

# Light Force

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**Abstract** : What falls into the realm of light and what it means to design and the human experience? Can light be material? How does light change space into place?

## Acknowledgements

To my parents for their love

To all my professors for their wisdom

To my friends for their support

And to God for All.....



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# LIGHT FORCE:

## An Exploration of light through design

The premise of this thesis is to explore the realm of light and what it means to design and the human experience. I believe light is still a concept. It is something that cannot be contained in singular knowledge, but yet it has the propensity to evolve over time through the curiosity to create. Perhaps if there is a better understanding of what light is and what it has been, only then can designers truly shape the potential of what it can become.

Light is the primary building block of life itself. Here on earth sunlight is a truly precious commodity. It drives weather patterns, grows our food, and allows us to see. All the resources we use today to provide energy for society are generated by the sun. Buckminster Fuller reminded us of this dependence in the Critical Path: "Pointing to the logs burning in the fireplace, one child asked me, 'What is fire?' I answered, 'Fire is the sun unwinding from the tree's log.'"



The most important aspect of light is that it allows us to see. We are dependent on it in more ways than we realize both physiologically as well as psychologically. The pineal gland, located near the center of the brain, is sensitive to light received through our eyes. This gland, working in conjunction with our eyes, regulates the production of the melatonin hormone. Melatonin is mainly responsible for controlling our sleep cycles, but it also affects mood. Short winter days makes us feel tired and long summer days makes us energized. People in extreme cases of depression are diagnosed with Seasonal Affective Disorder. Light therefore plays a major role in our overall behavior in our immediate environment.

Light that is sensible to the human eye constitutes an extremely small area of the electromagnetic spectrum which consists of both visible and invisible wavelengths. White light, or the light from the sun, occupies the visible spectrum; whereas ultraviolet light and x-rays make up the invisible spectrum. This convergence of the visible part of the spectrum and the structure of the human eye and entire perceptual system seems more miraculous the more you think about it. Each one of us sees in a unique way, although average sensitivity ranges to light and color have already been established through experimentation.



Light travels in two forms. It is both a particle form in packets of photons and a wave form through electromagnetic radiation. To put it simply, light is a vibration and different kinds of light operate at different frequencies. Ultraviolet light, for example, is on the low end of the vibration spectrum and lasers, on the other hand, operate at high frequency.

Although light is ever changing, the laws of physics controlling it are not. Unforeseen effects often transpire with light, but upon investigation, they can be seen to have occurred according to the rules. Intensity falls off with the square of the distance. Reflection is reciprocal: the angle of reflection equals the angle of incidence for specular surfaces, such as mirrors and polished surfaces. Surfaces with a matte finish spread reflected light diffusely and evenly in all directions. As a surface is turned away from a light source, it receives light at an angle, and the illumination on the surface is reduced by the cosine of the angle of incidence.

Lighting in general depends on six factors: the source; the form; the surface, the person who is observing the source and illuminated surfaces; color; and contrast. For this thesis I will explore how light behaves in accordance to these factors and how they reveal space through design.

# 1: SOURCES



Light has many sources. The sun, moon, fire and electricity all work to reveal our world. Each type of light is unique in its scale and effects. These differences begin to shape the way humans have perceived their existence throughout history. Just as light changes from dawn to dusk and from season to season, the technology in illumination has evolved to a point where designers can begin to sculpt the environment around us in the shadows. Light enriches a sense of place and invokes our deepest emotions.

## Natural Light:

The sun is a tiny speck in the universe billions of miles away from the earth. Yet the sun is ideally situated in location and size relative to the earth. Despite the enormous distance, it provides the perfect amount of energy in light to sustain life on the planet.

Sunlight varies in color and intensity for different regions on earth. Even though natural light is a constant source from a fixed location, the atmosphere, the shape, the surface, and the rotation of the earth gives us a variety of naturally occurring lighting conditions. Painters who are particularly perceptive to light have transcribed its subtle and not so subtle effects through the changing of day and seasons. Some even choose only to paint at a particular time of day to work not only in natural light, but more importantly working in a type of light that has the same intensity and angle of incidence. A very notable example of this "light-sensitive" research is Claude Monet's series of "grainstack" paintings. The haystacks tell a particularly compelling story of the changing light and colors of the seasons. Monet, who spoke little about his art, wrote in a letter to a colleague about these paintings: "... the further I go, the more I understand that it is imperative to work a great deal to achieve what I seek: 'instantaneity,' above all...the same light present everywhere and more than ever easy things that come in a single stroke disgust me. In the end, I am excited by the need to render what I feel..."

As a set these paintings reveal to us the constant morphing of light and color that occur in accordance to the position of the sun, the seasons, and the landscapes. These changes are natural cues that we see and feel in our settings. These things remind us that we are part of an environment of constant change, and that change is part of our experience of life. The light of day reveals this change. Louis Kahn stated: "I have no color applied on the walls of my home. I wouldn't want to disturb the wonder of natural light. The light really does make the room. The changing light according to the time of day and the seasons of the year give color."

A building can make us aware of the passing of day and the seasons. Philip Johnson's Glass house in New Canaan Ct, has a "free plan" and perimeter glazing that brings the outside in. Shadows are cast across the floor as the days and seasons progress. A carefully placed opaque bathroom core defines the different living spaces within the box.

A more specific lighting condition is revealed in Corbusier's studio. He did not follow the principle that artists' studios should face north, an orientation to which reflected light from the environment maintains a fairly constant color and ambient light level throughout the day. Instead he viewed intense sunlight as a stimulant to work more precisely. He said of his studio

...the light, contradictory, coming from the east, from the west, not at all from the north as a result of the arrangement of the house, light unfavorable at each instant, at each hour of the day, all year long, a permanent adversary (abominable from the classical point of view of a painting studio) but in fact a useful adversary, seeing that here again it plays a role, that of forcing one...to concentrate, to condense, to express.

The active role that the light plays in the Corbusier's Studio marks time and keeps one continually aware of the natural conditions outside and at the same time another layer of complexity is added to the interior space in that changing light.

Fire:

Fire is the most basic form of survival known to man. Not only does it give light for sight, but also gives off heat to keep warm and cook our food. Before the invention of the light bulb, candlelight was the standard method of lighting at night. It was man's first real testament to the control of fire. To this day, fire has remained a fixture of mystery and security to those who get captured in its rhythmic dance. Part of the attraction can be attributed to its power. It has the ability to create but also to destroy. The hearth in ancient times was a place for ritual and spiritual salvation. The modern hearth or fireplace has also remained the focal point in many residential settings.

## Electric Lighting:

Just as the sun is tailored to the needs of the earth, humans have harnessed the power of electricity to provide lighting in various applications. Unlike the sun, electrical lighting has scale. The distance, the intensity, and location of powered lighting can all be controlled within the different types of lighting technologies. Much of our experience of light comes from working in it. We are most acutely aware of light when there is either not enough of it, or too much, to be able to comfortably do what we want to do.

