CURATING LIGHT:

DAYLIGHT-CENTRIC DESIGN FOR PROMOTING WELLNESS

by

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Bachelor of Architectural Science, Ryerson University, 2013

A design thesis project

presented to Ryerson University

in partial fulfillment of the

requirements for the degree of

Master of Architecture

Toronto, Ontario, Canada, 2015

AUTHOR'S DECLARATION

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Curating Light: Daylight-Centric design for promoting wellness

M.Arch. 2015

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Master of Architecture

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THESIS ABSTRACT

Daylighting in architecture has traditionally been a practice-based, intuitive and experiential process, based on the common notion that daylight enhances our spatial and sensory awareness. This Thesis tests the effectiveness of daylight as a mechanism for creating a psychological and emotional impact, and promoting wellness within the confines of designed spaces. The creation of the project is based on a Maggie's Cancer Centre model of patient-centric design. Maggie's Centers have been traditionally located in suburban settings, where they may be ideally oriented for day-light infiltration and outdoor connectivity. The Maggie's model promotes three primary design factors: i) abundance of daylight, ii) connection to nature, and iii) a de-institutionalized environment.

The design project was purposefully situated within the specific constraint of an urban environment, in downtown Toronto, Ontario; where the goal is to achieve a spatial character that embodies these three design factors where daylight and access to views of nature are limited by the urban context. The project demonstrates a method of daylight centric design that utilizes three primary techniques for daylighting that were extracted from precedent analysis: i) Direct light, ii) Bounced light, and iii) Diffused light.

Through the methodical harvesting and manipulation of daylight, the project highlights its potential for positively enhancing patient experience and aptly demonstrates the curation of varied experiential narratives in light.

ACKNOWLEDGEMENTS

Firstly I would like to thank my thesis supervisor, Cheryl Atkinson, who has, through our conversations, various coursework, and involvement in extracurricular projects, been pivotal in my development during my time at Ryerson University. With her guidance and patience, she has helped me grow in understanding of my subject matter and inspired my fundamental engagement with the phenomenon of daylight. I would also like to thank Masha Etkind for her encouragement and support ever since first term of Undergraduate studies at Ryerson. I would finally like to thank my parents, Stephanie and Andrew, as well as the rest of my family for their love and support every step of the way.

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INTRODUCTION

BACKGROUND

Daylight in architecture is defined as the combination of skylight and direct sunlight. Daylight and architecture are intimately and inherently connected, and throughout the history of architecture, light has always been recognized as a powerful factor that brings form to architecture. As aptly stated by Le Corbusier (1923), "architecture is the masterly, correct and magnificent play of masses brought together in light". Light is a medium that provides us with a sense of both place and time, and through its static and transformational nature, it not only illuminates architectural form, but also gives it emotional depth (Zumthor, 2009). In addition to the critical functions of light that allows us to see things and perform activities, is the profound psychological and physiological effects it has on human beings.

According to the World Health Organization, Wellness is defined as "...a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity." A growing body of evidence-based knowledge supports the importance of light in reducing depression, decreasing fatigue, improving alertness, enhancing productivity and learning potential, and regulating our body's circadian rhythms (Ulrich, Zimring, Joseph, Quan, & Choudhary, 2004).

I was first introduced to area of evidence based design when I had the opportunity to be involved with a Post-occupancy evaluation of Bridgepoint Hospital in Toronto, Ontario. The study focused on quantitative architectural analysis of a new facility that would act as a companion to a parallel qualitative study of the facility's patients, who experienced a migration from the previous facility to the new one. From the results of the study, it was fascinating to observe how much of an impact the more patient-centric spaces had on behavioral patterns and preferences, particularly how patients gravitated toward spaces with an abundance of natural light, for both social interaction, as well as solitary activity. Well-lit spaces seemed to have helped people feel better in addition to the medical treatment being received. Further investigation revealed a growing body of quantitative evidence supporting and illustrating the positive effect of natural light on the human body.

AREA OF CONCERN

A particular area that has seen a recent shift in thought, primarily due to the growing body of evidence-based knowledge, is the realm of health care design. Traditionally centered on the concept of efficiency and functionality, the view of the hospital is shifting from that of a "place of illness" to that a "place of wellness". A main focus is placed on the creation of a de-institutionalized and patient-centric environment, thereby fighting the sensory deprivation from the sterility associated with typical hospital design.

With a departure from the traditional large medical campus, with a hospital and supporting outpatient medical facilities, there has been increasingly smaller, patient-centric facilities models proposed, which focus on emotional well-being for a more holistically defined idea of "wellness" and health promotion

A health-care model that has embodied this shift in focus is the Maggie's Cancer Centre, where the design focus is placed on putting patients in an environment that feels like "home", allowing individuals going through a traumatic experience in their lives to feel comforted. Their mission is to provide an environment for support, information, advice, and treatment for those affected by cancer. Maggie's Centres have developed an Evidence-based programme for the support they offer people during diagnosis, treatment and survivorship. According to patients and staff of Maggie's, this focus allows for deeper, potentially more meaningful conversations that would otherwise be more difficult to occur and would take a longer time to build comfort in an institutional environment.

Over the last decade Maggie's Centres have grown to seventeen facilities, primarily in the UK and one each in Hong Kong and Spain, designed by renowned architects such as Frank Gehry, Zaha Hadid, Rem Koolhaas to name but a few. Each facility has focused on how the design of spaces, materiality, and landscapes can promote psychological and emotional healing – essentially creating a type of 'anti-hospital' based on three primary design factors: i) the abundance of

daylight, ii) connection to nature, and iii) a de-institutionalized environment.

While the typical Maggie's Centre is undeniably successful in achieving this promotion of wellness, the majority of the facilities are located in a suburban context, where they can be ideally oriented for optimal daylight infiltration and connection to nature with the surrounding landscape. The question is then: how can a model that relies heavily on these three design factors be achieved in an urban environment, where daylight and connection to nature is often limited?

THESIS POSITION

The basic or typical approach with lighting design for an environment has too often focused on the idea of "task" needs as an objective; a criteria measured by quantity that only satisfies whether a space has "enough" light to perform a certain task. This approach often overlook or minimizes the experiential character and qualitative aspect of light that has the ability to triggers emotional, biological and psychological response. The cyclical nature of both the human body and of the 24-hour movement of the sun has a tremendous impact on our spatial awareness and sensory engagement. In an ever increasing digital world, cyber interaction, detached from the natural environment losing touch with the circadian rhythms has effectively becoming 'out of sync.'

Recognizing that a state of wellness encompasses a physical and psychological aspect, this thesis looks at daylight as a mechanism for creating psychological and emotional impact. A method of daylight-centric design will be developed using three primary techniques for daylight infiltration: i) Direct light, ii) Bounced light, and iii) Diffused light.

CURATING LIGHT

The act of curating is to "select, organize, and present items in an exhibit or gallery" (Merriam-Webster). The curator specializes in each piece, with knowledge of the optimal viewing position, environmental conditions such as temperature, moisture control, and lighting and sequencing to enhance and create a holistic experience. The curator most importantly lays out a narrative of space through art or artifacts. The exercise of the thesis project is analogous to the exploration and application of day lit environments optimized for the enhancing experience with the goal of creating a psychological and emotional impact, and promoting wellness. Utilizing light's dynamic and transformative nature, this thesis will essentially curate varied experiential narratives in light.

RESEARCH METHODOLOGY

The thesis research will use the following methodology for developing a background foundation for the thesis position:

i) HISTORY OF DAYLIGHT IN ARCHITECTURE: a comprehensive overview of daylighting in architecture, focusing on the connection with wellness, as well as the shifting views towards the inclusion of daylight, as demonstrated by various architects and minds throughout different periods in time.

ii) PHYSICAL IMPACT OF NATURAL LIGHT – Reviewing the growing body of evidence-based knowledge concerning the impact of natural light on the human body.

iii) PSYCHOLOGICAL IMPACT OFNATURAL LIGHT – theoretical discourse of the qualitative, phenomenological aspects of light and its psychological impact.

iv) ARCHITECTURAL PRECEDENTS OF DAYLIGHTING – An analysis of daylighting techniques by a range of architects who use light as a central feature in their designs.

DESIGN PROJECT

This design project will demonstrate the effectiveness of daylight as a mechanism for creating a psychological and emotional impact, and promoting wellness. The creation of the project is based on the The Maggie's Cancer Centre model of patient-centric design. Traditionally located in a suburban setting, where they may be ideally oriented for day-light infiltration and outdoor connectivity, the Maggie's model promotes three primary design factors: i) abundance of daylight, ii) connection to nature, and iii) a de-institutionalized environment.

The design project will be purposefully situated in an urban environment, where the goal is to achieve a spatial character that embodies these three design factors where daylight availability is limited. The design project demonstrates a method of daylight centric design that utilizes three primary techniques for daylighting that were extracted from precedent analysis: i) Direct light, ii) Bounced light, and iii) Diffused light. Through the methodical harvesting and manipulation of daylight in an urban setting, thereby creating spaces with a range of character which will synchronize with the functionality of the different programmatic spaces; the project will highlight the potential for enhancing patient experience and promoting wellness.

1 A HISTORY OF DAYLIGHTING IN ARCHITECTURE

Fig. 1: Ruins of Antic Temple

Fig. 2: El Djem, Tunisia

INTRODUCTION

This chapter will take a comprehensive look exploring the advances and experimentation with daylight from architects and minds throughout the centuries. Since the dawn of architecture, this use of daylight has, as evident by the remnants of ancient peoples, shown a relationship between humans and light that transcended necessity. Perhaps most significantly is religious architecture, which by nature in its use of light was used to emphasize the character and experience as well as sacred or spiritual space, and evoke feelings of mysticism, light itself being identified with the presence of the divine.

The concept of light and health has assumed different forms and meaning and our relationship to the sun, as has our behavior, has changed. Prevention of diseases is gradually supplemented and replaced by more therapeutic treatment and medical healing. We have gone from being exposed to the sunlight most of the day, during the agrarian economy, to the industrialized, commercial, and technological work of today, which predominantly takes place in an indoor environment, protected from the light of the sun.

DAYLIGHTING IN THE ANCIENT WORLD

From ancient times, sunlight has played a central role in health and wellness. Architects and engineers built cities and buildings planned on the basis of the sun. Much of the work was done to facilitate sun worship and mark the suns path through the heavens. Impressive monumental examples such as Hypostyle halls in the Temple of Amon-Ra, Karnak, were aimed to points on the desert horizon where the sun would rise or set on specific important dates (Plummer, 2009) They also appreciated that sunlit buildings to promote health. Nearly five thousand years ago,

Fig. 3: Temple of Amun Ra

Fig. 4: Pyramid of Djoser

Egypt's first pyramid, the Step Pyramid, near Memphis. The architect in charge was also a doctor, and high priest of an Egyptian solar cult. Today, Imhotep is remembered as the master builder of this monument but also personifies one of the first documented historical links between the sun, architecture, and health.

The Greek physician and Architect Hippocrates (460 – 370 BC,) in detail describes the physical environment and its effect on the health. He warned against the double-edged sword of the sun and pleaded for moderation and balance, as he warned against what is today known as sunstroke or excessive exposure to sunlight, while at the same time he recommending sunlight as a healing and preventative agent against a variety of diseases. (Hobday, 2006) Also, doctors in Greece, Rome, and the Arabic world practiced sunlight therapy, where physicians called the emotion associated with gloom and darkness `melancholia' and the idea that lethargy, sadness and despair can be triggered by low light levels is certainly a very ancient one. The romans built Solaria where they could sunbathe for health, and their best villas, baths and temples were purposefully oriented for the sun. Citizens of imperial Rome considered sunlight exposure so important they had a right-to-sunlight legislation

Prominent architects such as Vitruvius, has described seasonal changes with respect to the sun and health considerations based on two empirical observation: One is that the early rays of the morning sun warm up the winter facades, whereby moisture and disease can be avoided. The second is that the morning sun is generally milder.

FROM ANTIQUITY TO RENAISSANCE: THE CLASSICAL ERA

One of the most stunning examples of the use of light during this era is the Pantheon (AD 118-28) Sun acts as "sundial" accentuating intricate details in the dome interior. Within this temple dedicated to the Gods is a great bounded volume of space that is absolutely still, with a single light source being the perfect circle oculus (Latin for 'eye') in the centre of a hemispherical dome that sends dramatic beams of sunlight that sweep around the interior revealing the intricate detail of

Fig. 5: The Pantheon

the dome walls.

In the years that followed the Fall of Rome, as medical treatment began to advance, doctors placed less importance on sunlight, hygiene and sanitation. According to many historians, there is barely a reference to the sun in western medical literature until the end of the 17th century. And it was not until the latter part of the 19th century, following the discovery of the suns benefits, that buildings were arranged to admit sunlight again. However, the use of the light in religious architecture was emphasized.

Sunlight remained an important element in religious buildings, particularly in cathedrals. In Christianity, light became quite dramatic and a symbol of God. Gothic Cathedrals with giant masses and voids formed incredible sights and a spiritual connection with the divine. As Plummer describes, there is a way that the physical reality is completely upstaged by a "mystical twilight in the air" from the light entering the arrays of full stained glass in the cathedrals of Chartes in France, or Leon in Spain.

During the renaissance, spiritualized space that was emphasized during the Middle Ages let to a "calm and uniform treatment of light, where the goal was the articulate space rather than to enthrall" (Plummer, 2009). The role of light during this time was meant to enhance space, devoid

Fig. 6: St. Peter's Basilica

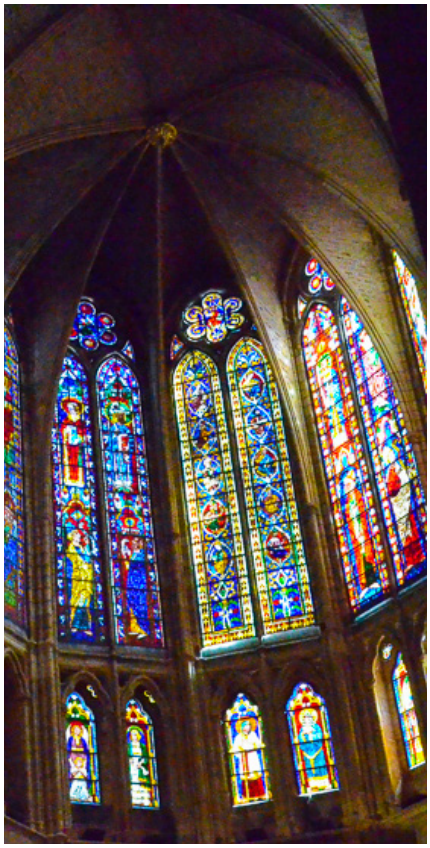


Fig. 7: Cathedral of Leon

of mystery, to emphasize the objective aspects of architecture such as precision, completeness, proportion, order and geometry.

During this period, Eastern architecture took a completely different attitude in its treatment of light, used to communicate their own beliefs about life and existence (Plummer, 2009). Illumination of the interior was purposefully and carefully withheld in the Buddhist or Hindu temples and womb-like caves in order to heighten feelings of spirituality as Tanizaki comments "gloomy darkness made spiritual rebirth possible", where a journey would take place that ended in a slow emerging glow of light at the centre. The vernacular architecture of Japan, for example, used light for domestic rather than religious aims. The cavernous roofs above the porous walls of traditional Japanese houses would intercept the sun and wain, while a horizontal filtering of light would occur through the white paper shoji screen walls and doors, resulting in a tranquility and mystery that resonated with the Japanese psyche (Tanizaki, 1933). This psychological impact of this architecture as discussed by Junicero Tanizaki in his *"In Praise of Shadows"* will be further explored in Chapter 3.

INDUSTRIAL REVOLUTION

Fig. 8: "Over London" by Gustave Doré

The advent of industrialization In the Western World, particularly England, a decline in the emphasis of light in architecture took place. The words of Charles Dickens, even the term "Dickensian", evoke imagery of the dark industrial city. Victorian London was tightly cramped and densely packed. In 1833, writer Richard Rush commented "I am tempted to ask, how the English became great with so little daylight?" (Dyckhoff, 2010). The government introduced a Window Tax in 1695, where windows were bricked up and houses were often designed with the minimum of fenestration to avoid payment, so windows were essentially saved for the elite.

In England, the air pollution and dismal housing meant that sunlight was in very short supply outside buildings as well as inside. While legislators were ignorant of the relationship between sunlight and occupant wellness, there were two highly notable advocates of daylight individuals who encouraged and placed emphasis on the importance of daylight in architecture.

The first is architect Sir John Soane. Working in the 1830s, Soane addressed this problem head on: how to, not only capture light in the dark industrial, but make magic with it. Soane's architecture is described as neoclassical with a touch of oddness, marking is originality. His buildings have a particular atmosphere that deal directly with light. A prime example is his use of light in the Dulwich Picture Gallery, where he employed the idea of lighting art from above, an idea quite

Fig. 9: Soane Museum dome

radical for its time and one that has influenced the gallery design ever since. His ideas of light filling interior space was also present in the paintings of Joseph Michael Gandy, who for thirty-five years illustrated Soane's architectural designs, showing a stark contrast to the surrounding urban context. However, his methods of light infiltration were perhaps best portrayed in the design of his home, the now-called, John Soane Museum. The interior spaces, described as "labyrinthine kaleidoscope of light" (Dyckhoff, 2010). Although the methods of building at the time were heavy or massive, he used light to make the walls and surfaces appear lighter. Even in the darkest spaces at the core, he utilizes hidden windows and domed ceilings capped with coloured glass and the top corners of the walls covered in convex mirrors which amplify and ricochets light down into the interior.

The second individual, and perhaps more significant in regards to light's impact on health, is Florence Nightingale (1820-1920), who is regarded as a pioneer of modern nursing, first pointed out the antibacterial and healing effects of sunlight, commented regarding the state of hospitals in 1859:

"All hospital buildings in this climate should be erected so that as great a surface as possible should receive direct sunlight – a rule which has been observed in several of our best hospitals, but, I am sorry to say, passed over in some of those most recently constructed. Window-blinds can always moderate the light of a light ward; but the gloom of a dark ward is irremediable... The escape of heat may be diminished by plate or double glass. But while we can generate warmth, we cannot generate daylight, or the purifying and curative effect of the sun's rays."

Fig. 10: Waverly Hills Sanatorium

Fig. 10: Early Tuberculosis treatments

When Florence Nightingale made these observations, architects and doctors were still largely unaware of the health benefits of getting sunlight indoors. Her thinking on the subject was in advance of scientific opinion and ran counter to the prevailing orthodoxy, which was to keep patients out of direct sunlight. It was only later in 1933, the Royal Institute of British Architects published a report on sunlight penetration in buildings, in which they referred to the principles described in Notes on Hospitals, as follows: "It is gratifying to note that some architects are at last, although half a century too late, beginning to take advantage of Florence Nightingale's common sense..."

20TH CENTURY

The identification of bacteria in the late 1870s established a new relationship to health and disease, one that quickly expanded also to include light. This happened in 1877, when the British Scientists Dowes and Blunt demonstrated how sunlight can kill and inhibit the development of these newly discovered bacteria. By placing bacteria in different environments , respectively in direct sunlight, indirect sunlight and darkness; it was observed through the new and improved microscopes how the bacteria only strives in darkness, deprived of the direct and energetic ultraviolet light. (UV). In 1896 article titled, "Treatment of Lupus with concentrated chemical light", Nobel Prize winner Dr. Niels Finsen describes how the UV light penetrates the skin and kills the Lupus bacteria. He further demonstrated that both the UV light of the sun and artificial lighting

containing UV light-respectively called heliotherapy; were vital and complimentary in his light treatments. From the turn of the century onwards, the discovery of the sanitary and therapeutic properties of sunlight brought about by Finsen and others had a marked effect on building - Sunlight was being hailed as 'natures' universal disinfectant'

In 1890, Theobald A. Palm first demonstrated the health-supportive function of UV light by his discovery that the disease rickets mainly occurred at northern latitudes, that is, where there is less UV light due to lower angles from the sun; while the disease was virtually non-existent further south, such as Japan, where the sunlight is prevalent. Palm's discovery essentially paved the way for later discoveries which would clearly show that sunlight helps in the making of vitamin D, which in turn helps in the formation of calcium in the body, a critical component in bones a and teeth. (Carter 2007)

These UV pioneers, like Palm, Rollier and Finsen, draw a picture of the double nature of the sun; on the one hand, the sunlight has a lethal effect on bacteria, while on the other hand, the sunlight seems to have a life-giving power due to the fact that our bodies have adapted to the sunlight, using light to absorb and form substances, which the body would not otherwise be able to form itself. And so, the special status of the sun received during this period is largely due to the discoveries of these UV pioneers. In part, however, there is another reason why heliotherapy and the worship of the sunlight gained ground during this period: The belief in medical treatment was in a crisis (Carter, 2007) for decades, diseases, such as tuberculosis, kill thousands and epidemic diseases were ravaging the large and often densely populated cities, without the doctors being able to prevent it or do anything about it. Light almost becomes a weapon in the hands of the dawning hygiene movements around the 1900s and onwards to the 1930s, especially in the cities, where darkness and diseases belong to the everyday order. Based on the new, scientific knowledge of light and the impact of light on the body, an actual dosage of light is introduced, both as an antiseptic and a medical element.

DAYLIGHT AND MODERNISM

With the guiding principles of Modernism combined with the mass production of glass and steel, daylighting in buildings transformed in its degree of application. It is important to note that ideas were formulated at a time when the building professions were in the vanguard against tuberculosis. Throughout Europe, hundreds and thousands of people each year were dying from the 'white plague', although in retreat, was still taking more lives than smallpox, typhoid, scarlet fever, etc. Many of the pioneers of modern architecture were involved in the construction of tuberculosis sanatoriums and worked alongside doctors who used sunlight to cure their patients. During World War I surgeons used sunlight to disinfect and heal wounds of casualties. This era

Figure 12: Villa Savoye, Le Corbusier

can be seen as a story of architects' determination either to exploit the expressive potential of materials and textures radically suppressing them, to place architectural surfaces wholly at the service of natural light. With the quantitative discovery that sunlight could cure rickets and tuberculosis, and that it could kill bacteria, there were significant grounds for making the exposure to sunlight in and around buildings a priority.

The architectural language that Le Corbusier developed in the 1920s onwards reflects this; drawing its inspiration from the sun-lit ward of the sanatorium, and the terraces of heliotherapy clinics. His Villa Savoye, near Paris 1929, is designed for sunbathing, where he believed the sun conferred physical and moral regeneration on those who exposed themselves to it. In the Athens Charter (published 1943, based on works from the 1930s), his manifesto, he proclaimed that: "To bring in the sun, that is the new and the most imperative duty of the architect". L'Unité d'Habitation was the realization of the mass housing schemes that had exercised Le Corbusier since the 1920s. He designed L'Unité to alleviate a severe post-war housing shortage in France. This milestone of modern architecture is arranged for sunlight and incorporates many of the features of a heliotherapy clinic.

Figure 13: Hotel Vejlefjord

The sanatoriums are classic examples of this close relationship between architecture and medicine - and the power struggle between them. One example is The Vejle Fjord Sanatorium, originally designed by Wilhelm Dahlerup, where a stay a typically includes natural surroundings, and walks in the sun, along the "cure-paths" as they were called, where light and exercise are prescribed for the paying patients, together with therapeutic treatment. The final end of the sanatoriums reflects the slippage which occurs from a belief in the surroundings and their impact on the health, to a belief that good health instead rests in the hands of medical treatment. A treatment which finally triumphs with the distribution of the Bacillus-Calmette-Guerin (BCG) vaccine during the late 1940s. In turn, many sanatoriums throughout Europe and North America that were closed because better medical treatment became available.

A significant example of this development is incidentally seen in the language and in the name of the institution, sanatorium, for the treatment of tuberculosis. These institutions were called sanitariums, derived from the word 'sanitas' which includes healthy living in healthy, natural surroundings. At these sanitariums, isolated from the cities, light and fresh air were important parts of the treatment. But together with better medical care, the word sanitarium gradually is replaced with the present word sanatorium, which is derived from the word 'sanare', meaning "to treat".

Figure 14: Artifically-lit, deep office space

At the sanatoriums, a more active and improved medical treatment becomes predominant and played a leading role in the treatment of the patients. (Schmidt & Steffensen 2004)

TECHNOLOGICAL ADVANCEMENT/ANTIBIOTIC ERA

But with the advent of low-wattage fluorescent tubes in the 1930s, and air conditioning, reflective glass and cheap energy, the urban landscape began to change. Daylight was no longer a critical design element as these technological advances made lighting deep-plan buildings a practical proposition. Medicine was changing too, and with the1940s brought the arrival of antibiotics: infectious diseases were much more amenable to treatment. This was reflected in hospital design, where sunlit, airy wards came to be replaced by structures that were more complex, and closed to the elements. Gradually, the emphasis shifted from putting hospital patients in wards that supported healing and prevented infection, to ones that created a comfortable and more convenient environment for patients and staff to function. Architects with medical knowledge, and doctors with architectural knowledge become rarer, and it became evident that doctors no longer involve themselves in the construction of schools and hospitals to the same extent as before (Adams, 2008).

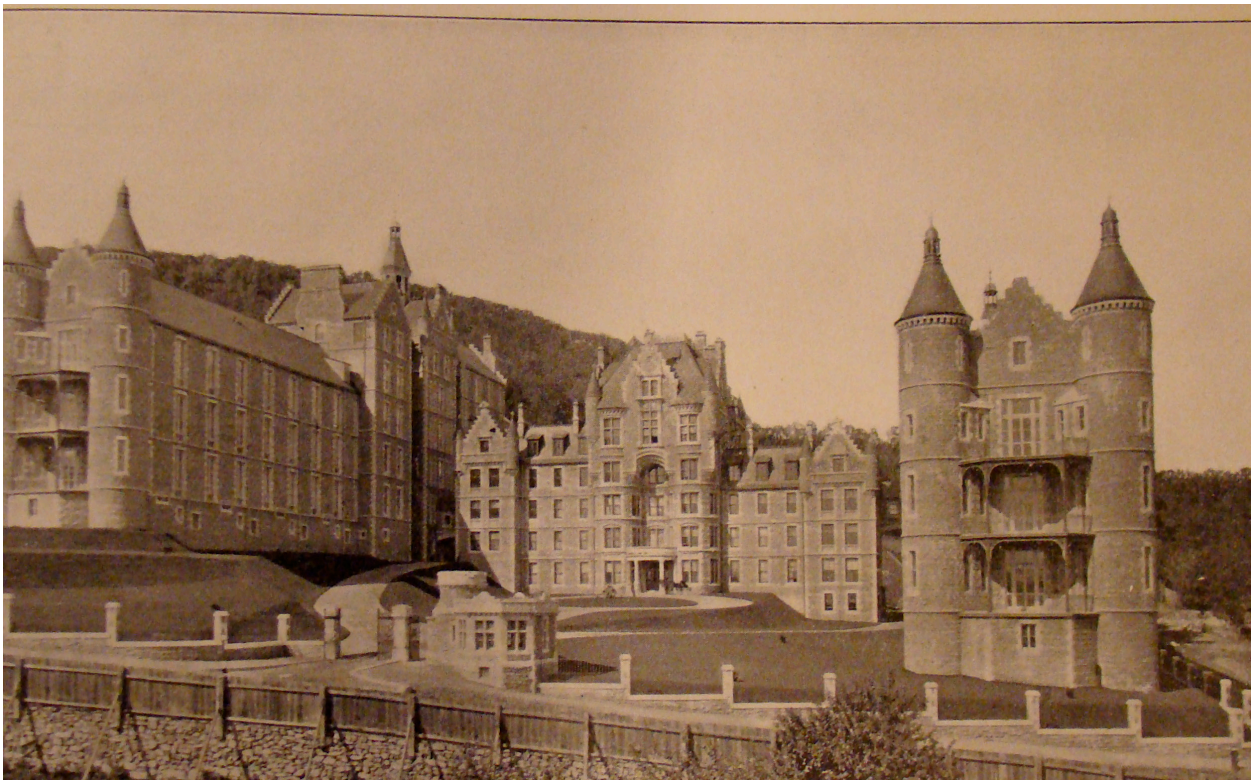


Figure 15: Royal Victoria Hospital, Montreal

In this context it is noteworthy that medicine, and particularly the development of various vaccines, manifest themselves so clearly in the architecture. It became evident that as more effective medications became widespread during this period and up to the present day, so did the emphasis on light as a healing factor declined. Thus, the architecture no longer offers the same framework for fresh air, or for that matter natural light, as it did before.

In deep, low-ceilinged buildings and building typologies, which let in less light and less fresh air, the preventive and healing elements of the architecture were lost and forgotten - in a period where neither light nor architecture were no longer associated with health. In the following decades in accordance with the focus on medical treatment the technological hospitals move into the center of the cities: in the same densely populated areas, and in the same lack of light and fresh air- which the sanatoriums fled from originally. Throughout this period, from World War II to recent times, technology from and the size of the hospitals seem to impress more than actual intentions regarding health and healing seem to do.

During what has become known as 'the antibiotic era', a period ranging from 1945 to the present day, there was vast growth both in new discoveries and the commercialization of existing and new vaccines. This period had a huge impact on the architecture of hospitals and health facilities in general. The ceiling heights and the building forms changed in order to better optimize spatial area and volume. The result was lower ceiling heights in deeper buildings with less daylight uti-

lization; a factor which was no longer considered a prerequisite to health. Moreover, this is aided by the emergence and cheapening of artificial 1ighting during this period, making this change of buildings and architecture possible. A prime example of a classic 'pre-antibiotic era 'Health facility is the Royal Victorian Hospital in Montreal, 1893, Canada. Designed by the Scottish architect Henry Saxon Snell, This building was oriented in order to balance the morning sun both summer and winter. The morning sun was utilized, while the evening sun was shaded. However, later additions and renovations to the Royal Victoria Hospital were not structured in the same careful manner according to the sun, and this became, for most parts another typical example of the 'antibiotic era'.

And so, the new post-war architecture demonstrated less understanding of the importance of light to health, less understanding of the direct sunlight and less understanding of the clear, low-iron glass and its importance to the quality of the light. All factors, which many nursing homes and hospitals in the 20s and 30s where taking for granted (Carter, 2007).

At a typical 'technological' hospital, the light was planned in a more scientific way, using measurable quantities, measured in lux and in daylight factors, to take less account of the fundamental difference between eastern morning light and western evening light, or for that matter the body's various needs for light, during the day and the year. The new hospitals in the antibiotic era were often characterized by their simple geometric, Euclidean shapes, which actually did not utilize the daylight as well as the previous building typologies, such as the classic E, H-and U-shaped buildings which had utilized the daylight from multiple angles and with several corner-rooms, flooded with sunlight from two sides, often with solarium-rooms, oriented towards the sun. And so, during the post-world war II era, most classical typologies were replaced by more compact building shapes, which, as noted, did not utilize the sunlight as well, reducing the actual number of sunshine-hours inside the building during the day and during the year. In effect, the new designs were not planned according to the sun and geographical orientation. Deeper building-plans and lower ceiling heights were implemented. Instead of previously recommended ceiling-heights of 14 feet 9 - equivalent to approx. 4.25 m- the ceiling heights are lowered to the current 2. 7 m. (Adams 2008) In this context, it is interesting that the electricity prices during this period – that is, from the late 1940s and until the oil crisis in 1972- fell, enabling the architecture to takes less account of the daylight, simply because the artificial lighting became cheaper. White, hygienic walls help increased the daylight factor at the new hospitals, compensating for the lowered ceiling heights. Horizontal window openings also become common during this period allowing less direct skylight into the building - thus reducing the healthy light. This development did not only applied to hospitals, but was implemented within the built environment in general.

