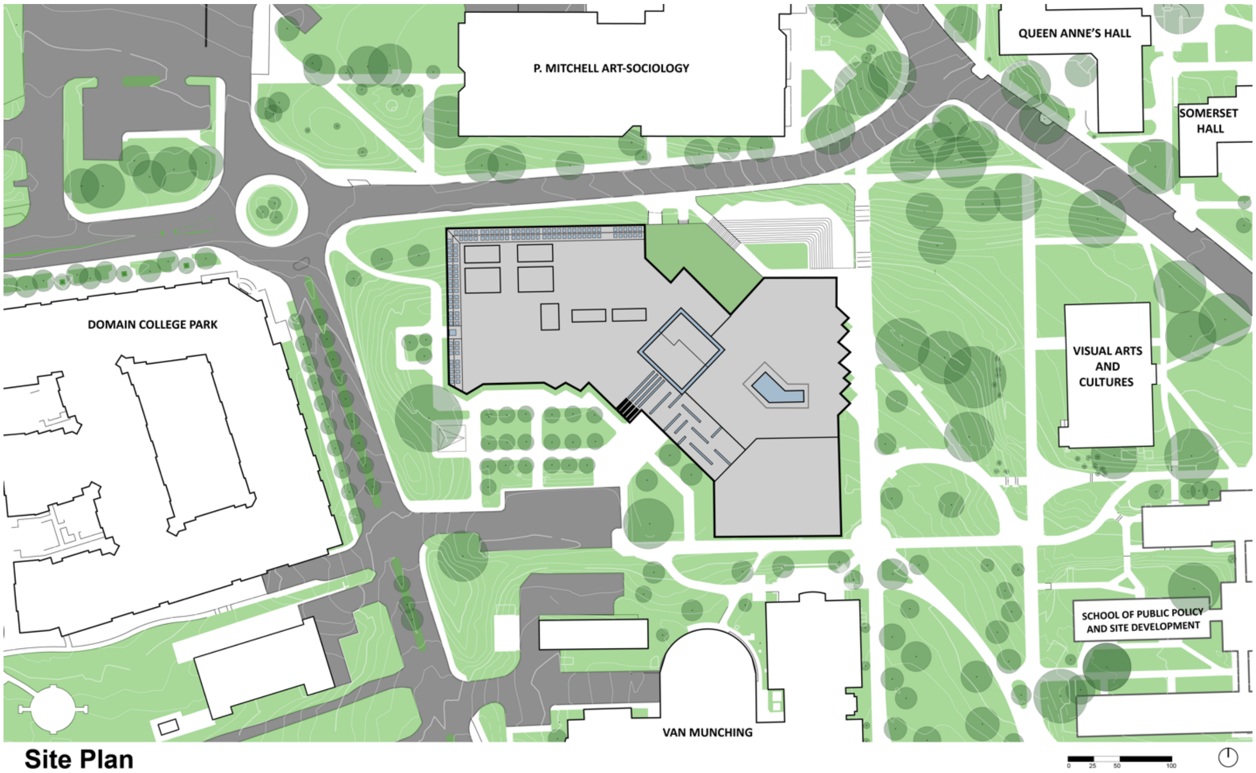


Figure 118 - Site plan made by Author, May 2023

Lighting Strategies

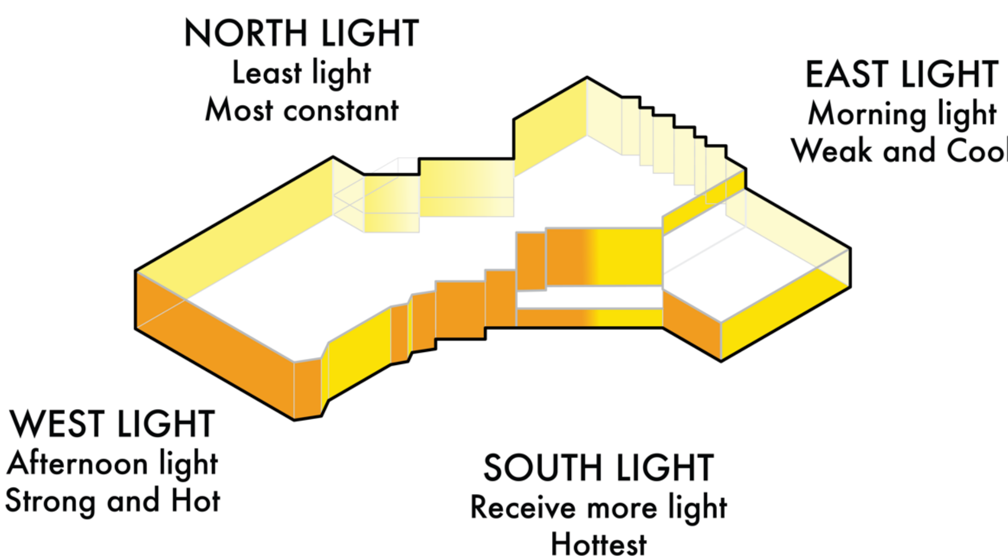


Figure 119 - Diagram made by Author, May 2023