“Levels of illumination have most often been used as criteria for specifying lighting conditions for work environments, although in some countries considerations of the quality of the light have been used as well. Although based on scientific evidence, recommended levels of illumination have historically risen with the technical and economic ability to provide them. For example, the Illuminating Engineering Society of North America has issued recommended levels of illumination for various tasks since 1913. During this time the illumination recommended for office work has moved from a range of 2 to 4 foot-candles to a high of 100 foot-candles in 1960 and then, following the “energy crisis” of 1973, to its current level range of 50 to 100 foot-candles. There are, however, additional ways of improving visibility other than adding light—presumably from an electric source—to the task. In the end, the responsibility falls on us as designers to draw from our clients the

particularities of their personal conditions and visual tasks and try to accommodate them in the luminous environments that we design. We can also observe exemplary buildings as well as the luminous conditions that afford us comfort and bring these observations to bear in our designs.

The lighting concept for the Johnson Wax Administration Building was very unique: "Work itself is correlated in one vast room...day-lit by the walls and roof becoming crystal wherever light will be most useful. The "crystal" effect was achieved by wiring Pyrex glass tubing to specially shaped aluminium racks to form two layers of glazing, one interior and one exterior. Incandescent lamps were mounted between the two layers so that light always entered the room from the same places. Wright wrote that "In the interior, the box-like structure vanished completely." Added to the open workspace and unique organizational plan for the company was a new expression of structure and construction. Employees held varying opinions concerning the lighting; some remembered good lighting conditions, but there were also some complaints of glare from direct sunlight coming from the glass tubing. The lighting cannot be separated from its concept, its structure, its construction, or from the resultant work environment."

"The Finnish architect Alvar Aalto placed emphasis in the quality of both natural and artificial light in the buildings he designed, among them libraries. During the several years that he had to design the Viipuri Municipal Library (1927-35), he searched for an appropriate quality of light for reading. This search is documented in his preliminary study sketches for the library. He investigated the distribution of daylight and electric light. His explorations range from sketches of one man with a book to sections across the main library room showing the reflection and distribution of light. He studied a man and a book from the front and from the side, showing that light reaching the book would arrive from all directions: a diffuse light free of shadows. The way which round skylights provide this light coming from all directions is diagrammed here also, both in section and in plan in the lower center of the "daylight" page. In the section, the lines tracing the path of the incoming skylight diverge from the splayed interior of the skylight well. In the circle below, showing a horizontal cut through the skylight well, the light entering from one direction is reflected in many directions from the curved sides. The skylight well acts as a daylighting fixture, redistributing the light from the sun and sky.

The electric lighting fixtures were designed to produce the same effect of diffuse light. On the page of sketches entitled "artificial light," a man looking at books on a bookshelf is shown, in a section sketch, with the direct light from above casting a shadow on the lower part of the bookshelf. In plain view of the same situation, the reflected light coming from the sides is shown canceling out the shadows.

The result of this careful, formal, and qualitative study of light for reading was an understanding of light quality that became part of Aalto's formal vocabulary. He investigated the relationship between light and form: how form shapes light and changes its directional qualities. The study was a qualitative in that it used as a criteria the distribution of light relative to the reading task rather than the quantity of light: "a shadow-free, diffuse light was obtained-ideal for the reader who could take his book to any point in the room without being bothered by shadows or stark sunlight." "

## 2: FORM



There are many definitions for the word form. When it comes to design, form is the character and meaning of shape defined by light. When an object is illuminated, its form is a visual shape of mass and volume. The manner in which light renders mass defines the essential relationship between architecture and light. The perception of form is translated through the direction and intensity of light. The contrast of light and shadow also helps us to perceive form. A shape can be refined or redefined by altering the light it receives. Form remains constant; light changes. Light gives vivid movement in an otherwise visually stagnant world.

Jewish Museum, *Daniel Libeskind*:

To view Daniel Libeskind's Jewish Museum in Berlin is to be immersed in one giant sculpture. The zinc zigzagging façade of the building and its constellation of skewed windows begin to project the dynamic form and quality of light encountered inside.

The building is entered through a historic Baroque courthouse structure called the Kollegianhaus. From there a stair burrows down into the main building which is entirely sheathed in zinc. This metal cladding, which is presently still unoxidized, is expected to weather into varying shades of blue and green.

Inside the building Libeskind designed a series of underground pathways. These pathways which he refers to them as "streets" connect the various spaces within the complex. Just as people now from all over take the pilgrimage to this museum, a smaller yet more profound pilgrimage is experienced within.

One of the streets leads to an outdoor garden below grade. The Hoffman Garden is said to represent the exile and emigration of Jews from Germany. Forty-Nine enormous pillars occupy space on a sloped grid within a concrete enclosure. At the top of each pillar stands one massive oak tree planted in German soil except for one that contains soil from Israel. One could argue that the space not only evokes emotional disorientation but also disorientation in time with the skewed scribing of daylight against the unworldly lean of the pillars.

Another street leads to a memorial called the "Holocaust Void." The space is uniquely raw in the sense that it is uninsulated and non-climate-controlled. Entering the "void" with the heavy door closing behind is to experience a sense of internment. Even the floors are finished rough as to create an uneasy audio ambience of scraping metal. The hard and angled surfaces of the walls work to amplify the sensation of confinement. To bring it all together visually, Libeskind leaves the room windowless except for one vertical strip where light is allowed to penetrate from high above. This light is specific and in a very real sense an object that starts to pierce at the very core of the observer. Because of the light's acuteness the form of the room is rendered with remarkable contrast where the gradient of light to dark seems to disappear all together. You cannot help but to be aware of your occupation and more importantly your presence in the space of light and sound.

2: SURFACE



Do we see light? I will suggest that we do not. We only see the residual evidence of the existence of light through the surfaces it affects. There are two categories of light we can sense. Among these include surfaces that emit light, such as lamps, fire, and the sun. One must realize that light cannot exist spontaneously. It is a product of a greater fundamental reaction in which light it produces is seen only through a medium. Light also exists through surfaces that reflect and scatter light. The moon is an excellent example of a light reflecting surface. Everything from metal, rock, and organic surfaces reflect light and they begin to define the qualities of spaces that surround us. Surface is form unraveled.

Kimbell Art Museum, *Louis Kahn*:

The Kimbell Art Museum is located approximately two miles from the center of downtown Fort Worth. It is situated on a 9.5 acre park and faces west looking out onto an expansive lawn and parallel rows of trees.

The approach to the building was carefully articulated by Kahn. If coming from the south, one passes a grove of crape myrtle and a sunken sculpture court on one side and, on the other, sculpture, trees, and greenery. If coming from the north, the approach leads one past the sunken service court which is screened by a low wall to the left and densely planted scrubs and trees which exist to the right. In each case, when the portico is reached, there is a reflecting pool with the sound of spilling water over an edge, which is in alignment with the first row of yaupon hollies screening the museum entrance.

