I, Emily Elizabeth Hikade Stribling, hereby submit this original work as part of the requirements for the degree of: Master in Architecture.

It is entitled: Light, Color and Texture: How the Physical Environment Can Aid the Treatment of Cancer

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Light, Color and Texture: How the Physical Environment Can Aid the Treatment of Cancer

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Abstract

While medical centers have historically been understood to be sterile, cold environments, today there is a movement toward a more natural, comfortable place to heal. Though this has greatly improved the experience and recovery time of patients, those dealing with cancer are more likely to experience more frequent and extended stays in the hospital. An additional level of design can be implemented that provides an atmosphere that enhances this experience through the handling of light, color and texture; these manipulations allow patients to alter their environment to confront the emotional and mental aspects of their treatment along with the physical. Through these filters of light, color and texture, this thesis seeks to contribute to an already established cancer center, the Lemmen-Holton Cancer Pavilion in Grand Rapids, MI, as a physical place in which patients can meditate upon their experiences and come to terms with their emotional, spiritual and psychological selves while undergoing the ritual of their treatment. The outcome of this project will be an addition for the Lemmen-Holton Cancer Pavilion that gives patients a physical place to confront their treatment; this will be an infusion center where they can manipulate the intensity of light, color and texture to reflect the particular emotion they are feeling, which can allow for treatment to take place physically, emotionally and spiritually through interaction with their environment.
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Chapter 1: Introduction

Why do some places resonate within long after experiencing them while others quickly fade away? I have always been drawn to architecture that transcends the program. By looking at specific buildings, this thesis will analyze and respond to different aspects that contribute to the sublime quality they generate. The main principles it will focus on are light, color, and texture. Ritual will also play a role in the design of the space. Through the investigation of these variables, understandings will be drawn and tested to develop a design methodology for the creation of a healing place, in this case a place for cancer patients to heal their minds, bodies, emotions and spirits through their interaction with and control of the surrounding environment.

This thesis consists of precedent studies, research and application to make conjectures regarding the impact of light, color and texture on our environments as well as our responses both physically and emotionally to them. Precedents studied are the St. Ignatius Chapel in Seattle by Steven Holl, the Kimbell Art Museum in Fort Worth by Louis Kahn, and the Rothko Chapel in Houston by Philip Johnson with Howard Barnstone and Eugene Aubry.

The Japanese tea ceremony is also examined in this thesis because of the strong connection to the ritual taking place in the ceremony, which relates to the process of receiving treatment for cancer; the sheer number of treatments received by patients take healing to the level of ritual.
Light
Light is the primary focus of this thesis. Each category that follows is explored as a supplementary study in addition to light. Light control and intensity is manipulated in three ways: first, as it is filtered through a screen, second, as it enters through an aperture, and third, as it is brought into a space through a light scoop.

Color
Color was studied both alone and in addition to light. Alone, there are physical responses our bodies experience in relation to particular colors as well as emotional associations we each hold for particular color combinations, saturations or hues. Combined with light, color allows for a greater intensity in its impact on the environment.

Texture
In this thesis, texture is subservient to light. It is a vehicle for adding or subtracting intensity of light as well as the enhancement of light quality. Texture provides a receptacle with which to receive the light.

Photograph by Author.

Chapter 1
Chapter 2: Theories

Light

Louis I. Kahn dubbed light as, “the giver of all presences.” While a very simple statement, it has immeasurable depth and illustrates just how important light is to architecture. Light allows us to see structure or materials; shadow is the result of light’s interaction with these. Natural light connects the inhabitants of a place with the outside, the natural world, and alerts them to the movements of the clouds, the weather and the passage of time. Natural light gives life to a room; it allows one to experience it in different veils from one part of the day or year to the next.

Kahn’s famous speech, “Silence and Light,” discusses the importance of natural light to architecture while expressing the necessity of reducing the architecture to its essence, or the intrinsic nature involved with each program inhabiting form. Kahn explains that artificial light removes us from a shifting, sensual environment and places us in a homogenous, static one. Our desire for more control over interior light quality removes us from the constant variation enriching the natural environment our bodies are used to inhabiting. The human body feels more comfortable and engaged in an environment that is more akin to how natural

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environments are; this is not to say we need to design an artificial “natural” environment, rather we need to create an environment that subtly shifts and changes throughout the day in a way similar to the way it does in nature. This stresses the importance of natural light in design; it connects us with the outside world and gives the constant variation in light we desire without added mechanics and our own interpretation of what a natural light should be. Kahn says, “the most wonderful aspects of the indoors are the moods that light gives to space. The electric bulb fights the sun.”

