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INTRODUCTION

This thesis confronts the issue of designing a building with a healthful quality of light. Towards this end, it explored how a variety of light qualities could influence the healthful concepts of the environment. Light variations were explored as a way of stimulating movement from private areas to public areas and encouraging social interaction.

The knowledge of human ergonomics in relation to light will correct the schism created in today’s nursing home environments. Architects have somehow disconnected themselves by designing buildings without linking them to their users. We must design them with the intent of connecting the users to the surrounding environment. The surrounding environment should be a connection of neighborhoods and commercial areas. These two catalysts create a stimulating area that surrounds, penetrates and infuses the homes for the aging into the environment. Blurring the boundaries of the home into its context will help make it a welcoming place for visitors and residents.

This social interaction must not be limited to the environment within the home of the aging but must expose itself to the community.
While visiting grandparents, my mother, and others in nursing homes, I noticed that homes for the aging (nursing homes) generally lack attention to the natural light qualities. Fluorescent light dominated the interior. When visiting my grandparents' home for the aging, I observed that most of the residents were huddled around the nurse's station, or scattered intermittently down the hall. The nurse's station and hall were mainly lit by fluorescent lights. The area is depressing and the urge to escape it crossed my mind. Research performed on this issue of uniform lighting shows how detrimental it is for workers (Plants, 1970). This must have similar ramifications for residents, especially since workers are only exposed for approximately eight hours per day, while these residents are exposed everyday, whenever these lights are on.

These observations and curiosity about how lighting quality might improve the spatial experience led me to start investigating the issue. I have read and studied the articles mentioned in the following pages, along with many books. These sources help show that a healthful variety of light is important to our welfare.
During research, a set of questions developed about light. Answers were found that quantifiably explain the problems that exist today. These cannot be solved by simply looking at popular trends in nursing homes or calculating how architects can produce the most economic building for the fastest payback. These time and money issues have nothing to do with the residents’ health. Although those issues can be taken into account, ideally they should not be the main driving force of decisions. Problems from homes of the aging residents can be improved by addressing two questions: Can variety of natural light be used in a healthful way for the aging population? And, how can a healthful variety of light be influenced properly with materials?

Can variety of natural light be used in a healthful way for the aging population?

The articles referenced below provide support and strength for the hypothesis that a diversity of light can be used in a beneficial way for the aging population.

When observing my grandparents’ nursing home I observed a mood of neglect. Most of the nursing home residents were huddled around the nurse’s station. At the time I did not understand why this was. There was a recreational room, but it was practically empty. The room contained books, a radio, and a television, but only a few residents ever went to this room. This observation concurs with Spivack’s article, which states:

One of the problems is that the elderly are isolated in the building, so few family members see the elderly, and their only human contact is with nurses. This creates a sterile environment that does not work (Spivack, 1984).

The residents were gathering around the nurse’s station because this area provided the only contact that they got from the world outside. So, there needed to be a way to fuse my building with society in order to create a stimulating environment. Natural light can be used to do this very thing.
The light in the public spaces could be brighter than the rest of the building in order to draw the residents toward the public area and toward society.

This quote shouldn’t just say elderly people are attracted to brighter light, it should say all people are attracted to brighter light. Towards the end of winter when the sun begins to pierce through the clouds and warm your face from the bitter cold air, there is a sense of release from the dismal winter days. This connection and warmth are important, so the building is designed to have the most intense light at the southern edge. In addition to increasing social stimulation and providing nourishing light, my design also follows this information:

Activity rooms should be more lit than hallways or corridors. This variation of light will help individuals orient themselves more easily (Torrington, 1996). Changes in the level and direction of lighting should be of high importance (Torrington, 1996).

There needed to be thoughtful sensitivity when using different intensities of light. An example of a problem would be the idea of pulling the drapes open in the morning and being blinded by the sun; or in the case of designing a building, moving from a corridor with less light into a brightly lit activity room. This problem is addressed with this design function:

Older people have a harder time adjusting to bright or glaring light, so when designing a garden it is helpful to create an arbor or overhang that allows them to adjust to the sunlight (Barnes, 1999).