This relatively low building consists of a series of repeated units each over 100 feet in length. The roof structure of the upper floor is composed of concrete vaults which are cycloids in section. Light is emitted into the galleries in a number of ways. The most distinctive of these is a sophisticated skylight system on the apex of each vault. Internal courtyards and light slots also serve to bring in light, depending on one's location in the building. Eight-foot channels between the vaults house vital service elements and divide the units. Along the sides of the metal soffits that cover the channels are keys used for attaching moveable walls. Thus the spaces in the museum are extremely flexible

and can accommodate various installations and exhibitions.

In the Kimbell, Kahn establishes a strong sense of grain to the architecture, but it is the views across the grain that enrich the experience of the museum visitor. Natural light bouncing off the metal reflectors and shimmering on the concrete ceiling creates a special setting both visually and psychologically. Standing in the museum's forecourt, Louis Kahn explained himself:

"My mind is full of roman greatness and the vault so etched itself in my mind that, though I cannot employ it, it's there always ready. And the vault seems to be the best. And I realize that the light must come from the highest point where the light is best in its zenith. The vault, rising not high in an august manner, but somehow appropriate to the size of the individual. And its feeling of being home and safe came to mind." "No space, architecturally, is a space unless it has natural light...I am designing an art museum in Texas. Here I felt that the light of the rooms structured in concrete will have the luminosity of silver."

The Kimbell reveals a certain beauty in order that is apparent in all good design. In terms of light, Louis Kahn develops a system in which the vaulted concrete surfaces capture the brilliance of the regional light of Texas. A smooth surface resulting from good formwork was critical in its success in lighting the space. In the end the hierarchy of the museum was built primarily around a single system which

### 3: OBSERVER



There was a time in history where the light we carried defined the room around the body at night. The body took part in the lighting of space and with it comes the constant awareness of place. We see by touching and feel by seeing. We are constantly being bombarded with sensory information and often they seem to blend together to enhance our subjective judgment. Light gives us such wonderful opportunity in the visual world to stir the senses and create new relationships between sight and emotion.

## Ronchamp, *Le Corbusier*:

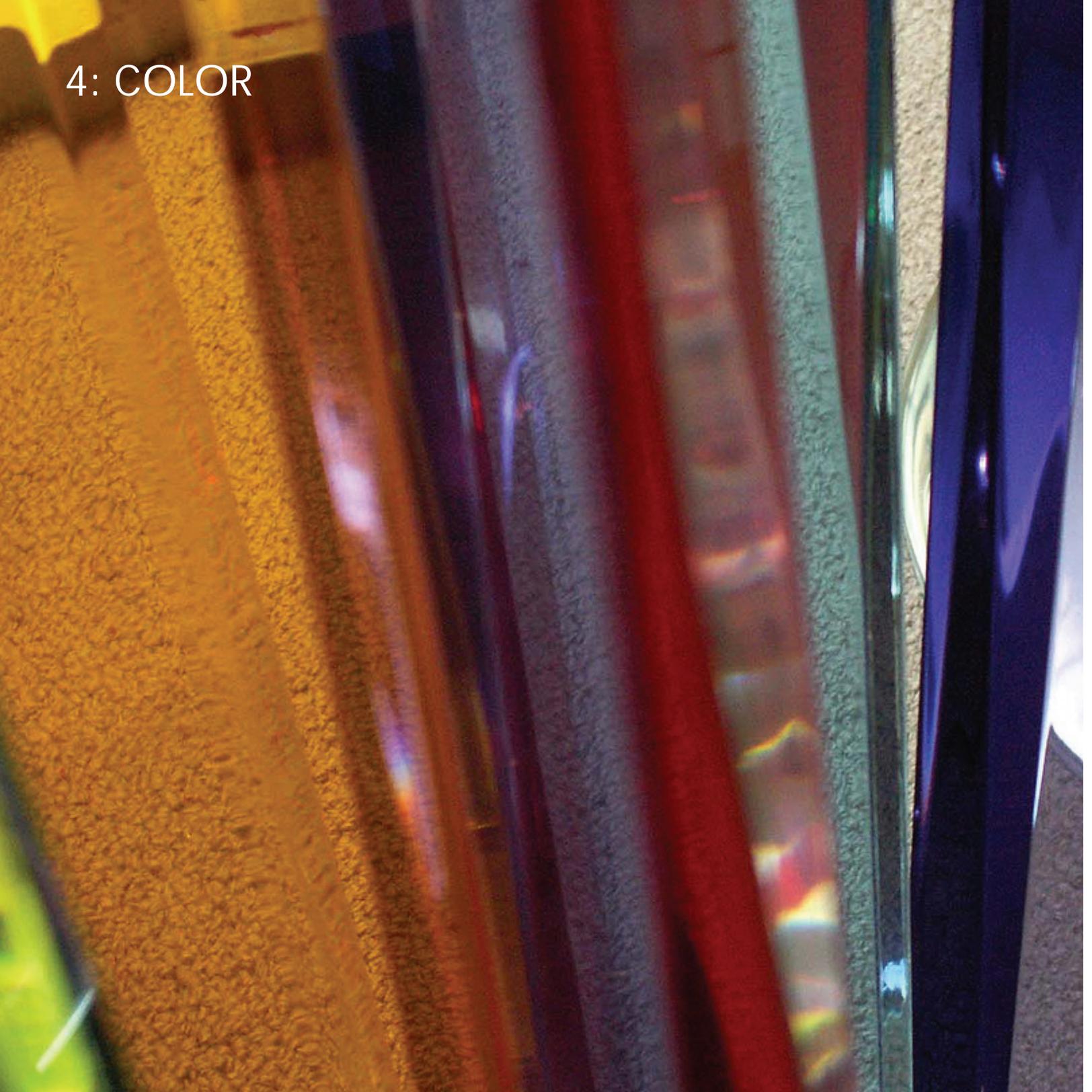
Since the thirteenth century, Notre-Dame-du-Haut located in Ronchamp, France, has been a spiritual magnet for many generations. The church rests atop a hill in country-side far from the urban churches in France which share its sacred ground with the chaos of the profane city. Delineated by topography, its sacred and commanding site enables Le Corbusier to express the connection to nature and light through the form of the building. The exterior of the church reveals a sort of playfulness in the form and the scale. One could say it's rather ambiguously organic in its design, but upon further inspection you come to realize the genius in its structure and the way it deals with light.

From the inside a tiny sliver of light separates the main curved roof from the walls. Under different circumstances this massive column-less truss roof would most likely compress the space beneath visually. However, by putting a small light reveal where the roof and walls usually connect, Corbusier creates the opposite effect of weightlessness. The roof and the walls are enhanced as elements through separation. The observer in turn participates in the awareness of space and in way becomes a component to the architecture.