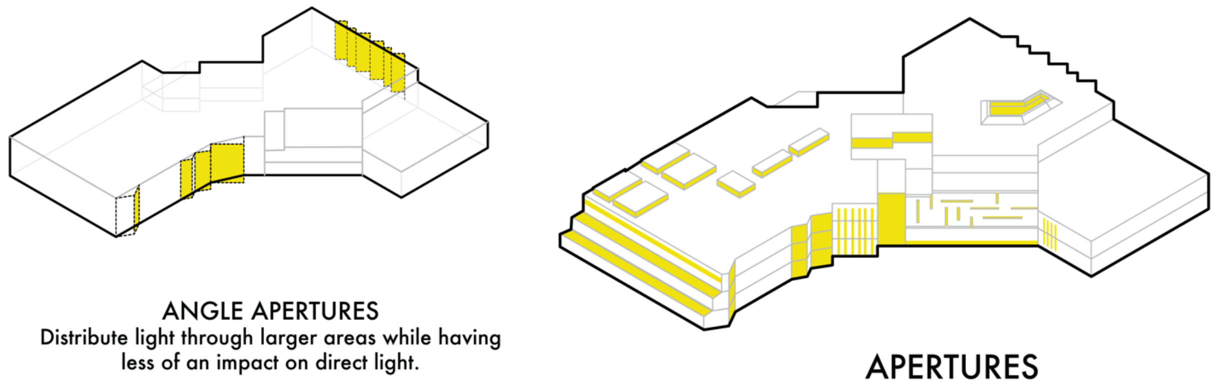


Figure 120 - Diagram made by Author, May 2023

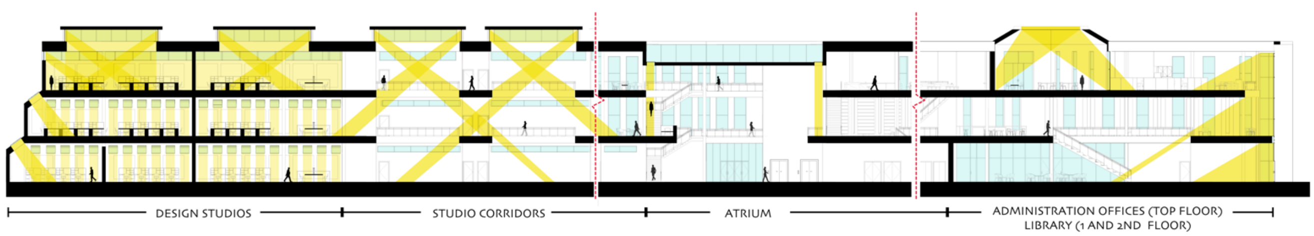


Figure 121 – Building section, Diagram made by Author, May 2023