Juhani Pallasmaa devotes a portion of his book, “The Eyes of the Skin,” to “the significance of the shadow;” he states that “deep shadows and darkness are essential, because they dim the sharpness of vision, make depth and distance ambiguous, and invite unconscious peripheral vision and tactile fantasy.” Later, he goes on to say that “the shadow gives shape and life to the object in light.” Uneven distribution of light adds a level of intimacy to our spaces and gives a space more akin to how we’re naturally inclined to experience the environment around us. Pallasmaa explains that, “in emotional states, sense stimuli seem to shift from the more refined senses towards the more archaic, from vision down to hearing, touch and smell, and from

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2 Ibid 231
light to shadow. This means that when we are in a state of heightened emotions (in this case, when battling cancer), we revert to core senses and desire a space that is not homogenous and evenly lit. We crave a space that has varying intensities of light and areas that are bathed in shadow; it gives us a sense of privacy as well as a place to contemplate our personal thoughts in peace.
Color

Color is the next filter explored, and is done in a way that adds to the previous studies of light. The areas of color focused on are hue, saturation and intensity. An initial study intended to explore Steven Holl’s use of complimentary colors through colored lenses and reflected surfaces was done with a model that had interchangeable lenses and surfaces to examine the various effects that could be produced. Using complimentary colors, the light coming into the model shifts from one color to another as the light moves across the space; a room that is swathed in red light when the light angle is low transforms to green as the angle rises. According to Steven Holl, complimentary colors were used in the St. Ignatius Chapel because of they form the afterimages of each other; for example, if one looks for a length of time at a blue square and then at a neutral surface, the image of a yellow square is seen on the neutral surface. Holl used this relationship as a physical representation of the phenomenological motives of the chapel, especially as a vehicle to connect the parishioners with the outside phenomena of the sun moving across the sky and the seasons changing, while also furthering the impact of his concept of bottles of light in a concrete box.

Color has the ability to affect our emotions. One of the important revelations found in Birren’s work is the importance of sequence in relation to the impact of color. In fact, Birren predicts that, “it may well be that carefully controlled changes in light intensity and changes in color will prove more normal and therefore superior to the static values recognized today.” This conclusion is drawn as a result of our eyes being accustomed to seeing colors shifting and changing constantly throughout the day. A color scheme that alternates rather than remains static is more akin to how we experience the world around us, thus more reflective of how we physically and mentally expect our surroundings to be. According to Birren, “no human sense – including vision – can respond consistently to fixed stimuli.”

Munsell Color System for categorizing color based on Value, Chroma (Saturation) and Hue (Color). These three variables are the means for analyzing the color used in each precedent as well as the final project. Hue is the actual color used. Value refers to the amount of black added to that color; that is, how dark that color is. Chroma categorizes the extent to which the color is saturated with the value of black; this means the intensity of the color.

5  Birren 207
6  Ibid 261
Texture

Texture has the ability to bring about a memory of a past experience; Marcel Proust used an analogy about time transcending experience while walking on cobblestones. When one walks upon the stones at the Baptistery of San Marco, the experience takes one back to another time walking on the stones in the Guermantes courtyard; both experiences are the same because the texture makes it so. Time ceases to matter; it is the same and both experiences are happening at the same time. This can be beneficial in designing a space for treatment because specific textures can transcend current experience and take the user back to another time, allowing for a mental escape from the present.

Louis Kahn used materials for their textural qualities and glorified the impurities and marks in their surfaces. “Material was made to cast a shadow, and the shadow belongs to the light.” What Kahn meant by this was the primary purpose of texture is to receive light and to give it depth, adding another layer of information and richness to the light itself.

Juhani Pallasmaa covers “Materiality and Time” in his book, “The Eyes of the Skin.” Pallasmaa says that natural materials show age and depth in their grain and variation; they also have a scale. His criticism

8 Twombly 236

Chapter 2
for today’s architecture is the lack of scale in it. The selection of materials that will not show wear is a reflection of our fear of death. The homogeneity in our current architecture removes personality and the variation we desire in our surroundings; an environment that subtly changes as we experience it is engaging and vital for our comfort.

Steen Eiler Rasmussen’s book, “Experiencing Architecture,” was the precursor to Juhani Pallasmaa’s book; Rasmussen devotes a considerable amount of this to discussion of texture. He describes materials as possessing hardness or softness, heaviness or lightness inherent in their nature, and we must be fully aware of these distinctions to understand architecture. He also goes on to discuss our being able to recognize these qualities without physically touching them, which allow us to distinguish the difference between concrete, stone, brick or clay with purely the naked eye.

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Chapter 2
Chapter 3: Case Studies

St. Ignatius Chapel in Seattle

The design concept for the St. Ignatius Chapel was inspired by St. Ignatius’ written spiritual exercises, which take place over a four week period and are intended to “overcome oneself and for regulating one’s life without being swayed by any inordinate attachment.” In other words, the exercises are meant to bring one into greater spiritual balance with regard to personal values in an effort to overcome earthly desires and lead one’s soul to ultimate salvation. Holl’s techniques in the St. Ignatius Chapel highlight the ceremonial aspects in an unquantifiable way. St. Ignatius uses a metaphor of light, “the light to perceive what can best be decided upon must come down from above,” to illustrate the importance of divine reverence in life. This metaphor inspired Steven Holl to design the chapel with the theme of “a gathering of different lights,” stressing the relationship to St. Ignatius’ metaphor for spiritual rejuvenation. Holl took the seven sacraments and allocated each to one bottle of light in the chapel’s “box.”
Light

The St. Ignatius Chapel consists of a series of light wells that bring light in from above; the light is bounced off a surface, filtered through a lens, or falls directly on the surface itself.

Holl used the direction of the light entering the chapel to generate different effects created by the varying types of sunlight that occur throughout the year. Also, to enhance the light qualities he wanted to achieve, Holl hid artificial light behind the surfaces in case the natural light was not bright enough to produce the desired effect.