The main Source of the interior light is the south wall, which contains window-like volumes chamfered in section towards the inside. The wall is quite deep in section, so the chamfered voided volumes allow for light to mature in the thickness of the wall before hitting the altar. Looking

at the apertures from within, the volumes of light seem to float in space through contrast. Le Corbusier uses the contrast of light and darkness and also the contrast between the colors of the openings against the whiteness of the church to reveal something more wondrous than they would operating individually. The light in this space envelops the observer in a sea of visual awe through its creative focus and in an emotional sense it starts to illustrate the greatness of God.

4: COLOR



Light is made of color. Evidence of color is first exposed by things in nature. The passing of day reveals the color of time. Constantly changing from yellow dawn, blue day, to reddish orange dawn, the sky is the universal palette that connects the world. In terms of architecture, color also has to deal with location on site. Rooms facing the north tend to have cooler reflected colors while the southern facing spaces receive warmer colors directly from the sun. There are many experts in color throughout history. Among the most notable ones include, Sir Isaac Newton, Joseph Albers, Johannes Itten, and Goethe. Newton was the first to discover the spectral colors in white light in his experiment with a prism. Both Albers and Itten taught theories on color at the Bauhaus. In their work, the entire color spectrum was laid out formally in a series of wheels and diagrams. They also studied the relationships and interactions between colors and how they affected people. Goethe's work focused on the color of shadow. He revealed the phenomenon of shadows having color, particularly at the edge. It is interesting to think about light, seemingly one of the most basic of elements, as having the diversity of color in its inherent make-up

## Chapel of St. Ignatius, *Steven Holl*:

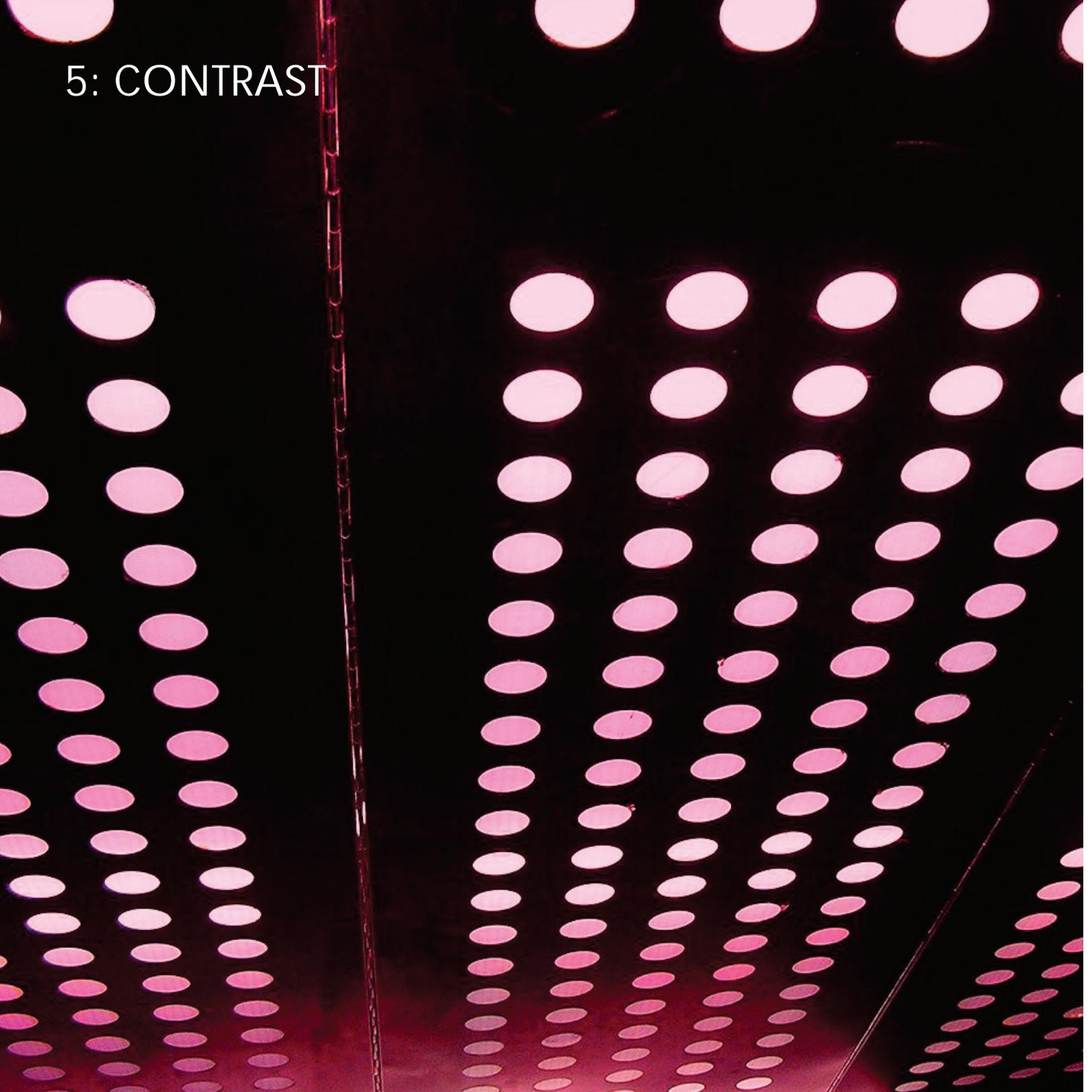
Steven Holl describes the Chapel of St. Ignatius at Seattle University very simply: a stone box, containing seven bottles of light. St. Ignatius, the university Jesuit founder, was Holl's inspiration for the design of the chapel. The saint's writings described spiritual life as a series of lights and darkneses and used the metaphor of a light that comes from above as a manifestation of the divine. The design of the chapel incorporates skylights and colored surfaces, to create seven qualities of light, corresponding to the different programmatic elements.

The seven lights are as follows:

1. Procession: natural sunlight
2. Narthex: natural sunlight
3. Nave: yellow field with blue lens (east); blue field with yellow lens (west)
4. Blessed Sacrament: orange field with purple lens
5. Choir: green field with red lens
6. Reconciliation Chapel: purple field with orange lens
7. Bell Tower and Pool: reflecting colors at night.

Like Le Corbusier's church at Ronchamp, the Chapel of St. Ignatius uses colors to offset the white surfaces of the church. The major difference however, is how the two architects mediate the color into the space. At Ronchamp the natural light is transmitted through the stained glass windows of the south wall filtering the white light into color when it reaches the interior. Steven Holl took a different approach to revealing the color. Not only does the natural light filter through a colored "lens", he also allows the light to enter the volume of the skylight. There the natural light picks up a majority of its pigmentation by way of reflection off a colored surface. The resulting colored light is subtle yet uniquely rich and powerful in its effects.