ENERGY CRISIS/SUSTAINABILITY ERA

Scientific evidence emerged linking depressive illness and light deprivation. Based on this and other more recent findings, it has become clear that building occupants do not get enough bright light to have a positive impact on their health and emotional stability. The light levels required for this are much higher than those needed to perform visual tasks. Electric lighting developed under the assumption that the only significant purpose of light for humans is to see. Until recently, the impact of artificial light on physiological and psychological well-being was not generally considered. This quantifiable data has come to be known as Evidence-based knowledge, which will be discussed in the following chapter.

2 THE QUANTITATIVE IMPACTS OF DAYLIGHT ON THE HUMAN BODY

EVIDENCE BASED DESIGN

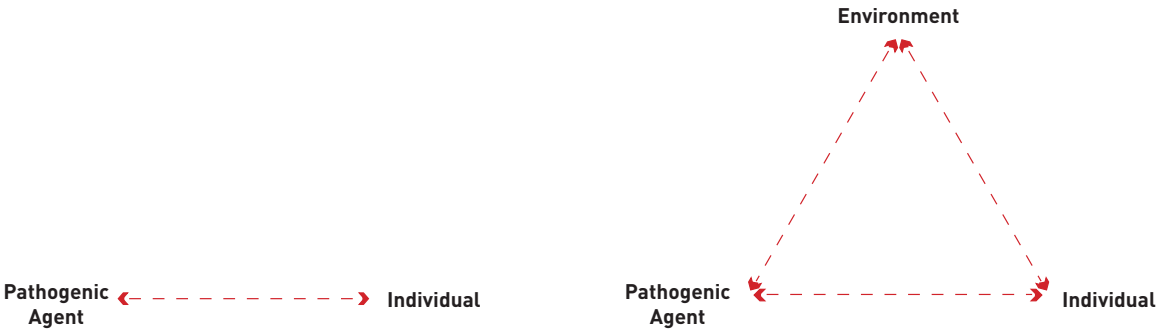


Figure 16: Environment to health, causal relationship model

Natural daylight is essential in deterring a large number of diseases, as well as maintaining our biological rhythms, and hormonal distribution. While we have invented many types and means of artificial lighting that supplements the light from the sun, the radiation of artificial light lacks the wavelength, nuance and tone (Plummer, 2009) that comes with natural light.

Recent studies and new research, have examined how the physical environment can influence well-being, promote healing, relieve patient pain and stress and reduce medical errors, infections and falls. Many hospitals, community health centers and residential care centers are adopting evidence-based design for new construction, expansion and remodeling. Remarkably, it is the same driving medical forces that in the 1940s abolished the healthy architecture, which today, restore the importance of the physical environment, including light and architecture. This is partly based on the recent discoveries regarding the importance of Vitamin D and the discovery of non-visual light. (Berson, Dunn & Takao 2003).

In many ways, we are returning to the basic realization that medicine and technology alone, do not support health and wellness in the best possible way, and that the environment may be more important to our health than we have imagined through the past 50 years. In several scientific publications both daylight and natural surroundings are re-introduced as important factors to healing and to health. Several factors suggest that the era of antibiotics is over. According to the World Health Organization (WHO), we are facing a global crisis in antibiotics, looking at an increasing number of multi-resistant bacteria, while we, unfortunately, see fewer, new medical responses, in the form of effective vaccines against these bacteria. With drug-resistant bacteria posing an ever greater threat to public health, sunlight's germicidal properties merit rather more attention than they receive. So too do the therapeutic properties of sunlit spaces. In this context, there is good reason to restore the significance of architecture and reestablish light and the physical environment as a factor, important to the overall health and to the prevention of diseases.

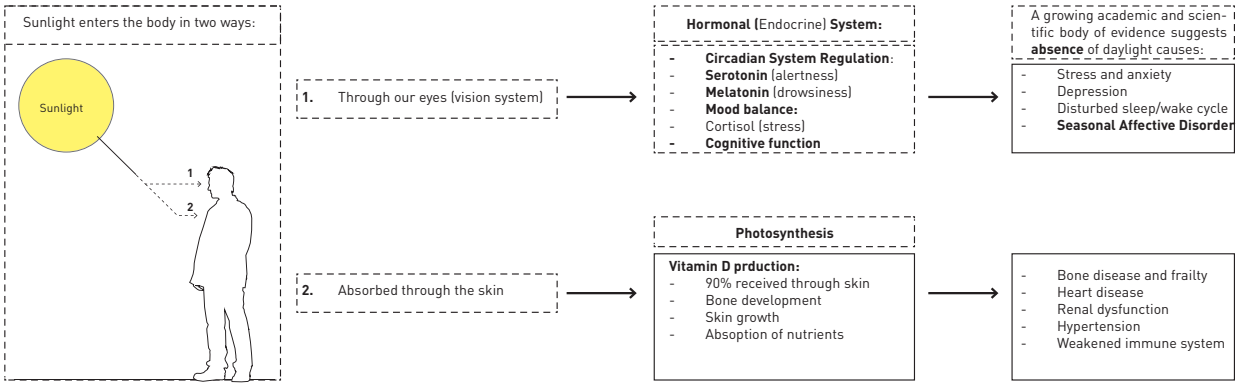


Figure 17: Daylight impact on human body

According to the WHO, four major diseases are currently threatening the western world today, these diseases are cardiovascular disease, cancer, obesity and depression. All of these diseases are affected by light and can be treated with light. For both cardiovascular disease and cancer, there seems to be a striking correlation between latitude and dissemination. The further away we move from the equator, and the UV light of the sun, the more the cholesterol levels increase, also increasing the mortality from cardiovascular disease and several types of cancer. Sunlight seems to play an, albeit still unclear and complex, role in the development of these diseases. (Giovannucci, et al 2005).

Today, new scientific studies confirm the early discoveries of Niels Finsen, clarifying the effects of the UV light on health and the general well-being. Researchers have also discovered that our immune system is critically dependent on vitamin D in order to function. Vitamin D is in fact not a vitamin at all. It was originally misclassified as a vitamin and is in fact a so called steroid hormone, that is, a substance which the body - unlike vitamins - can produce itself. The UV-B light of the sun converts 7-dehydrocholesterol into the skin to a so called inactive vitamin D. which in turn, via the liver and the kidneys, is converted to the active vitamin D3. The formation of vitamin D3 is therefore not the result of the sun alone, or for that matter a result of the body alone, but the result of a complex interaction between the body and the environment. The discovery of vitamin D -and in particular the discovery of what the lack of sunshine and vitamin D can cause to the human body has since then been supplemented with new knowledge.

Figure 18: Daily Sun sequence

In his research paper, Psychosocially Supportive Design: As a Theory and Model to Promote Health, Dr. Alan Dilani, focuses on the link between design and wellbeing, based on a multidisciplinary approach, leading to new definitions of design that not only foster functional efficiency, but improve health processes. His paper is a critical view of the challenges facing the field of healthcare design. He notes the persistence of institutional and narrow functionally oriented approaches in which high propriety is given to functional efficiency and largely neglect environmental qualities that could be considered psychosocially supportive. States that modern disease concepts are multifaceted, no longer narrowly pathogenic, with the quality of the physical environment having a great impact. Dr. Dilani's theories of design from a "salutogenic" model, offer a framework for design of new healthcare facilities, by defines environmental causes of stress, introducing environmental wellness factors (particularly natural daylight) that stimulate the senses, thereby promoting health processes.

Another proponent of Evidence-based design is Roger Ulrich, Ph.D., who asserts that these environmental factors are supportive in nature, beyond purely medical treatment received by patients, referring to the factors that support or facilitate coping restoration with respect to the stress that accompanies illness and hospitalization patients, as well as lowering dependence on analgesics (painkillers). Ulrich outlines the environmental characteristics found to influence health outcomes. These include materiality, furniture arrangements, and air quality.

The two most important environmental factors, according to Ulrich, are the acoustic properties influencing noise levels level in the patient room (which affect sleeplessness and elevated heart rate with enhanced sensory deprivation from sources such as repetitive sounds of respirators), and Lighting quality (particularly inadequate daylight exposure has adverse effects on patients by reducing positive stimulation). He references two studies (Beauchemin, 1996, and Hays, 1998) in Canadian hospitals where patients had shorter hospitalization times when assigned to rooms

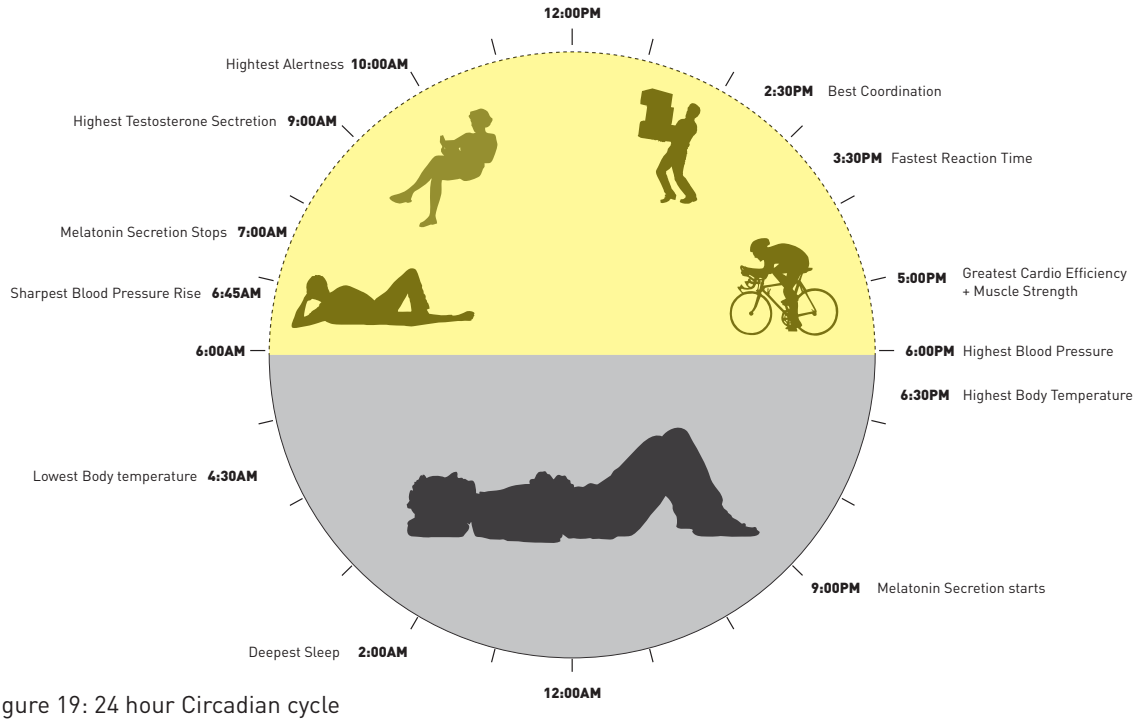


Figure 19: 24 hour Circadian cycle

with an abundance of daylight (compared to rooms in the same institution lacking in daylight exposure) and also notes that evenly sunlight-illuminated rooms were more effective than rooms directly exposed to the sun that create bright glare patches. Ulrich's material is relevant to the project with his in depth evidence-based discussion on the environmental factors that affect both patient outcomes and duration of hospital stays. From this material, it can be concluded that even daylight illumination throughout the space is much more effective in terms of patient response, than rooms directly exposed to sun creating harsh glare conditions. These implications will be noted in the Experiment.

In a paper by Joonho Choi and Liliana O. Beltran, Ph.D., is an investigation on how daylight affects patient recovery by evaluating daylight levels in patient rooms in comparison to their periods of recovery time. Patient data for the study was taken at Yonsei Medical Center in Seoul, South Korea, and St. Joseph hospital in Bryan Texas, USA. There is an overview and assessment of the existing physical environment of each hospital, particularly their daylighting conditions. Results of the study also identify the types of diseases that are responsive to high daylight levels in a patient room. In the study, measurement of illuminance levels and daylight factors were sampled from a selected patient room from each orientation in the hospitals and it was found that patients in a room with higher daylight levels had shorter stays than those in rooms with lower daylight levels. According to the authors, the information of this study can be used as a basis for the development of guidelines for patient rooms in healthcare facilities in order to achieve more effective

healing environments. Particular attention to orientation of patient room and methods of design that can increase daylight infiltration are noted from this work.

THE CIRCADIAN RHYTHM (INTERNAL BODY-CLOCK)

The Circadian rhythm is a 24 hour cycle of chemical, psychological, and behavioral processes. Our bodies have around 200 'clocks' that are triggered by either internal or external cues. The primary external cue experienced by humans is daylight. Daylight controls the release of serotonin and melatonin (the hormone that prompts the body to sleep). Other important function-clocks include body temperature, blood pressure, and cortisol release (the stress hormone). Body temperature fluctuates throughout the day but has a strict cycle that helps trigger the body to sleep and awaken each day. In recent years (post-2000) the discovery of a new type of light sensitive ganglia cells has revolutionized the importance of light and the way in which we as architects and planners must consider both daylight and artificial lighting during the design process.

The importance of daylight and its positive impact on the health has once again been established as a fact. Berson, Dunn & Takao (2002) recall thoughts of modernism and the time before effective medical treatment and antibiotics. However, the missing piece not only consolidates Modernism and its 'mantra' of more light and more health, it also restores darkness as an important health factor. Thus, new evidence-based knowledge actually breaks with Modernism. A break, which means that, rather than focusing on light itself, we should be more aware of the interaction between the circadian rhythm of the body and the various graduations of light and darkness during the day. There exists a very complex, opposing relationship between the darkness-hormone melatonin and the happiness hormone serotonin. Both hormones are controlling and regulating our circadian rhythm. When we speak of the circadian rhythm, the timing of the exposure to light is absolutely essential. This timing can both support and obstruct the circadian rhythm. This happens through the shifts in what is called the dark-night-ratio, making the light an active factor, which can alter the circadian rhythm. While early morning light advances fatigue and the need for sleep the following night - which is very healthy, because it improves the sleep period. Light during the evening conversely delays the fatigue and reduces the need for sleep, thus working counterproductively on the health.

DARKNESS AND HEALTH: (DARKNESS IS ESSENTIALLY HEALTHY)

Our sleep is regulated by two independent factors; a homeostatic factor and a circadian factor. While the homeostatic factor is controlled internally by the body, the circadian factor is controlled by cues from the environment, in the form of light. The sleep period is no longer regarded as an unconscious state, but rather as the foundation of all activity and good health. (Lockley & Foster 2012).

Research has indicated that we, in the Western world, generally receive too much light during the evening, impairing our sleep, which again impairs our health. In our industrialized society we sleep on an average only approx. 7 hours a day, often suppressing the need for sleep by going to bed too late at night. Before the industrialization, our sleep pattern was longer and varied more compared to the season. During the wintertime we could sleep for up to 10 hoursu6 and during the summer significantly less. These seasonal variations was primarily caused by one factor- the amount of daylight.

However, darkness and areas with darkness are not welcome in many cities today, because darkness may result in increased risk of crime. Therefore the illumination of the 1900s is spreading to large parts of the cities all over the world, illuminating the skies at night. In fact so much so, that e.g. migratory birds and turtles - using light to navigate -no longer seem to be able to orient themselves in relation to time and place. Similarly, the opportunity to see the stars and the moon above is often impaired by the light pollution created by dense city-development and excessive use of artificial lighting.

Also stressing our circadian rhythm, when living in a society, where circannual differences between summer and winter, and circadian differences between day and night, are not taken more seriously. Our 24/7-society questions the relevance of darkness -a concept, which Modernism fought because it was unhealthy and harbored bacteria. But a concept, which we today may consider as absolutely healthy.

To illustrate this, we are often more tired and sleepy at night, after a long day outside in the sun. The light stimulates the production of serotonin, which again, over time, increases the levels of melatonin in the body. Moreover, there are indications that this relationship also works the other way round: The presence of increased melatonin at night releases more serotonin during the day, which corresponds to the fact that we wake up more fresh and active- having slept in full darkness.

Fig 20: Seasonal Affective Disorder (SAD)

LIGHT AND DEPRESSION: SEASONAL AFFECTIVE DISORDER (SAD)

A major breakthrough came in 2002, when scientists discovered a new sensory system in the human eye. This is not involved in vision: it is there to receive and respond to light, sending signals directly to the body's biological clock. This clock, in turn, regulates the secretion of hormones and neurotransmitters in the brain. These have a direct influence on our health and the amount of light and darkness we expose ourselves to dictates when, and how much of them, is secreted. Although bright light is known to have health benefits, and has been used to treat conditions such as seasonal affective disorder (sad) and non-seasonal depression for some time, no one knows exactly how, or why, it works. The discovery of this new photosensitive system explains a great deal about the ways in which light affects our well-being. In April 2005, a study published in the American Journal of Psychiatry concluded that bright light therapy is as effective as medication in the treatment of major depressive illnesses and that it has fewer side effects.

Significantly, recent studies also suggest Florence Nightingale was correct in her assertion regarding the positive impact of sunlight on the recovery of hospital patients. Research shows that heart attack victims stand a better chance of recovery if they are in sunlit rooms. Depressed psychiatric patients fare better if they get some sun while in hospital, as do premature babies with jaundice. In addition, patients in hospital wards suffer less pain following surgery if they can

Fig. Light treatment room for SAD

see the sun. Of course, solar radiation can trigger skin cancer in susceptible individuals but, paradoxically, the rays that cause tanning and burning are the same ones that synthesize vitamin D in the skin. According to the WHO, depression is one of the diseases that potentially threaten to undermine the modern welfare state (Hobday, 1999). Depression today represents the 4th major disorder in the Western world, second only to cancer, cardiovascular disease and obesity. In the future it is expected that depression will be one of the conditions resulting in the greatest loss of healthy life.

The lack of light is closely linked to depression and light therapy is a recognized non-medical treatment for most forms of depression. As we have seen, light influences the production of serotonin, directly affecting mood (Golden, et al 2005).

Light, therefore, has a positive anti-depressive effect, not only reducing the need for other medications, but also increasing the efficiency of other medicine. Light as a form of treatment for depression is most effective during the morning hours (Lewy, et al 1998) and not during the evening hours, when the light actually seems to have the opposite effect- both delaying and impairing the nocturnal sleep. Again, this is about the production of serotonin, which is best stimulated by light in the morning. However, to have any effect, the light must have a certain intensity and quality, and again the architecture and the quality of glass become central factors.

3 PSYCHOLOGICAL IMPACT OF DAYLIGHT

A DISCOURSE OF PHENOMENOLOGY

We have come to expect our built environment, beyond the minimal concept of shelter from the elements, to be emotionally satisfying and to stimulate the senses. Light brings architecture that life. While Evidence Based Design (quantitative) recognizes the physiological advantages impacts, the field of Phenomenology primary deals with the idea that the environment can impact a emotional and mental well-being. These ideas have been reflected in the design of new health care typologies and models of patient-centric design. These architectural works show daylight being manipulated to give a unique presence, constructing places and spaces that have a "more fluid reality that people are empowered to creatively engage with" and quite often have a psychologically healing effect (Plummer, 2009).

A new-found importance and understanding of light had a transformative impact on twentieth-century. Pioneering architects such as Frank Lloyd Wright, Le Corbusier, Alvar Aalto and Louis Khan became intrigued with the relationship between the material and immaterial, and the experiential aspects of architecture.

Louis Khan described a poetics of space and considered light to be a metaphysical presence. Describing his 1966 Kimball Art Museum, Khan declared light to be "the source of all being we were born of light. The seasons are felt through light. We only know the world as it is evoked by light, and from this comes the thought that material is spent light. Natural light is the only light that makes architecture, architecture". He was effectively conveying that the coexistence of light and material in offsetting each other's quality to enhance spatial experience.

Experience of space falls into the realm of Phenomenology, a topic in which many significant minds have touched on, and architects have brought into manifestation in their work. Developed during the mid-twentieth Century, offers a method of examining phenomena through intensified seeing and sensing. According to Henry Plummer, by suspending judgement and grasping things in a kind of primal encounter, it becomes possible to discern the most elusive and subtle aspects of buildings, in the aspects of light that we would normally fail to consciously notice. It was French philosopher Gaston Bachelard, his 1958 work The Poetics of Space, that introduced the concept of a 'primal image' and locates a source of its power in simple archetypal places from 'nests' and corners' and 'cellars' and 'attics', and in metaphysical places such as 'the lamp that glows in the window' (Bachelard, 1958).

Through the second half of the last century, phenomenology has been addressed in a more directly-architectural way, by architects speaking on and creating space. For instance, Danish architect Steen Eiler Rasmussen speculates on how some as "capricious as natural light can be artistically controlled", concluding that the adaptability of the human eye makes variations in the quantity of light insignificant, and it is rather the quality of light that is important. Another view is the work of Norwegian architect Christian Norberg-Schultz. His concepts of phenomenology are

based on the earlier concepts formed by the likes of Bachelard, as well as Martin Heidegger and Maurice Merleau-Ponty, where his aim is to return the focus to the poetic and qualitative realities of architecture (Norberg-Schultz, 1980); that the goal of the "art of building" is to create a "spirit of place" whose totality consists, as stated by Merleau-Ponty, "not only of concrete things with material presence, but also intangible things - primarily light and atmosphere" (Merleau-Ponty, 1962).

Architect Henry Plummer is an advocate of equating light with experience and the art of place, and to deepen our appreciation of light as human beings. Plummer discusses his fascination with daylight in the context of architectural design and examines the Phenomenological dimension of light as a function of our human connection with daylight. Drawing on the works of Gyorgy Kepes, Le Corbusier, Louis Kahn, as well as Junichiro Tanizaki and John Ruskin, Plummer explains in part how he developed his characteristic poetic language that he uses to describe the atmosphere of light. He refers to light as an 'intangible subject': One best described by the use of poetic language.

Light, according to Plummer, through its static and transformational nature, can be manipulated as a material in architectural design and can be shaped to impart a spirit of place in buildings. He insists that fundamental to daylight as a creative tool in architecture is, that it has moods, which are able to infuse physical things with a metaphysical spirit and can totally alter the character of a building. Daylight not only illuminates architectural form, but also gives it emotional depth. This 'atmospheric presence of daylight', as he calls it, helps sustains our spirit as human beings. He describes his primary interest in light as its human experience; the phenomenological dimension; that is, our immediate relationship with light itself and how it helps us feel more incarnate as it enliven and invigorate our built world. Further, how light imparts emotional and spiritual depth to buildings through moods that can resonate deeply within us.

Plummer markedly points out that despite its importance, phenomenology should not be the sole answer to understanding light, for as architects we need to also comprehend how light can be shaped and managed through time by specific building forms. Hence he suggests that Phenomenology be complemented with a more rational process, which would allow us to question how phenomena come into being through an interaction of sky and building, as the ebb and flow of incident light is guided by architectural openings and volumes, colors and textures.

Over the recent decades, proponents of a phenomenological view such as Juhani Pallasmaa, Peter Zumthor, and Steven Holl, have continued to expand, both in text and built work, the phenomenological basis of architecture. Finnish architect, Juhani Pallasmaa, in his 1996 work Eyes of the Skin , suggests a bias towards vision in our culture as a whole and in the architecture in particular. Buildings are conceived based on the way they look, not how the body interacts with them.

He reminds us that light plays a crucial role in helping us become fully conscious of our existence in the world and provokes interaction at an immediate, visceral and pre-cognitive level with the light we encounter (Pallasmaa, 1996) . A similar point of view is held by American architect Steven Holl, whose architecture attempts to embody the central idea that "the perceptual spirit and metaphysical strength of architecture are driven by the quality of light and shadow shaped by solids and voids, by opacities, transparencies and translucencies. Natural Light, with its ethereal variety of change, fundamentally orchestrates the intensities of architecture" (Holl, 1994).

Swiss architect Peter Zumthor, in his Thinking Architecture (1998) and Atmospheres (2006) recounts the influence of personal childhood memories as the 'soft gleam of the waxed oak staircase' in his aunt's house, the minute impressions that have stayed with him, and acknowledges that "daylight, the light on things, is so moving to me that I feel it almost as a spiritual quality...I don't understand light. It gives me the feeling that there's something beyond me, something beyond all understanding. And I am glad, very grateful that there is such as thing" (Zumthor, 2006)

In his book 'In Praise of Shadows', Junichiro Tanizaki explains the cultural differences with regards to light and its interaction with material surfaces that existed between traditional Japanese and modern western cultures. Tanizaki further elaborates that there exists a traditional preference of Japanese people for shadows and soft, broken light. Returning to the Japanese theme of simplicity, Tanazaki introduces the idea of shadows as place-makers, environment setters and an aesthetic all in one, in saying that the beauty of a Japanese room is illustrated by shadows. The simple contrast of light and dark spaces, rather than partitions, or even furniture, illuminate the idea of a space. The shoji screens in traditional Japanese houses diff use all the daylight that enters, whether the skies outside are sunny or overcast. The light is first shaded by the large overhanging roofs acting as a parasol, so that the interior muted effect is constant. The interior surfaces are carefully crafted to interact with the light.

Tanizaki makes it quite clear that Japanese integrity in preserving simplicity versus Western complexity and separation of the function and the appliances that allow that function, the clean and the unclean, the celebrated and the ugly. In talking about the environment surrounding the Japanese toilet, Tanazaki describes "a degree of dimness, absolute cleanliness and quiet so complete one can hear the dim of a mosquito," while "Westerners regard the toilet as utterly unclean and avoid even the mention of it." Tanazaki concludes, "the Japanese toilet is perfection." It is perfection because it functions as a toilet and contains all the parts of a toilet, yet does not have the negative aesthetic, or stigma of uncleanliness that the Western toilet has. It is a tranquil, celebrated space of reflection and increased sensitivity to sensual perception. This relates to architecture in terms of pureness of form, cleanliness coupled with efficiency, a building that functions: heats, cools, ventilates, while integrating the "stuff" of these functions into a minimalist, seamless design. Architects spend much time crafting spaces, atmospheres, that demand a

certain aesthetic, and pipes and other mechanical things are thrown aside, hidden, covered up as annoyances yet necessities. The toilet is a necessity, yet it often denotes a dirty space, a messy space that can be unpleasant, yet the Japanese celebrate it. Perhaps our western understanding is a bit muddied. Perhaps it falls in the grey area between dark and light– the fainted portion of the shadow. I think it is because we have competing interests. We strive for complexity in simplicity, or, conversely, simplicity in complexity. On the other hand, the Japanese find beauty in purity, an understood reality rather than a personal interpretation. Pure simple forms are tranquil, beautiful. It is that simple.

QUANTITY VS QUALITY: A DISSECTION OF THE EXPERIENCE OF LIGHT AND SPACE

With the recent emergence and growth of a body of empirical knowledge, wellness can finally be quantified and accurately digitally represented. When we experience a place first-hand, we perceive all its tangible elements such as the material, tactile, and colourful, but what we may perceive as "bright and beautiful" can be quantified as a specific amount of Lumens or Candelas/m2 present in a space. This in turn has a measurable effect on our productivity, health promotion, and cognitive function. We may strive to understand the elements that make up that experience through dissection of representation. As a point of discourse, presence first-hand is raw experience, we then turn to the photograph, the literal depiction capable of capturing the qualities of a space in a two-dimensional form.

To help us understand the measurable elements that are present, we look to digital simulation methods such as the False Colour composite image. As modes of architectural representation, these digital simulations pose vital questions: can these numbers tell us how we are going to feel? Does the 'whole' of the qualitative architectural experience equate to the sum of its measurable parts? Can experience be quantified? Merleau-Ponty points out the essential integration of the sensory realms: "My perception is not a sum of visual, tactile and audible givens: I perceive in a total way with my whole being: I grasp a unique structure of the thing, a unique way of being, which speaks to all my senses at once." Gaston Bachelard calls this fused sensory interaction "the polyphony of the senses".

Let us now discuss the concept of experience itself through a dissection of four stages, of experience and representation, with this abstraction of the elements of which that experience is comprised we may further understand where this degradation occurs, whether it is gradual, or if the digital representation truly does contain the elements of experience. The First Stage is subjective, first-hand experience, when we are present in a space, we perceive our surrounding and it in turn affects us. This is a natural and involuntary process that is inexplicable ultimately affecting our actions, feelings and thoughts. Certain spaces of all our sensory perception, it can be argued that sight, our visual perception has the most impact on our experience. In addition to being regarded

as the noblest of the senses,

Vision has also been connected with thinking and truth, thus granting vision an added authority. As early as in classical Greek times, thought based certainty on vision and visibility. "The eyes are more exact witnesses than the ears", Heraclitus wrote. Our visual experience of space is primarily facilitated through the lighting conditions of that space. Experience also has a lot to do with the impact a space leaves on us when we are gone... not just being somewhere presently. Experience lingers; if a space has truly affected us, it will remain in our memory and we will continue to experience it in our mind, unless, of course, we had a physical object such as a photograph to help us remember our experience.

The Second Stage of the dissection is the photograph. As a two-dimensional image of a three-dimensional space, we rely on our accumulated life experience, cognitive ability of memory and imagination to become truly immersed in what the image represents, we in turn experience the scene portrayed in the image more than our present act of looking at the image itself. The photographer has given us a glimpse of their experience. Apart from the unpopulated photographs of architecture that show us the details and features of the built artifact, they are not so much focused on the experience. Experience is perhaps more present in social media, for example: we may stumble upon pictures our friend took while on a trip to Italy, and the spaces they encountered, and we are immersed and are able to get a taste of being there. They are sharing their experience through representation. This is the next-best alternative to actually being in a space. We can see in this image the lighting conditions, how light plays with shadow. In looking at this image, we now rely entirely on our visual sensory perception, even in the supplementation of other senses. Our viewing experience depends heavily on memory and imagination, the presence of experience is removed.

The Third Stage is the photo-realistic digital rendering as a mode of representation and the third step in the dissection of experience. With recent advances in technology and the sophistication of digital software, it is now possible to achieve a photo-realistic perspective rendering of a digital model. With the advent of digital 3d rendering, we had to rely on our own sense and understanding of the then-primitive software capabilities, and see a depiction of what the building could look like, while now with current digital technological capabilities, a rendering shows what the building looks like, as it is so realistic, the human-eye could not tell the difference. At this mode of representation, although the rendering is a mimic of the photograph, regardless of its level of realism, it is ultimately a depiction of an object that does not physically exist.

The Fourth Stage of our exploration of experience is representation of the space through the means of digital lighting simulation, particularly the false colour composite image. When most of us think of light, we naturally think about the light we can see with our eyes, however visible

light is only a small fraction of the electromagnetic spectrum. In order to help us visualize wavelengths of light that are out of this visible range, a false colour composite simulation method using colours we can see to represent wavelengths that we cannot. As a representation, the image suggests that the space may be beautiful as it has embedded all of the necessary visual elements in quantitative format. The image is, of course, not meant to be a literal depiction of the space, and yet, are these numerical values of light not correlated to a physical outcome and as we see the physical qualities of the space, could this image dictate of possible experience? Or perhaps it is merely those adept at reading this quantitative data who would be able imagine themselves within this space and could visualize its experience by looking at this image. As an image itself, removed from the spatial qualities that is being represented, an entirely different experience could be had by one who looks at it as a literal visual interpretation. The saturated tones of green and red and blue these colours would impact mood perhaps even induce a feeling of uneasiness. This digital simulation is more informative than it experiential, it portrays all from this image, and we have ultimately lose the sense of experience.