When traveling from one area of light into another, a transition area is made available to allow time for adjustment. The building has three distinct levels of light intensities and the transition areas allow for the residents to adjust as they move between them.

As was mentioned earlier, nursing home residents, that I observed, sat near the nursing station. This meant that they were sitting in the corridor under fluorescent lighting, all day long, every day, with limited access to natural light. Fluorescent lighting is a form of uniform light.
Information was found that supports how bad it is to sit under this light.

*Prolonged exposure to uniform light can cause anxiety and panic (Boyce, 2003).*

*Czechoslovakian and Russian literature provide evidence that workers in windowless factories have more headaches, faintness, and sickness than those working in factories with windows (Plants, 1970).*

This shows that uniform lighting is not good for anyone, especially the residents sitting in the hallways by the nurse’s station. When they are connected with different varieties of light, the health, and living environment of the residents will improve compared to the residents that sit under fluorescent lights.

So, the person who sits under the fluorescent light will produce more serotonin and less vitamin D. These two bodily processes will cause depression; this happens for many people during Indiana’s winter months. Light variations within a building can lead residents into public areas and provide a health benefit, allowing individuals to choose how much light they need throughout the day. In designing a home for the aging, the building should naturally move residents out of the private areas and into the public areas through the use of variety of light. The health benefits for the person obtaining a healthful variety of light must be considered. Given this information, and much more, light is critical in designing a building. Therefore, principles were formed to be used in the design. These principles work with lighting devices that will aid in producing a defined amount of daylight within each space: direct light used in the most public area to allow it to become the brightest spot; diffuse light used in the library to allow some light to enter the space and some light to reflect off of the ceiling - creating an environment to read easily in; filtered light used in the most private areas and semi-private areas to tone down the intensity; reflected light used to brighten or dull an area depending on whether it is public or private; and mixed light used to create a smooth transition from a brighter lit area to a duller lit area, or vise versa. As seen in the succeeding pages, the light variations achieved through these devices range from bright to dark.
Lighting Devices

Direct light: uninterrupted light passes through into the space

Diffuse light: scattered light created by allowing light to penetrate and/or reflect

Filtered light: light that passes through a medium
Mixed light: light that enters into both ends of the room and mixes

Reflected light: light that does not pass through the object, but bounces off

Shown through the readings and diagrams mentioned and shown above, the sun is an important element that allows different types of lighting devices to be used to create different levels of lighting based on the natural cycle of the day. This is beneficial to the residents, employees, and visitors. Another question was addressed that helped to greatly enhance the variety of light.
How can a healthful variety of light be used properly with materials?

The following information supports this question.

Smooth and rough surfaces reflect light differently. Light falling on a smooth surface is reflected very directly off the surface. Light reaching a rough surface is reflected in many different directions and the surface appears darker (Holtzschue, 9).

This quote allowed me to grasp how material can affect the intensity of light. This can easily be visualized by imagining the difference between rough sandstone and polished sandstone. The rough sandstone can aid in reducing the intensity of light and polished sandstone can intensify the brightness of light. The following definitions aided further in the choice of materials used in the building design.

In the illuminant mode of vision, the viewer sees light as a color. In the object mode of vision, the viewer sees color in tangible objects. The object mode of vision has three variables: light source, object, and viewer. Objects and their colorants are material. In the object mode of vision, light is modified by materials. Materials modify light in one of the following three ways:

Transmission: The light passes through a material, as through glass.
Absorption: The material soaks up the light like a sponge, so it is lost as visible light.
Scattering or reflection: The light neither passes through nor is absorbed; instead, it bounces off the object, changing direction and scattering (Holtzschue, 9).