The primary worship space is illuminated by east and west light, the east light fills the narthex and the procession. As the sun moves across the sky, shafts of light shift along the walls creating a subtly changing palette throughout the day and year. Direct light comes into the main worship space at the baptismal font and on either side of the altar.

The chapel uses techniques found to be successful through explorations in erased charcoal as well as in physical models (discussed later in this document) for this thesis relating to light; the relationship to the sun’s movement across the sky is emphasized by the carefully selected openings that trace its path throughout the day. Holl’s use of surfaces that block direct light while allowing indirect to filter around them embodies both Louis Kahn’s and Juhani Pallasmaa’s writings on the importance of a dark shadow (the surface) to give more...
power and magnitude to the light filtering out from behind it. This provides an ethereal glow that has the mystery of a concealed source, which heightens the connection the celebrants feel with the supernatural reasons for their visit.
Color

Color is used sparingly in the chapel; the light filtered through lenses and reflected off the surfaces are the primary source for the color fields moving across the plain white walls of the chapel. The walls are a shade of white to allow for the undistorted reception of the color patches that move across them throughout the day.

Holl uses complimentary colors in the chapel; a red lens is used in conjunction with a green reflective surface, a purple lens with an orange surface, a blue lens with a yellow surface, and so forth. This complimentary connection was chosen because “when people stare at a blue rectangle and then a white surface, they see a yellow rectangle.” His use of complimentary colors is done to visually articulate the connection between his ‘gathering of different lights’ concept and the phenomena of the sun and changing light conditions.

Complimentary colors are extremes, yet Faber Birren believes we have the greatest preference for complimentary as well as color combinations that are closely related. The color combinations Holl used also, being complimentary, contain both warm and cold spectra, which gives the tension and shifts from warm to cool to warm that are necessary for our natural comfort within our environments. Variation is what we are accustomed to in our surroundings, which is provided in the St. Ignatius chapel through Chapter 3.
a constantly shifting palette of colors. Not only is this palette shifting constantly, it is also a subtle change. Birren stresses the importance of this change by saying, “when [the use of color] is overdone, when the colors chosen are too bright, the combinations too “dramatic,” the effect may be wholly out of place, and the observer may actually be distracted from his tasks or made uncomfortable in his environment.”

Subtlety is vitally important for a successful use of color variations, and variations are necessary to create a more natural, comfortable environment.

According to the Munsell system, Holl uses

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Birren 256


complimentary hues that are high in value and chroma. This means little to no shading has occurred (the color is not darkened) and the color is further out on the chroma portion of the diagram, which means it is more pure a tone of color. These pure tones are ideal for filtering light through when they are lenses or reflecting light off of them when it is a colored surface. The more grey added, the less reflective the surface is.
Texture

The most notable texture of the chapel is the raked plaster walls. These enhance the impact of the light as it washes the surface, calling attention to the light itself by highlighting it with texture. They catch the light coming in through the openings. Great care was taken in material selection. The texture Holl used in his chapel is subservient to the light and used in a manner to more greatly intensify the light washing the walls. The effect of texture on light, such as the light entering from above and reflected on the polished concrete floor is more important than purely for the sake of the haptic sense of texture. The highly polished floors echo the patterns painted with light above and provide an additional layer of depth to the impact of the illumination. In the chapel of the tabernacle, an additional layer of texture is used; beeswax is dripped along the walls, giving them a delicate sheen and distinctive smell. The light is more faceted as a result.

Holl's use of texture gives the chapel a thickness as well as calling even greater attention to the light filtering through and behind the panels. Not only do the raked plaster walls catch the light as it moves across them, they also give the light a dappled effect that would otherwise be a smooth surface; this adds to the power given by the constantly shifting light. My erased charcoal explorations in texture (shown later in this document) indicate his specific use of texture.
aids the success of his project by shifting the light in a more nuanced fashion over the course of the day. Faber Birren describes the importance of our being in environments that subtly vary around us; static environments are uncomfortable for us to be in. After World War I, people suffering from “shell shock” were put into rooms that had “colors of brilliant intensity arranged in garish patterns;” the variation in their surroundings contributed to their healing by matching the complexity of their psychological issues. This explains the discomfort we feel in neutral, unchanging surroundings, such as a uniformly lit, colored and textured office space.

11 Ibid 261
Rothko Chapel in Houston

The Rothko Chapel is essentially one room that houses paintings by Mark Rothko; it was built as a non-denominational place of worship and reflection for those wishing to come and pray, meditate or simply gaze at the paintings and get lost in thought. The room is minimally ornamented to lessen distractions for the visitors, and the furniture is sparse, only a few simple benches, cushions and mats for gazing and meditation. The chapel holds fourteen paintings by Rothko, each painting a layering of several different colors. The focus is meant to be on the paintings, which grow in depth and detail as you gaze upon them. The architecture serves as a backdrop for the paintings.
Light

When you walk in the chapel, your immediate reaction is that the room is dark; your eyes have not adjusted yet from the brightness outside. Slowly, as your eyes become accustomed to the lower light level, the room becomes less dark and the color of the paintings begins to materialize. The chapel is illuminated from a hexagonal oculus above, which allows light through an opening and around the edges of a folded surface hung below the large oculus. While artificial light is available for times when the light level is low, the intent for the chapel was to be fully illuminated by daylight. As visitors sit in the chapel over an extended period of time, the sunlight grows and then decreases in intensity, changing the appearance of the paintings inside. This focuses the attention on the paintings and gives a more intent meditation, because it holds attention due to the shifting nature of the artwork inside.