Any form of representation, the descriptive text, photography, photo-realistic rendering, and digital simulation all contain the elements from which experience is comprised, dissected and quantifiable, but somewhere through the process, the element of presence in place is degraded. As we arrive closer to understanding the quantifiable elements of experience, we move further from the essence of experience itself. Ultimately, there will always remain an intuitive qualitative element to design and inherent in the presence of space and its facilitation through daylight that is not able to be quantified by modes of digital representation.

4 ARCHITECTURAL PRECEDENTS FOR DAYLIGHTING STRATEGIES

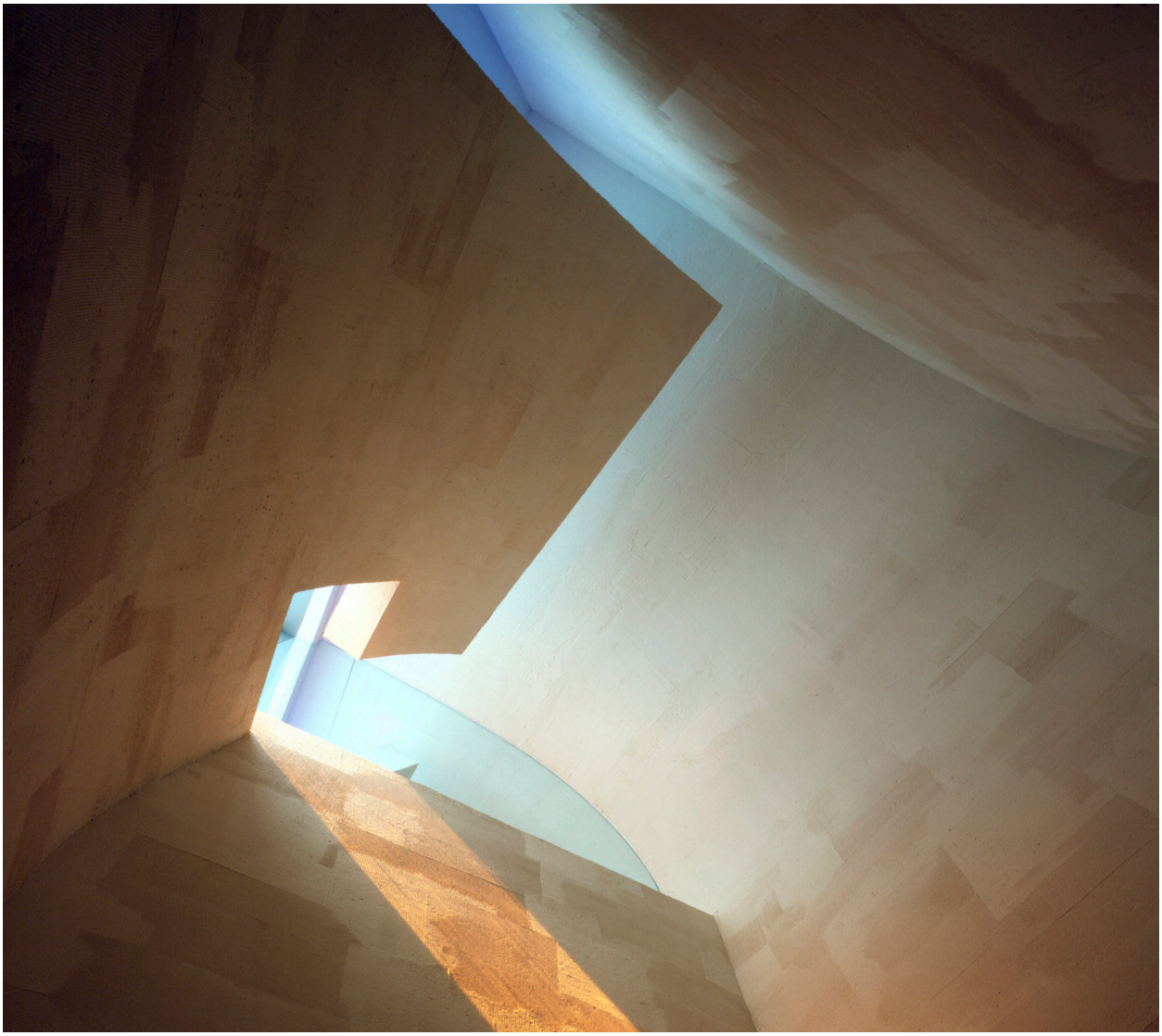


Fig 22: Bounced light in Chapel of St. Ignatius

This chapter of the Thesis will explore architectural precedents for methods of daylight techniques. These precedents will fall under three primary categories: Direct Light, which is essentially concerned with the 'aperture' which permits light. The void that the shaft of light travels, and the surface which the direct light hits. The character created by this technique is the creation of dynamic or animated space, aiding in bringing awareness to the passage of time or change in the suns path. The second category is Bounced Light (or reflected) which is concerned with the movement and redirection of light on a surface. The character created from Bounced light is that it draws emphasis to particular surfaces or areas of space, used to heighted or evoke emotion. The third category is Diffused Light, which is concerned with the filtering of light where the incident ray of light passes through or is reflected at many angles. The character of this type of lighting is the creation of calm, tranquil or soft space. The essence of the techniques from each category will then be extracted and applied as a three-fold strategy during the design project.

Fig 23: Arab Baths of Baza interior A

Fig 24: Arab Baths of Baza interior B

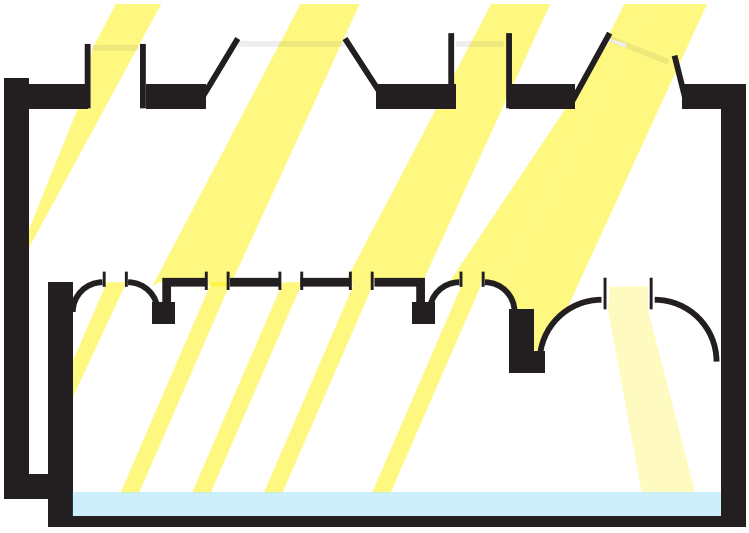


Fig. 25: Arab Baths of Baza lighting diagram

DIRECT LIGHT

The Arab Baths of Baza, a project by Ibáñez architects is located in Granada, Spain, involved a restoration to the medieval baths, and an addition of an outer shell to add program space to the building and increase its scale. The building is especially interesting in its handling of direct light shafts and the apertures which allow light to permeate into the sub-level baths. The outer envelope roof uses rectilinear skylights in strategic positions that allow direct light to hit star-shaped apertures of old building's envelope. The result is a two tiered control of light shafts bringing a dramatic effect. As stated by the architects: "The enhancement of the monument is based on four essential respects. The "scale" of the object in itself and in relation to the plot and urban scene. The light, key to the perception of interior spaces. The water, as a characterization of the bath

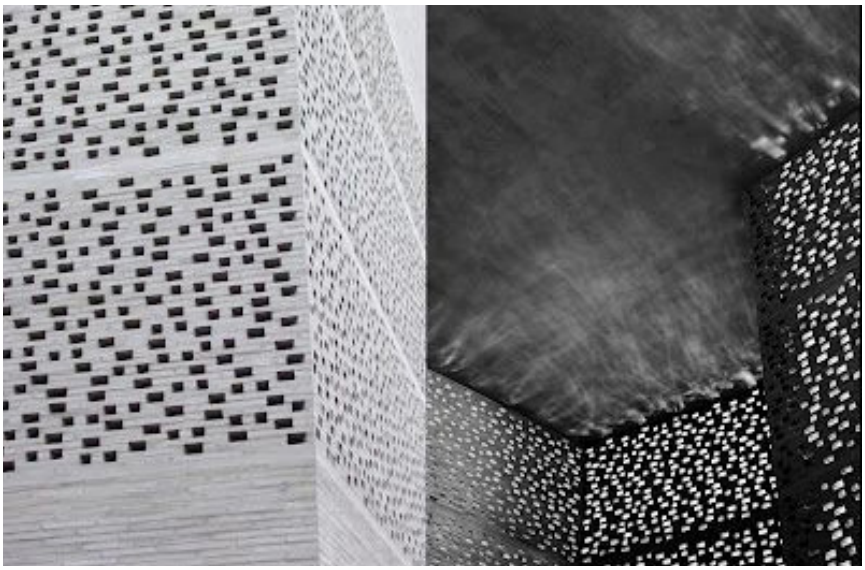


Fig. 26: Kolumba museum interior A

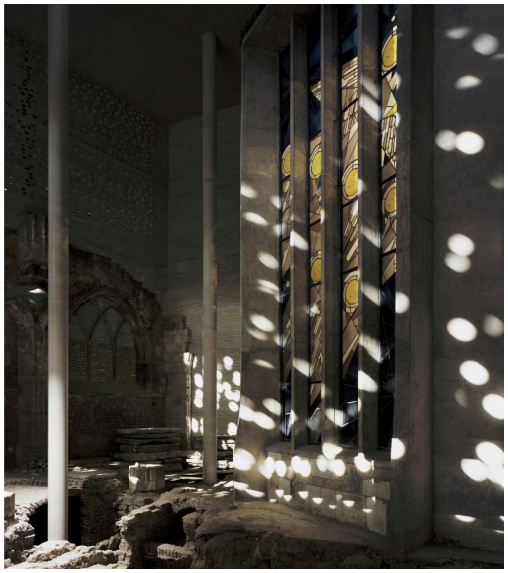


Fig.27: Kolumba museum interior B

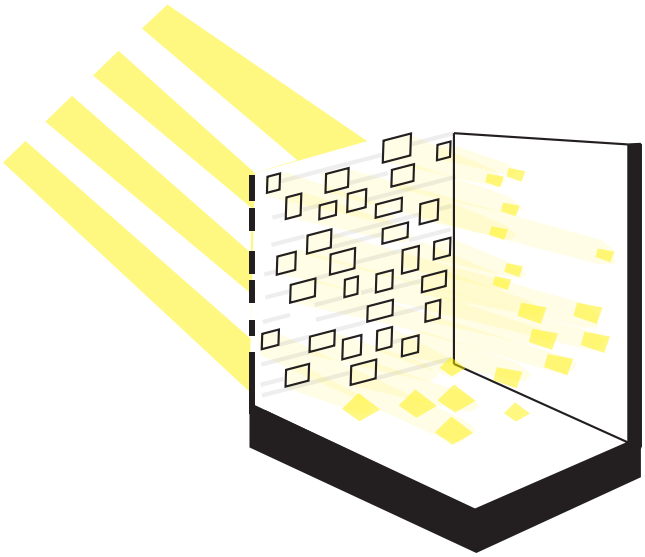


Fig. 28: Kolumba museum lighting diagram

itself and its divisions, as evoked intangible and material. The materiality of the medieval building, characterized by the thickness and mass of the building systems".

Peter Zumthor's Kolumba museum, makes excellent use of the aperture in the envelope for direct lighting effects. Similar to the Arab Baths, Zumthor aimed to not only preserve and respect the integrity of the original ruins of a late-Gothic church, but enhance its essence. As Zumthor stated, "They believe in the inner values of art, its ability to make us think and feel, its spiritual values. This project emerged from the inside out, and from the place." Both the exterior and interior of the building shows the contrast between old and new, but only on the inside can we appreciate the dazzling effects that light brings to the architecture. As the brick patterning is the aperture and permits light through the holes. This has a transformative effect on, firstly, the

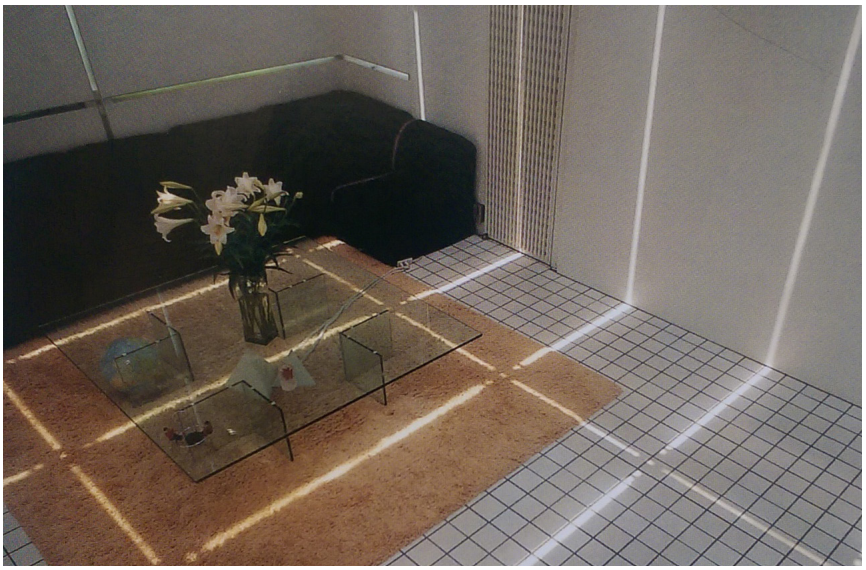


Fig. 29: Light-lattice house interior A

Fig. 30 Light-lattice house interior B

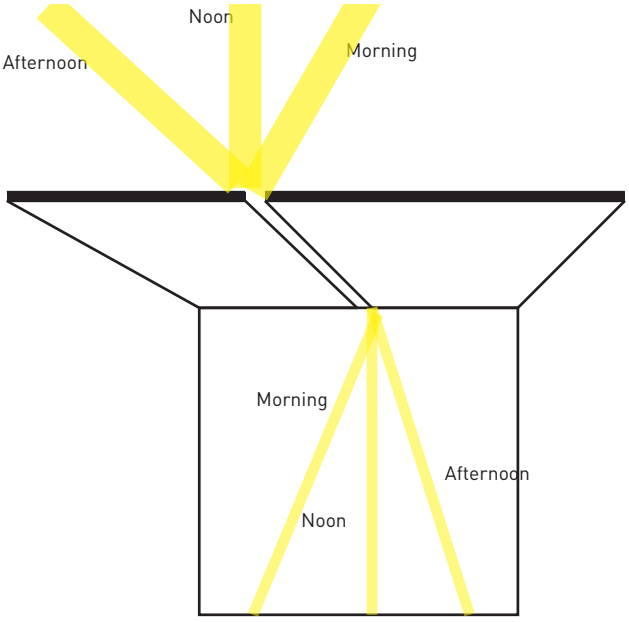


Fig.31 Light Lattice House lighting diagram

source which is the massive brick wall that seemingly dematerializes, and secondly is the surface upon which the shafts of light fall. They are enhanced by the shafts of light that animate the walls, ceilings, and floors.

The next project in this category is the Light-lattice house, by Shoei Yoh located in Nagasaki, Japan. Gyrating webs of direct light are cast through the day, the apertures are gaps left between the double-grid structures of steel channels. Projected patters double the radiant lines of the envelope that glide slowly around each room of the house. The use slant of direct light in this project helps to indicate the passage of time within the interior, recording every new sun angle, from morning, to completely vertical at noon, to the afternoon light, the solar path is projected on the walls in a grid formation.

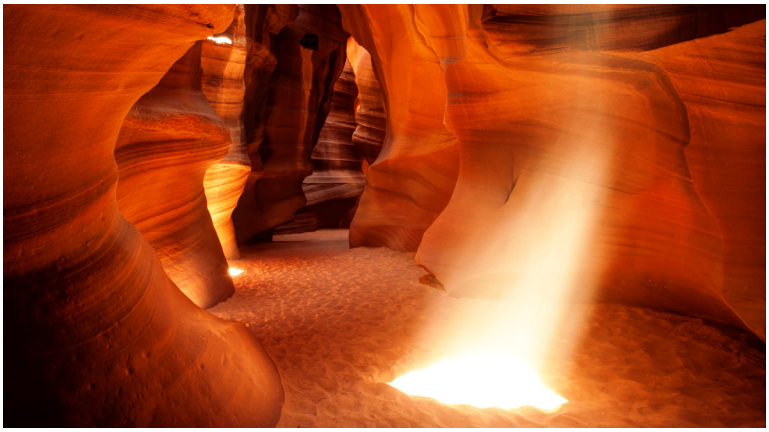


Fig.32: Antelope Canyon - light shaft A

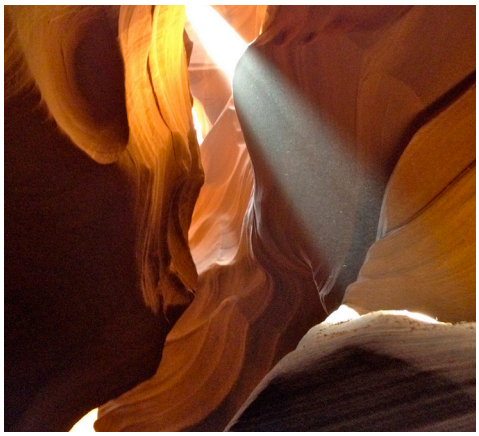


Fig.33: Antelope Canyon - light shaft B

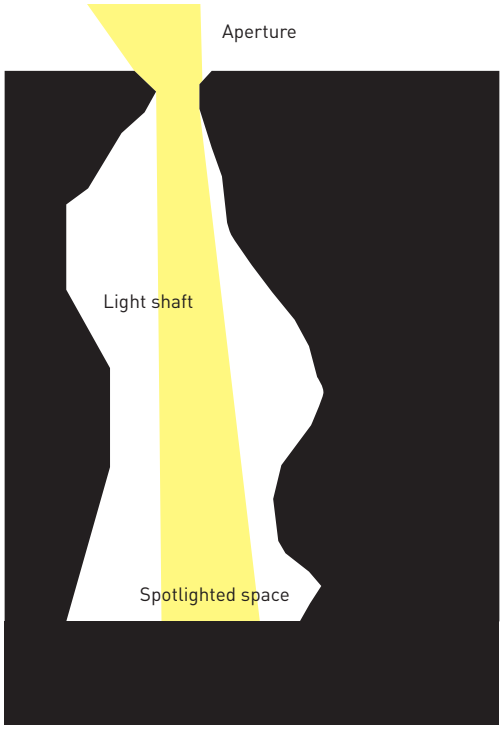


Fig.34 Antelope Canyon - light shaft diagram

The final precedent for this category is from the natural world. It is possible to draw inspiration from how daylight is manipulated by natural forms, providing an excellent example of technique. According to French/Turkish architect Ahmet Gülgönen, "Light defines space, and only through light does a dark void become space: It is not a void, and a void without light is not a black space". Antelope Canyon in Arizona is a water-eroded slot canyon. The natural daylighting techniques featured here fall into the Direct Daylight as well as the Bounced (reflected) daylight category, discussed in the following section. Apertures of the fissures at the top of canyon controls the direct light and creates shafts or beams of light that hit the bottom canyon floor directly. This only occurs when there are no obstructions from the masses of the side canyon walls.

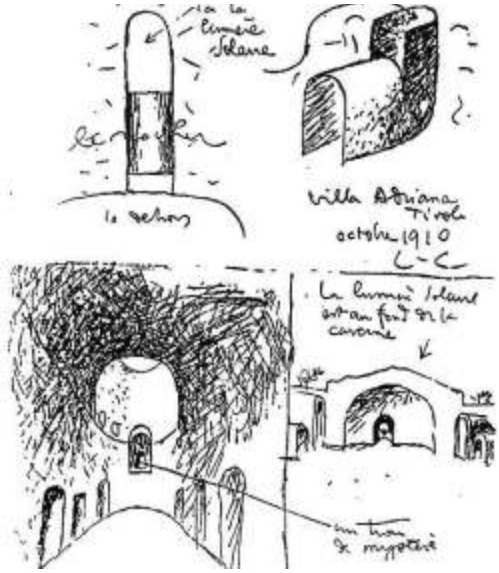


Fig.35: Le Corbusier Villa Adriana sketch

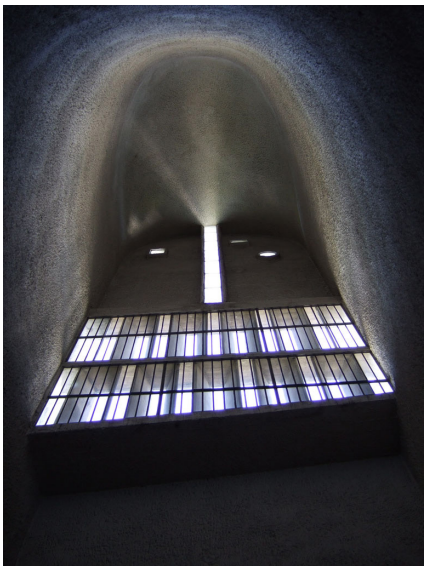


Fig.36: Ronchamp Chapel interior A

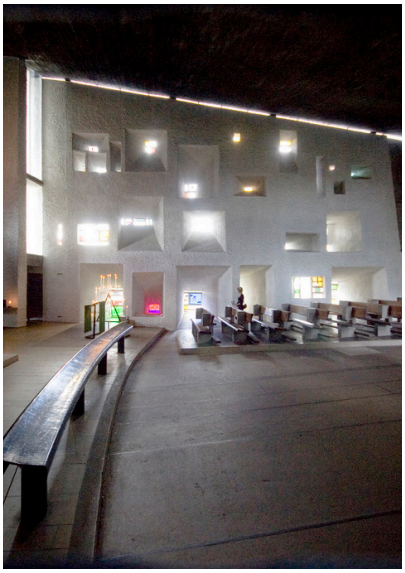


Fig.37: Ronchamp Chapel interior B

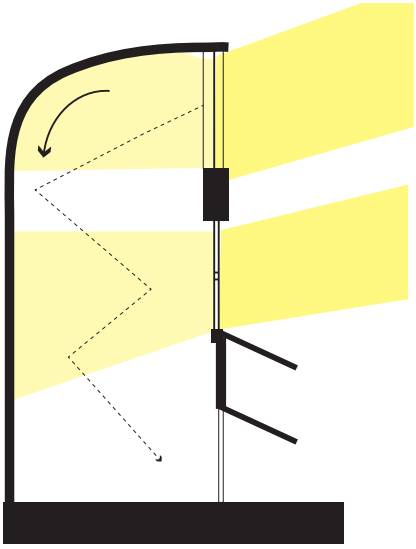


Fig.38 Ronchamp Chapel lighting diagram A

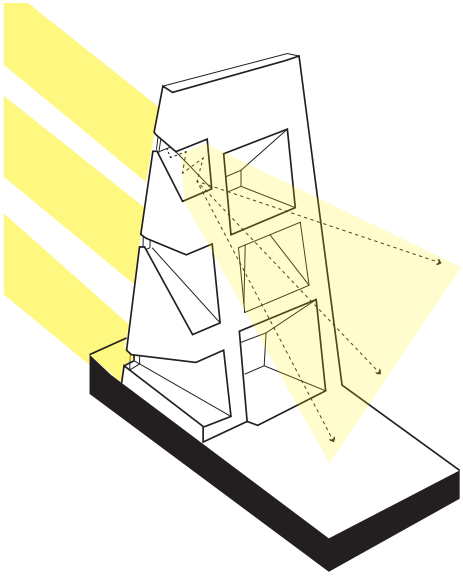


Fig.39 Ronchamp Chapel lighting diagram B

BOUNCED (REFLECTED) LIGHT

The second category of architectural precedents is the use of Bounced (reflected light). We will first explore two projects by Le Corbusier: The Ronchamp Chapel and The Convent of La Tourette. Le Corbusier used in his inspiration for Ronchamp, studies of ancient Greek and Roman sites. His famous sketches are indications of his understanding of the techniques of lighting used at these sites. Figure - shows his sketch of the Serapeum of the Villa Adriana at Tivoli, drawn during the voyage d'Orient. This technique of bounced light was used to influence his light infiltration design at Ronchamp, we see this particularly in the West Tower, where the light comes in first through the slit at the top of the tower, and then through the compressed window apertures lower down and is reflected down the curved surface of the tower. The next technique used in Ronchamp

Fig.40: La Tourette light cannons

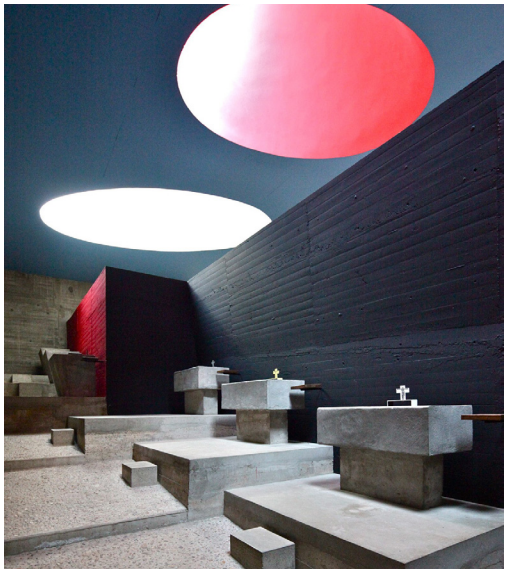


Fig.41: La Tourette interior

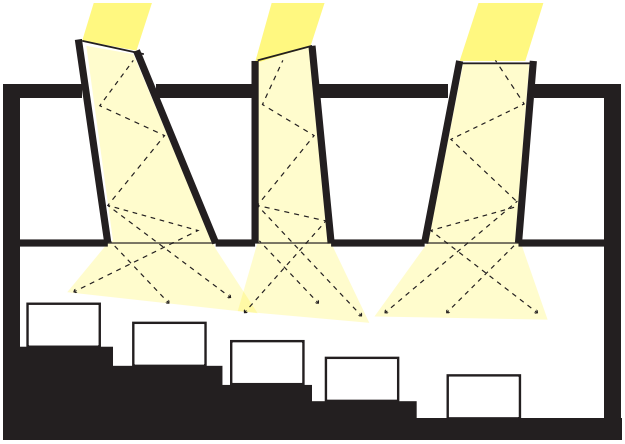


Fig.42: La Tourette lighting diagram

Chapel are the multitude of apertures used on the South Wall into the congregation. The outer aperture squeezes the direct light which is then bounced around the massive whitewashed wall section and finally spread out through the larger inner aperture. Le Corbusier's intention was that the light from a place in the congregation, no particular feature is spotlighted (as in the manner of a Baroque Church). An asymmetrical balance of light created by this lighting technique enhances visual perception by eliminating excessive brightness contrast associated with a single opening in dimly lit space which normally leads to glare.

At the Convent Sainte-Marie de La Tourette, Le Corbusier Combination of top and side-daylighting is used to accentuate the contrast between the natural wood and concrete materiality. The piercing light-wells, variety of wall washing and apertures. For this precedent study, the focus will be on his use of Bounced light in the Light wells (light cannons) that carry light down into the quiet three tiered North alter near the Crypt. There are three large circular light cannons angled

Fig. 43: Chapel of St. Ignatius interior A

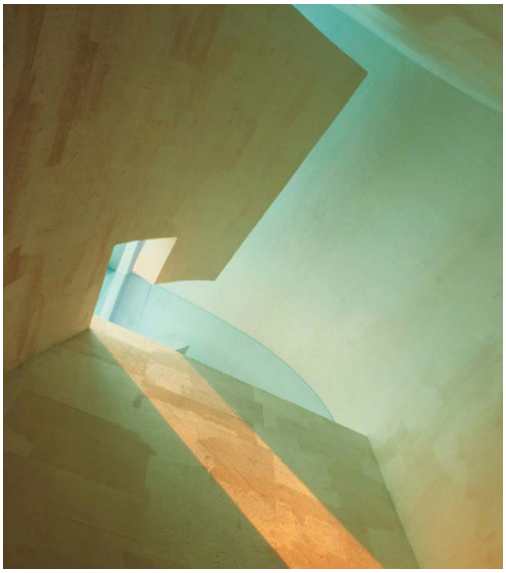


Fig.44: Chapel of St. Ignatius interior B

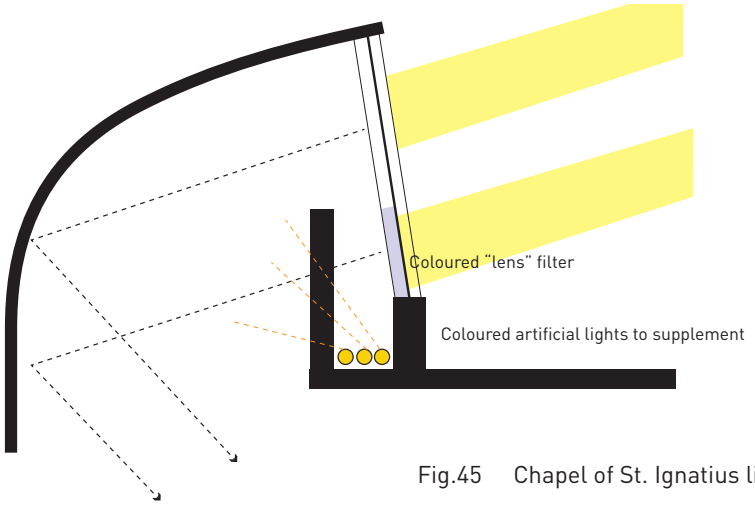


Fig.45 Chapel of St. Ignatius lighting diagram

at various directions so catch various moments in the solar path. Of the three cannons, the one in the middle is painted red on the interior, so what when the light is bounced of this surface, it takes on the coloured glow, affecting the emotions and evoking feelings of the sacred atmosphere. "Architecture is the skillful, accurate and magnificent play of volumes seen in light." - Le Corbusier.