When light enters a building, materials will either enhance or reduce its quality. Considering this information, I chose to use four different materials in the interior of the building. To create another layer of healthful variety of light the materials must range from rough to smooth. Brick, wood, sandstone and gypsum allow the light to become fully embodied in its use, and influence the quality of light experienced.
Materials

Brick

A rough surface inherently refracts light and effectively reduces the intensity of light.
Materials

Semi smooth surfaces refract some light and enable reflection without glare.
Materials

Sandstone

Gypsum board

Smooth to semi smooth can be used to reflect light into a space.
When these principles were set in place, designing the building became plausible with the agenda of: 1) defining appropriate light qualities for different areas of the building and 2) defining how materials influence light quality. After experimenting with building concepts, I needed to test these principals in the heliodon and mirror box.

The heliodon is an instrument used to determine how light interacts with the space by using the latitude angle, time of year, month, and hour.

The heliodon became a great tool in developing the conservatory. It helped in understanding how to blend different qualities of light.

In testing different models in the heliodon one can understand the spacial relationship to light. In this model the areas are further defined by the types of light in each space.
The mirror box is a device that emits light which resembles light on overcast days. Light meters are placed in the model being tested and read the light levels. After using a formula and inserting the readings a person will be able to tell how much light enters the building.

This mirror box photo shows how light is measured. The black cylinders are light meters that indicate how much light exists in that part of the room.
Many sources are available for this thesis topic. I will start by reviewing some more of the written findings that support the thesis questions.

(SAD) Seasonal Affective Disorder
The harmful effect of not getting enough sunlight, especially in the winter time, is called Seasonal Affective Disorder (SAD). All of our internal time clocks run in 24-hour cycles, precisely the time the earth rotates one revolution. Since the earth’s equator is not perfectly angled parallel with the sun, days shorten or lengthen depending on where we are located around the sun. This shortening and lengthening of the days can throw off on our internal time clocks. In the winter, if the sun is hidden behind thick clouds or day-time hours are shorter, people often get depressed. Throwing off the biological time clock sometimes causes the brain to produce too much melatonin, a chemical produced at night that the brain uses to induce sleep.

Symptoms of the Disorder
- Craving of sweets and starchy food such as potatoes
- Excessive eating and sleeping resulting in weight gain and reoccurring symptoms of depression in the fall and/or winter months
- Depression subsides in the spring and summer months
- Seasonal depression episodes substantially outnumber non-seasonal episodes

Glare
When the light scatters within the eye, glare increases in intensity. Since older person’s eye muscles adjust more slowly, glare could cause temporary blindness when moving from a dark room into a well lit room.

Ultra Violet Radiation
The harmful part of sunlight is called ultraviolet radiation (UVR). Too much exposure to UVR could cause cancer. However, I found no book that says how much time it takes to achieve too much light.
how much time it takes to achieve too much light.

Healthful day lighting and the physical aspect of humans

• Ultraviolet B is essential for humans to create vitamin D, which is produced in the skin.

• People should have at least 15 minutes of sunlight a day, even in cloudy areas.

• People with skin disease and psoriasis need to sit in the sun for treatment.

Healthful Lighting in the Interior

• Activity rooms should be more lit than hallways or corridors. This variation of light will help individuals orient themselves more easily. A frail elderly person is attracted to more light and will naturally adjust or move to that brighter lit area (Torrington, 1996).

• Changes in the level and direction of lighting also should be of high importance (Torrington, 1996).

• Any hazards should be well lit, especially at lower levels such as the floor and seating (Torrington, 1996).

• Careful attention should be paid to avoid producing glare (Torrington, 1996).

Lighting

• Lighting in public buildings improved greatly in the 1980’s - 1990’s. Hosking (1999) looks at how lighting meets different needs for both the employees and patients with their different moods.

• Most hospital designs use skylights and clerestory windows. When skylights are used, they should be produced with clear glazing so that workers and patients can feel connected with the outdoors (which lightens their mood) and eradicate the feeling of claustrophobia (Hosking, 1999).
• Studies suggest full spectrum day lighting should be included in patients' rooms (Hosking, 1999).