# 5: CONTRAST



Contrast is the vehicle in which we judge our environment. We see, touch, feel, taste, and smell through contrast. Something is smooth only in reference to our memories of rough. And why is something rough visually? Yes part of it has to do with our sense of touch, but that memory is also linked to our visual senses. A surface is rough because it is a receptacle for light revealed by the darker pixels that are associated with it. We are sensitive to qualities only through their counterpart. The way we see light is no different. Light exists in accordance to darkness and vice versa. It is this variety in our environment that stimulates us and keeps us continuously aware and mentally vivacious.

## Church of Light, *Tadao Ando*:

Tadao Ando's Church of Light located in Ibaraki, a small residential neighborhood 30 miles outside of Osaka, Japan. The building is quite humble in appearance as a concrete cube with only one wall intersecting through it at a 15 degree angle. The heavy cast-in-place walls help separate the religious experience inside the small chapel from the outside world. Like many of Ando's Work, the use of concrete as a material functions to shield the sacred from the profane.

The experience starts with worshipper making his way past the existing minister's house, to the back of the concrete church. The intersecting walls create an entry forecourt, forcing the visitor to take an S-turn to enter. Once confined inside, the space is under the control of the glowing cross at the end of the nave. The dominance of the cross is paramount in the church, requiring the pastor to preach from one side, which took some convincing on Ando's part. The interior is perhaps claustrophobic, with views to the outside only available through the 8 inch cruciform gap on the western wall which ultimately casts its anti-shadow on the wooden floor. The darkness of the space is only heightened through the acuteness of the cross through contrast. Ando focuses the attention of worshippers to the altar by using light as a material. In this case the light and the cross are one in the same giving a profound sense of the divine embodied in light.

Ando's Church of Light was a very low-budget affair, where the starkness of the interior was a necessity, and not so much an aesthetic choice. Even the pews of the church are made from the concrete formwork. In the end, the quality of light in the church is a result of simplicity through its form. Its visual power is defined through the synthesis of darkness and light.

## 6: CONCLUSION



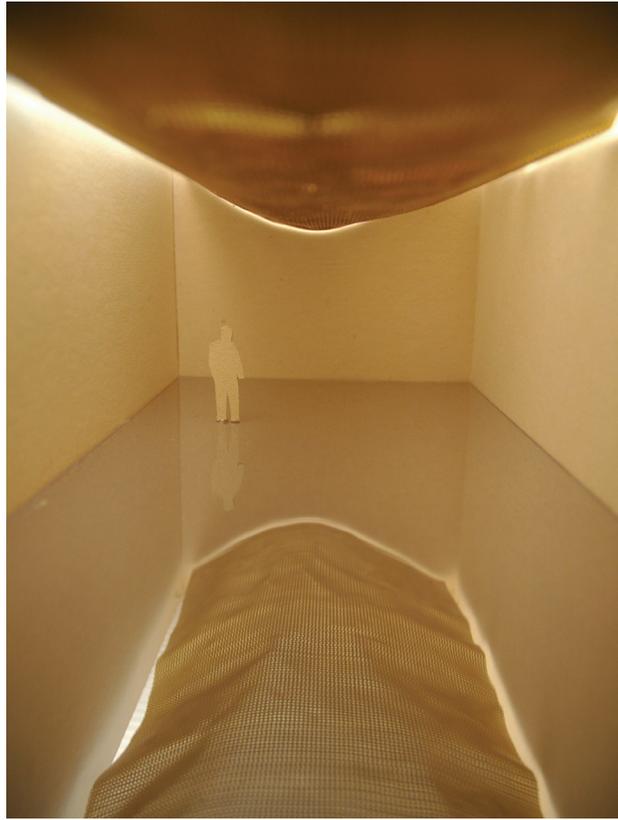
Light can be defined through layers much like architecture is defined through space. The layers of form, surface, the observer, color, and contrast all work together to bring architectural space a sense of visual tactility that appeals to the human condition and the variable of time. The program of a space should always be in direct correlation to the program of light. As an observer, we can sense whether a space has too little light or too much light. As a designer, we not only have to account for the right quantity of light, but also the quality light used for a particular function in a space. It is through the careful study and application of each of the specific components and layers of light that space becomes place; a place that enriches and defines the places for viewing, thinking, and worshipping to name a few. Light gives space meaning.

## Light Volume Studies:

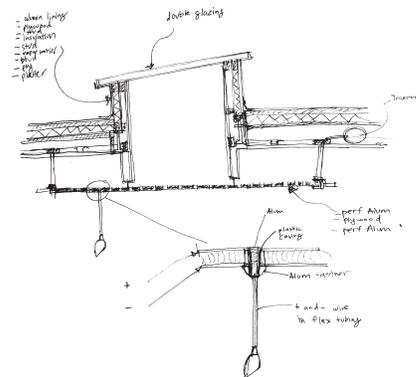
Early model studies dealing with the volume and the shape of light. In each case a suspended perforated ceiling was used as a medium in which light can be seen as an object. In the "shape of light" studies the depth of the screen and the shape of the skylight above were varied, by doing so the amount of light entering the space can be adjusted. This also allows for a smoother transition from daylighting to artificial lighting because both types of light would enter from the same space.

In the "volume of light" studies the perforated screen changed in section allowing the light to morph in volume as time passes. In this case, light takes an even stronger presence in the space. The passage of time is scribed by the change in shape and texture.

Light therefore becomes material. It is a component of space because it is an element within that space through shape and volume. The factor of time that is so innately imbedded in light's character can be revealed in the properties of a medium. These properties include, texture, surface, and form.