Proposed Landscape

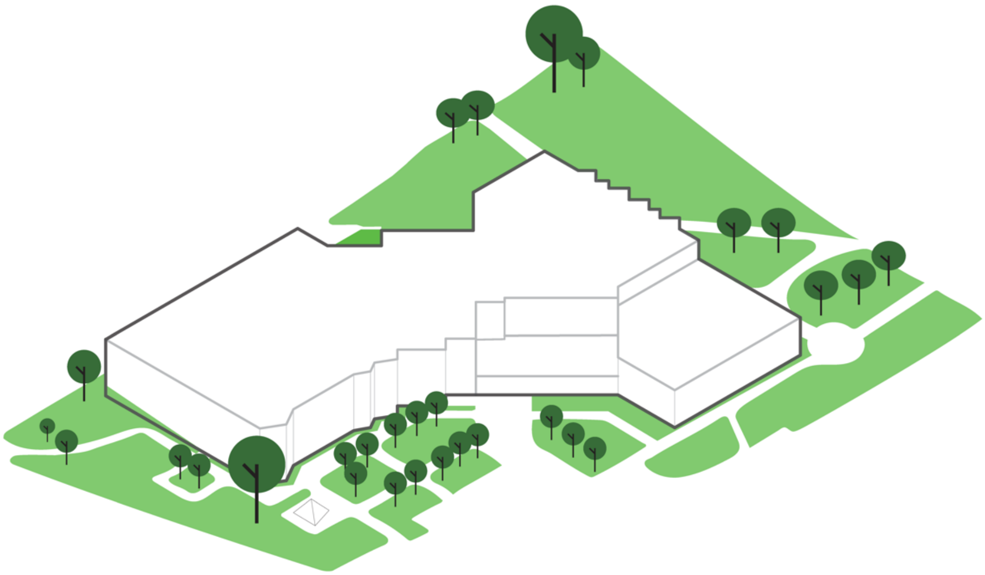


Figure 122 - Diagram made by Author, May 2023

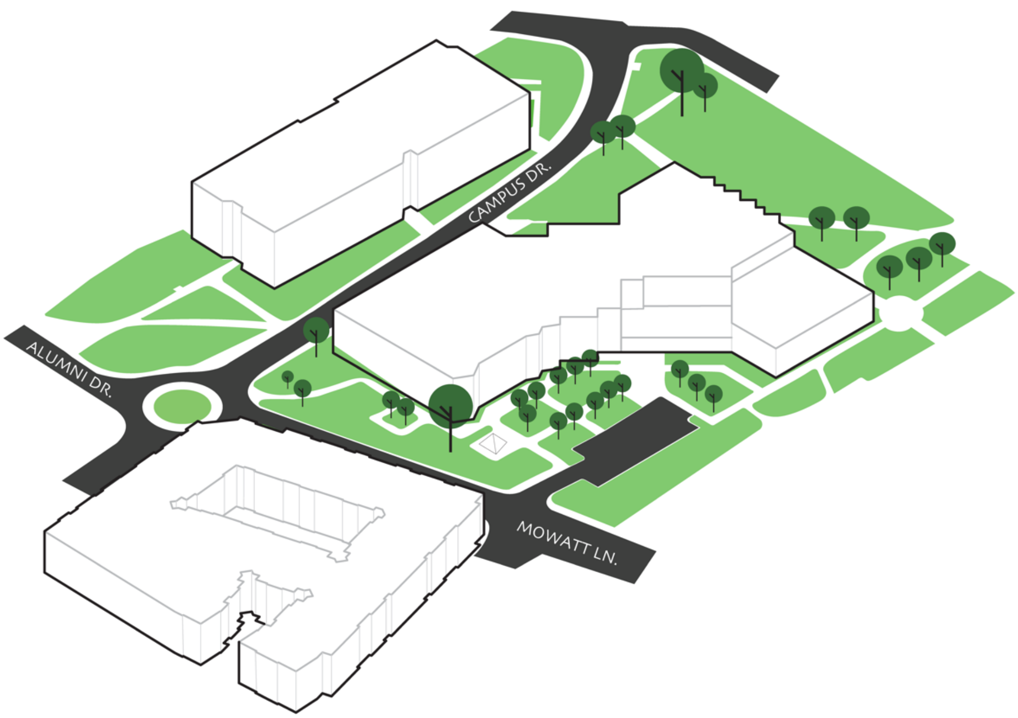