Based on my explorations in physical models and erased charcoal drawings (discussed later in this document), the success of this lighting lies in the use of natural light to illuminate the room; this creates a connection with the outside world but also intensifies the experience for the visitors to the chapel by creating an environment that subtly shifts throughout their time there, satisfying their natural desire for an environment that is constantly, albeit very gradually, altering itself in response to the movement of the
natural phenomena surrounding them. The changing atmosphere is exactly what is needed to engage the visitors in their surroundings and connect them with the transcendent plane needed for meditation.
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Chapter 3

Color

The walls are a gradient of white, allowing the focus of the occupant to rest on the paintings in a quiet meditation. According to the docent, each of the paintings is layered with fifteen different colors. These give a depth to the artwork that is revealed as the intensity of the light grows throughout the day. Color throughout the chapel itself is subdued, the floors are a dark shade of brick tile to compliment the hue and saturation found in the paintings.

My explorations with physical models indicates the changing appearance of the colors throughout the day allows for the ideal meditative setting: Faber Birren stressed the importance of subtle shifts in color over time as an imitation of the way our eyes are accustomed to viewing the natural world. As the sun moves across the sky, the foliage changes in its intensities of greens, from the early morning dark green to the midday glowing bright green as the sun shines through it, to the almost black color as the light fades from the sky. The variations in the paintings is the focus in the chapel, all other colors are subservient and neutral to not distract from the focus. As the light shifts and intensifies throughout the day, the paintings shift and more of the depth of color is revealed. The guests at the chapel are meant to lose themselves in the slowly shifting paintings, which provide the perfect focus for contemplation and meditation. They shift slowly enough to avoid distraction, but at a rate that is quickly
enough to engage viewing over an extended period of time; also, they are uniform enough as to allow one’s mind to wander. The chapel architecture uses colors in a similar hue with varying values and chroma. The floors are a darker value; the walls and ceilings are light value. The paintings are darker value with varying chroma and hues. The similar hues in the chapel make the paintings more of a focus for their multiple hues and chroma. Because the chapel does not use complimentary colors, it is not surprising that the colors are closely related in hue and chroma according to Faber Birren’s theory that those are the two types of color combinations we most desire in our environments.
Texture

The walls are sponged plaster, which reduces the reflective quality of the surface and direct one’s focus to the paintings on the walls. Their texture softens the light without having enough variation to become a distraction. Their texture is not meant to draw attention, because the paintings are meant to be the center of attention. In this chapel, texture was totally subservient to the light and color of the canvas. The only means of texture perception was either through the brick floor or through a visual understanding of the texture on the ceiling, walls and canvas.
Kimbell Art Museum in Ft. Worth

The Kimbell Art Museum by Louis Kahn is composed of six by three bays of cycloid arches with a slit cut in the center and a fixture washing the interior of the arch with a silvery light that naturally illuminates the museum while protecting the artwork inside from direct sunlight. Louis Kahn’s primary focus in designing the museum was to allow natural light to bathe the interior, albeit indirectly. In his essay titled, “Silence and Light,” he is quoted as saying, “Architects in planning rooms today have forgotten the faith in natural light depending on the touch of a finger on a switch satisfied with only static light compared to the endlessly changing qualities of natural light in which a room is a different room every second of the day.” Light was his primary consideration in architecture; how to contain and express it combined with how it gives sense and order to our creations. Later in the essay, Kahn expresses his belief about the nature of specific buildings and how each has a particular form it must be based on the spatial qualities it needs to honor what is to take place within, and that we must use our intuition to put these pieces together as “an offering to architecture.” This essay explains to us the intent behind his design for the Kimbell Art Museum; the following pages contain discussion of his results.

12 Twombly 231-232
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Light

Louis Kahn’s use of indirect light is seen in the light fixtures at the top of the cycloid vaults, which allow the natural Texas light to wash the arches in a silvery light while preventing the artwork housed in the museum from being exposed to harsh, direct sunlight. Kahn believed that you wouldn’t be able to appreciate how dark a place is without a small sliver of light, which is why he kept a sliver of natural light at the edges of the auditorium; white light would detract from images projected on the screen, however, so he used red glass to allow the audience to perceive the darkness of the auditorium without the intensity of white light. The interplay between the interior space and intense Texas light was the primary focus of the design for the museum. Kahn’s belief for the importance of natural light in a space was the motivation behind his design for the light scoops at the top of each vault; they connect the people inside the museum with the sun outside. Its movement can be sensed as the quality of light gradually shifts throughout the day and occasionally is darkened by the movement of clouds overhead.