*Volume of Light*



*Detail Sketch*



*Volume of Light 2*



*Shape of Light 1*



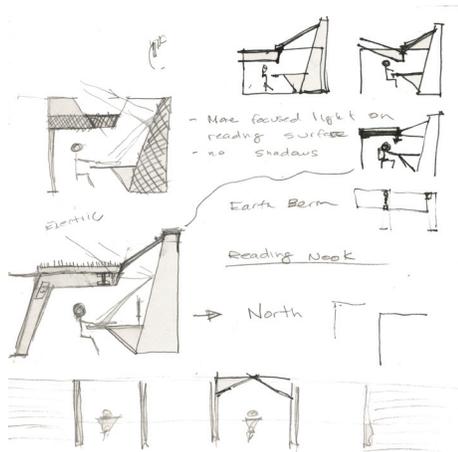
*Shape of Light 2*



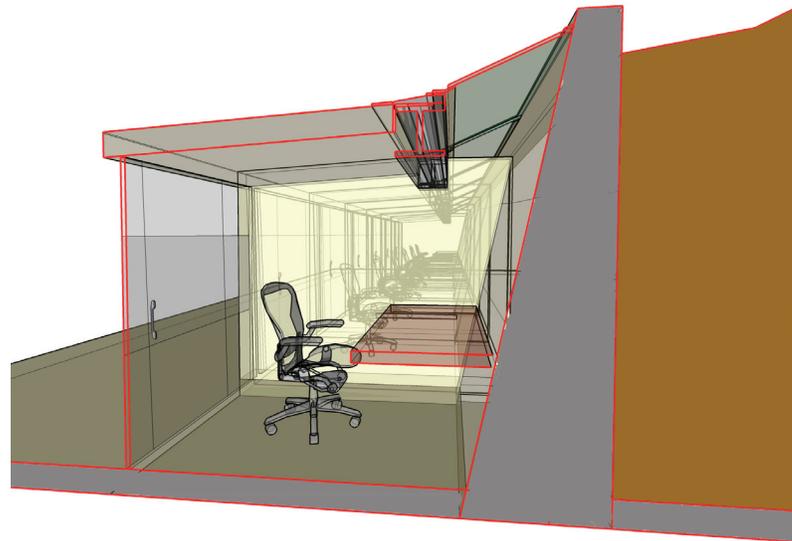
*Shape of Light 3*

## Reading Light:

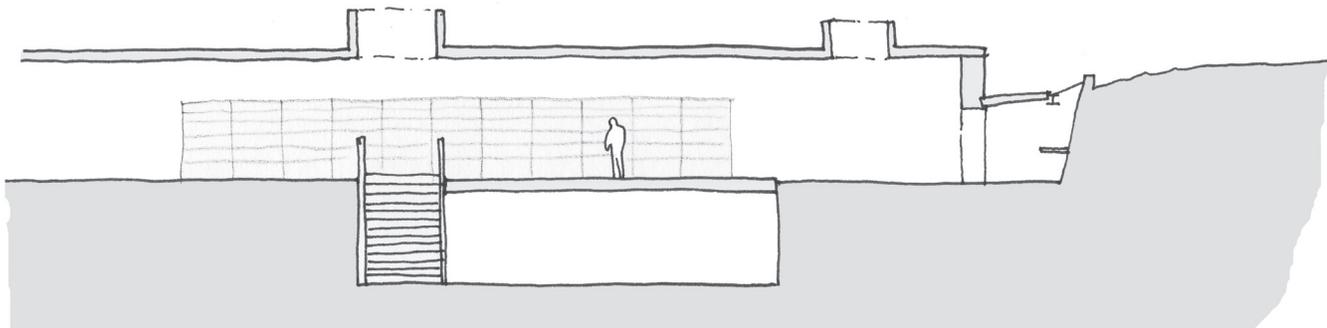
A series of individual studying rooms face north in a rare books library. The concrete retaining wall holds back earth and also reflects light onto the reading surface from the skylight above. I-Beams span through each room providing support for the roof system as well as housing supplemental lighting in its section. Partially frosted glass give privacy, but also reveals occupancy.



Sketches



Detail Section



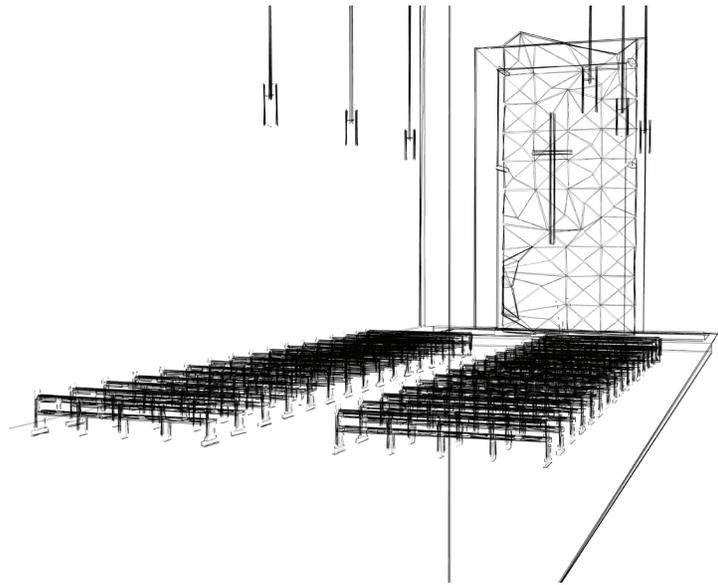
Section



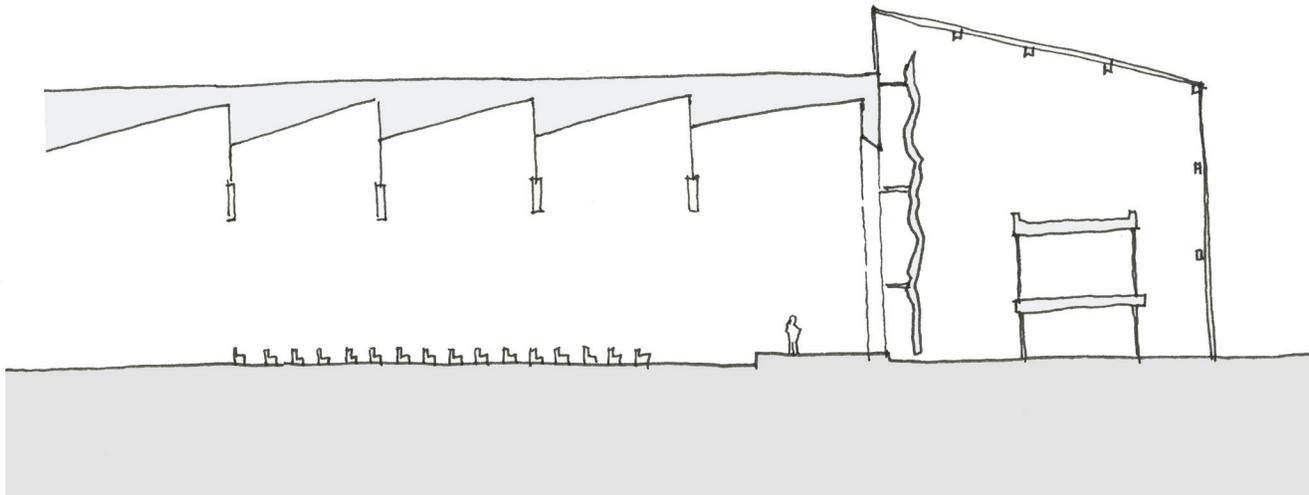
*Interior Rendering*

## Holy Light:

This church design draws inspiration from the various sections on light. A textured copper surface is set back at the altar from a simple black slate box. Light enters between the surface of the copper and the outer edge of the box. The result is a surface enhancing light that focuses the worshipper's attention towards the altar. The surface changes in complexity as time passes and is only amplified by the dark simplicity of the enclosure. The copper wall is slightly polished to reflect images of observers at certain times on surfaces that fall in shadow.