Figure 123 – Landscape connection with streets, Diagram made by Author, May 2023

Proposed Floor Plans

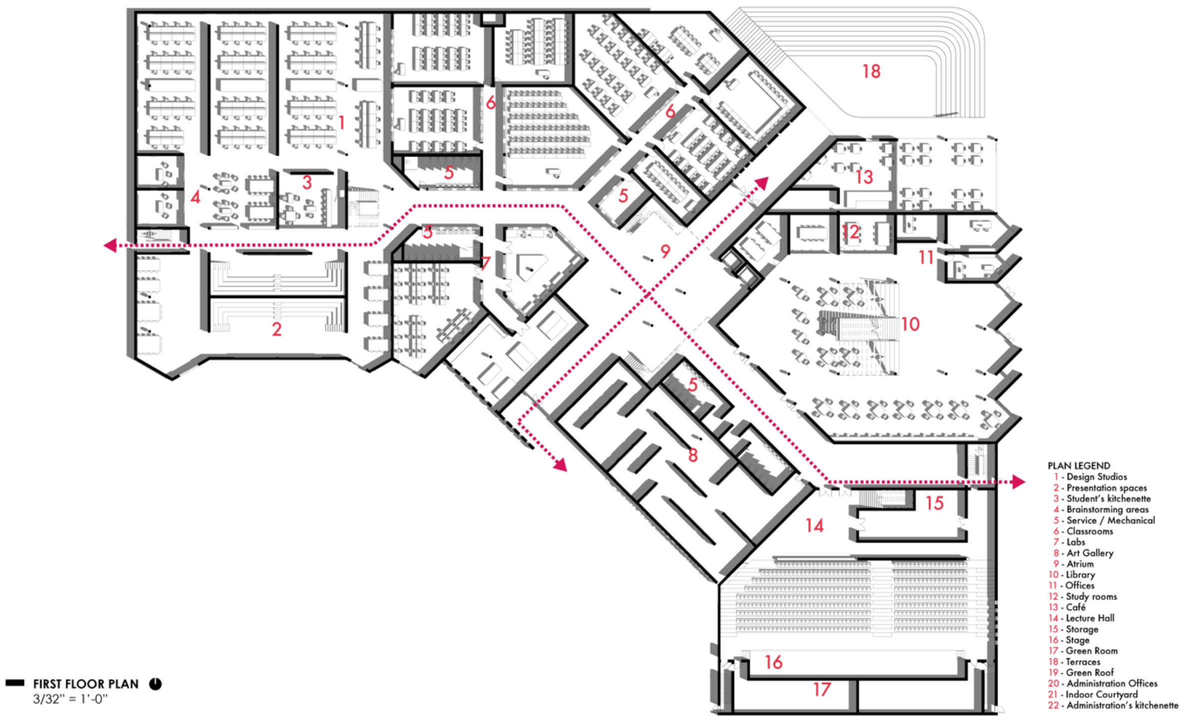


Figure 124 - First Floor Plan, Diagram made by Author, May 2023