Steven Holl's use of Bounced light at the Chapel of St. Ignatius is the next architectural precedent we will study. His guiding concept for light in the chapel was "Seven bottles of light in a stone box". Each bottle or vessel corresponds to a focal aspect catholic worship. Light passes through each bottle in a specific area of the building to define physical and spiritual spaces with pools and coloured light. His methods of technical light infiltration, dealing with colour like filtering and bounced light - Lighting conditions directed to specific areas to create a mix of different spaces with different character. The light "Bottles" are curved at the as directional scoop light as it bounces down into the interior and washes on the surfaces. Each "bottle" of light behaves as

Fig.46: Antelope Canyon bounced light A

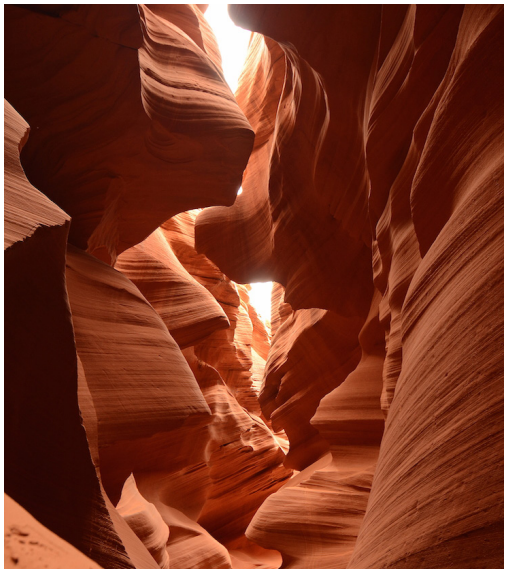


Fig.47: Antelope Canyon bounced light B

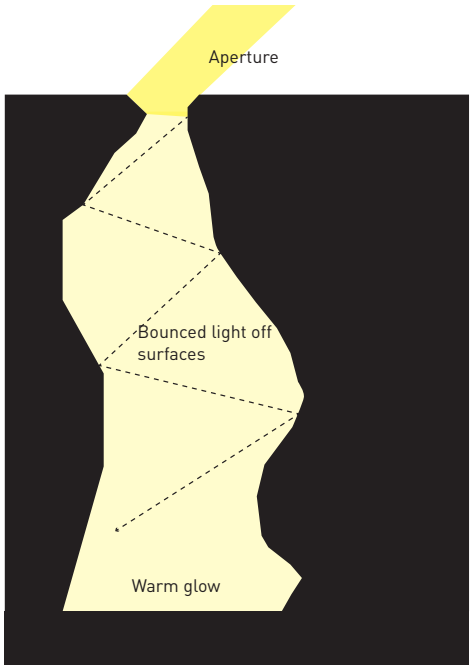


Fig.48: Antelope Canyon lighting diagram - bounced light

periscope, reminiscent of Le Corbusier's tower scoops at Ronchamp. We will focus on the "Bottle" of light his Reconciliation Chapel, which not only allows light into the interior but allows light to animate with changing colours as the sun moves throughout the day. Holl employs the use of coloured glass "lens" to filter the daylight coming through, but also supplements with the use of artificial bulbs of a different colour (in this case, orange)

The final precedent for this category is again looking at the natural world. With the Antelope Canyon, when light is not passing through the aperture to hit the ground directly, it enters the top

Fig.49: Nelson Atkins diffused light interior A

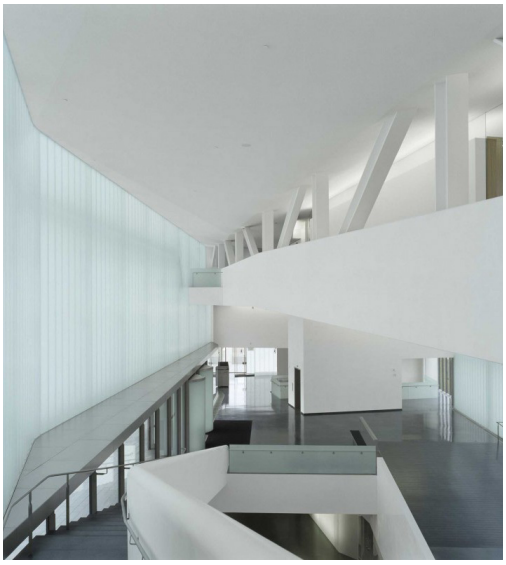


Fig.50: Nelson Atkins diffused light interior B

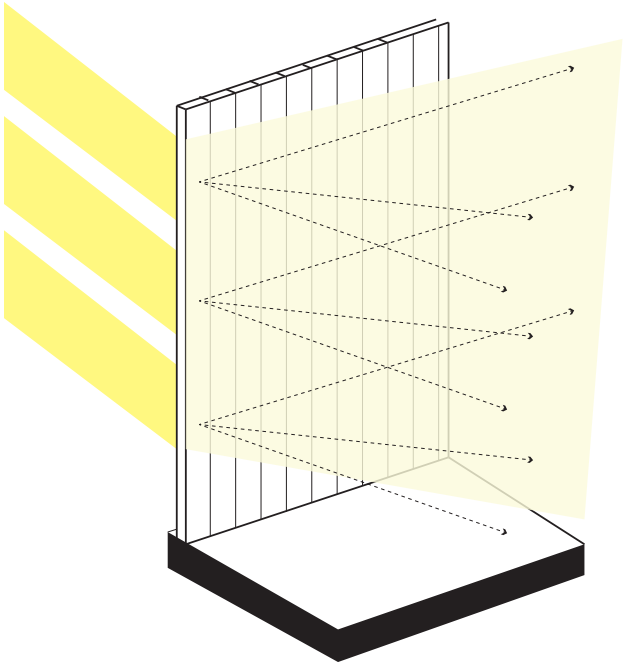


Fig.51: Nelson Atkins lighting diagram

of the canyon and is bounced around the walls of the canyon surfaces, creating a warm glow that embodied the colour and texture of the rock.

DIFFUSED LIGHT

The first precedent for diffused light is the Nelson Atkins Museum by Steven Holl. It was Holl's intention to allow the visitor to experience a flow between diffused light (from the channel glass envelope) and reflected (bounced) light, art, architecture, and the surrounding landscape. Pre-cast concrete "Breathing-T" structure that acts as a light well, reflecting and curving light into the

Fig.52: Kunsthaus Bregenz interior A

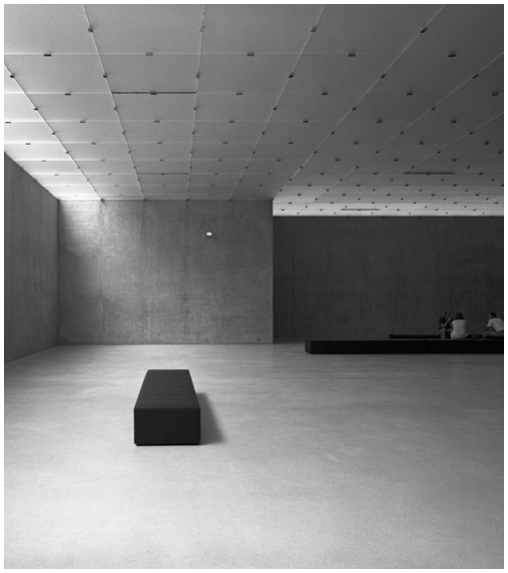


Fig.53: Kunsthaus Bregenz interior B

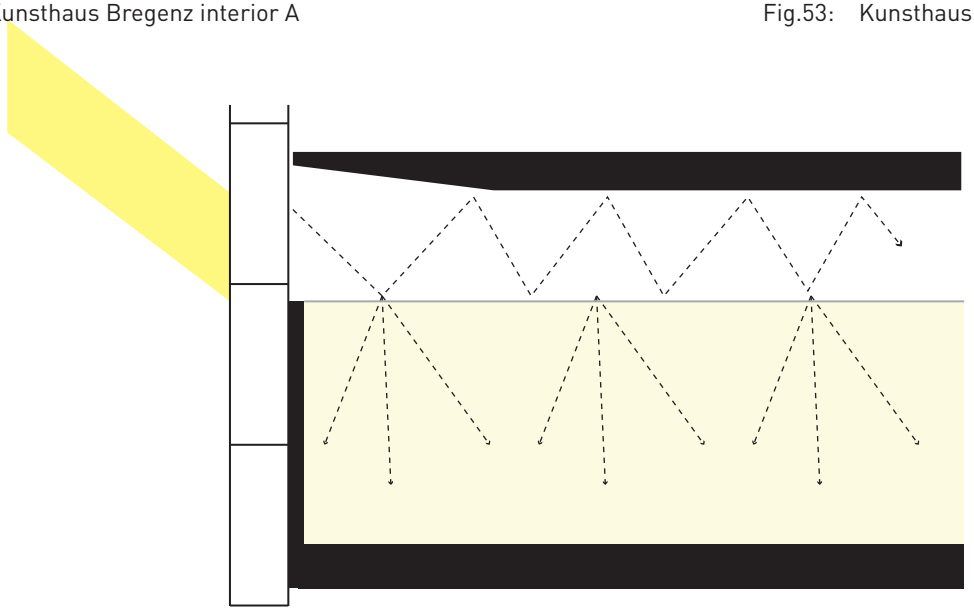


Fig.54: Kunsthaus Bregenz lighting diagram

lower level spaces. For this precedent we will be looking at the outer envelope of the building. The dual glazed U-shaped channel glass gives the spaces of the interior a bright, evenly illuminated diffused glow.

The second project in the diffused light category is the Kunsthaus Bregenz by Peter Zumthor. The daylight that is captured by the glass façade gets filtered through the plenum and distributed throughout the ceilings of the gallery spaces. According to Zumthor, "It absorbs the changing light of the sky, the haze of the lake, it reflects light and colour and gives an intimation of its inner life according to the angle of vision, the daylight and the weather."

Fig.55: Yoshijima House interior A

Fig.56: Yoshijima House interior B

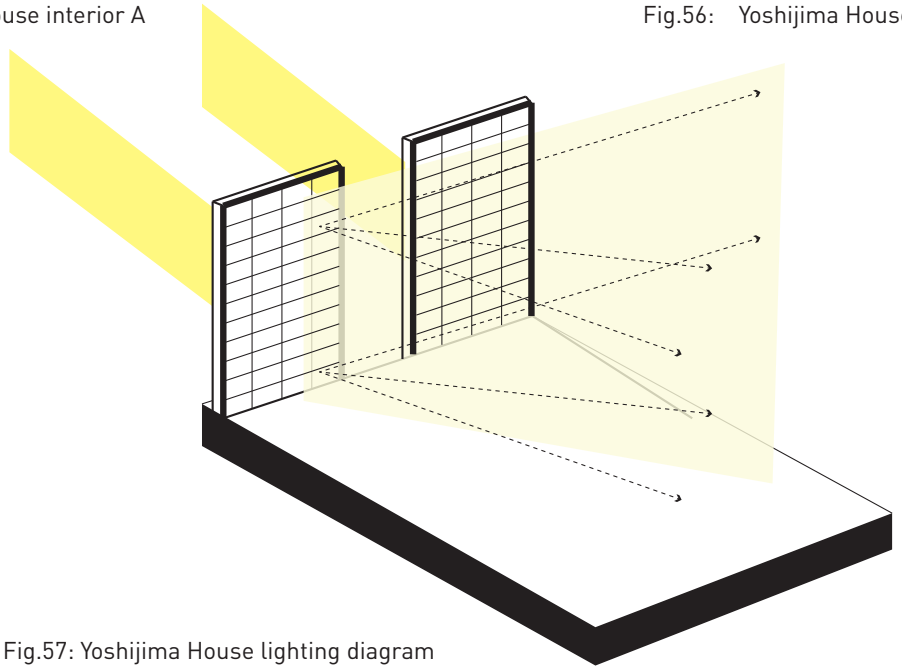


Fig.57: Yoshijima House lighting diagram

The third architectural precedent for the diffused light category is the typology of the Japanese Tea House. As a specific example, we will use Yoshijima House, built in 1907 and located in Takayama, Japane. This building captures much of the essence of traditional Japanese architecture with its characteristically diffused lit interiors. While bounced light filters from clerestories and trickles down through the rafters, the sliding Shoji white paper doors and windows diffuse the light as it enters the spaces, providing a calm, tranquil and often dim living spaces.

5 DESIGN PROJECT

PROJECT DESCRIPTION + OBJECTIVES

Throughout the previous chapters, it has been established that daylight is important, not just for physical, but for mental wellness. New health care models, such as Maggie's Cancer Care Centres are taking these Evidence-based Design factors into consideration and are quite successful in their implementation. A large factor in what makes Maggie's Centres successful in having such a psychological, emotional and physical impact is their non-institutional environment situated in a suburban context, which allows for liberty in orientation that maximizes solar exposure, as well as sprawling into the surrounding landscape for a physical and visual connection to nature.

Architectural question:

How can a health-care model that thrives on an abundance of light and connection to nature) be achieved in an urban context where available light is significantly less plentiful?

What methods can be used from studied precedents to augment, elaborate and orchestrate that available light to maximize its impact and effects rather than mere quantity?

The design project will be purposefully situated but with a specific constraint of an urban environment, where the goal is to achieve a spatial character that embodies these three design factors where daylight availability is limited. The design project demonstrates a method of daylight centric design that utilizes three primary techniques for daylighting that were extracted from precedent analysis: i) Direct light, ii) Bounced light, and iii) Diffused light. Through the methodical harvesting and manipulation of daylight in an urban setting, the project will demonstrate the potential for enhancing patient experience and the curation of varied experiential narratives in light.

In setting the context for the design exploration, a background of Maggie's will be explored, from its beginnings, to where the organization is today. The factors which make Maggie's Centres so successful in their mission will be analyzed, extracted and applied to an urban site. After choosing the site based on a specified set of criteria, the chosen site will then be analyzed in terms of its opportunities and limitations to both access to nature and natural light.

PROJECT CONTEXT

According to the organization, Maggie's Centres "are uplifting places with professional staff on hand to offer the support people need: practical advice about benefits and eating well; emotional support from qualified experts; a friendly place to meet other people; a calming space simply to sit quietly with a cup of tea".

The concept began with a woman named Maggie Jencks, who at 47, was diagnosed with breast cancer. During her time of treatment, she noted the "awful interior spaces" and "windowless corridors" in which she and her husband, architect and theorist Charles Jencks, had no option but

to wait in. She came up with the idea that, while there may be no cure for her cancer, there was something she could do about that sensitive period of waiting and treatment that are experienced by so many individuals with cancer. She then devoted the rest of her life to planning a "cancer caring centre", with the help of her husband, as well as her nurse Laura Lee (who is now Chief Executive of Maggie's).

According to those closest to her, she understood the need to feel in charge, "not a helpless passenger in a hospital production line). People needed information about their treatment options that was easily available and in an environment more comforting to them during a difficult period in their lives. She imagined "a beautiful space was needed in which to digest even the worst of news". She envisioned: A room with a view, a library, an "old fashioned" ladies room (which would supply "privacy for crying, water for washing the face and a mirror for getting ready to deal with the world. The first Maggie's Centre opened in Edinburgh in 1996, and since that time has grown to 18 Centres scattered over the UK, one in Hong Kong, and one in Spain. While there are similar cancer wellness Centres in North America, none have quiet the impact, reputation, and cultural zeitgeist of Maggie's, to have 17 of the top architects in the world queuing up to design.

PROJECT DESCRIPTION + OBJECTIVES

Maggie's Design and Programmatic Criteria:

Maggie's Centres have developed an Evidence-based programme and spatial requirements for the Evidence-based support they offer people during diagnosis, treatment, post-treatment and survivorship. Their official programmatic criteria is as follows:

- Entrance: obvious, welcoming, not intimidating.
- Small coat-hanging/brolly space.
- A welcome/sitting/information/library area.
- There should be as much light as possible.
- There should be views out to grass/trees/sky.
- You should be able to see where the kitchen area is, equally the sitting room and fireplace-area (hearth & home).
- Office space for a) Centre Head and b) fundraiser/deputy. This should be easily accessible from the welcome area so that either person working at a desk can see somebody come into the Centre, in order to welcome them.
- A video-viewing and computer-link information area or bay for the use of 4 people.
- A kitchen area, like a 'country' kitchen, with room for a large table to sit 12, which could be used for demonstrations/seminars/discussion groups. The kitchen should be relaxed and inviting enough for anybody to feel welcome to help themselves to coffee or tea. A central 'island' on which cooking demonstrations could take place.
- A large room for relaxation groups/lectures/meetings. A space sufficient to take a maximum of 14 people lying down. As much as possible, you should be able to open and shut walls (perhaps between this and welcome area/kitchen area) to have flexi-space, for more or less privacy, as occasion demands. The relaxation space should be capable of being soundproof when closed off.
- Smaller sitting/counselling room.
- Two (or one if the large room can sub-divide) small rooms for counselling or therapy, prefer-

ably with big windows looking out to grass/trees/sky. They should have a bit of character and perhaps they could have sliding doors that can be left open and be inviting when not in use. They should be soundproof. One should be able to take a treatment bed, preferably facing a window.
• Washroom should not be all in a row with gaps under the doors. Private enough to cry.
• A very small quiet space to have a rest/lie down.
• The idea of a continuous flow between house and garden space there should be somewhere to sit, easily accessed from the kitchen. We want the garden, like the kitchen, to be an easy public space for people to share and feel refreshed by. The relationship between 'inside' and 'outside' is important. A house protects you from the 'outside'. Equally the 'outside' of a garden is a buffer to the real 'outside'.

EXISTING MAGGIE'S CENTRE CASE STUDIES

Relevant examples of existing Maggie's Centres with features that support the design goals of psychological, emotional and physical support through the space, materiality, scale, abundance of daylight, and connection to nature.

Fig.58: Maggie's Glasgow exterior view

Fig.59: Maggie's Glasgow interior A

Fig.60: Maggie's Glasgow interior B

Fig.61: Maggie's Glasgow interior C

Maggie's Glasgow

Architect: OMA
Year: 2011

We accepted the commission with eagerness. The space we have is linked to the existing hospi-tal, but far enough away from it for us to create another world. It has both privacy and a central position; both sheltered and slightly exposed.'

- Rem Koolhaas

Cozy sitting nook with garden view.

Openness of kitchen and dining area.

Spaces with no corridors off seamless transition between program areas.

Fig.62: Maggie's Dundee exterior view

Maggie's Dundee
Architect: Frank Gehry
Year: 2003

'There is a Yiddish expression, "Heymish". It means homelike, comfortable. That's what we were trying to do there.'

- Frank Gehry

Fig.63: Maggie's Dundee interior A

Daylight pouring into main hallway space

Fig.64: Maggie's Dundee interior B

Home-like setting with access

Fig.65: Maggie's Dundee interior C

Library area acesss from main circualtion space.

Fig.66: Maggie's West London exterior view

Maggie's West London
Architect: Sir Richard Rogers
Year: 2008

"Their (RSHP) achievement is in having created a completely informal, home-like sanctuary to help patients learn to live - or die - with cancer, beautifully."

- Alison Brooks, Chair of the Judges, RIBA London Awards

Fig.67: Maggie's West London interior A

Kitchen and dining area visually and physically linked with outdoor space.

Fig.68: Maggie's West London interior B

Openness of kitchen and dining area.

Fig.69: Maggie's West London interior C

Spaces with no corridors off seamless transition between program areas.

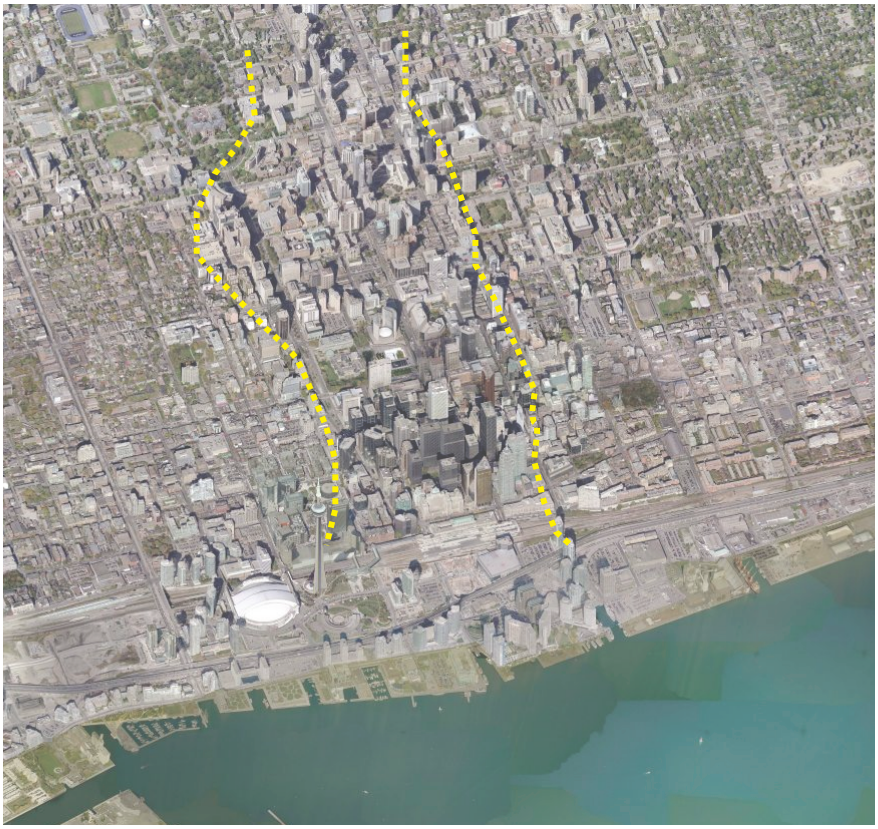
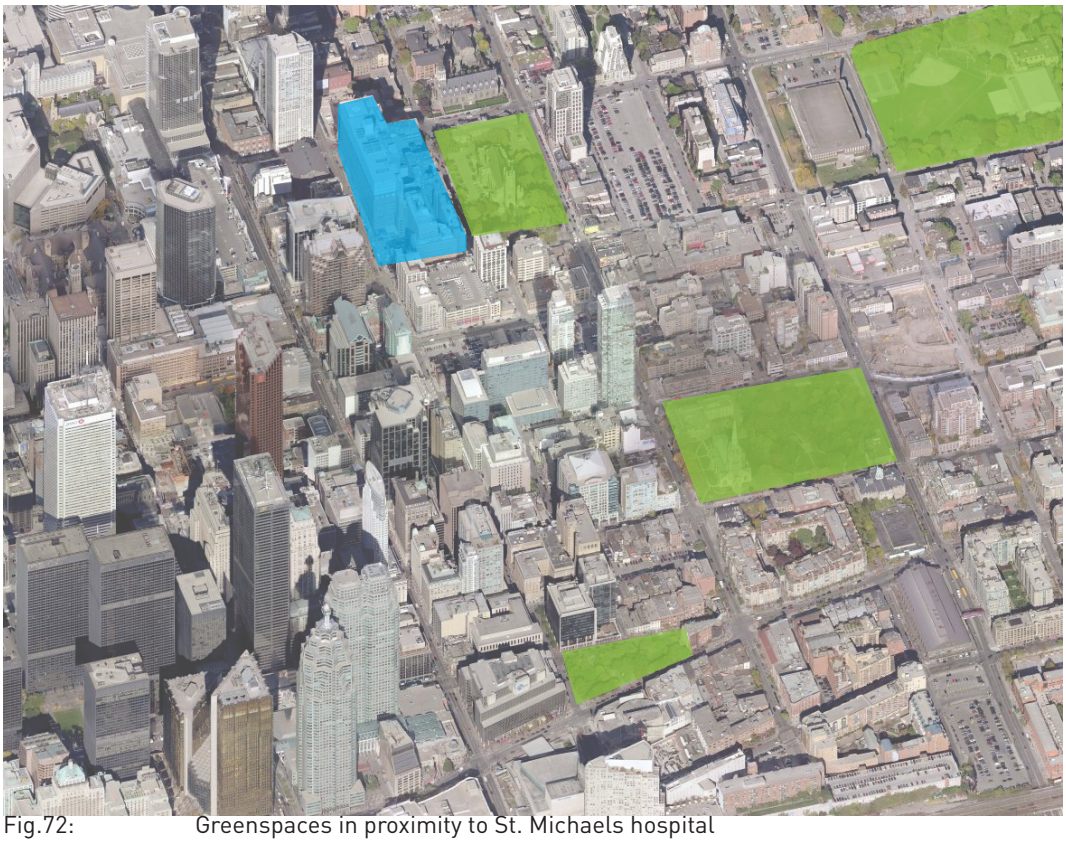


Fig.70: High-rise to mid rise threshold

The first criteria in narrowing down a potential site was to be located at an edge condition (boundary) between predominantly mid-rise and high-rise context. This was to be able to able to pose a challenging context to demonstrate the methods of daylight design.

Fig.71: The neighbourhood surrounding St. Michael's hospital



Several greenspaces are identified in close proximity to the hospital, addressing the criteria of connection to nature.

St. Michael's Hospital

Greenspaces

Fig.72: Greenspaces in proximity to St. Michaels hospital

In choosing a site the goal is to put it in a walkable urban community, and pedestrian friendly neighbourhood.

Fig.73: Neighbourhood around Berczy Park

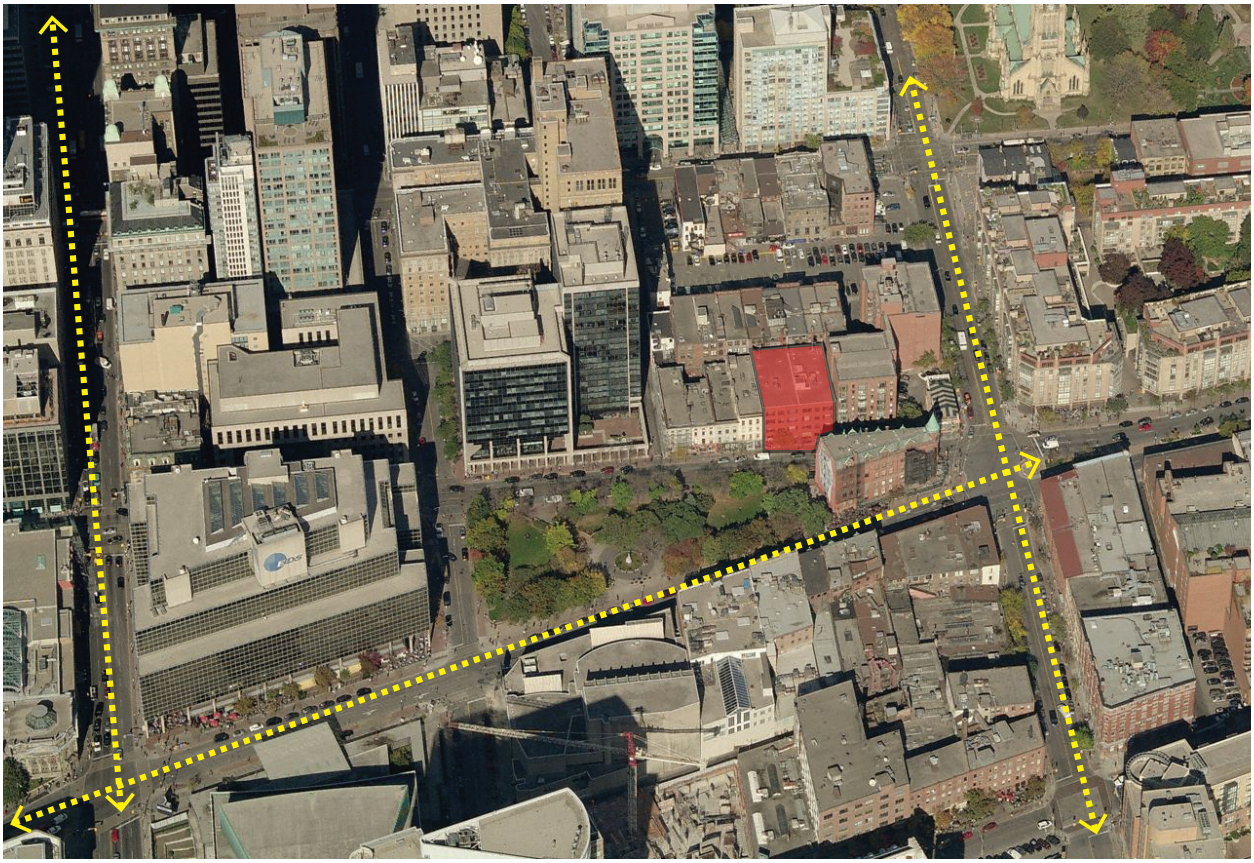


Fig.74 Public transportation routes - providing access to site.

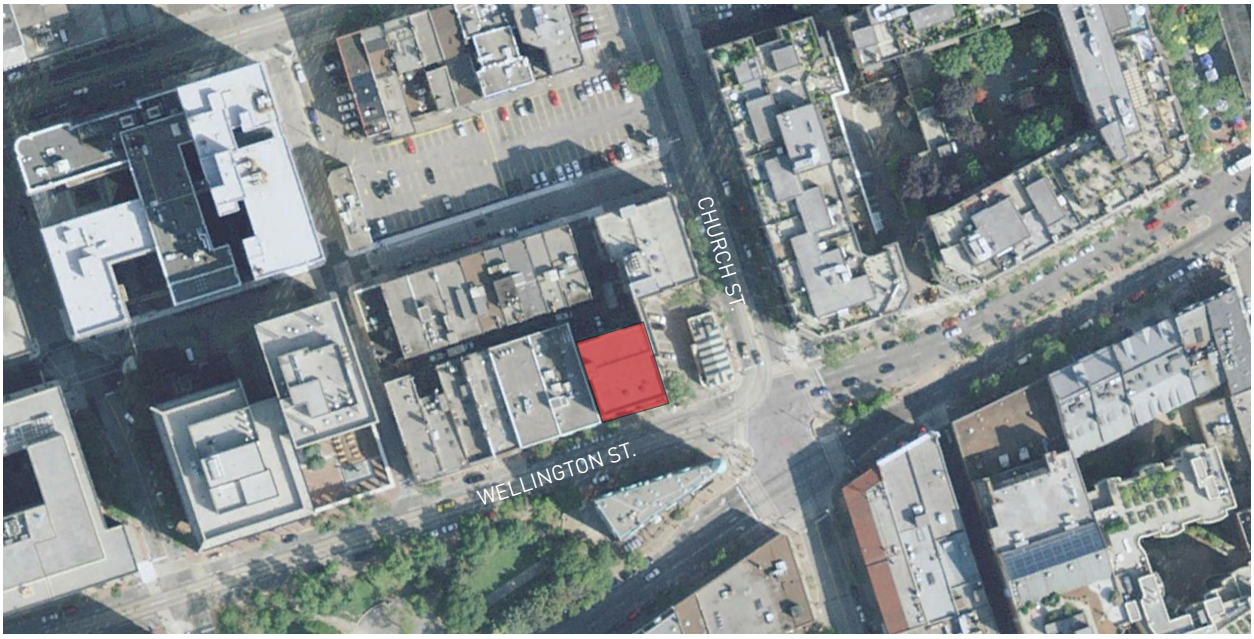


Fig.75 Chosen site for Maggie's Centre design project

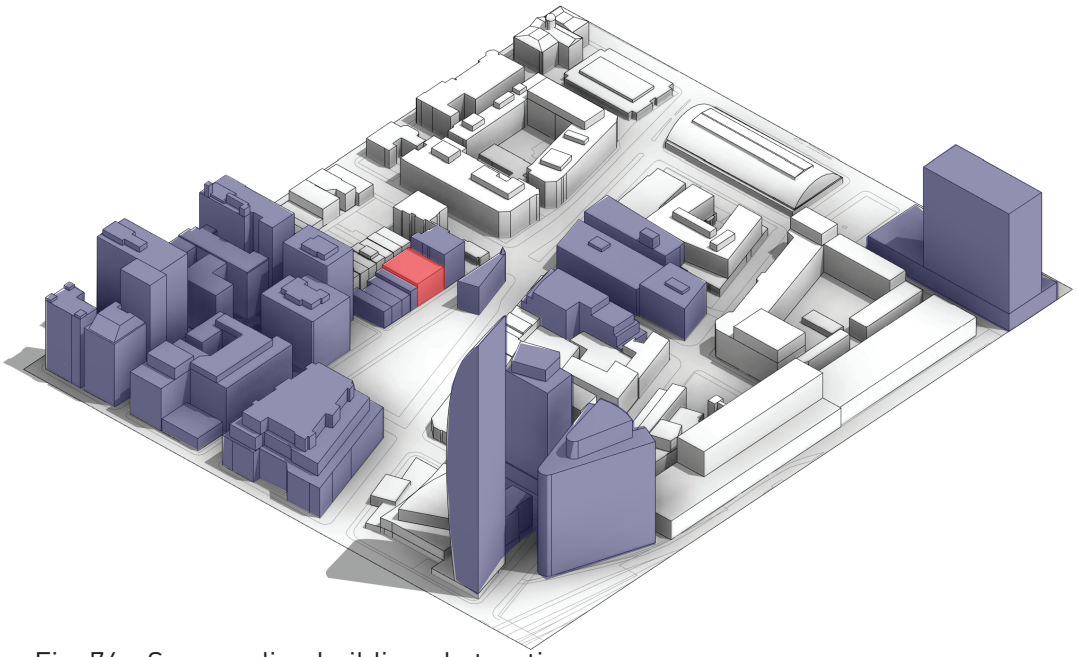


Fig. 76 - Surrounding building obstructions

The surrounding site contributes to the constraints of the design challenge with the mid to high-rise buildings to the East, South, and West, as obstructions to sunlight. These buildings cast shadows on the site, but offer windows of opportunity for light access when the sun passes between or over them according to the season and time of the day.