*Sketch*



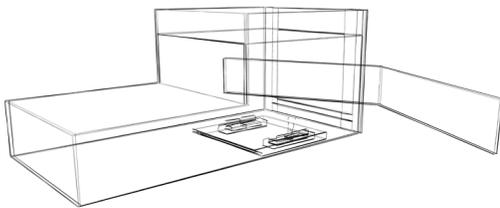
Section



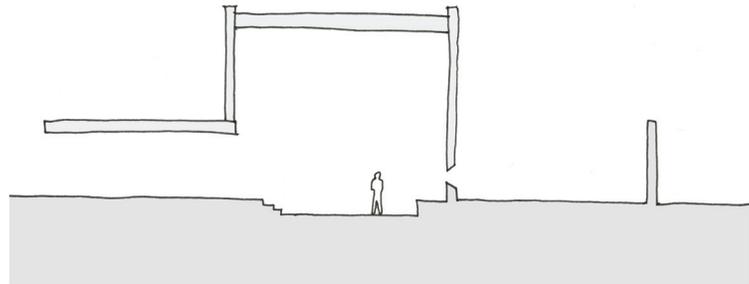
*Interior Rendering*

## Framing Light:

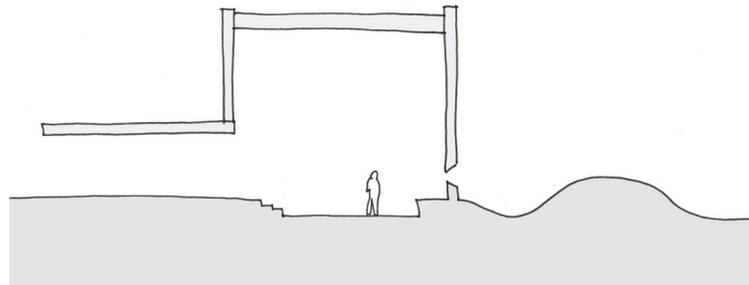
A low profile window is set low to the ground in a tall space that frames the north view towards the exterior. The room is given a greater sense of gravity because of the position of the window and also the stark contrast in light within the space. There was an investigation in the position of the ground plane and the light reflecting surfaces as well. The idea was to experience a space beyond a space and capture time through a window amplifying the colors of the sun through organic and inorganic surfaces.