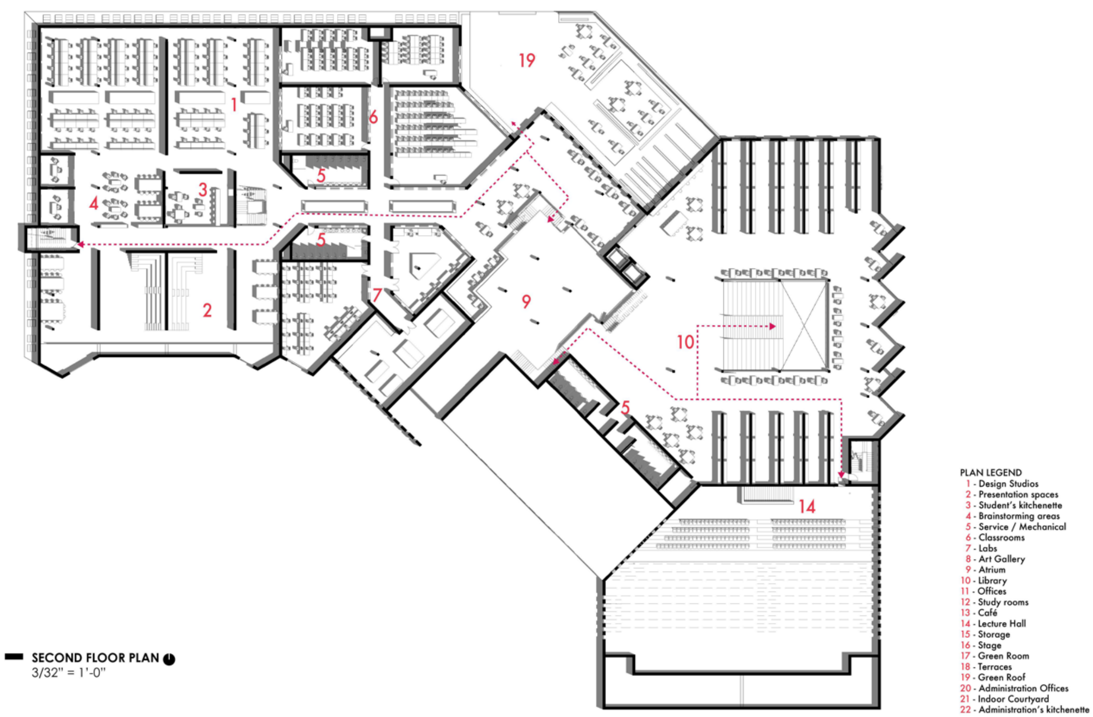


Figure 125 - Second Floor Plan, Diagram made by Author, May 2023

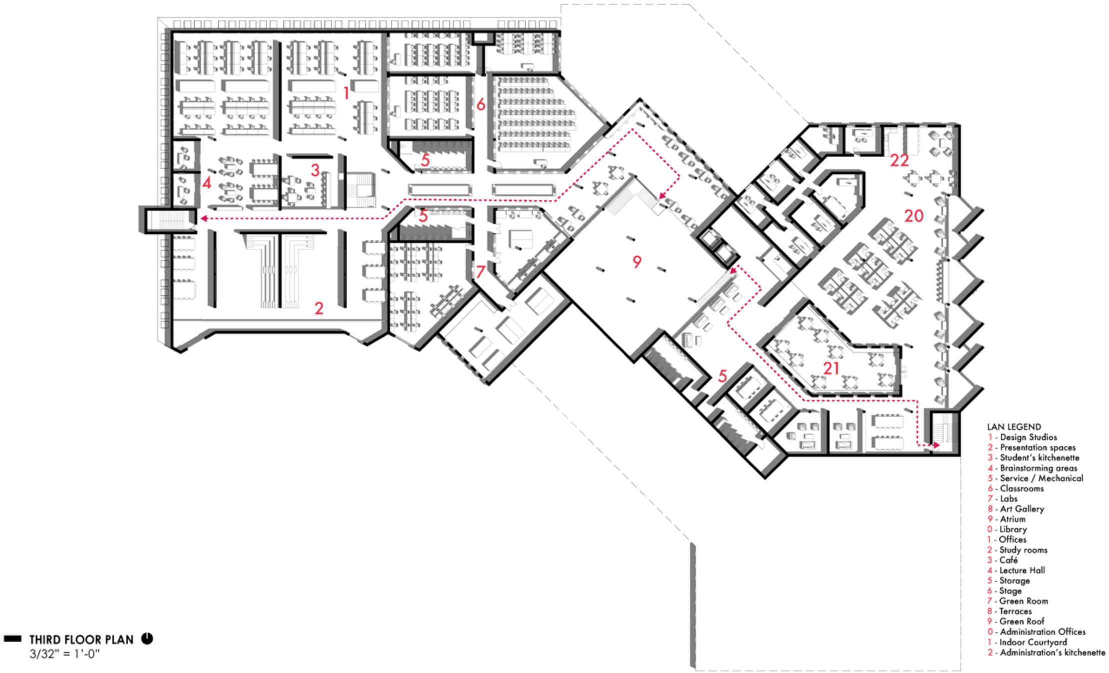
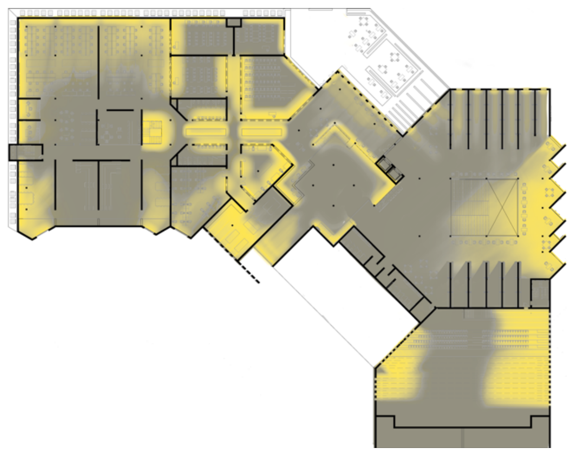