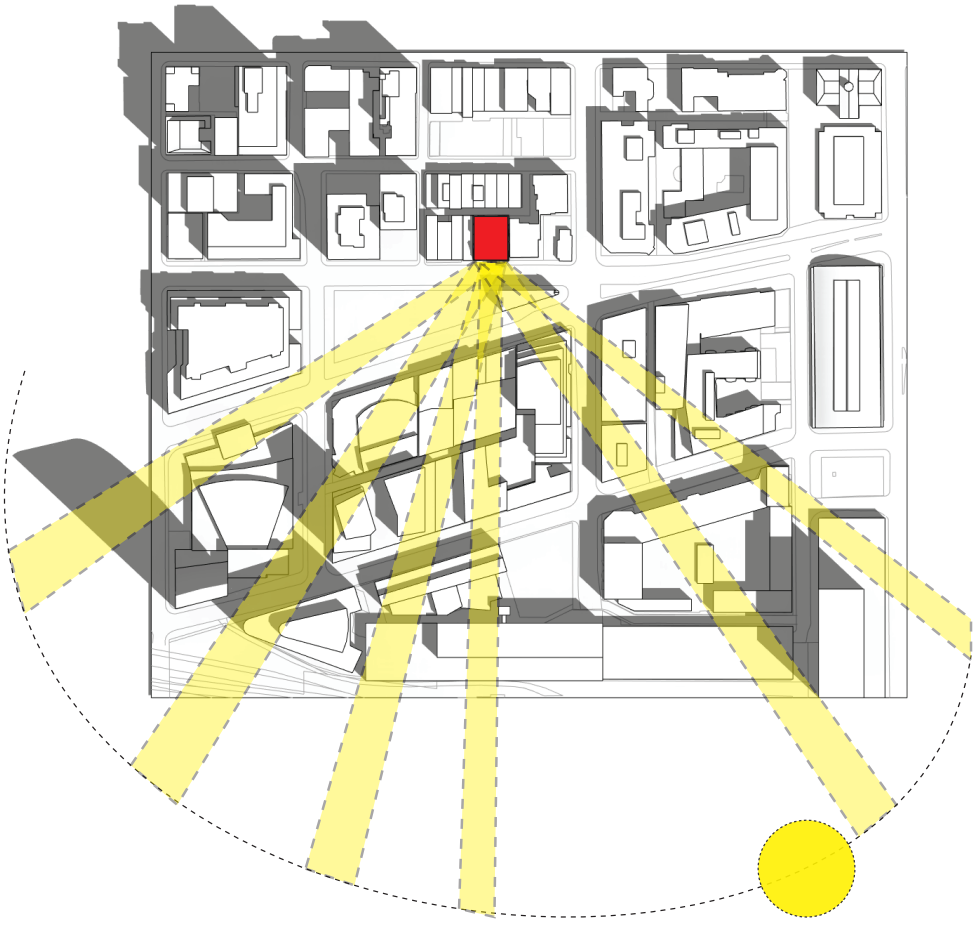


Fig. 77- Light opportunities between obstructions.

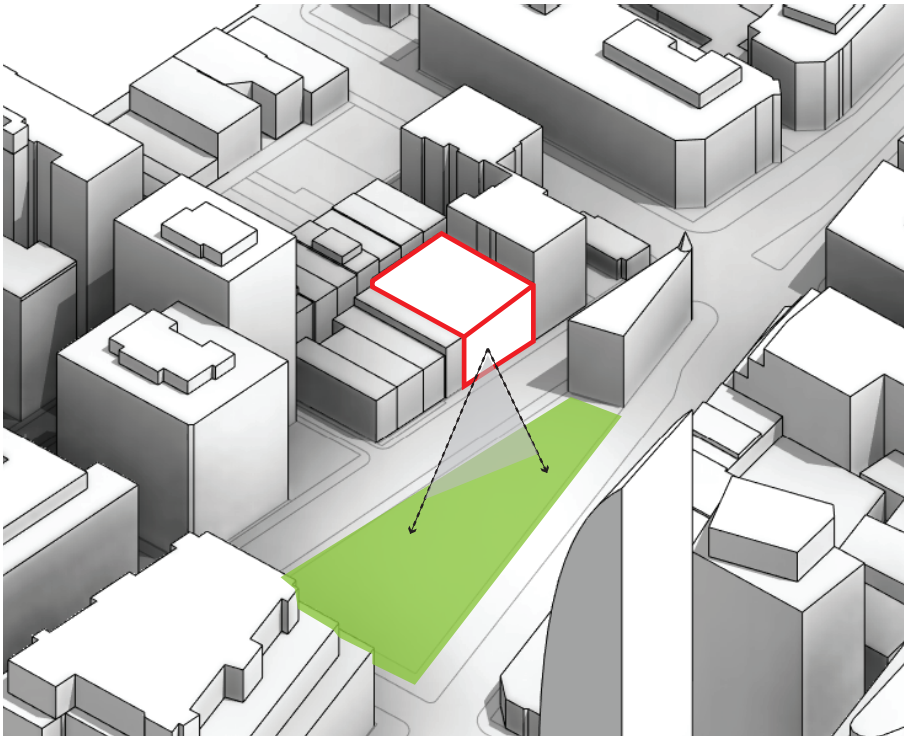


Fig. 78: Views to Greenspace from site.

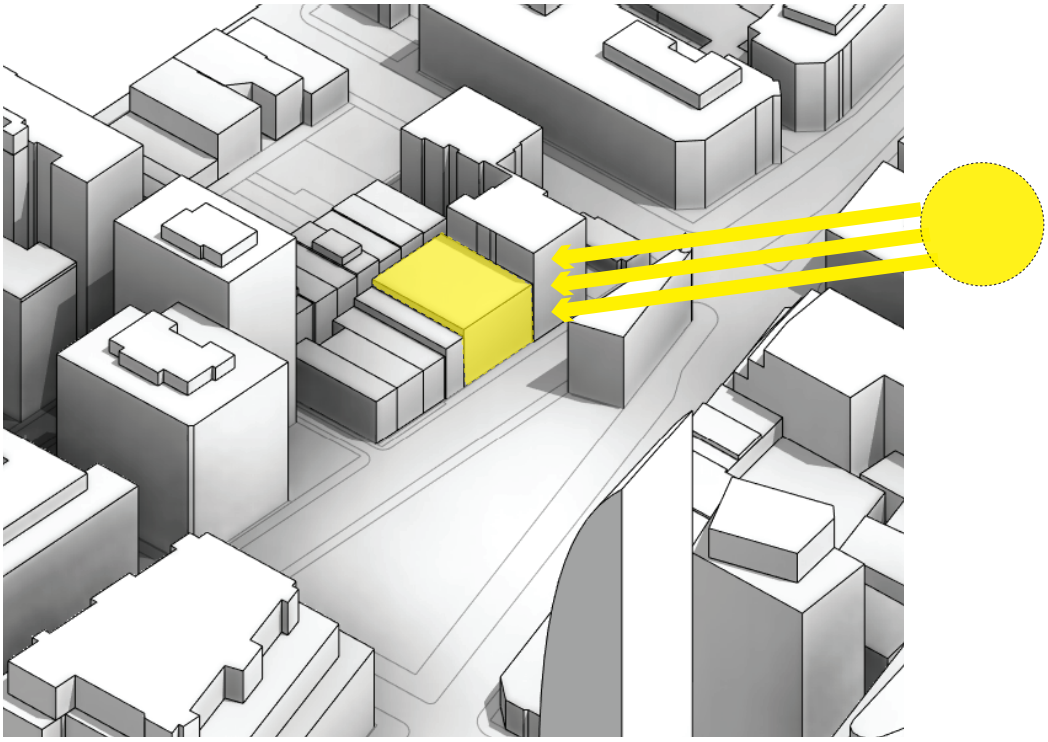


Fig 79: Mid-block, southfacing site - direct sunlight access limited to South facade (side lighting) and roof (top-lighting)

SPATIAL PROGRAM

The typical Maggie's Centre features a core set of program spaces, which will be present in the design project. The Spatial Program is then expanded for urban, North American location for Maggie's, featuring spaces typical of North American wellness centres:

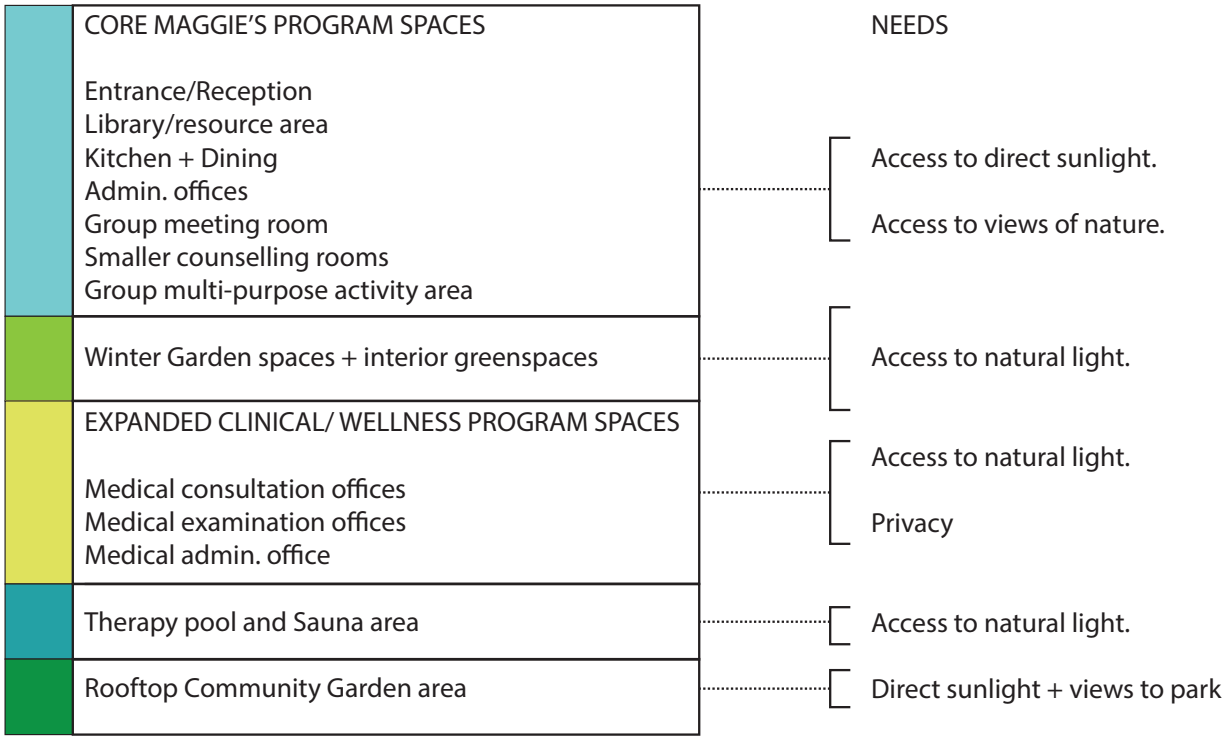


Fig. 80: Spatial program and specifc requirements

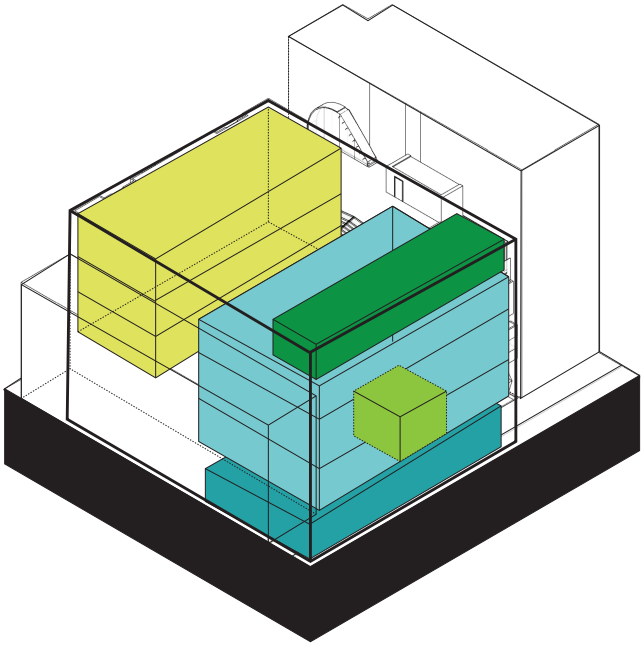


Fig.81: Program Organization diagram

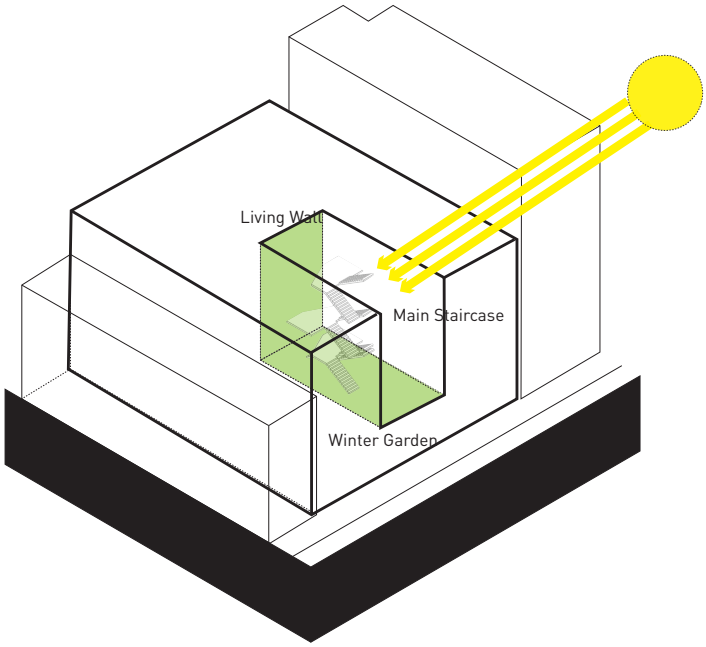


Fig.82: Central void for daylight infiltration

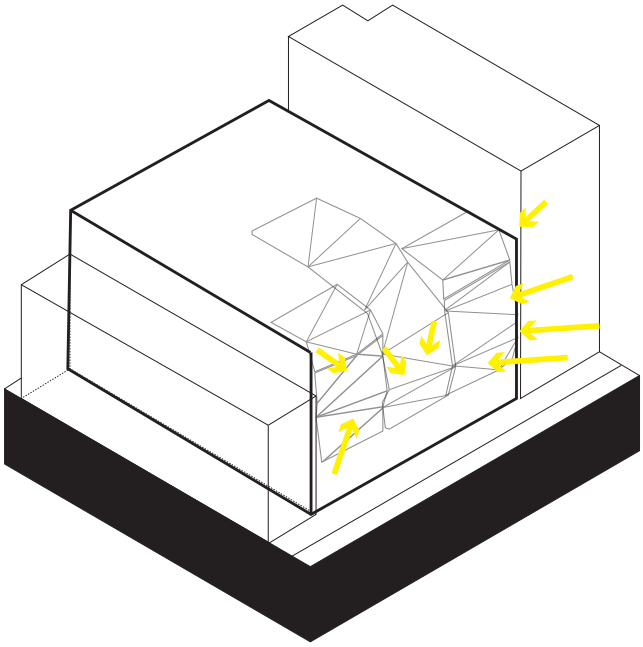


Fig.83: Facets on facade respond to windows of available direct light.

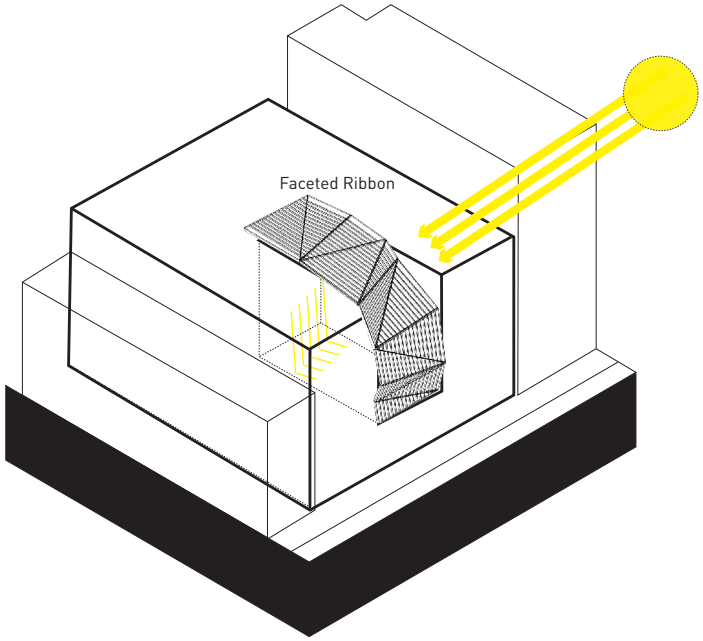


Fig.84: Facted Ribbion deflects direct light

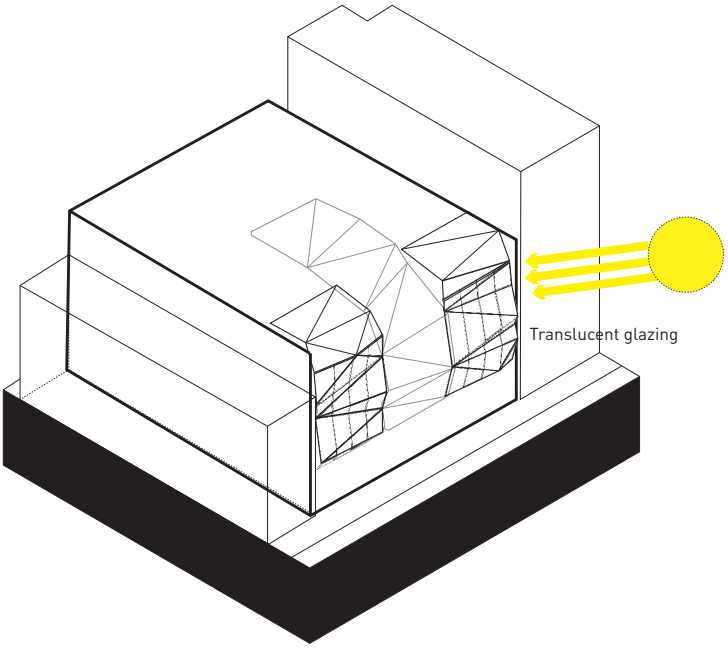


Fig.85 Diffused light through translucent glazing on facade

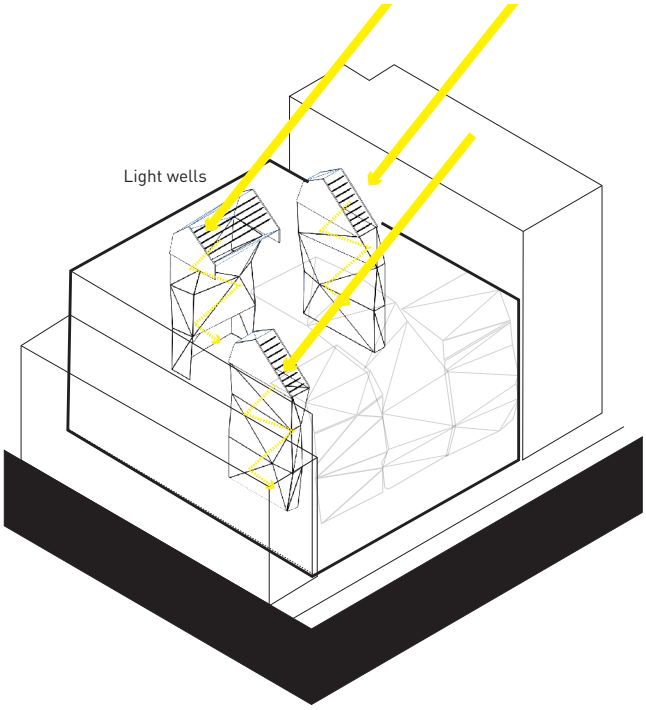


Fig.86: Bounced light through lightwells

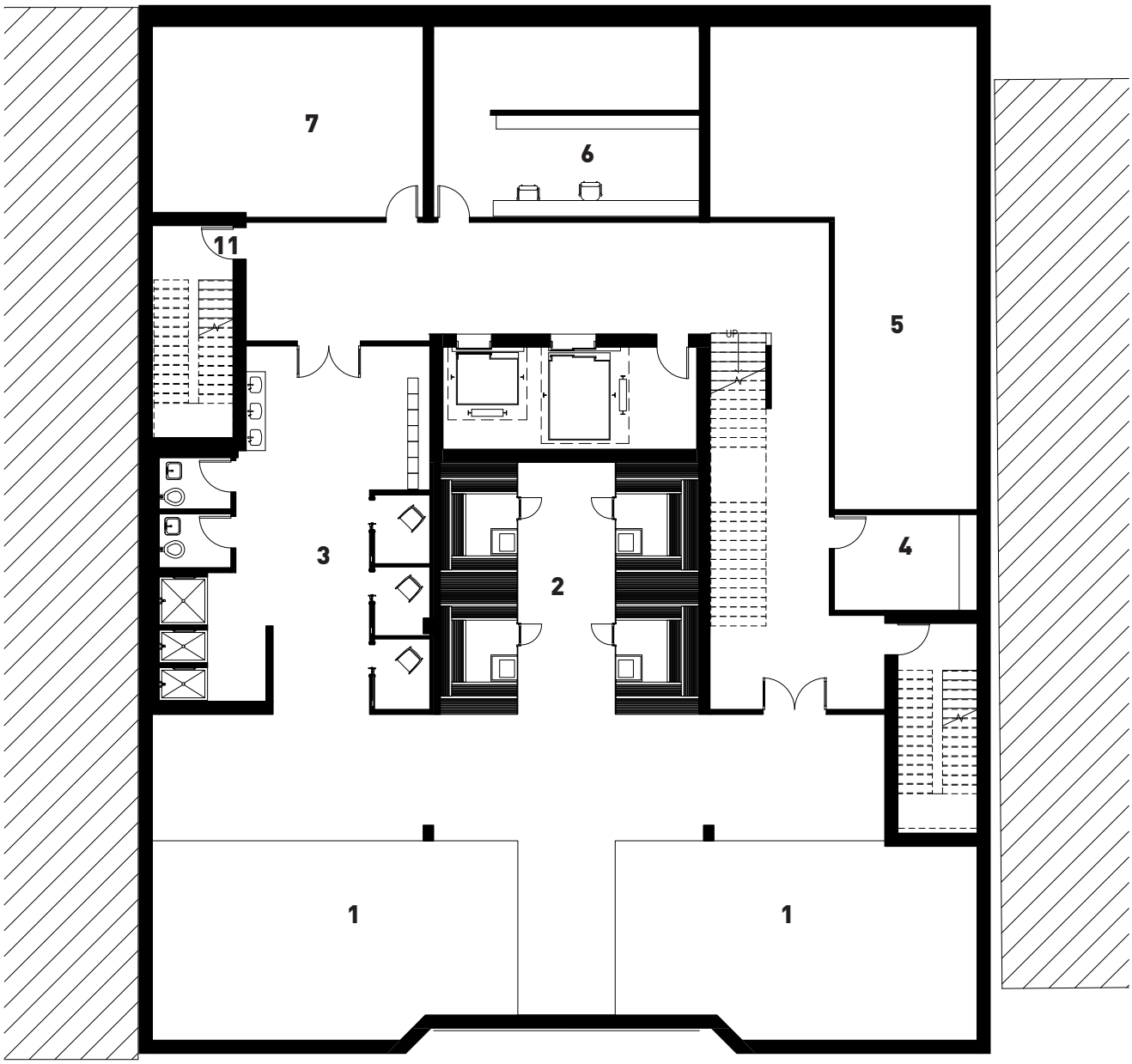
Fig. 88: Maggie's Centre view from Wellington St.

Fig. 87: Maggie's Centre view from Berczy Park

Upon approach, a visitor is greeted with a the warm exterior cladding of the wood panels, and the hint of greenery in the winter garden seen behind the Facted-Ribbon that invites one inside.

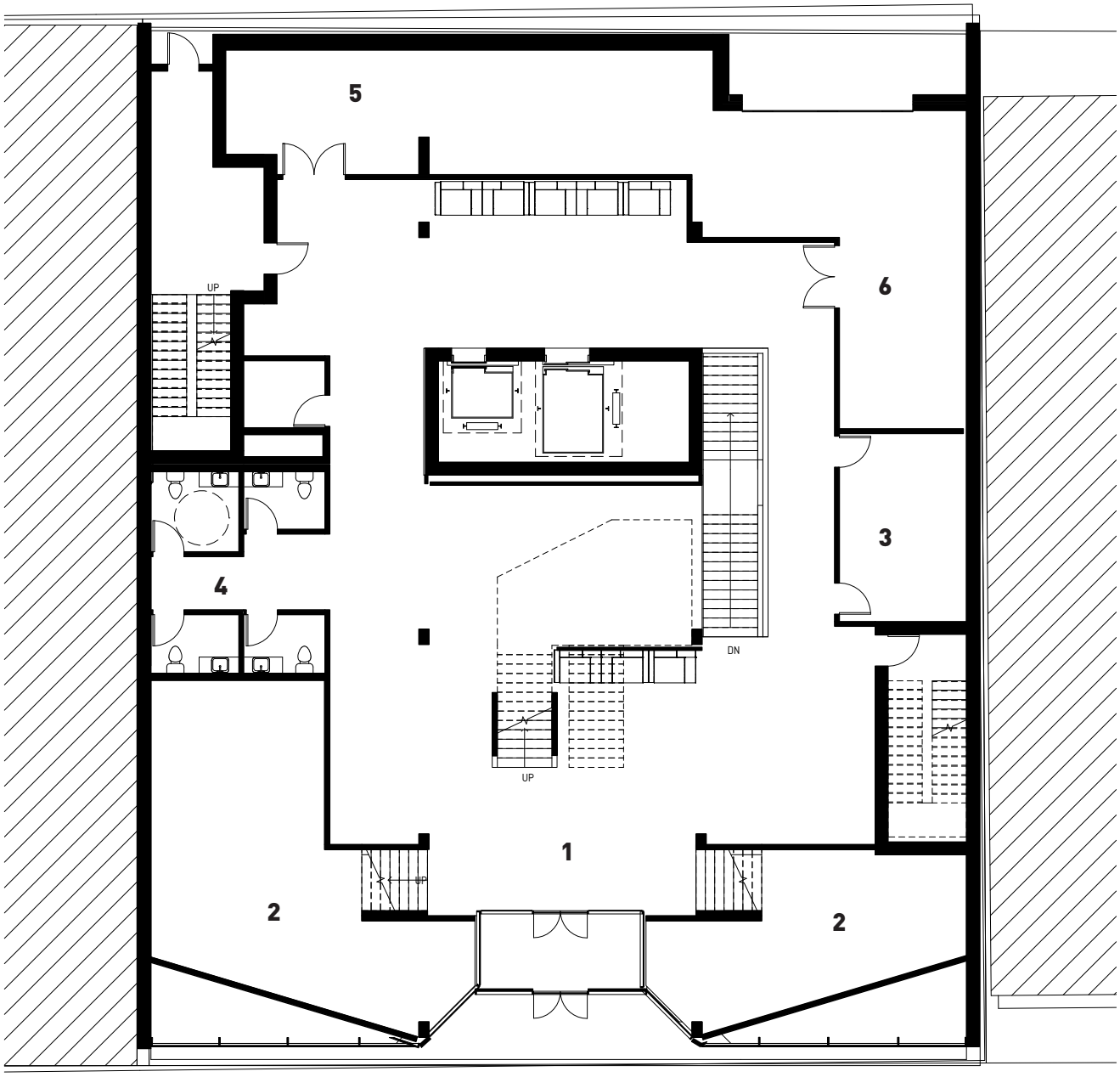
Fig. 89: Section A

Fig. 90: Section B



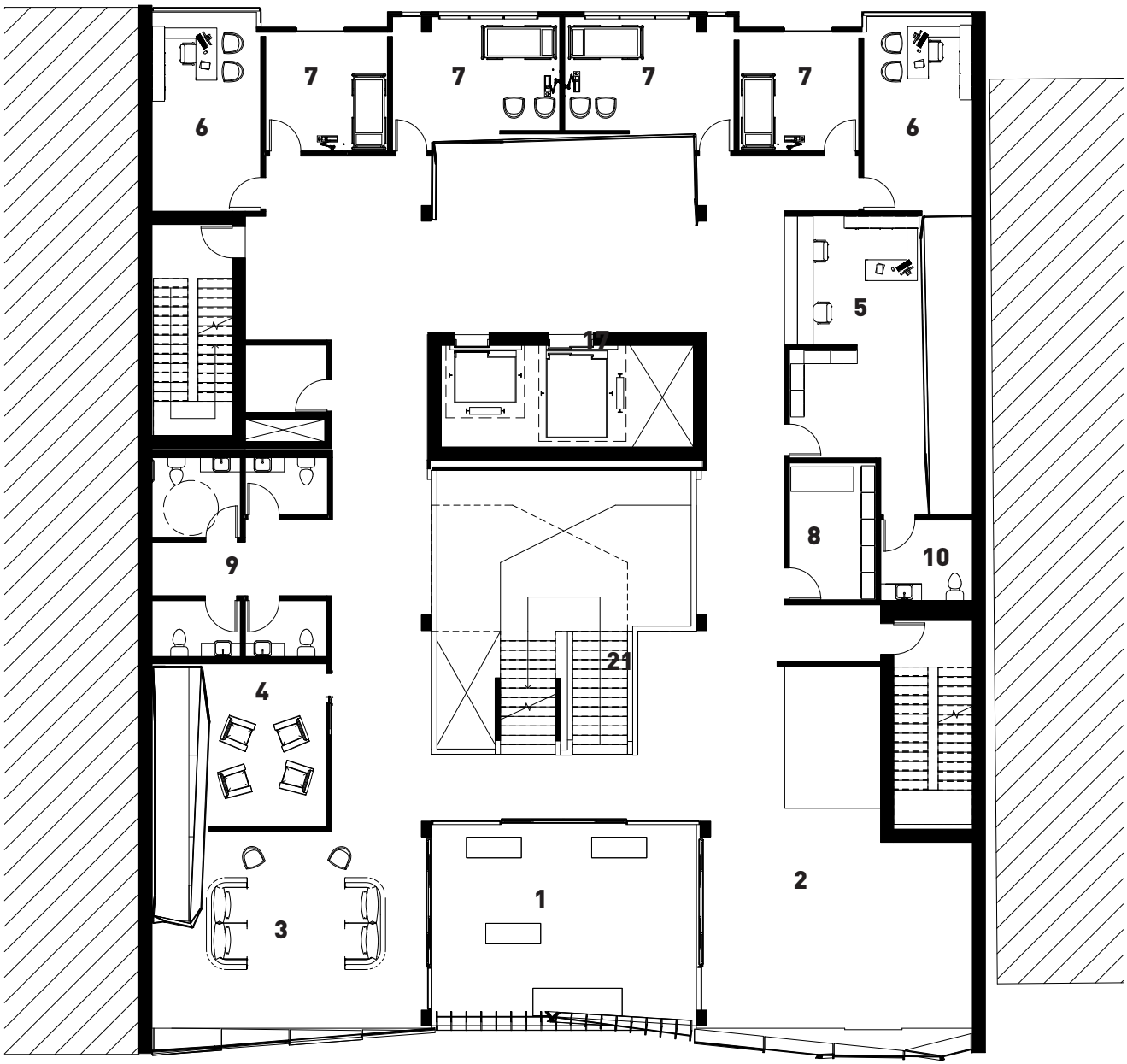
1. Therapy Pool
2. Sauna
3. Changerooms
4. Custodial
5. Mechanical
6. Staff
7. Storage