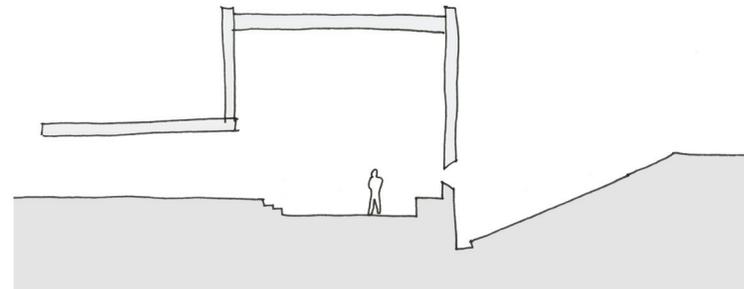
Sketch



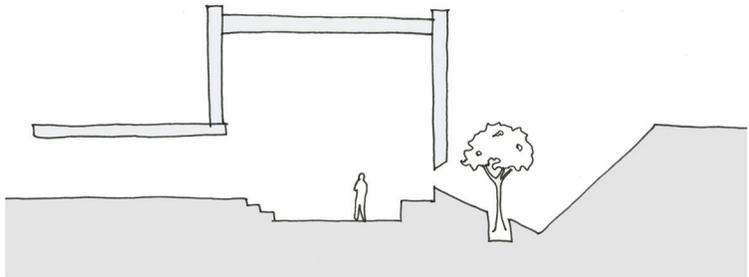
Section with Wall



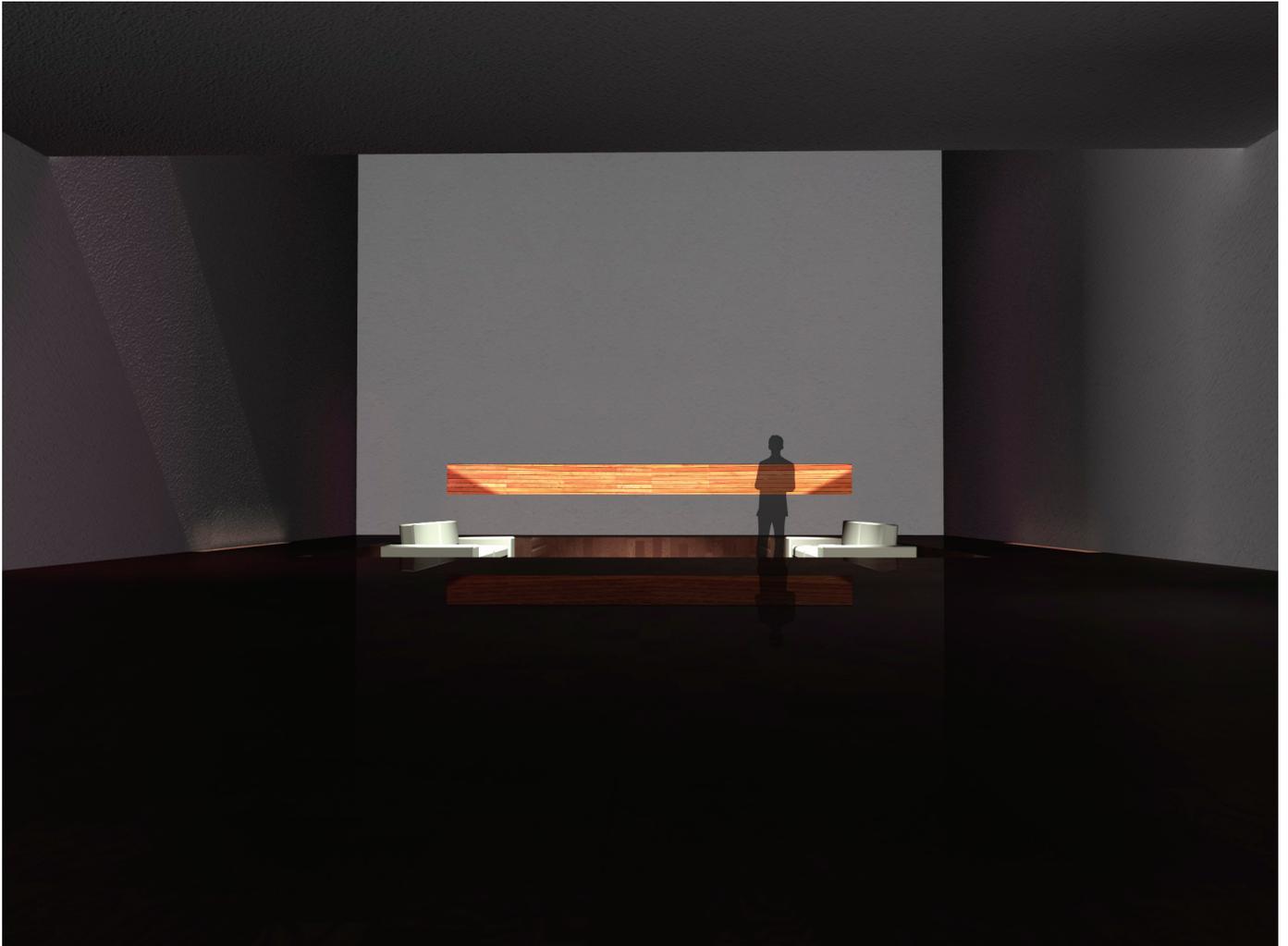
Section with Grass Berm



Section with Slope



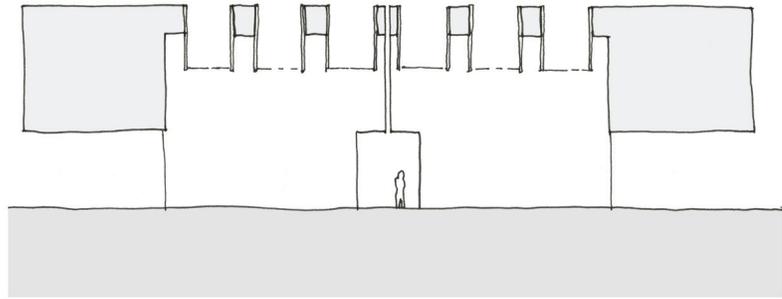
Section with Foliage



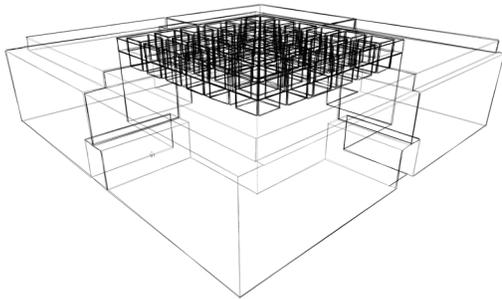
*Interior Rendering*

## Ambience and Colored Light:

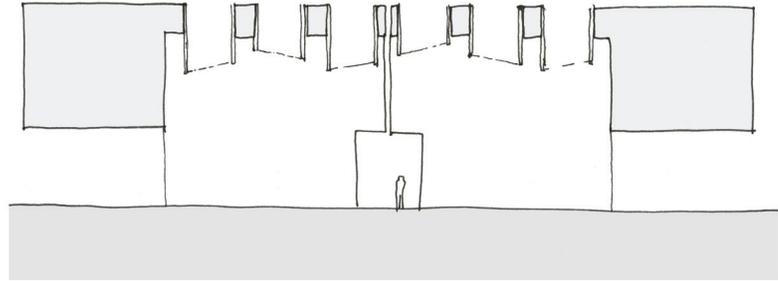
A series of frosted panels individually hung in concrete cells to create an ambient surface of light that changes with the sky. The form of the ceiling of the sculpture gallery can change depending on the depth of each panel fitted. Secondary colors can be introduced in the space to create a layering of colors for different types of exhibitions. If this ceiling skylight system occupies more space and spans greater distances, the movement of the clouds would be captured on partly cloudy days.



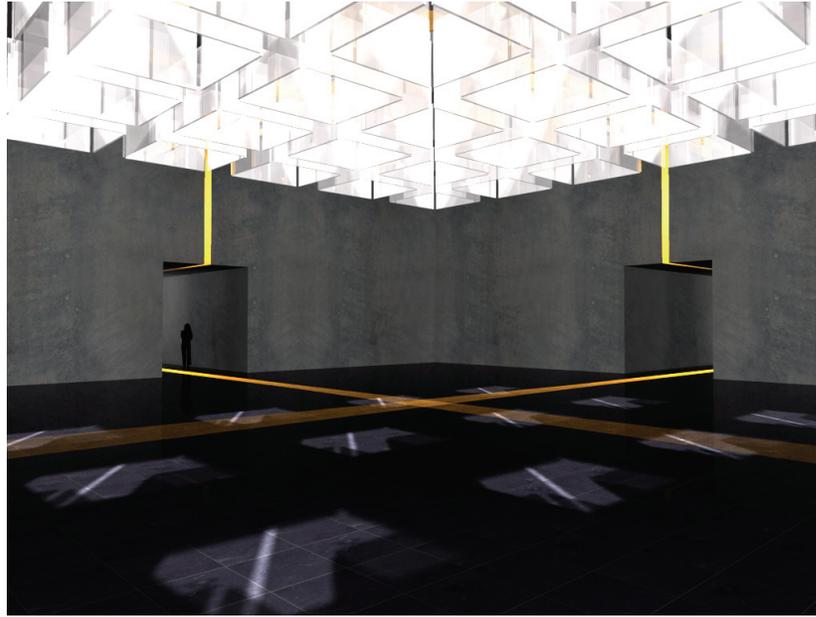
Section 1



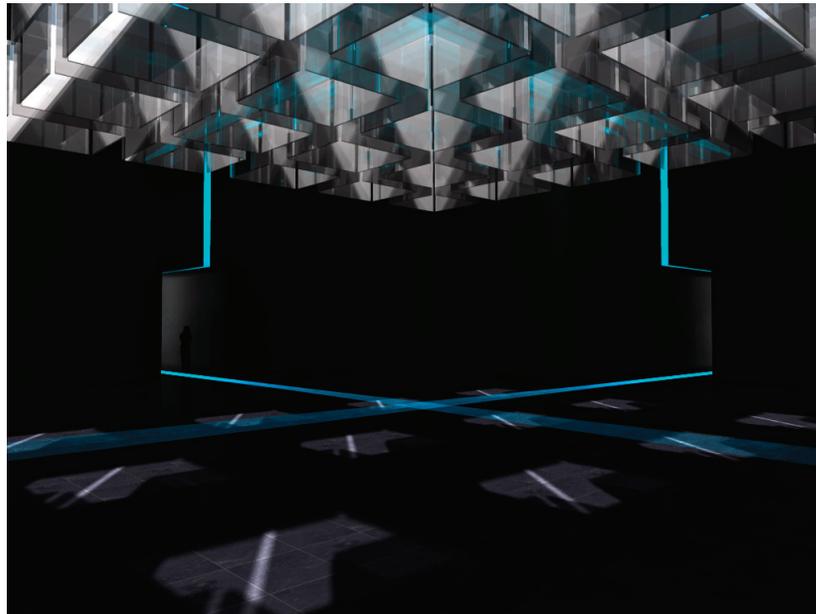
Sketch



Section 2



*Ambient Light During the Day*



*Colored Light at Night*

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