Figure 126 - Third Floor Plan, Diagram made by Author, May 2023

Floor Plans Light Strategies

First Floor Plan



Second Floor Plan

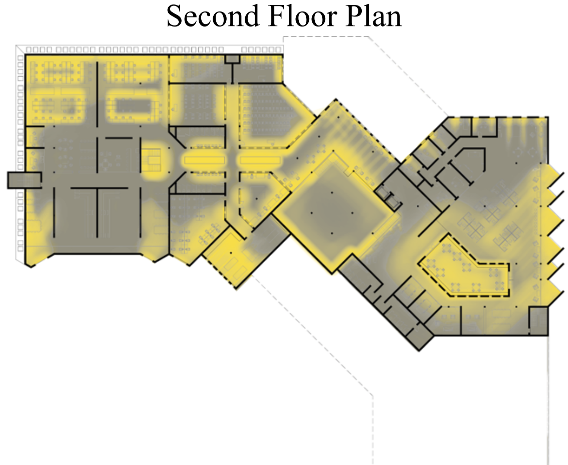


Figure 127 – Light Strategy Floor plans, Diagram made by Author, May 2023

Third Floor Plan

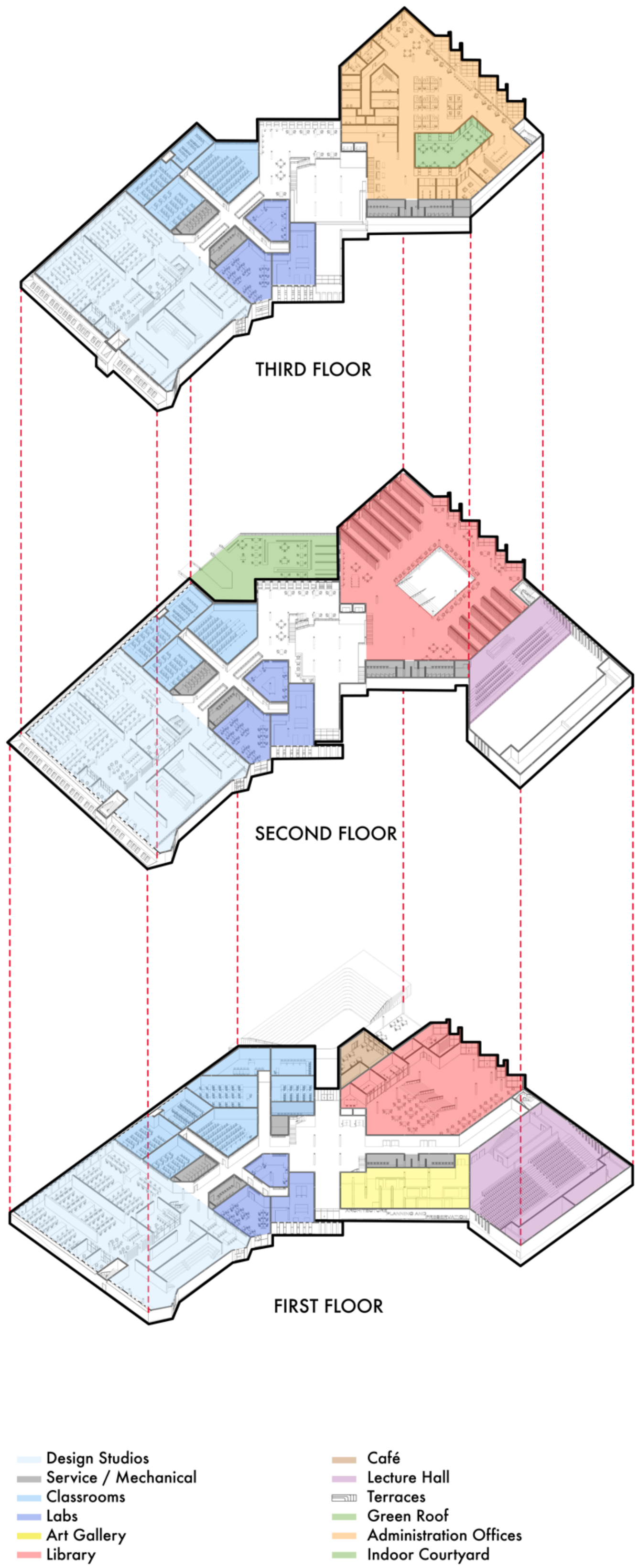


Figure 128 - Isometric View of floor plans, Diagram made by Author, May 2023

Building Section Lighting Strategies

Figure 129 - Design Studios section East to West, Diagram made by Author, May 2023

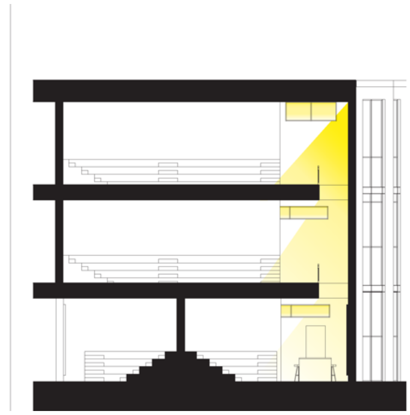


Figure 132 - Presentation spaces section North to South, Diagram made by Author, May 2023

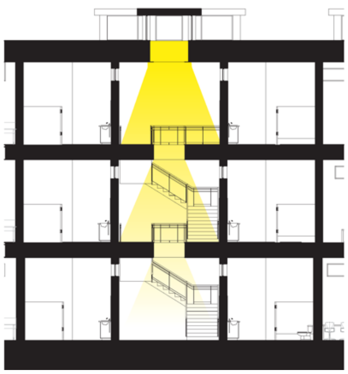


Figure 130 - Design Studio corridors, Diagram made by Author, May 2023

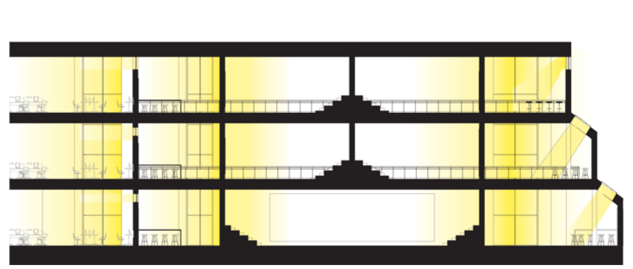


Figure 133 - Presentation Spaces section East to West, Diagram made by Author, May 2023