• When dealing with electric lighting and day lighting, it is tricky to design these building areas that are affected by both. For example, an entry design must be planned according to the fact that day lighting varies throughout the day and will change due to clouds or clear skies (Hosking, 1999).

• One study indicates that if the ceiling of the patient’s room is even slightly lit, it could cause nightmares. The hum of fluorescent lighting can also cause sleeping problems (Hosking, 1999).
EXEMPLAR STUDY

Building: Menil Collection  
Location: Huston, Texas  
Architect: Renzo Piano  
Style: High-tech Modern

Renzo Piano designed the building to take advantage of solar lighting without compromising the integrity of the artwork that direct sunlight can cause.

**Light device**  
His innovative louver design and full-height windows allow ample indirect sunlight to enter the gallery and also enable visitors to view the artwork with ease.

**Connection to context**  
The building takes advantage of the sunlight and also responds to the neighborhood context through the hierarchy of surrounding house heights and the aerial grid of the homes.
Building: Saynatsalo Town Hall
Location: Saynatsalo, Finland
Architect: Alvar Aalto
Style: Modern

**Light characteristic**
When designing the building, Alvar Aalto had the most public space (public hallway) on the south-facing side of the courtyard, enabling the hallway to be lit from the sun. While interior walls amplify the light entering the space, a more private space spilled into or connected to the hallway from the northern edge. This was denoted through brick, which begins to refract and reduce light to define a boundary between private to public areas. This hallway photo is illustrated on the next page.

**Site**
The site is surrounded by woods, and the building is nestled into a hill.
Building: Saynatsalo Town Hall
Location: Saynatsalo, Finland
Architect: Alvar Aalto
Style: Modern

This photo is of the courtyard and the hallway.
The site is located in Muncie, north of Jackson Avenue above White River Boulevard and south of West Gilbert Street just southeast of Ball State University. The building is nestled between a neighborhood and commercial activity, which includes a pathologist office to a church. The site is currently vacant, containing only a few trees and grass.

This site has a well established neighborhood that can support this home for the aging. The atmosphere surrounding the home for the aging can provide multigenerational living, a concept used in European countries for decades. The site has housing to the north, a river and medical center to the southwest, and a church at the northeast. Much activity takes place along this road, as people jog, walk, play and fish by the river. This area will provide ample sunlight into the building because of its ample southern exposure. The hierarchy of the building and brightness of light will express the lighting opportunities. The neighborhood’s hierarchy is different from the commercial area hierarchy, and the hierarchy of the building should shift according to the type of hierarchy at each side, the light should also adjust the same with the hierarchy. This will lead people to the most public space since it is the brightest.
First concept

In the first concept, the building was centered on a courtyard, which allowed different ranges of daylight to enter all rooms in a double-loaded corridor. The ranges of light consisted of direct light, filtered light and reflected light. This would have allowed for a resident to choose what type of light they wanted. It was the focal point of the building. The corners at the end of the bedroom corridors created opportunities for public space.

A problem arose: the building didn’t take into account the neighborhood and commercial hierarchy and city grid. It was introverted, disconnected, and rejected the surrounding context. The concept was not effective.

The above right side illustration defines how much light enters the spaces. Purple spaces receive filtered light. Red spaces are the bedrooms and receive various types of light ranging from direct to indirect light. The black spaces are the areas that receive ambient light. As shown in the above plans, the building’s courtyard inappropriately directs attention away from the neighborhood and focuses it on itself.
First concept heliodon models
The heliodon model study helped me to experiment with different ways of introducing light into the building. The working model confirms how the light will enter the space. The photo below shows that the light entering the space will cause glare. Light this intense at the entrance of a corridor would blind the residents.
First concept heliodon models
This model tested how horizontal louvers affected the amount of light entering the building windows. The large photo below shows what it would look like at noon on Friday, June 21. The louvers were supposed to block out direct sunlight. They did not achieve this, but helped spark other ideas in later concepts.
Second concept

The second concept acknowledged the site along with an interest in exploring how a gradient of light could reinforce the program and space planning decisions. The northern edge began to follow the neighborhood grid pattern. The back area also created a courtyard between the two wings of residence rooms. The courtyard was not connected to the nursing home, but had some connection to the neighborhood. Also, it was not used to provide another layer of light into the building, so more development of this idea was needed.