The strong focus on natural light in the museum and its successful execution further exemplifies the discoveries found in my research. A place cannot be fully engaging unless natural light is used liberally; artificial light should only be used to compensate for the necessary lighting requirements of a space.
Color

Minimal color is used in the museum; natural materials make up a neutral palette. The floors are maple, the walls travertine, and the arches poured concrete. Maple accents weave throughout the museum in the form of doors and dividing walls while steel forms the ceilings between and fixtures at the top of each vault. One distinct use of color is found in the auditorium, which has red acoustic paneling on the walls that match the sliver of red glass at the edges of the ceiling. The neutral color palette does little to distract from the artwork on display while Kahn uses a mixture of warm and cool color tones in his palette; the limestone and concrete provide a cool feeling with their shades more reflective of grey tones, while the wood accents and flooring add a warmth with their brown tones. The blend of warm and cool colors creates a balance along with a constantly undulating shift between the two. The Munsell Color System indicates that Kahn used materials that are closely related in chroma and value; the wood falls more toward the warm hues of yellow and red, while the travertine and concrete are cool hues with a medium value and chroma. All value in the Kimbell are located more along the middle range, with the chroma of the hues falling toward the lower levels for the cool colors and the middle for the warmer tones. Because Kahn’s color palette falls into a close range, this is a pleasing combination for guests.
Texture

Kahn’s use of natural materials brings a mixture of textures that understatedly change as you move through the space as a result of their natural origin. While the wood flooring is smooth, the grain is evident as are the markings on the limestone walls. These textures respond to the light in several ways: the concrete vaults absorb it, sending out a smooth, uniform glow, the wood floors reflect it with a matching intensity, creating a mirror to what is above, and the travertine absorbs it in its indentations while reflecting an uneven amount back from what hit the surface giving a dappled appearance.
Chapter 3: Case Studies

Conclusions

Subtle variation is key in creating an environment in which the inhabitants feel engaged and most comfortable. This is achieved primarily through the manipulation of light and color; texture highlights this and intensifies the impact of the other categories. Light is used indirectly in all projects. The St. Ignatius Chapel brings light into the space in two ways; it is either reflected off a surface or brought in directly through a lens. The Rothko Chapel uses natural light entering indirectly from an oculus above, which bathes the walls in an even natural illumination while maintaining a darker sense in the actual space. The Kimbell Art Museum also brings light indirectly from above, however uses reflective surfaces to create an even lighting of the interior space.

The indirect light used in all three projects has similar results; there is a distinction between areas bathed in light and those that have greater shadows. High contrast created by the indirect light creates a more dramatic interior environment, enhancing the effect of the activity within. Because of the dramatic lighting, each precedent naturally gets a response from visitors of silenced awe and reverence for the ritual within, be it worship, meditation or the viewing of artwork.

Views and direct light are either carefully controlled or removed from these projects in favor of directing...
more focus on the internal activity; any view to the outside is located away from the main activity. In the St. Ignatius Chapel, exterior views are located in the vestibule; in the Kimbell Art Museum, views to the outside are either to an interior courtyard if adjacent to an artwork space or directly outside if adjacent to public space. The Rothko Chapel has no view to the outside.

Color is approached in different ways for each project. The St. Ignatius Chapel uses three techniques for applying color; the first is through a colored lens, the second is reflecting it off a colored surface, and the third is the color of the surface itself. In the Rothko Chapel, color is applied to surfaces only, and minimal color is used in the materials other than the paintings on the walls. The Kimbell museum uses the colors inherent in the materials themselves while, in a special case, using a colored lens along with colored acoustical paneling on the walls in the auditorium, which is not visible to the general public or from the main interior space. All projects used a subdued color palette of closely related colors, the exception being in the St. Ignatius Chapel where complimentary colors are used in lenses and reflected surfaces. The rest of the Chapel uses a muted, more closely related palette. All projects possess similar relationships of hue and chroma with the value shifting in specific areas (such as the floors in the St. Ignatius and Rothko Chapels). Texture is subservient to light in all of the projects, intensifying the effects of light filtering in. In the Chapter 3
St. Ignatius Chapel, texture serves to catch the light on the walls and reflect the light on the floors and walls coated with beeswax. The Rothko Chapel uses texture as a way to absorb the light and direct more attention toward the paintings. The Kimbell Art Museum relies on texture to reflect light into the main spaces. In all projects, the texture palette is limited; the St. Ignatius Chapel has raked plaster walls and ceilings, polished concrete floors and Alaskan cedar doors and accents. The Rothko chapel has sponged plaster walls, popcorn texture on the ceiling, and brick floors with wood benches. The Kimbell Art Museum is clad in travertine, which is located on the walls and floor accents, concrete ceilings and arches, and maple floors, accents and doors.
Chapter 4: Explorations

Light

Erased Charcoal Drawings
The medium of erased charcoal allows for the examination of light hitting a surface; it also removes the distraction of color and gives an opportunity to quantify the light value alone. An image of Steven Holl’s St. Ignatius Chapel is used as a reference; from this image, the various light intensities are erased from a paper blackened with charcoal. This process allows for examination of light levels hitting a surface without the interference of other factors, such as color. There is an element of the unquantifiable in this exercise; it attempts to capture an aspect of the architecture that goes beyond the physical relationships in space. These unquantifiable elements can be described as the aura that transcends the construct, the part where the ritual of the ceremony meets the physical place it inhabits. Erased charcoal was used as a medium in an attempt to quantify natural lighting techniques used in the chapel. Moments were selected and drawn with the charcoal in an effort to filter the image down to purely a graphic of light intensity; this resulted in a series of evocative images that abstracted the light to the two dimensional characteristics of the light washing the surface of the wall.

Steven Holl, in understanding the spatial characteristics of his designs as he is creating them, draws the interior...
spaces that show varying levels of light and attempt to capture the nature of his architecture that escapes the quantifiable aspects; he is illustrating the mood, how the space will make you feel. Holl uses watercolor to illustrate his ideas, which have an intangible, seductive quality; they have more emotional representation and capture much more about what the space is meant to be than a line drawing or three-dimensional model. He is illustrating emotion.