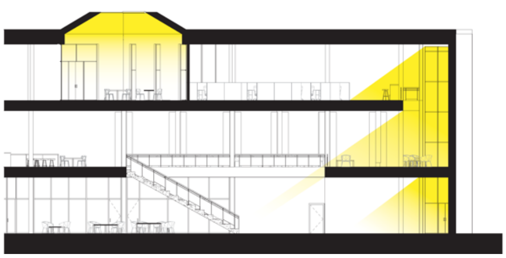


Figure 131 - Library section West to East, Diagram made by Author, May 2023

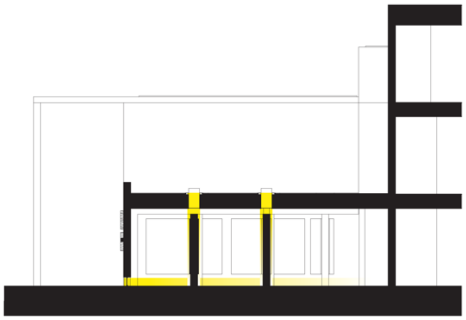


Figure 134 – Art Gallery section view from North to South Diagram made by Author, May 2023,

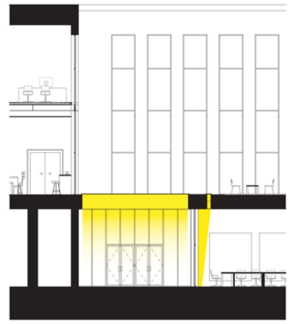


Figure 136 - North entry view from West to East, Diagram made by Author, May 2023

Figure 135 – Lecture Hall section view from South to North, Diagram made by Author, May 2023

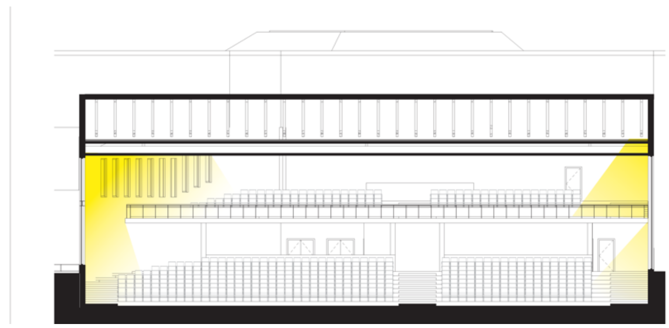


Figure 137 - Lecture Hall view from East to West , Diagram made by Author, May 2023

Interior Experiences

Figure 138 – View to presentation areas, Diagram made by Author, May 2023

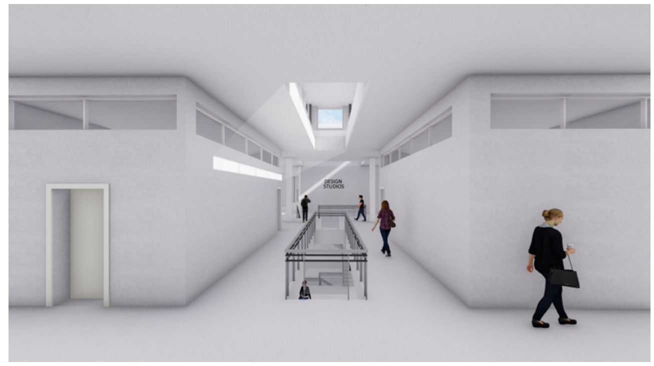


Figure 141 – View to Studio corridors, Diagram made by Author, May 2023

Figure 139 – View to Classroom under Green Roof, Diagram made by Author, May 2023

Figure 142 – View to Studio gathering spaces, Diagram made by Author, May 2023

Figure 140 – View to private presentation spaces, Diagram made by Author, May 2023