The southern edge design was one large activity area that used a common corridor to connect the subdivisions of the activity area. This common corridor, or transportation area, was reflecting the river and road - imitating what they do, and acted as an artery to collect and disperse people. The hall was darker than the activity area. The light in the hall was reduced by the use of trees and louvers. This was to subdue the corridor and add importance to the activity room. The activity area on the southern edge had exterior glazing. The inside had louvers and/or direct light to create a variety of light that would help residents choose what type of light they wanted to remain in. It also provided a variety of light into the space, while remaining brighter than the corridor.
Second concept

In the interior northern edge, the objective was to design bedroom areas with a node on the end. This was to promote traveling from one area to another area with a gradient of light starting at medium light that gradually increases to bright light. This created a destination point where the residents could become socially connected to one another. This part of the building was multi-level and inventively incorporated the variety of light. The upper floors in the northern edge consisted of bedrooms for the more ambulatory. Offices were located on the second floor in the northern edge.
This section illustrates what type of light was expected, through the use of trees, in this portion of the northern edge.

Second concept

I needed to create different variety of healthful light in the northern edge to allow the residents to choose what type of light they wanted to be in.

This section illustrates what type of light was expected, through the use of louvers, in this portion of the northern edge.
Second concept
This section began to illustrate that the light decreased as a person moved north and light increased as a resident moved south. It also explored having the floor slope up as the light became brighter. Since the light became brighter and the floor sloped up, this suggested that the light became more focused.
In reality, creating a node for the residents was an idea that did not work at all. In fact, it can be traced back to the experience with the nurse’s station or multipurpose rooms. Some nursing homes have these destination points called multipurpose rooms, and they don’t work. There was no reason why the offices would be located on the second floor, so this area also needed more development and thought.

One major design flaw was that the activity room would have become too hot for the residents to enjoy. The heating and cooling in this area would have been hard to regulate. The southern edge design didn’t fit with the existing commercial edge hierarchy. There still was no clear idea on how to socially connect the neighborhood with the building. Although the definitions of light devices were starting to develop, more experimentation was needed. The northern edge still lacked connection to the neighborhood, and more analysis needed to be done on the neighborhood itself, to further understand the connection. This is shown in the illustration on page 25. In designing this concept, the darker a room was the more obscure it became. The lighter the room, the more focused and secure your senses became. This design had some lose ends that needed to be studied and adjusted.
The third concept is a hybrid of the second concept. First, the building needs a healthful variety of light to direct people into a social and public situation and to provide a degree of intensity needed to keep the body functioning properly. Heightened awareness of brighter light will lead residents to the most public space. This concept is critical in introducing the residents to the public. In order for this to work residents must be able to see the increasing gradient of light. The current design considers degree of light intensity necessary to keep the body functioning properly. The intensity depends on whether the resident is in the private or public area. The public area will provide the most light and social interaction.

The building is designed so that the most private areas have the least amount of light. As residents progress through the building from the private area to the public area, the light gradually increases. Coinciding with the idea above, as light intensity increases, the building begins to open up to the outside, thus the more public the area becomes the more is revealed about what is inside.
Design process
During the design process, I used many different media to study a range of design issues. First, the ideas were sketched out, overlaying the site plan with trace paper. Second, a section of the building was traced out; illustrating what type of light was to be accomplished in that area. Third, a 3D rendering accompanied these sketches to explore how the façade would enhance the quality of light. Last, the physical model was developed. Physical models were used in testing the design in the heliodon and mirror box to determine if the design was a success.