By designing with an emotional result in mind as Holl does in his watercolors, or using an erased charcoal drawing to convey the light qualities, the process keeps one always in a state of consideration for the unquantifiable goals to be achieved; it brings architecture down to the nature of existing rather than pure functional and structural considerations. One designs for the nature of what a space needs to be or convey rather than relying on pure pragmatic means for making decisions; it gives one a balance and method for keeping the quality of space in mind. Texture is a part of this exercise through its medium; as the image is erased and charcoal is removed and added back to change the intensity of shadow, the evidence of its making is left in traces of the blending with the fingertips as well as the erasing. The process itself adds a dynamic of texture, a technique also exploited in the chapel itself. Holl’s raked plaster walls reveal their construction as the blending and erase marks are evident in the charcoal drawings.

Chapter 4
Charcoal Drawing by Author.
Chapter 4

Charcoal Drawings by Author.
erased charcoal drawings used to show light qualities of designed space.
Color + Light

Color and Light Model
Steven Holl uses complimentary colors to illuminate his chapel, which is the inspiration for this study model. The power of the complimentary lies in the vibrations we see when these are juxtaposed; Holl does not put these immediately against each other. Rather, he has one surface painted a color paired with a lens colored its compliment. This allows for a charged relationship between the light coming directly through the lens and the light washing the wall from behind the surface surrounding it. The model shown here uses these same techniques; colored surfaces reflect their color on the interior of the model as light hits them, these are paired with the complimentary lens and as a light is moved behind the model the light quality shifts from the reflected surface to the filtered lens as the series moves from left to right.

These techniques will be used in the final program as a way of bringing in color to the infusion center without becoming overwhelming. This also allows for color to vary throughout the day as our eyes are naturally inclined to perceive their surroundings. Birren also states that colored light has a greater impact on our psyches than colored surface, which explains why Holl’s chapel is such a success; he uses color in a way that it has the physical characteristics of light, avoiding specific colors in visible surface treatment.
Chalk Pastel Studies

These are done in a manner similar to the erased charcoal drawings with light, however they attempt to quantify the use of color along with light quantities. These also attempt to use the drawings as a means for design rather than a representation or analysis of an existing image. Color is shown in these drawings as a gradient, which is meant to embody what Faber Birren concludes in his research when he explains the importance of sequence in color rather than a specific palette. These are meant to represent the preferred sequential changes in color as we traverse space. The challenge found in the charcoal drawings was using them to create design as intriguing as the architecture that made the images themselves so powerful. Texture acts in a similar way as in the charcoal drawings; the evidence of the color pastel’s making is seen in the end product. Texture is found in the blending marks and imprints of the eraser, which adds a tectonic nature to the drawings beyond their pure color representation.
Texture

Texture was initially explored by casting plaster on an undulating surface to capture a soft quality in a hard texture, similar to what Rasmussen was expressing in his book, “Experiencing Architecture.” After the initial casting, however, I came to the conclusion that the primary function of material and its texture is to capture and reflect light, giving it more definition. As a result of this, the explorations in casting were ended in favor of more in depth study of light qualities and texture became a means for achieving these.
Ritual makes a space transcend programmatic needs; light, color and texture are used to increase the impact of the ceremony on the people participating in it. You enter a church and still understand the sacredness of the space because the light, color and texture have been designed to intensify the ritual that takes place within; its presence is still felt whether or not it is being practiced at the time.

The St. Ignatius Chapel has the ritual of the seven sacraments taking place in the mass, which are highlighted by the conceptual seven bottles of light. Six are found in the chapel and the seventh is the bell tower. Those found in the chapel are located in places with a connection to a portion of the service that is part of the ritual; the processional area, narthex, choir, nave (east and west), chapel of the blessed sacrament, and the reconciliation chapel.

A Japanese Tea House holds a specific ritual; the tea master is in charge of setting this up and creating a stage for the ceremony to take place. Following is a description of portions of this ceremony combined with an analysis of design with a focus on the interaction of the ritual with color, light and texture.
Ritual and the Japanese Tea Ceremony

I studied a Japanese tea ceremony in order to explore the connection of light, color and texture to a ceremony and how it can be manipulated to increase the emotions aroused by the ceremony through the design of the environment in which it takes place. A Japanese tea ceremony provides a ritual in which to explore the impact of light, color and texture. Especially important is my unfamiliarity with the ritual. This study is a way to explore the transition between the sacred and the profane, for example the cleansing that takes place at the tsukubai discussed later is a symbolic transition from the common world they are leaving for the sacred experience of the tea ceremony. Because it is incredibly involved, three moments of the ceremony were chosen as the script for this study: the tsukubai, tokonoma, and omogashi. Tsukubai is the space used directly after the moment the host of the ceremony reveals himself for the first time to the guests. The host appears from the inner sanctum of the tearoom carrying a wooden bucket, ‘teoke,’ of ‘dawn water’ to fill a stone or clay basin located along the path from the gate of the inner roji to the door to the tearoom. This basin holds less water than what is in the bucket, which is supposed to be poured into the basin in a manner allowing for splashing and overflowing along its sides in a symbolic show of purity. Dawn water is historically understood to be the purest water of the day, with night water being
considered poisonous for having been exposed to the toxins of the day; dawn water is traditionally used for medicinal and ritualistic purposes. The tsukubai is the area containing and surrounding the basin, which the host sprinkles with water dipped from the basin. Next, the host dips more water out of the basin for washing his hands and mouth, a practice also seen outside of Shintō shrines. While the host is performing this ritual, the guests are and remain seated at a bench outside of the gate separating the outer and inner roji. After the host is finished with this ritual, he walks to the gate near the guests and opens it before heading back to the teahouse to wait for the guests to arrive. The guests then move in order of their rank through the gate toward the tsukubai, where they will take in the path and surrounding objects and then cleanse themselves with water dipped from the basin before proceeding to the tearoom. Movement is measured and done carefully, taking great pains to take in all of the surroundings in an effort to prepare for the ceremony that is about to take place.