Fig.91: BasementFloor Plan



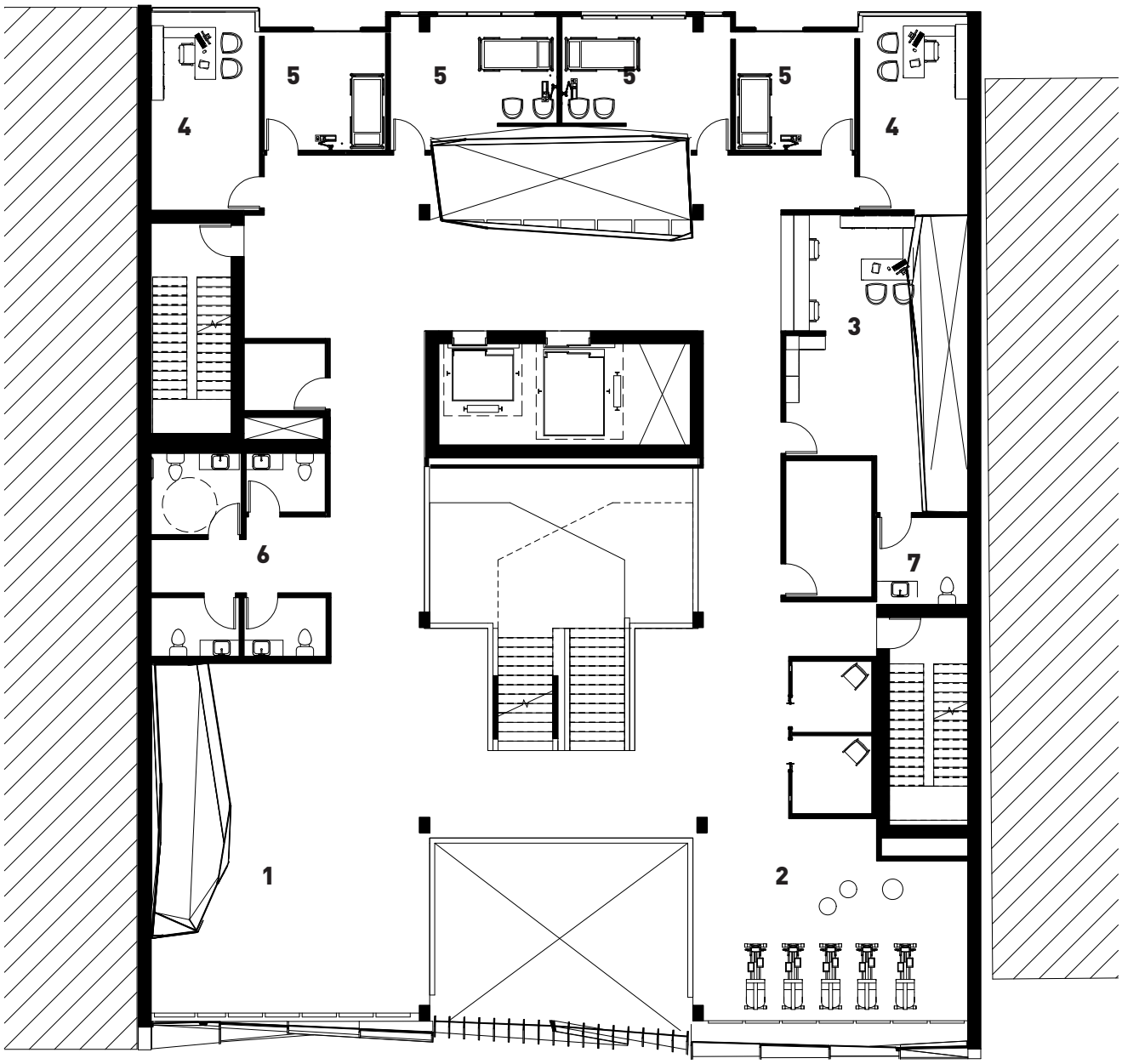
1. Entrance
2. Resource area
3. Security Office
4. Unisex WC
5. Garbage/recycling area
6. Loading

Fig. 92: First Floor Plan



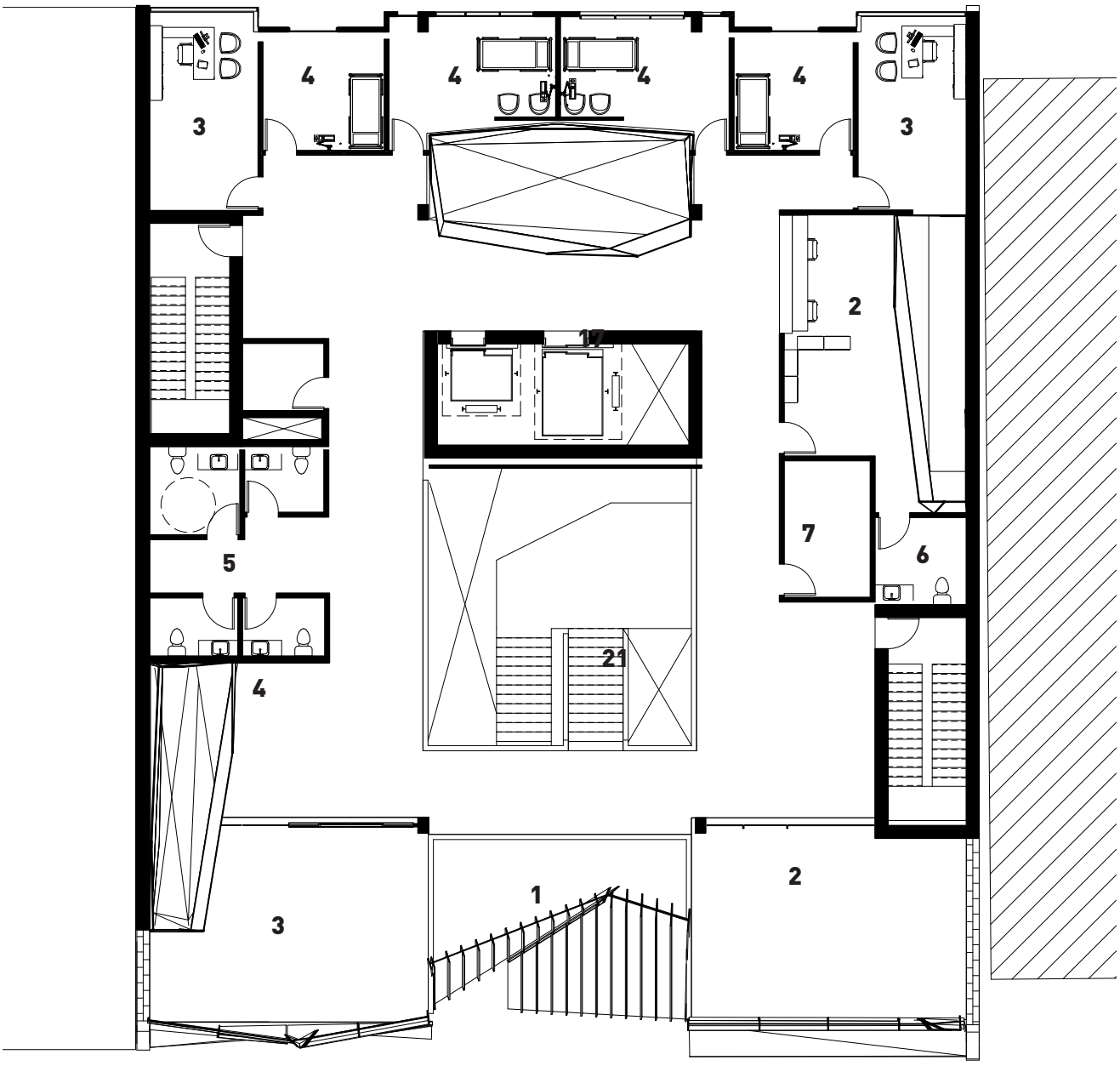
1. Winter Garden
2. Kitchen + Dining
3. Group meeting space
4. Small councelling room
5. Nurse Reception
6. Medical Office
7. Med. examination rooms
8. Pantry
9. Unisex WC
10. Staff WC

Fig. 93: Second Floor Plan



1. Group activity space
2. Gym
3. Nurse Reception
4. Medical Office
5. Med. examination rooms
6. Unisex WC
7. Staff WC
8. Storage

Fig. 94: Third Floor Plan



1. Rooftop Garden
2. Nurse Reception
3. Medical Office
4. Med. examination rooms
5. Unisex WC
6. Staff WC
7. Storage

Fig. 95: Fourth Floor Plan

Fig. 96: Main Entrance view

The character of the entrance space is intended to be inviting, with the light shining on the backs of those who enter, it is as if the light is pushing them through the door. Diffused Daylight passes thorugh the entrance vestibule. The idea follows the de-instituional feel of typical Maggie's Centres, with the absence of a formal 'lobby'.

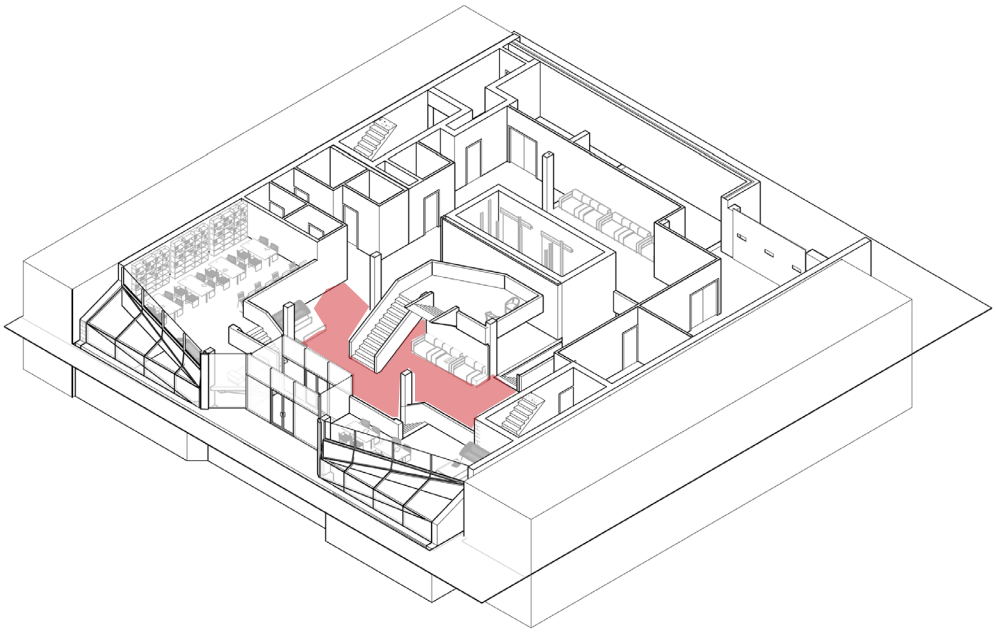


Fig.97: Second Floor axonometric indicating Main Entrance

Fig. 98: Main Entrance lighting diagram

Fig. 99: Main Entrance diagram B

Fig. 100: Resource Room view

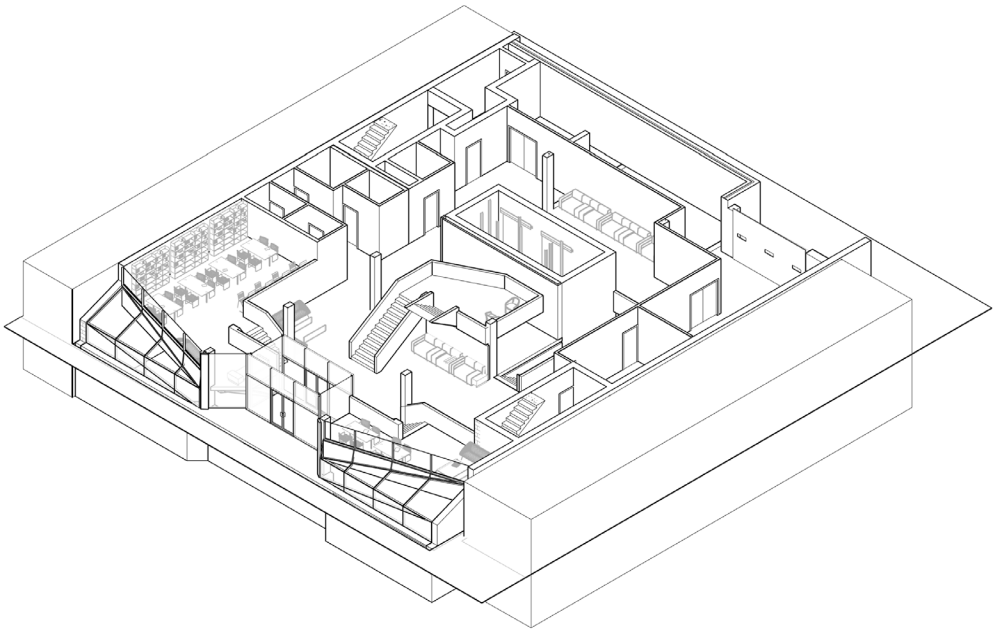


Fig. 101: Second Floor axonometric indicating Resource Room

The resource/library area is the first space that is experienced, right next to the entrance of the building. This space sets the tone for the rest of the building, a non-institutional, calming space. The character of the resource area is achieved by implementing two primary lighting strategies. Diffused daylight is brought into the space by the translucent glazing, as well as bounced light coming down from the lightwell.

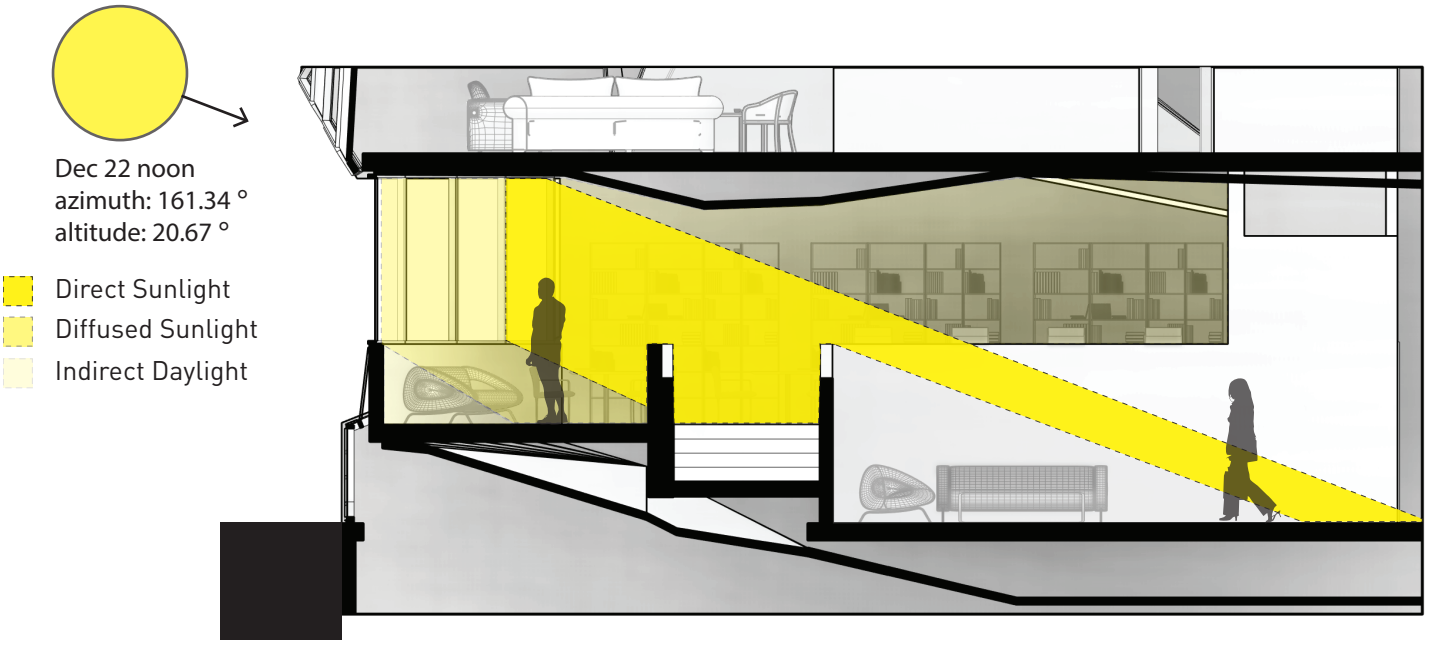


Fig. 102: Resource Room lighting diagram

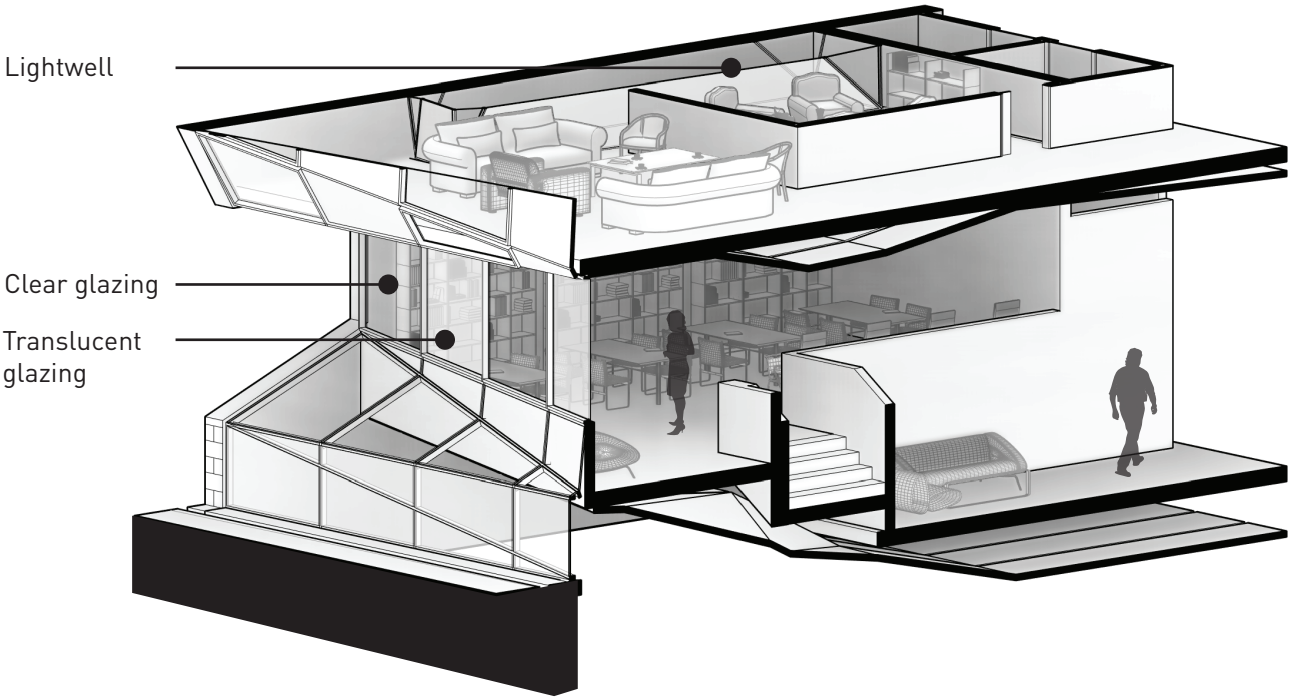


Fig. 103: Resource Room diagram

Fig. 104: Therapy pool view

The design of the therapy pool is intended to envoke. The character of light in this space is that of calm and tranquility.