Figure 143 - View to Studio, Diagram made by Author, May 2023

Figure 144 – Office view, Diagram made by Author, May 2023

Figure 145 – Lecture Hall, Diagram made by Author, May 2023

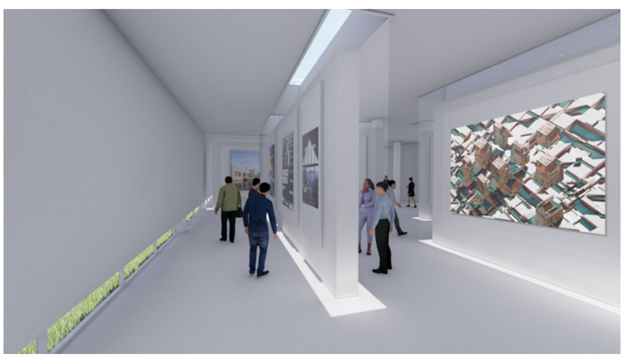


Figure 146 – Art Gallery view, Diagram made by Author, May 2023

Figure 147 – North Entry view, Diagram made by Author, May 2023

Figure 148 – Library view, Diagram made by Author, May 2023

Figure 149 – Office interior courtyard, Diagram made by Author, May 2023

Figure 150 – North Entry view, Diagram made by Author, May 2023

Building Elevations

Figure 151 - Southwest Elevation, Diagram made by Author, May 2023

Figure 152 - East Elevation, Diagram made by Author, May 2023

Figure 153 - North Elevation, Diagram made by Author, May 2023


Figure 154 - West Elevation, Diagram made by Author, May 2023

Figure 155 - Entry View, Diagram made by Author, May 2023

Proposed Reverse Engineering

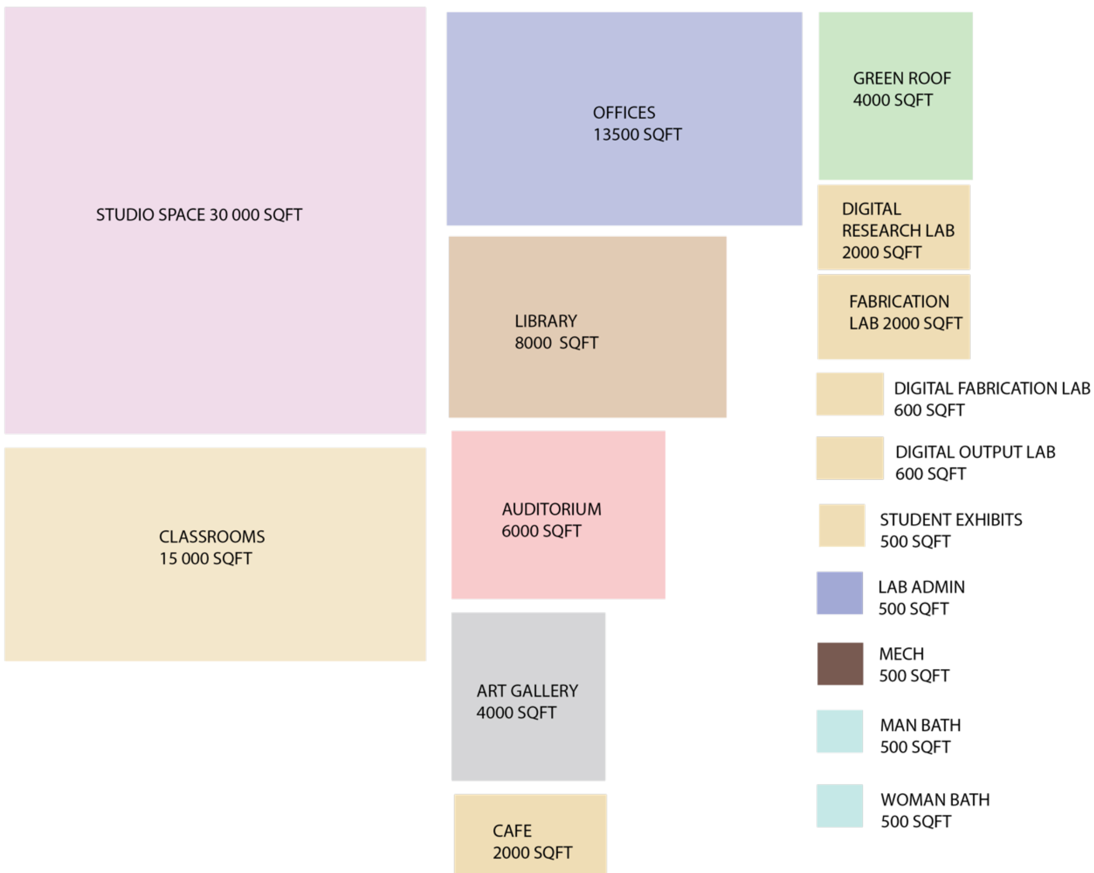


Figure 156 - Proposed expand program reverse engineering for the Architecture building, made by Author, 2023

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