Viewing the tokonoma, the scroll in particular, is the first activity that takes place when the guests enter the tearoom. The host is waiting in the adjacent room preparing to enter and begin the ceremony. The first guest enters the room alone, moves toward the tokonoma and bows to the scroll. The scroll is the most important item in the tearoom because it tells the theme of the ceremony. Once the first guest has bowed to the scroll, he moves somewhere unassuming
while each guest enters and takes his turn at the scroll. When the last guest enters, he closes the door loudly enough for the host to hear that all guests are in the tearoom and accounted for.

The omogashi, or main sweets, are served at the close of the first half of the tea ceremony. The host brings the sweets in a special tiered box, “fuchidaka”; each tier has one sweet in it with the bottom being empty for “kurumoji,” envelopes containing donations toward the expense of the ceremony from the guests. The host slides the door open and enters the room. After entering, the host walks toward the first guest, sets the box in front of him, and leaves the room after suggesting the guests enjoy some light refreshment before taking a moment to enjoy the garden. Before sliding the door behind him, the host bows to the guests. The first guest apologizes to the second guest for going before him, picks up the box, examines and admires it, rotates the bottom tier and, placing his envelope inside, closes the bottom tier and removes his sweet from the top tier with a moistened sweet pick located on top of the box. The sweet is placed on a kaishi he has brought with him; it has been concealed in the breast of his kimono with the other utensils and items used in the ceremony. The second guest repeats the steps just done by the first guest, apologizing to the person next in line after him, ending with placing a sweet on his kaishi. When all guests have their sweet in front of them, they consume them in tandem; the last guest places the dish in front of the host’s door.
and, after the other two guests have exited the tea room, exits himself, closing the door loudly enough for the host to understand that the room is empty and he can begin the preparations for the next portion of the ceremony.

**Relevant Tea Ceremony Definitions**

Outer roji: Outer path to the tearoom, symbolic of the path to spiritual enlightenment.

Inner roji: Inner path to the tearoom, symbolic of the path to spiritual enlightenment.

Tsukubai:
Tokonoma: An alcove in a shoin-style room or more informal tearoom where a scroll, flowers, or other appropriate articles may be displayed. The standard size for yojōhan is one tatami mast in area.

Omogashi: Moist sweets traditionally eaten before drinking thick tea

Teoke: In tea, the bucket used to carry water to the basin in the roji. A similar lacquered vessel is used as a mizusashi.

Kashi: Special Japanese paper carried in the bosom of the kimono and used as disposable plates for tea sweets and to wipe bowls clean after the kaiseki meal.

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Chapter 4
A filter: Light, Color and View to Intensify the Four Moments of the Tea Ceremony

The ritual makes a space sacred; it gives it the feeling that allows those participating to transcend the everyday aspects of their lives while experiencing a choreographed set of movements and sequences. The place that has been designed for a specific ritual holds the sense of its ritual in its appearance; light, color and texture have been manipulated to heighten the sense of the ritual within the participants and this can be perceived even when the ceremony is not taking place.

Each of the three moments, tsukubai, tokonoma and omogashi, were analyzed by body position, object, focus, and object location. These were then translated to a physical light and view diagram for each moment; light was brought in to highlight certain points. For example, as the container for sweets is passed from host to guests in the omogashi part of the ceremony, the container needs to be able to be viewed and appreciated by each guest; light needs to be constantly on the container, both when each guest admires it and to follow its path throughout the tearoom. Because food appears most pleasing in red light\(^\text{14}\), a red glow accents the room.

A tea ceremony in which the tea master host has control of the environment allows the guests to experience the ceremony in a room that changes light, color and views

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Chapter 4
to accommodate different parts of the ceremony. The tea master manipulates the experience of the guests by shifting the color to intensify key moments. For example, viewing the tokonoma takes place while the room is bathed in yellow light.

Upon further exploration, more natural light would have been brought into the tearoom to allow for a greater connection to the outside environment. The light would subtly shift along with the color and highlight certain moments, calling them out as special by differentiating them from the standard treatments.
Chapter 5: Connection to Health and Healing

Healthcare in the 1950s was conceptually focused on creating a sterile environment, more readily available through new technology and partially inspired by the advent of “single-use” products. In the late 20th and early 21st Century, there has been a shift to an environment of luxury or hospitality, focused more upon improving the patient experience in an effort to reduce healing time while providing a more satisfying hospital experience. This new concept of hospital design focuses on an environment that is less sterile-feeling and more directed toward patient comfort while enduring treatment.