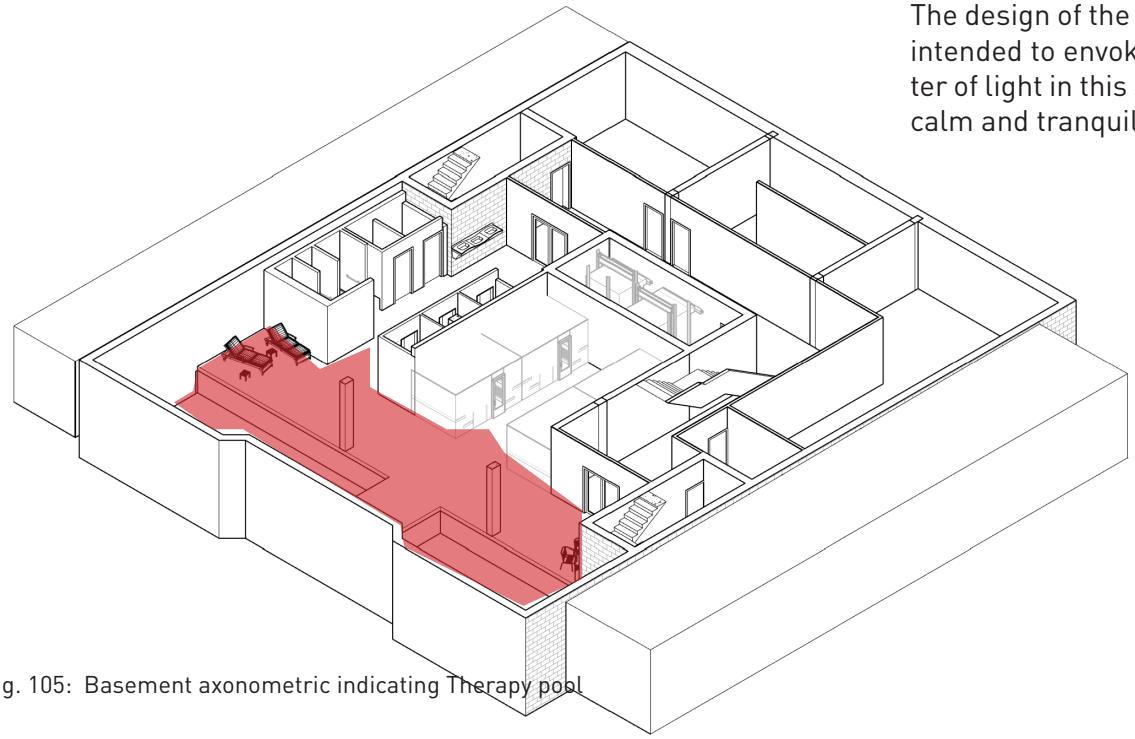


Fig. 105: Basement axonometric indicating Therapy pool

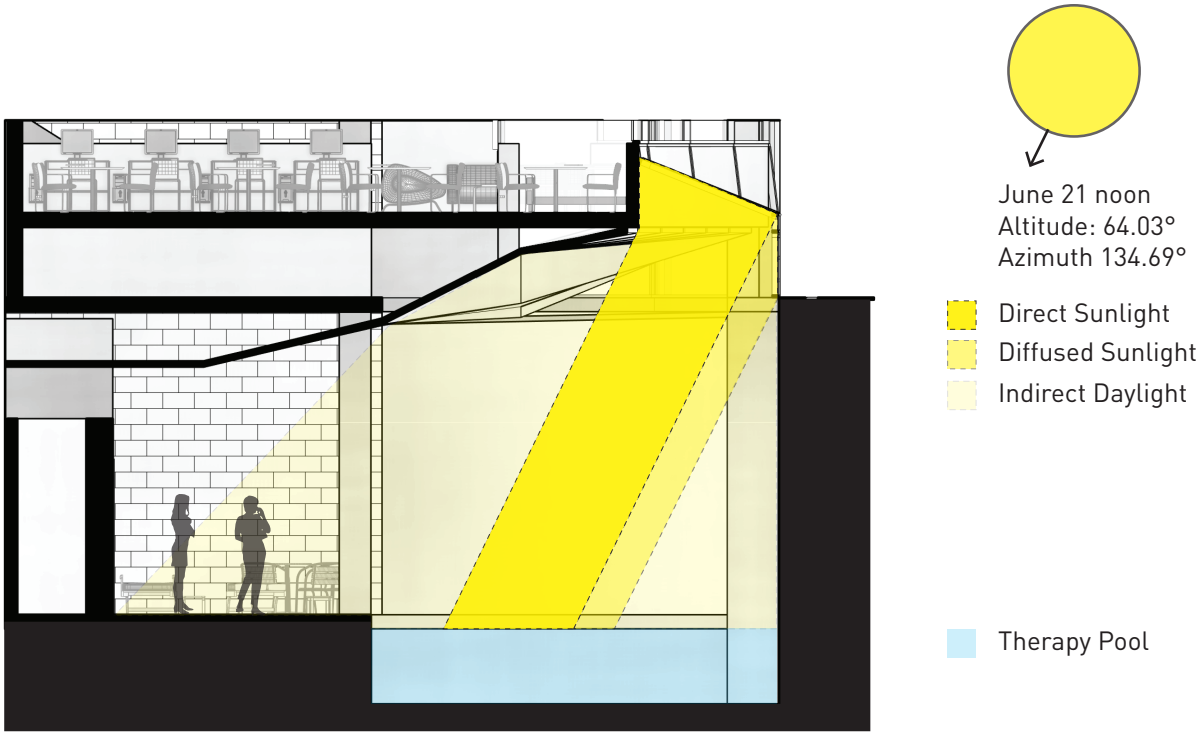


Fig. 106: Therapy Pool lighting diagram

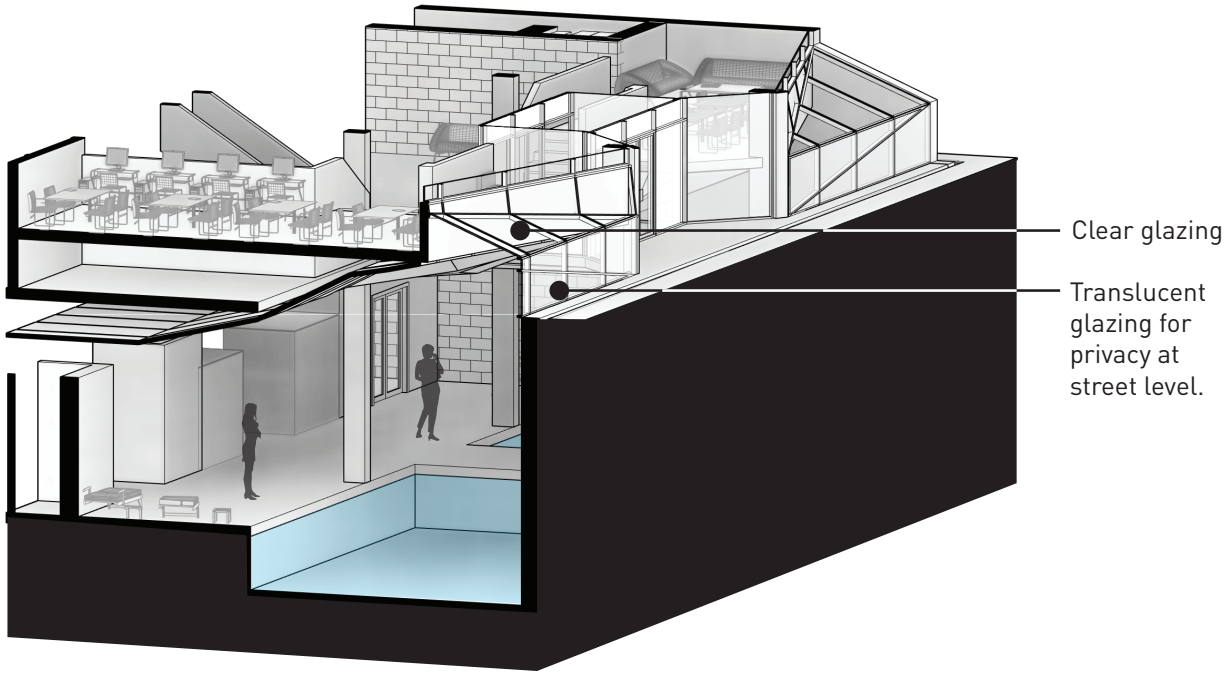


Fig. 107: Therapy pool diagram

Fig. 108: Kitchen-Dining space view

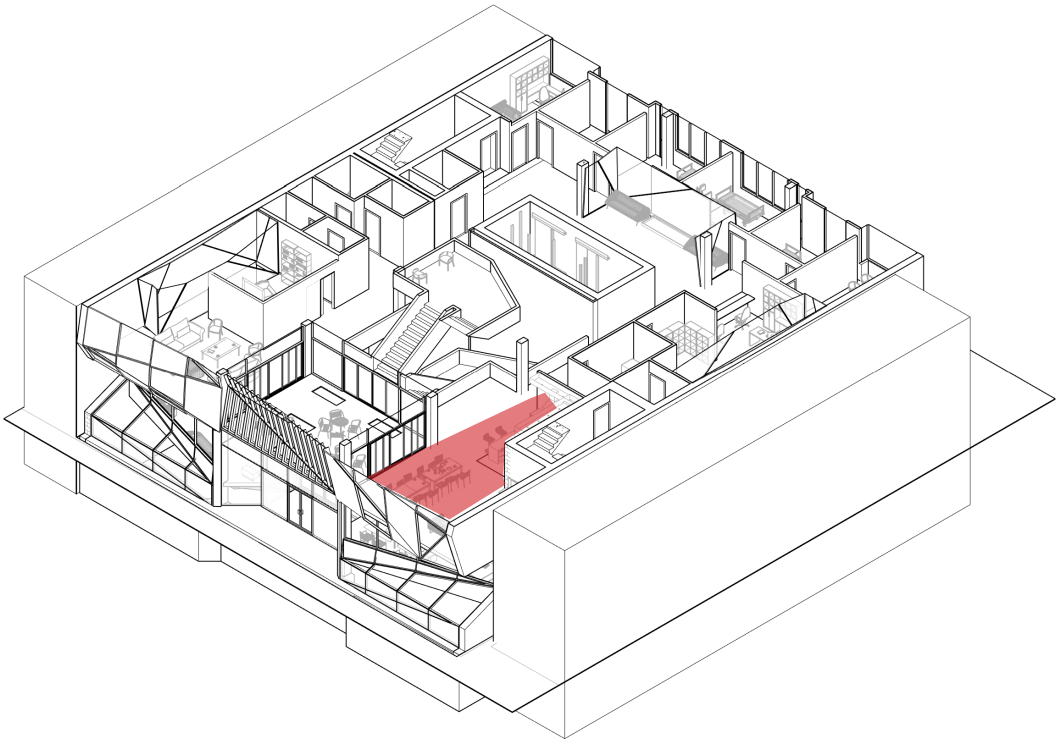


Fig. 109: Second Floor axonometric indicating Kitchen-Dining space

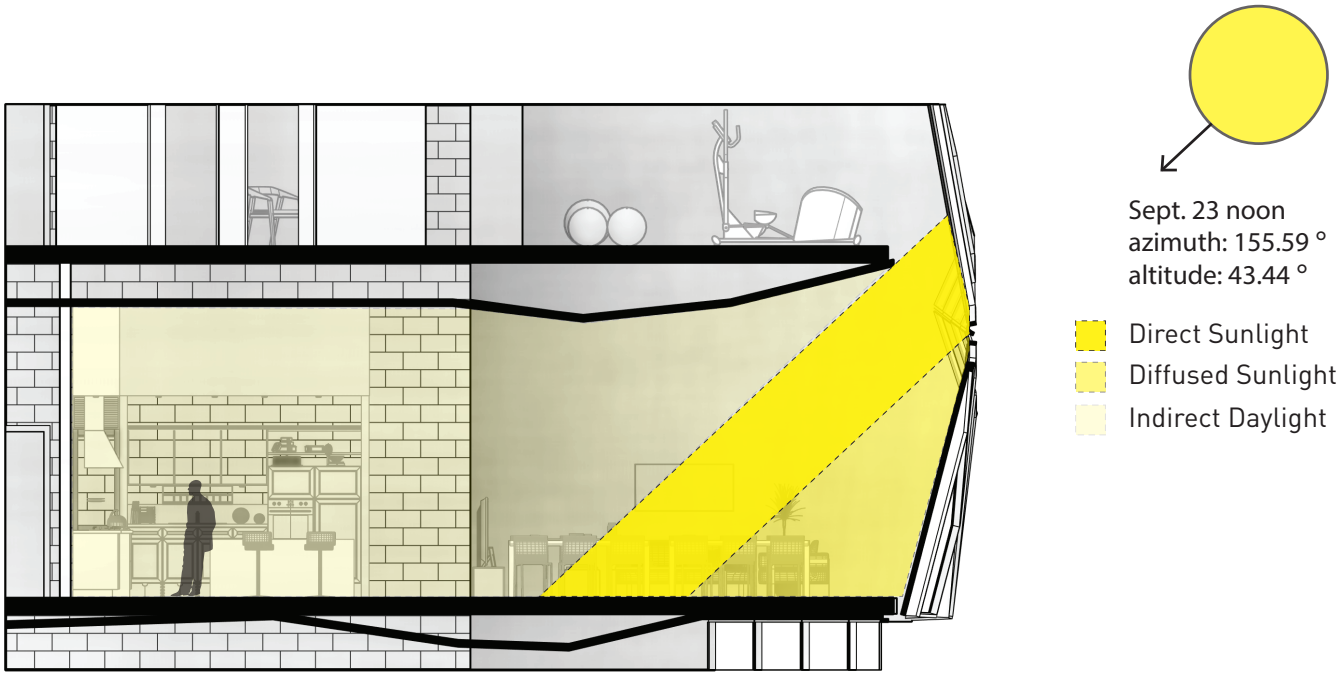


Fig. 110: Kitchen-Dining space lighting diagram

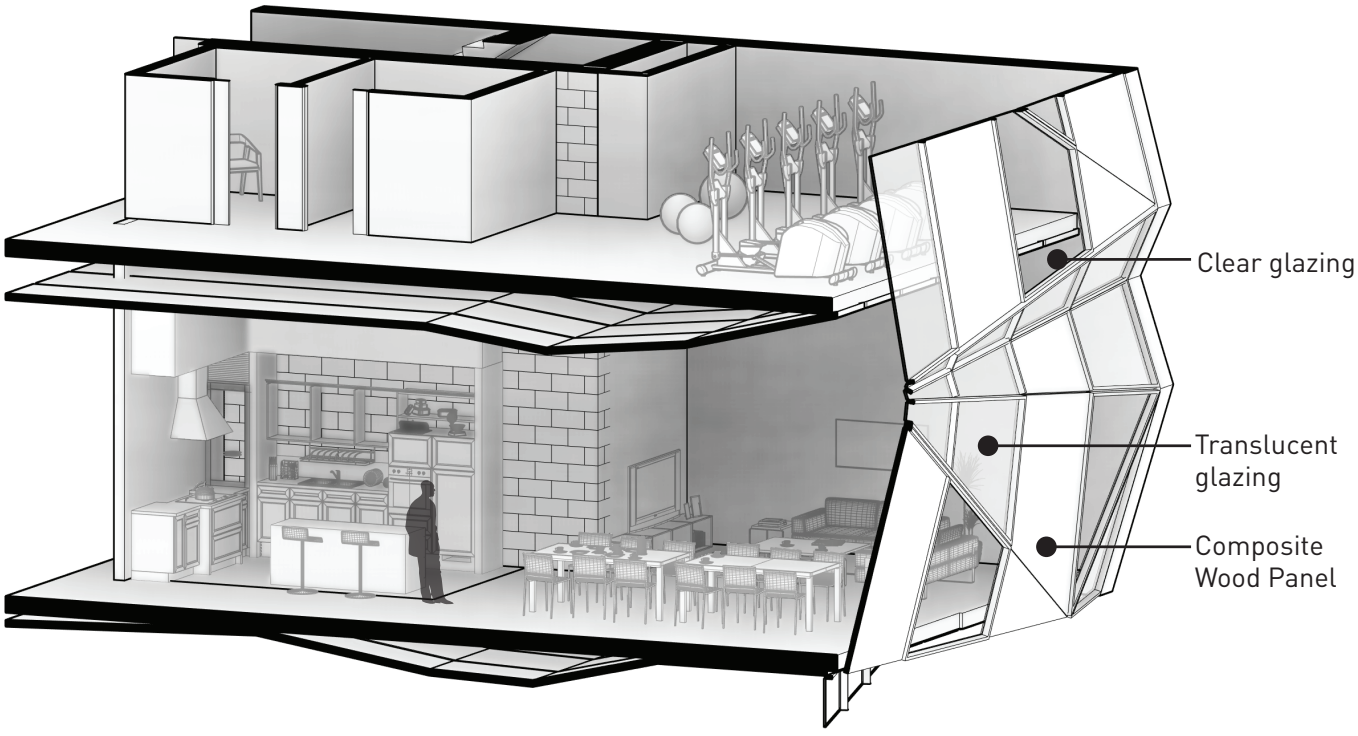


Fig. 111: Kitchen-Dining space diagram B

Fig. 112: Group Support Room view

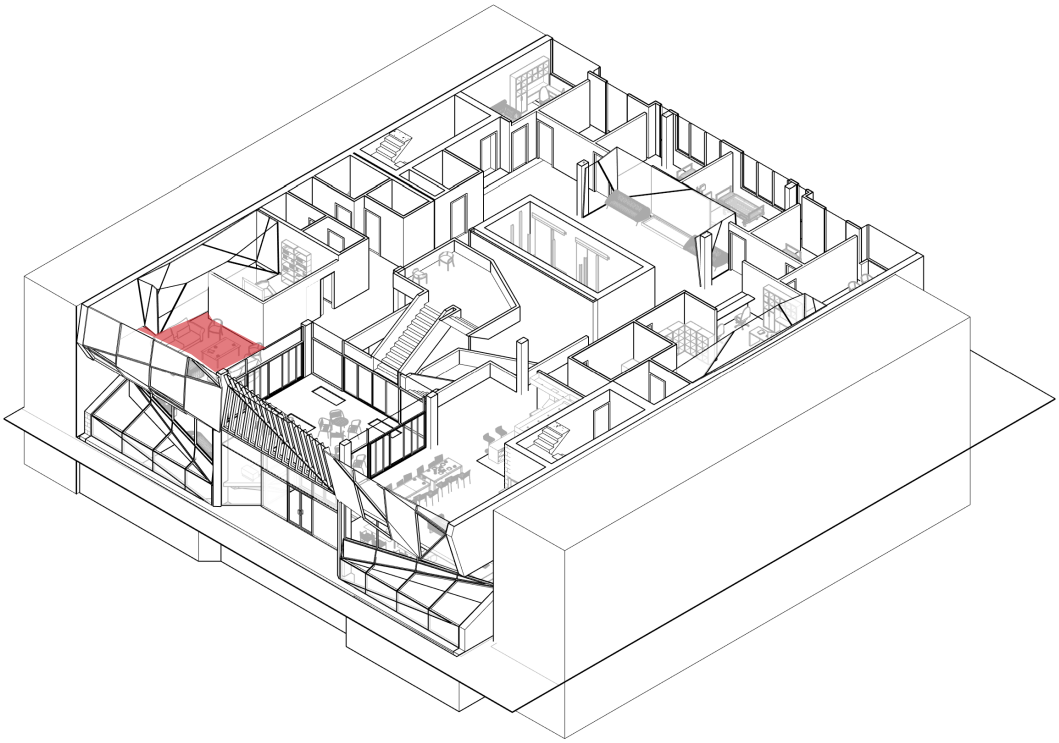


Fig. 113: Second Floor axonometric indicating Group Support Room

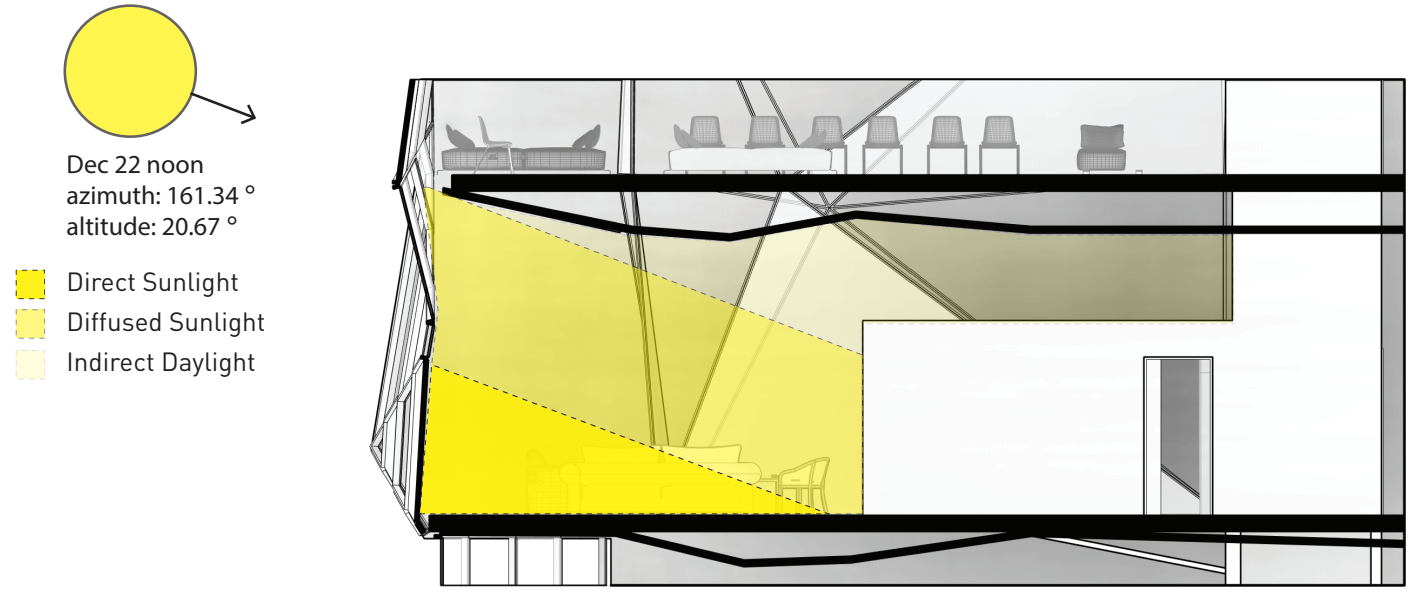


Fig. 114: Group Support Room lighting diagram

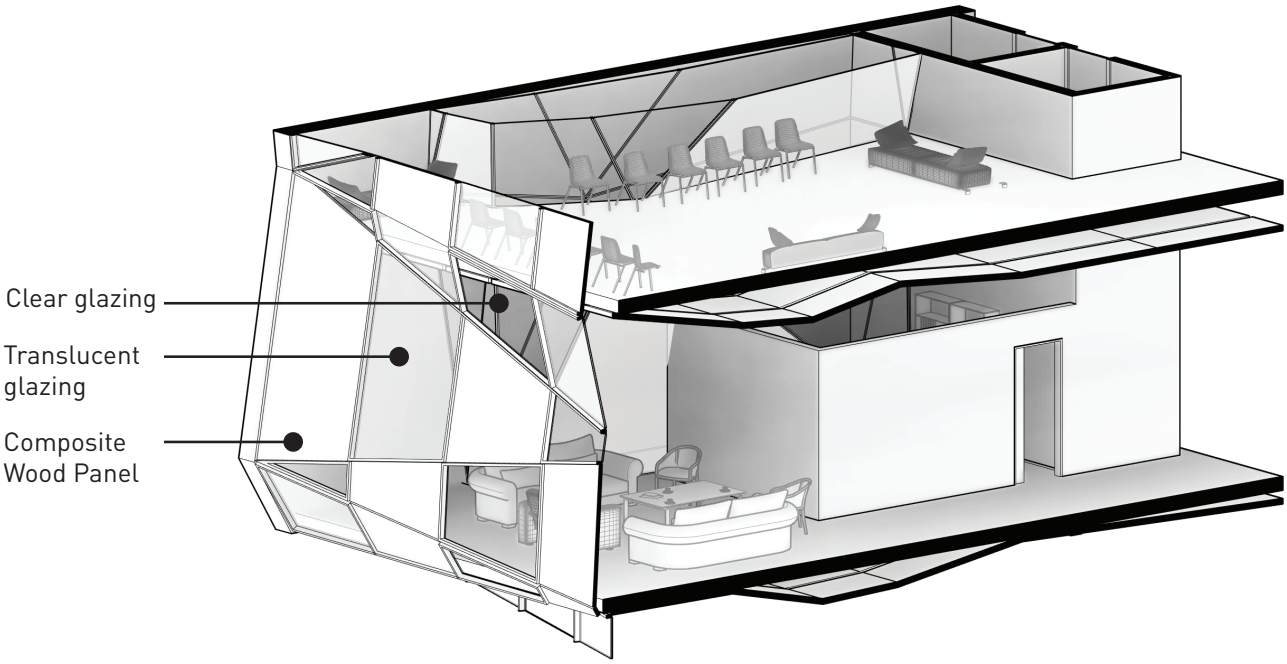


Fig. 115: Group Support Room diagram B

Fig. 116: Winter Garden view

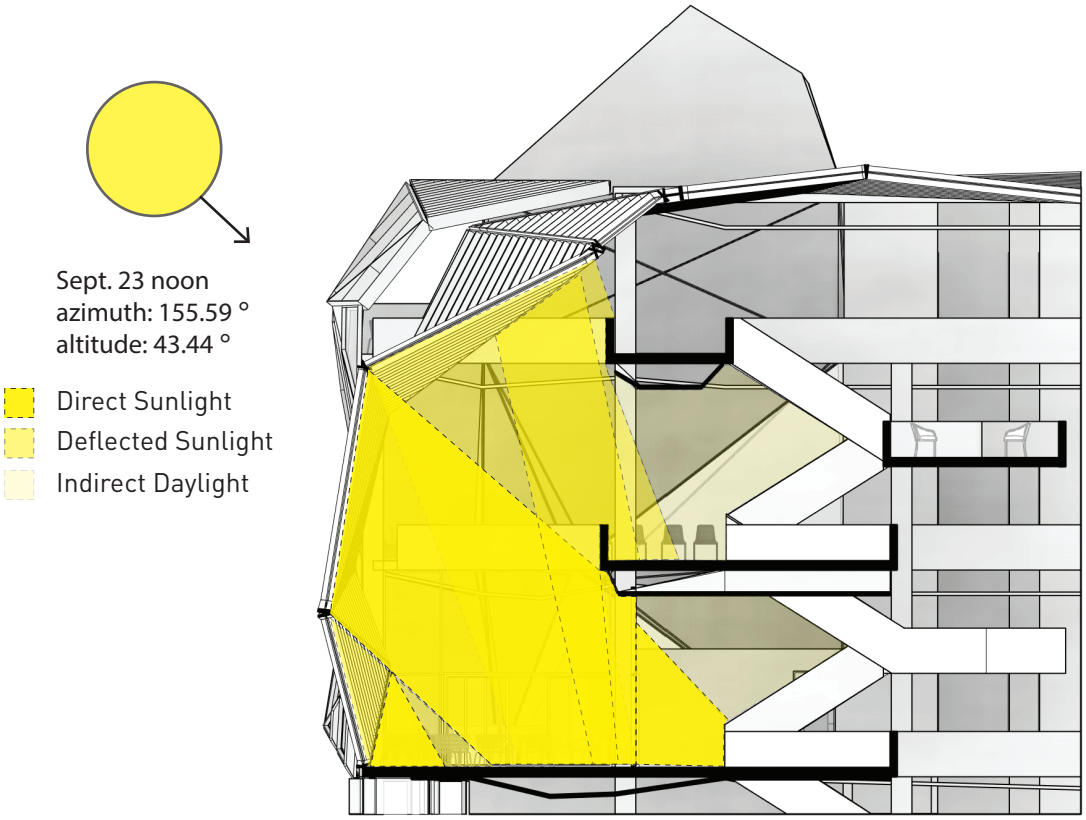


Fig. 117: Winter Garden lighting diagram

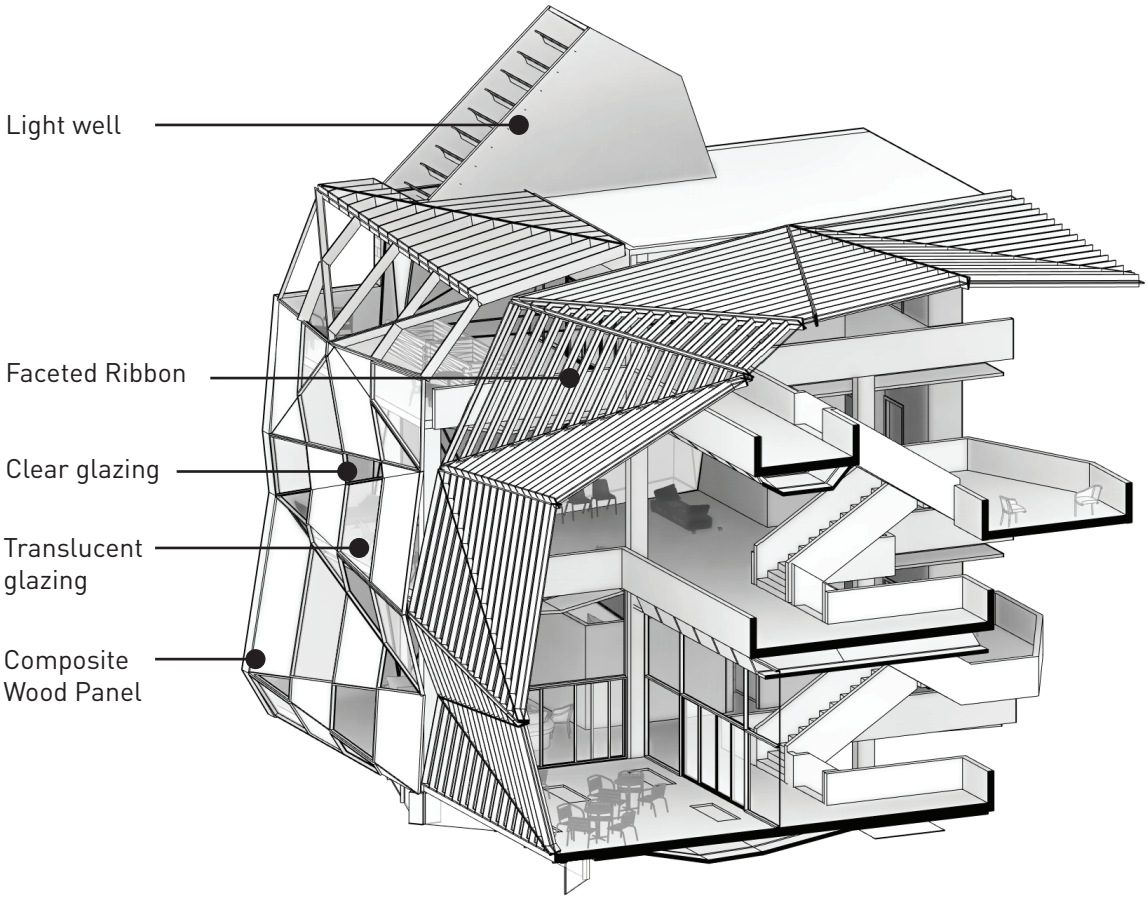


Fig. 118: Winter Garden diagram B

Fig. 119: Group Activty Room view

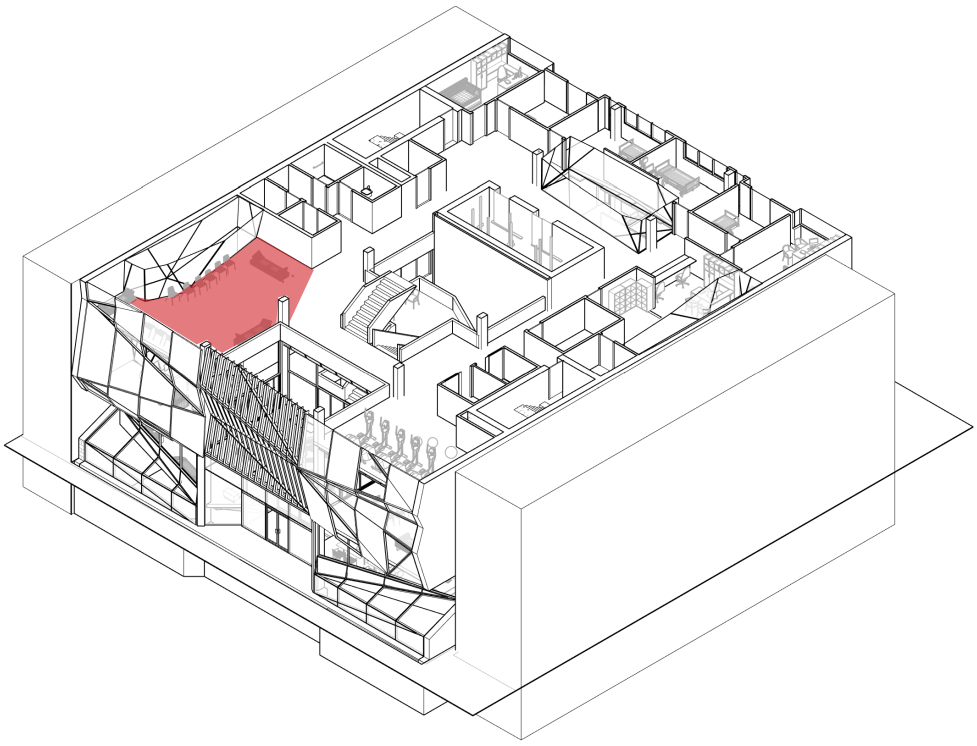


Fig. 120: Third Floor Axonometric indicating Group Activity Room

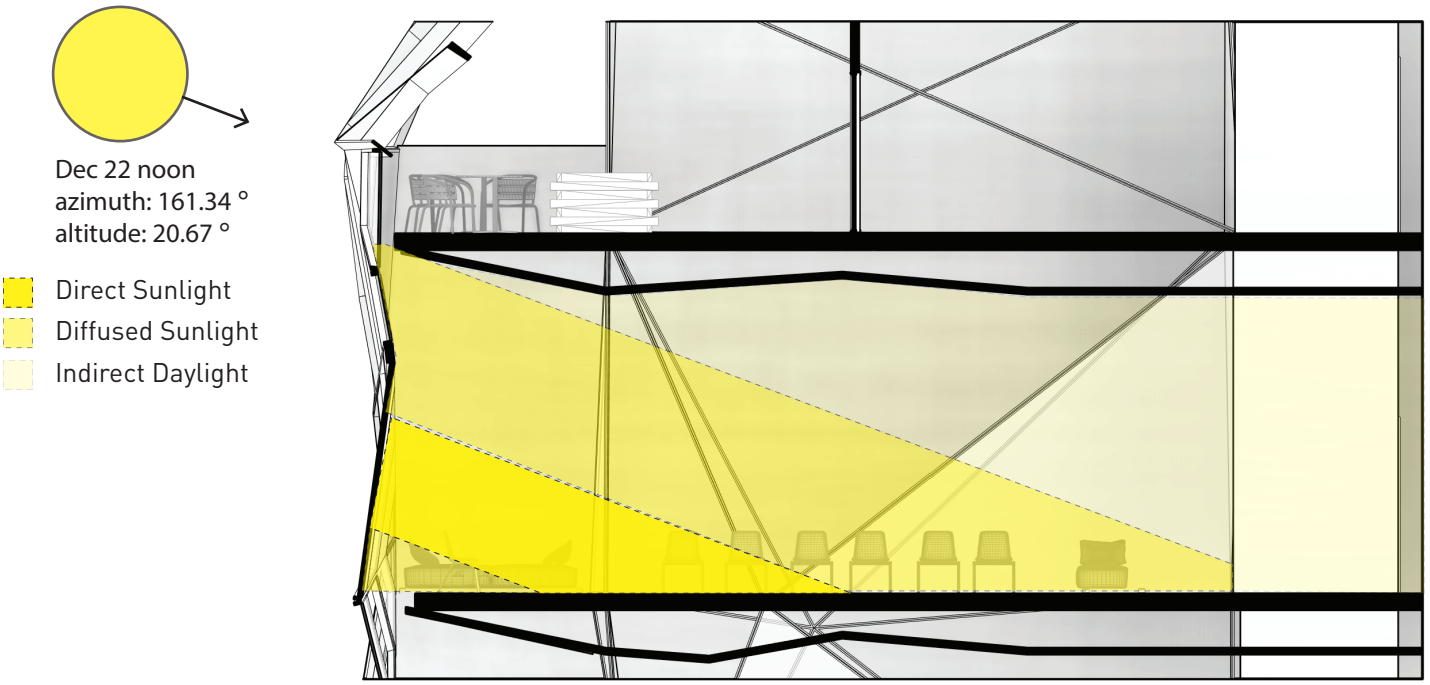


Fig. 121: Group Activty Room lighting diagram

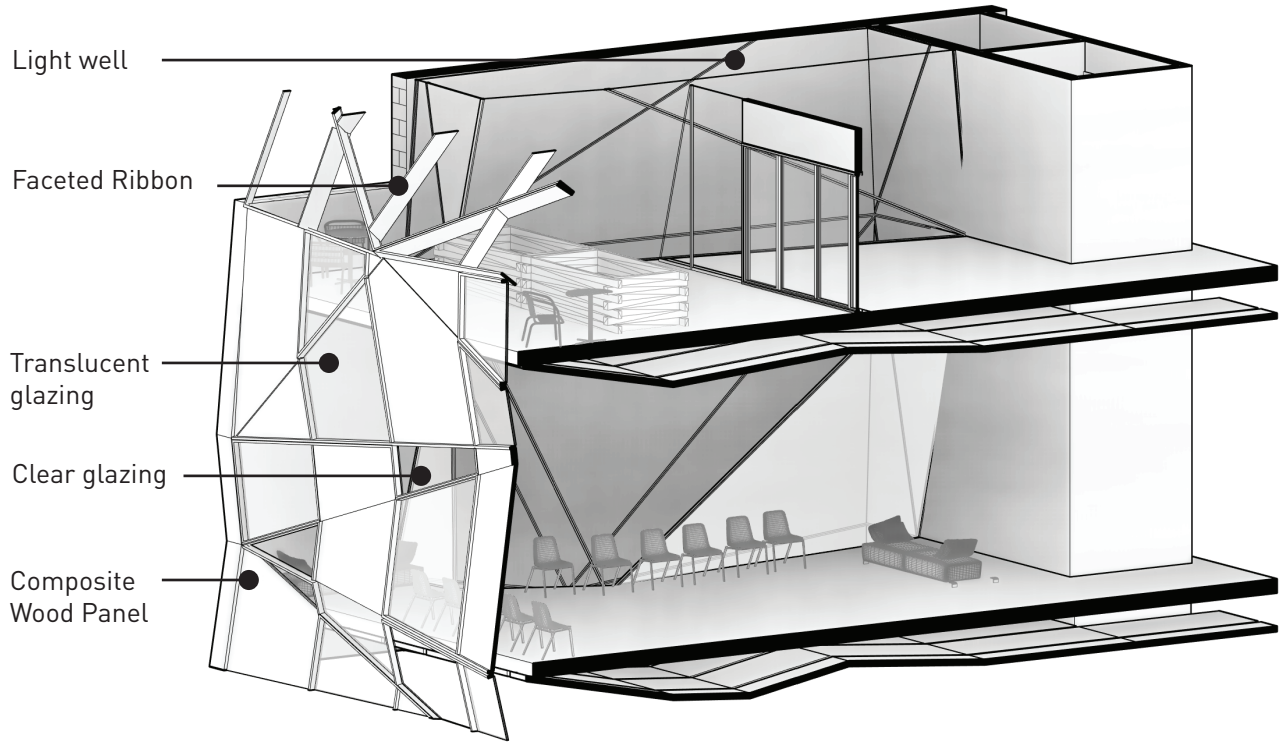


Fig. 122: Group Activty Room diagram B

Fig.123: Clinical waiting area view

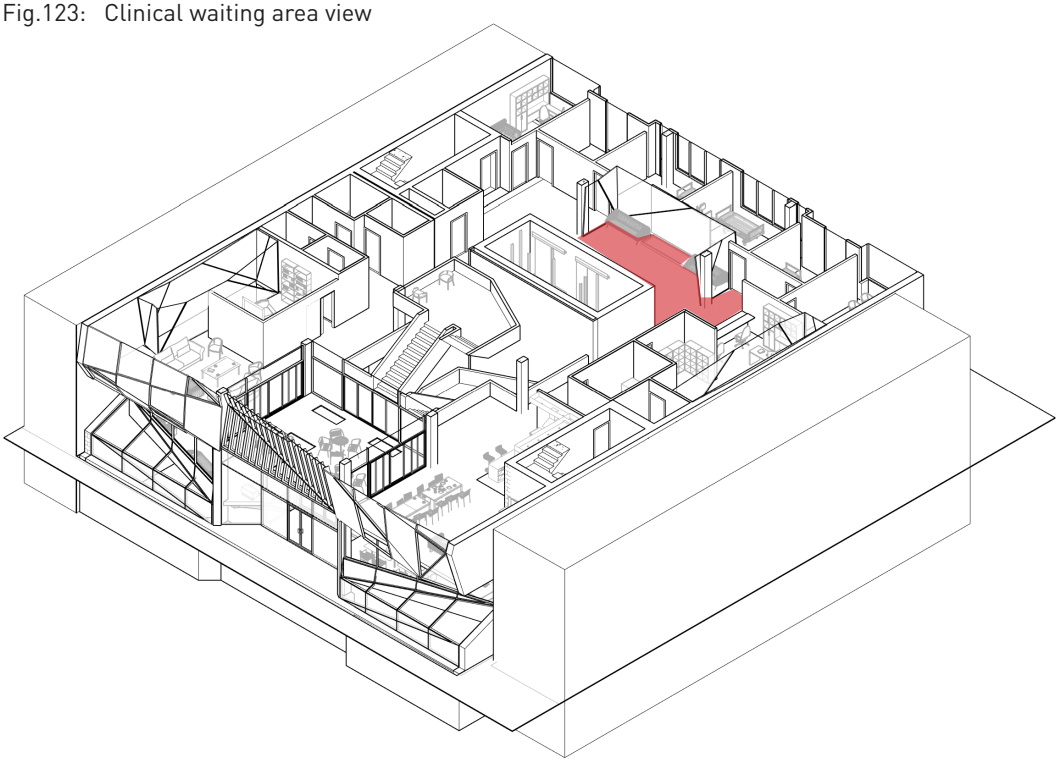


Fig. 124: Second Floor axonometric indicating Clinical waiting area

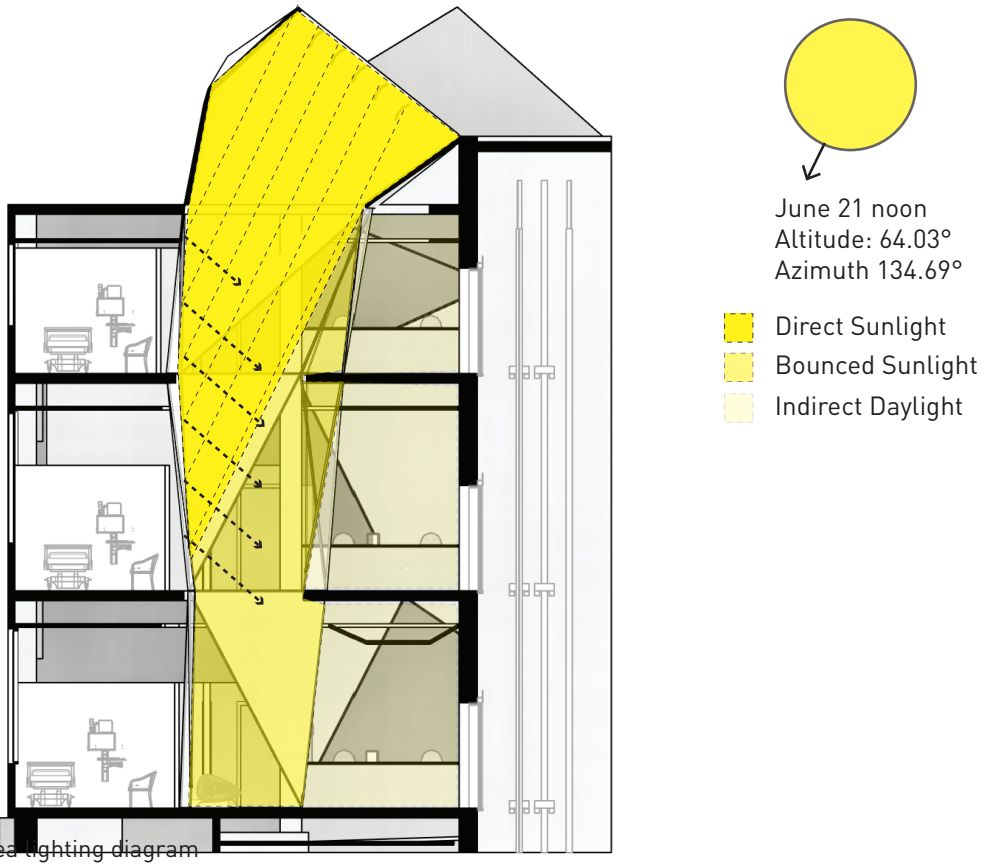


Fig. 125: Clinical waiting area lighting diagram

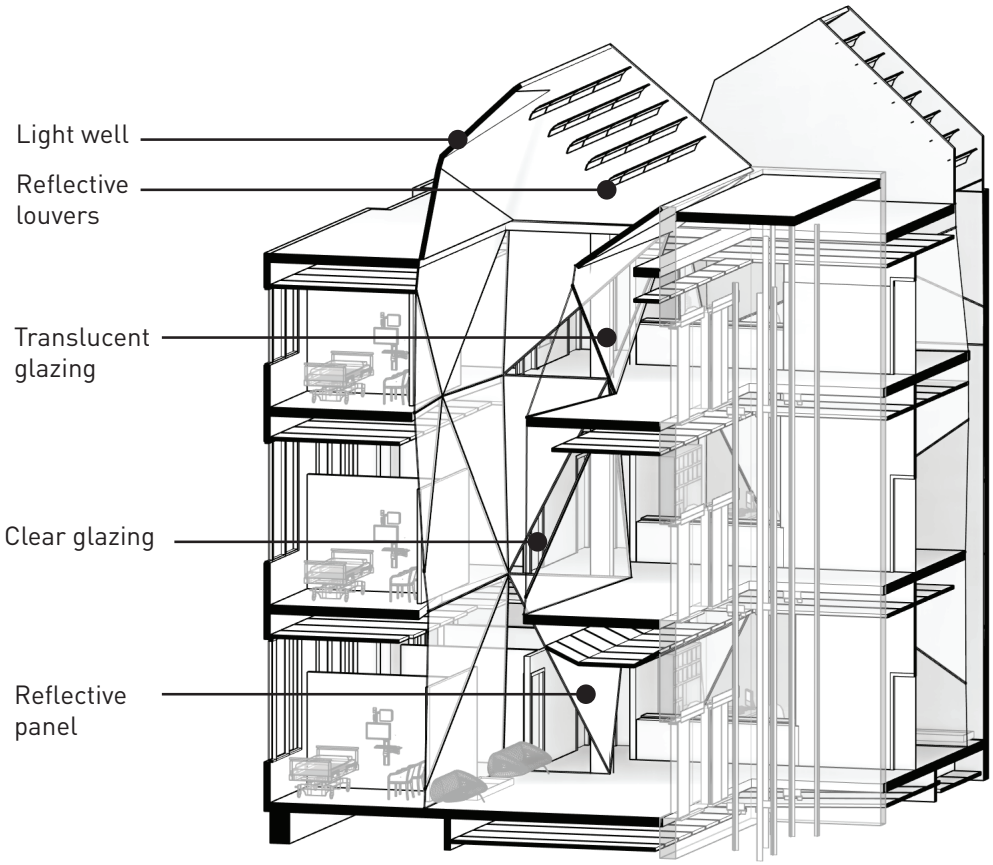


Fig. 126: Clinical waiting area diagram B

Fig. 127: View of Maggie's Centre from Church and Wellington intersection

CONCLUSION

This design project demonstrates the effectiveness of daylight as a mechanism for creating a psychological and emotional impact, and promoting wellness. The creation of the project is based on the The Maggie's Cancer Centre model of patient-centric design. Traditionally located in a suburban setting, where they may be ideally oriented for day-light infiltration and outdoor connectivity, the Maggie's model promotes three primary design factors: i) abundance of daylight, ii) connection to nature, and iii) a de-institutionalized environment.