Watching my mother undergo treatment for ovarian cancer this past year has given me a desire to create a healing environment that allows patients to interact with and manipulate their immediate surroundings while receiving infusion treatments in a way that their surrounding light, color and texture has a direct

reflection of their emotional state. Cancer patients are exposed to the hospital environment for a much longer time than most patients; this increases the need for surroundings that are rich in variation.
Chapter 6: Program and Site Analysis

The Lemmen-Holton Cancer Pavilion is located at the intersection of Michigan and Coit streets in downtown Grand Rapids, Michigan; it is adjacent to US 196 and near US 131. Its 200,000 square feet are distributed across six floors. The proposed addition, named the Mary A. Hikade Infusion Center, will be located on a new eighth floor.

The seventh floor currently is open to the sky and holds rooftop with a perimeter wall concealing them from street level. The proposed addition will enclose the seventh floor and add an eighth, raising the existing stairwells and elevator shaft to accommodate the additional floor. The newly enclosed seventh floor will be ventilated to provide adequate airflow for the rooftop units.

The Mary A. Hikade Infusion Center will contain individual treatment rooms for patients that receive a longer treatment (several hours), group treatment areas for patients with less intensive visits, areas for family members to sit with patients and relax, an admissions area, a support space for the storage of medicines and supplies, areas for nurses to work and set up treatment necessities, and outdoor areas that bring light into the center of the building as well as provide a place for patients and family members to comfortably and safely experience the outdoors.
Chapter 7: Design Process

The techniques from the tea ceremony used to set the mood for the participants will be translated to the cancer pavilion and applied to the sequence involved in arrival, receiving treatment, and departure from the Infusion Center. The goal is to create a place that gives the patient an amount of control over the intensity of their environment. This control involves the amount and intensity of light, color and texture in the immediate environment involved with treatment. As the patients arrive and depart from the center, there is a sequence of lighting and color techniques that are outside of their control; this sets the stage for their treatment and exposes them to the strategies developed throughout the study of this thesis but does not set them in an environment that is too intense for an extended period of time. The group and private treatment areas will have a less intense environment to avoid something that is too overwhelming to the sensitive patients.
sequence diagram using color sequence on the top, spatial sequence on the bottom, with the design synthesis in the center.
exploration of different screen techniques to filter light over various times of the day, indicated by the numbered squares
Chapter 8: Design

Goals
The purpose of this thesis is to create a place to receive treatment that focuses on light, color and texture as a vehicle for transporting a patient to a level outside of the pure treatment of cancer. The public spaces are controlled by the nurse, or healing master, but patients have the opportunity to interact with their environment by adjusting the intensity of light, color and texture to reflect their emotions or aid them in the recollection of a different time, giving them an opportunity to transcend their existing situation and recall a particular time or emotional state.

Methods
Sequence plays a significant role in the experience of the patients; primary areas of focus are the arrival sequence, passage through the infusion center toward the patient and family areas, private treatment rooms, group treatment areas, and departure sequence. Drawings will reflect the intangible aspects desired for the mood. Design models will explore different effects created by specific colors, textures and filters for light.
Outcomes
A design that involves color, light and texture to the extent that patients can manipulate and interact with their environment in order to respond to the needs for their emotional and physical comfort.

model explorations of light intensity variations through indirect sources and effects produced by washing surfaces with indirect light
Chapter 9: Conclusion

There is no magic bullet for color, light, and texture in a healthcare environment. There are, however, strategies that are more effective than others for creating an environment that contributes to the well-being of patients, thus aiding in their healing process.

Light

The first strategy for light uses contrasting light levels to create an environment rich in depth and stimulating to its inhabitants. Second, slow variation in the lighting scheme throughout the day keeps the inhabitants engaged in their surroundings because it reflects the way we experience a more natural environment. Third, natural light is necessary to connect us with the conditions outside and to provide the subtly changing illumination levels we require for comfort. Fourth, a combination of indirect and direct light provides greater depth and variation in the overall lighting scheme. The fifth is to optimize the power of natural light entering from above by abutting overhead openings with wall surfaces to wash them with light.
Color

Color strategy begins with the understanding that designing a sequence of color is more effective than the specific palette used, therefore a sequence of color must be designed in order to create an environment to increase the well-being of its occupants. The second strategy involves using either complimentary or closely related hues, because these have proven to be the most preferred combinations for comfort\textsuperscript{17}. Third, colored light is more effective in impacting physical and psychological response than colored surfaces, therefore color will be introduced by either filtering it through a colored lens or reflecting it off a colored surface. Surfaces directly visible are of a neutral hue, chroma and value to best receive the color. The fourth strategy is to introduce varying color rather than a static scheme, which is more engaging because of our experience with the continuously shifting chroma and value of the hues we see in our natural environments; this is achieved through the shifting of natural light across the colored lenses and reflected colored surfaces.

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Chapter 9
Texture

Texture strategy begins by using natural materials, which provide an environment with greater depth because of the scalability of its materials; this also allows materials to show signs of age, which enriches the space they form. The second purpose of texture is to give light the variation it needs by the surface qualities it possesses, which can reflect, absorb, soften, sharpen, and manipulate the light in numerous ways. The third, and most significant, purpose of texture in this thesis is to select texture with the intent for how it will receive and interact with light. Texture is subservient to light, is given presence by light, and depends on light to both acknowledge it as well as imbue it with character.
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