The design project was purposefully situated but with a specific constraint of an urban environment, where the goal is to achieve a spatial character that embodies these three design factors where daylight availability is limited. The design project demonstrates a method of daylight centric design that utilizes three primary techniques for daylighting that were extracted from precedent analysis: i) Direct light, ii) Bounced light, and iii) Diffused light. Through the methodi-

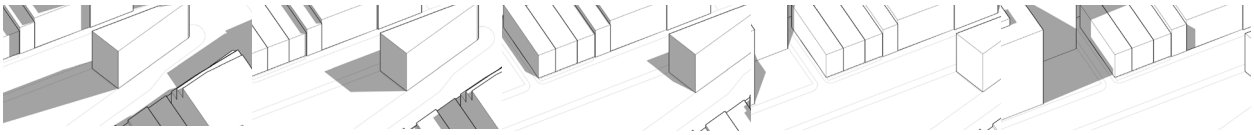
cal harvesting and manipulation of daylight in an urban setting, the project highlights its potential for enhancing patient experience and the curation of varied experiential narratives in light.

Daylighting in architecture has traditionally been a practice-based, intuitive and experiential process, based on the common notion that daylight enhances our spatial and sensory awareness. As the thesis has explored, advancements in technology, particularly in the last century, have provided the capability to discover quantitative links between daylight and health, substantiated by the growing body of evidence-based design. In addition to the physical effects, light also has a tremendous impact on the psychological state.

As evidence-based design expands beyond the realm of healthcare design we may consider the implications and applicability of daylight-centric design to other typologies such as office workplaces, which greatly benefit from increased productivity, as well as educational facilities which would benefit from increased cognitive function and learning potential inherent in more prominent daylight exposure. As these typologies shift toward a more human-focused design, the future will not be wholly successful without the full participation of design professionals who embrace a marrying of traditional intuitive design and evidence based knowledge.

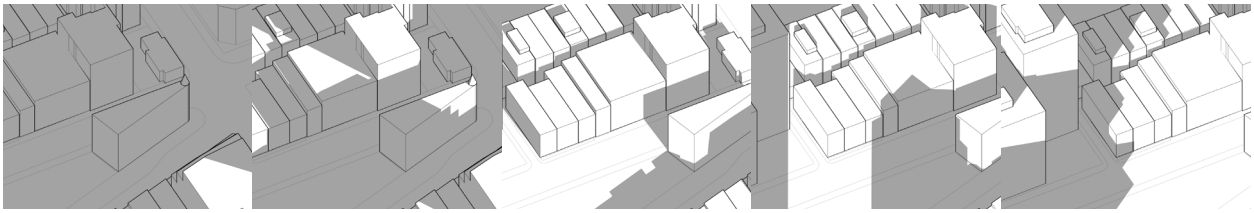
APPENDICES

A.1 SHADOW STUDY



8am 10am 12pm 2pm 4pm

Summer Solstice



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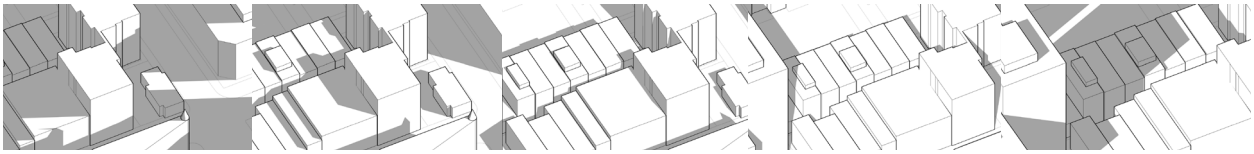
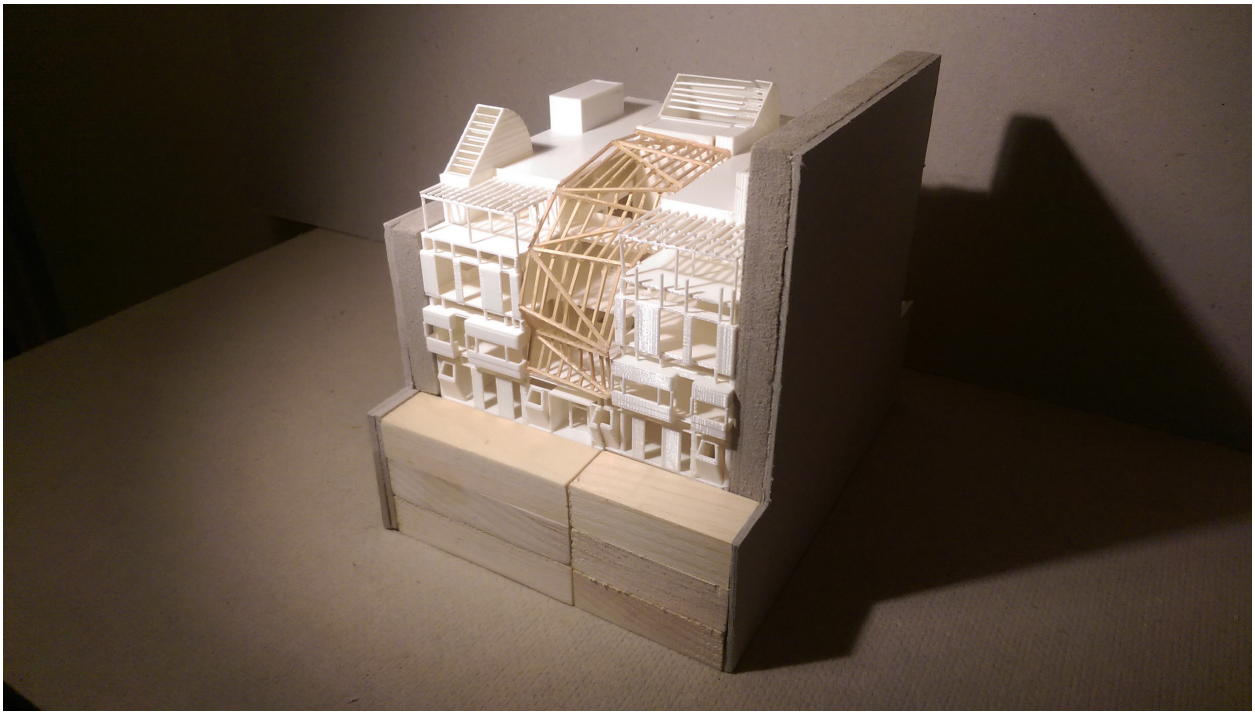
Winter Solstice

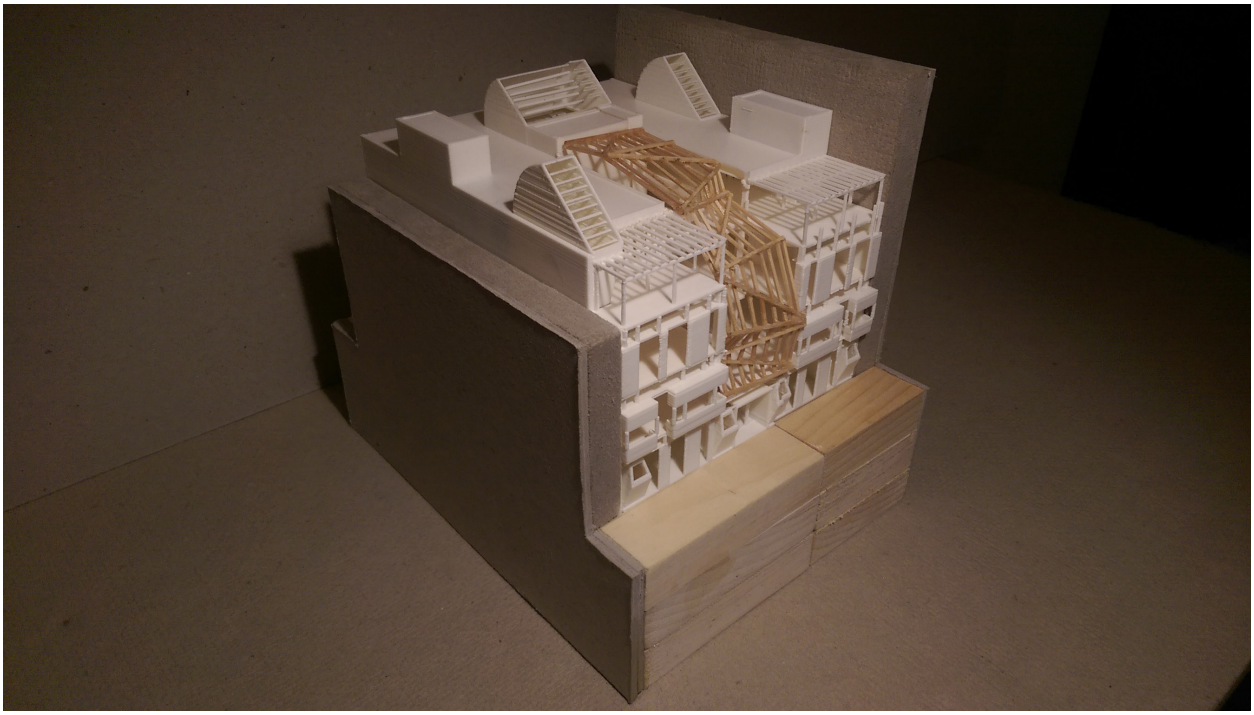


8am 10am 12pm 2pm 4pm

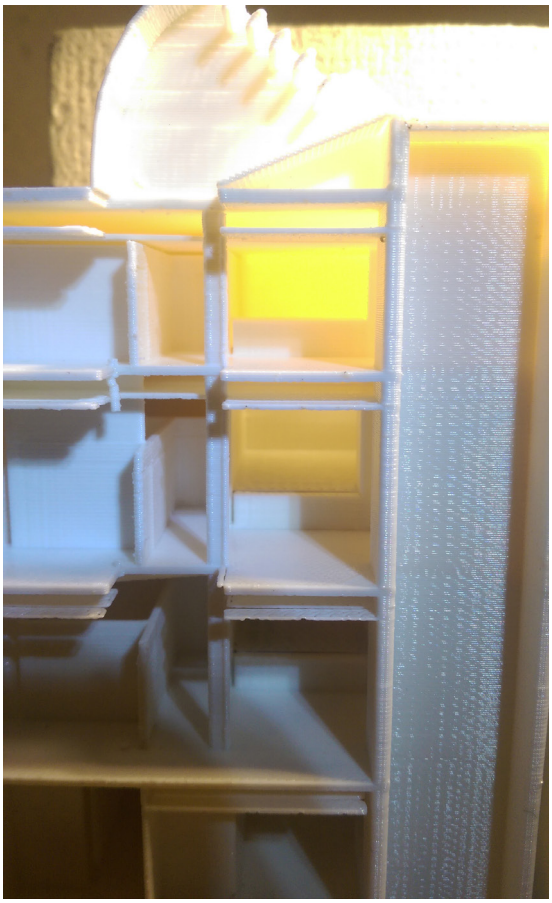
Fall Equinox

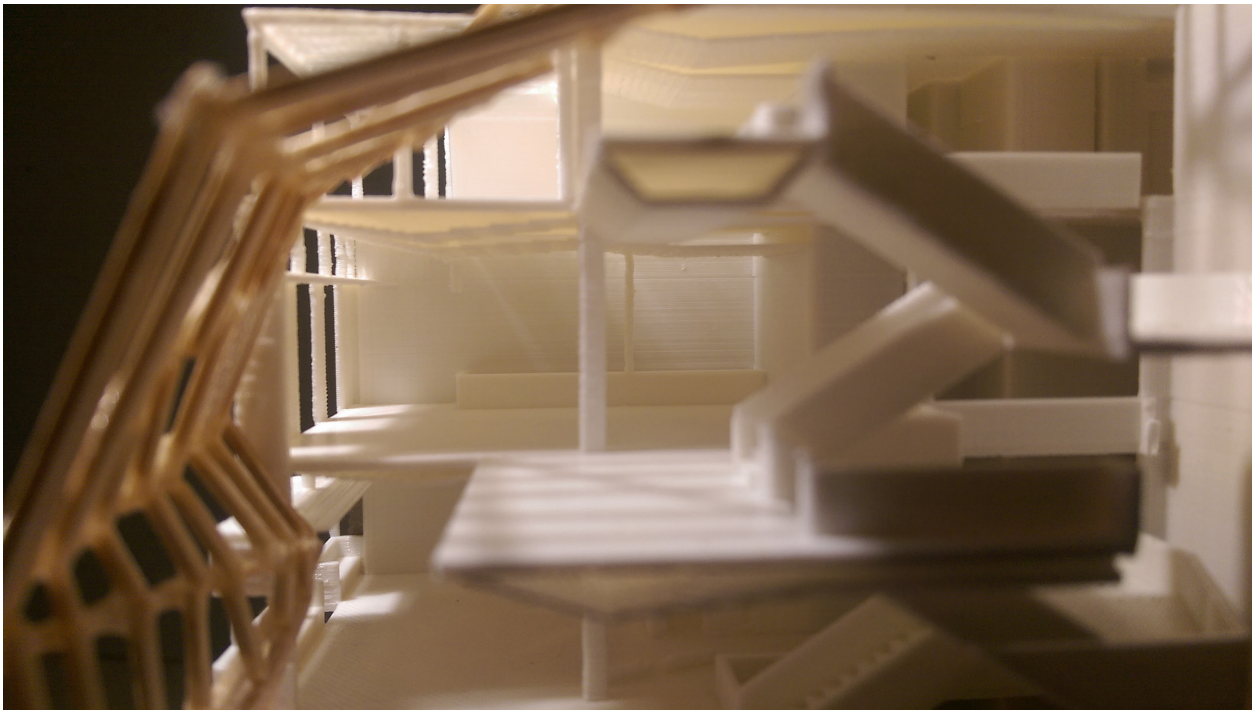
A.2 DESIGN PROCESS MODELS





A.2 DESIGN PROCESS MODELS





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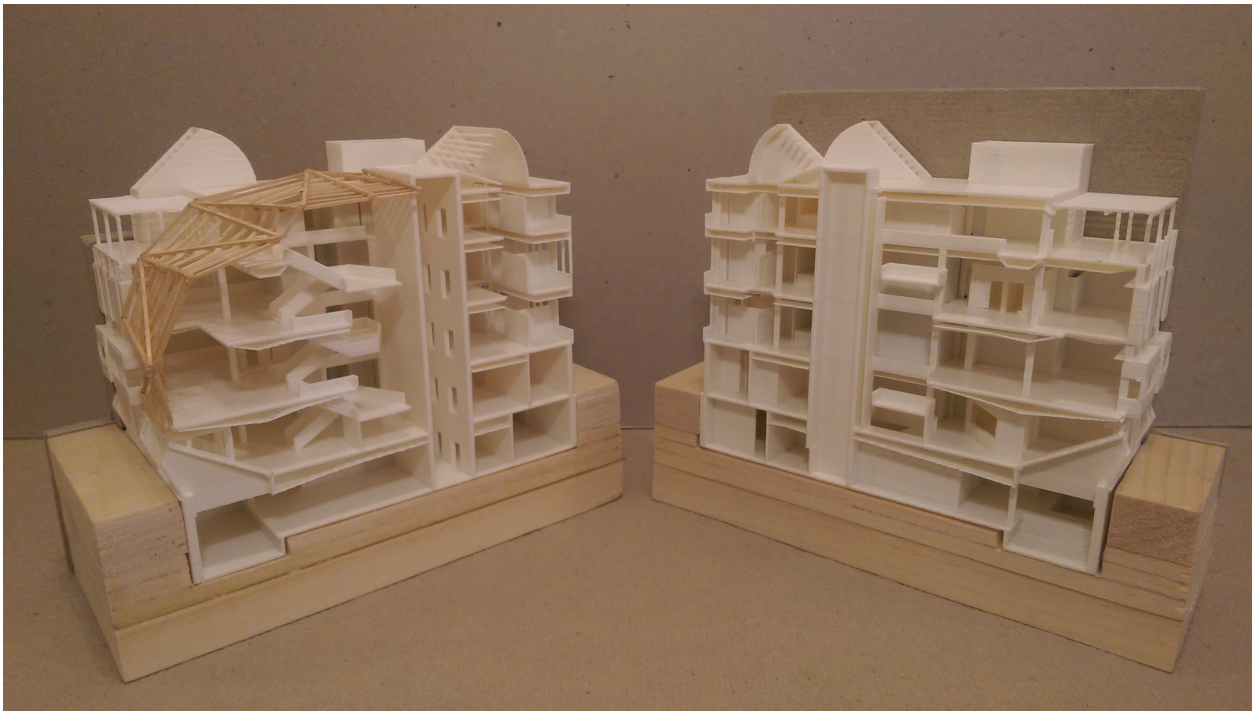

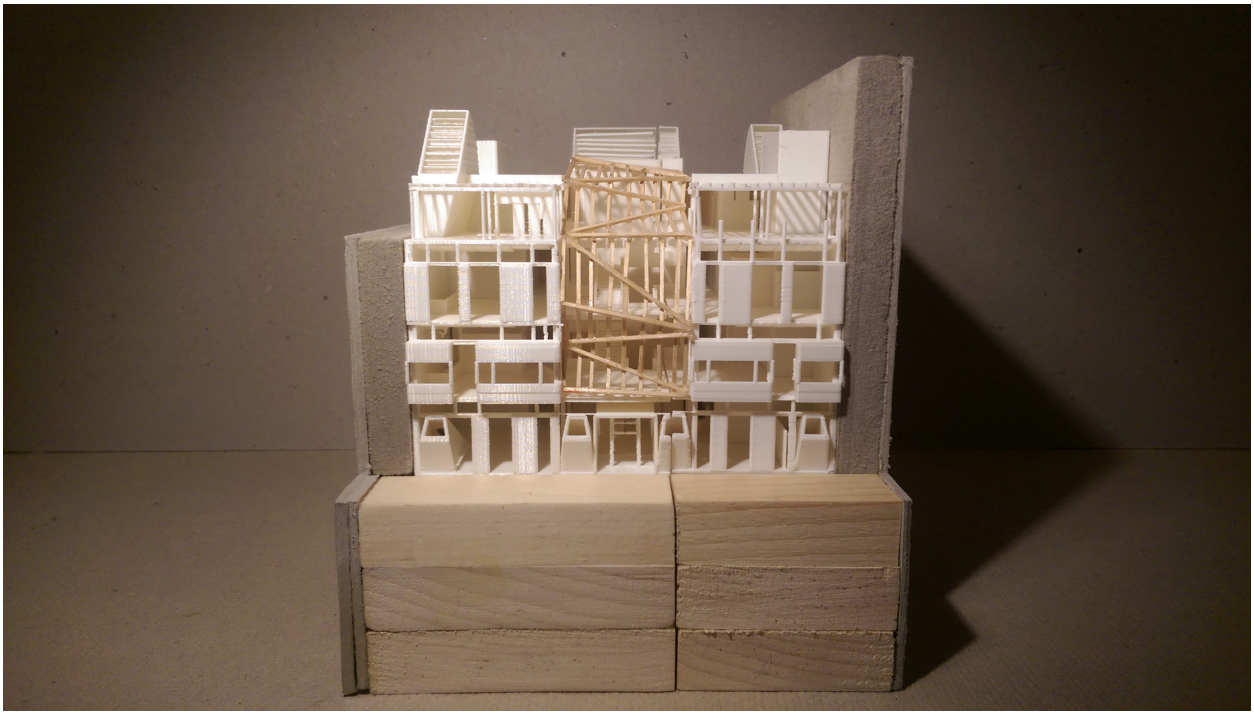

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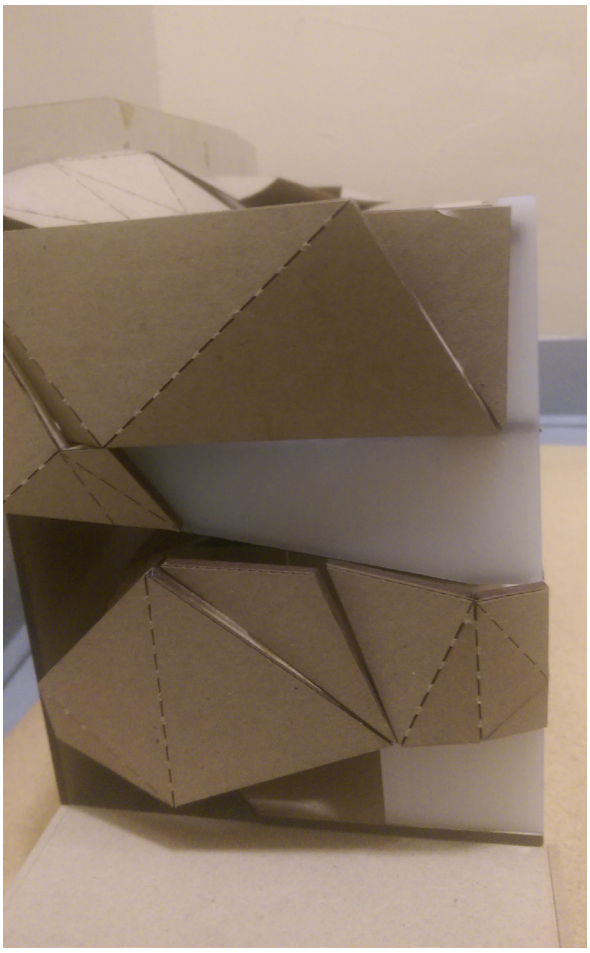

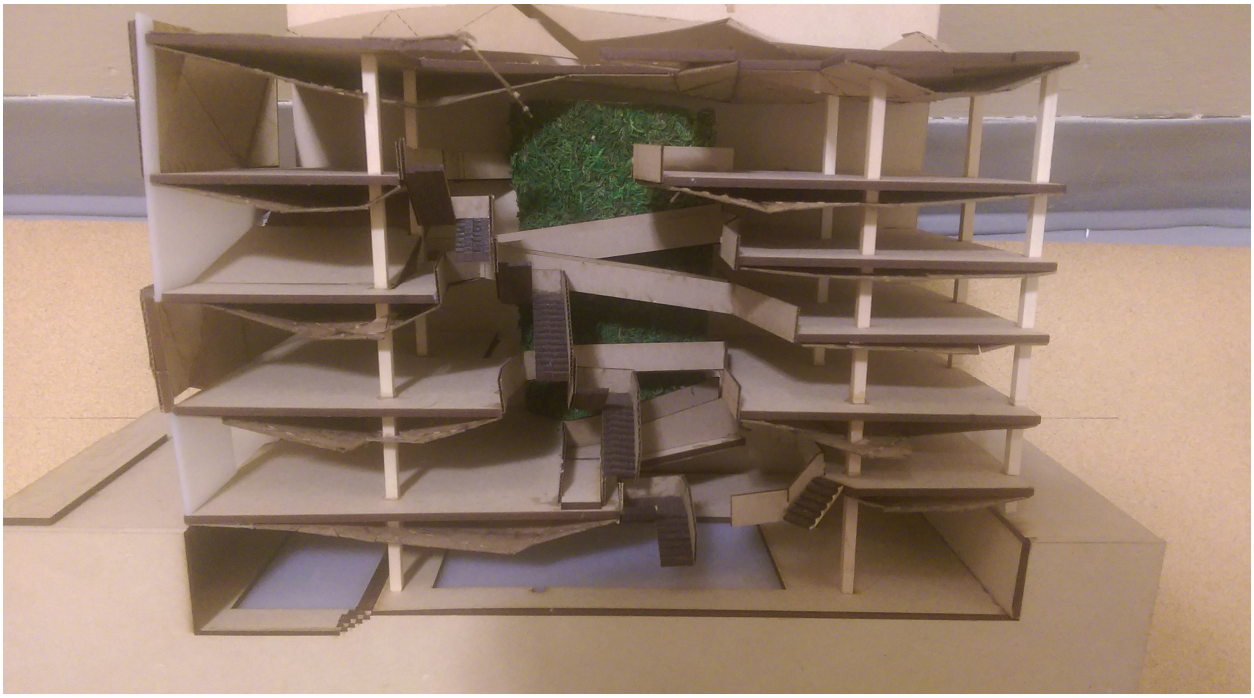

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