Design vocabulary
The building needed a vocabulary. The first set of vocabulary terms identified and described seven pictures, ranging from the brightest light to no light, which helped to identify different qualities of light for different areas of programmable space. This helped the building develop in the beginning stages, but a more accurate definition was required to have a consistent design throughout the building. The second set of vocabulary consisted of lighting devices and materials used in the design. The lighting devices created a means of consistent light uses for the different varieties of light used throughout the building. The definitions used are direct light, diffuse light, filtered light, reflected light, and mixed light. These lighting devices are illustrated in the issues and positions part of this text. For example, the most public area of the building is open to the sunlight, without obstruction, therefore receiving direct sunlight into the building. The most private parts of the southern and northern edges use only east and west light. Four main materials are used to enhance and/or reduce the effect of the light in the building: brick, wood, gypsum board, and sandstone. If an area needs to reduce light, a rough surface is used. If an area needs to intensify the light, a smooth material is used. When using a measurement of light the private areas should range from 900-1,600 (lux) and the public areas should range from 1,700 - 2,600 (lux). The range mentioned above meets with the standards from walking to reading...
Site

The aerial site begins to show how the building responds to the light and the context surrounding the site. The northern edge breaks down to the grid of the neighborhood. This is evident through the white and black roof system. The white roof areas are the more public areas, compared to the black areas; therefore these areas will receive more light. The corridor, or transportation area, begins to shift to the southern edge at an angle, responding to the angle of the river near the property. The public areas begin to reach out toward the river.
**Northern edge floorplans**

The floor plans begin to explain private and public areas. The private areas become dense with wall divisions. Diagrammatically this restricts the amount of light entering these spaces. The wall density decreases in the public areas, allowing more light to enter into the space. Note that the northern edge will receive less light than the southern edge. Therefore, the public side of the building is in the south. The public side is not only more lit, its hierarchy also corresponds to the commercial buildings.

The common space opens up and the nurse’s station has been eliminated so that the nurses are forced to become part of the community. This creates a larger and more sociable space.
Residents’ Quarters

The resident’s quarters illustrations show the light quality in the northern edge. The primary activities in this room will be sleeping, reading, writing, and watching TV. Therefore the room has two distinct areas of light; one for sleeping and one for activity. The activity area has a window facing west or east with a wooden desk-top underneath that reflects the light into the room in a non-glaring way. The trees in the adjacent courtyards further filter the light entering the room. With gypsum board and sandstone flooring, the activity area is brighter than the sleeping area, where brick and wood reduce the ambient light, creating two distinct zones in the residents’ quarters. Even though the private activity area of the resident’s quarters is brighter, it still is not as bright as the public common area.

The rooms only have east and west light since the residents’ quarters are meant to be more private. This reduces the exposure to the exterior, causing the resident to move into a brighter and more public area. The more public an area, the more visible and revealing it becomes to the exterior.
Common area
The common area becomes brighter than the residents’ quarters since it is more public. This area has a clerestory window that allows southern, eastern and western light into the space. The northern ambient light is addressed by having glazing to the north. The room’s main materials are gypsum and sandstone to reflect light into the main space. In the mirror box the light increased to 1603.2 (lux), bright enough to read, walk, converse with residents, and watch TV.

Heliodon Photos
Exterior neighborhood edge

In the northern edge, the building breaks down to the scale of the surrounding neighborhood, further infusing it into society and opening it to the public.
Conservatory & transition area floor plans

In the middle of the northern edge, conservatory, and southern edge are transition areas. These areas mix the light from connecting areas and allow the residents to adjust to the changing levels of brightness as they move from public to private spaces, or vise versa. These transition areas also help determine where the service rooms should be.

Transition area

The plan uses color coding to show the breakdown of the quality of light. The lightest color represents the brightest area and the darkest color represents the darkest area. Since these mixed areas are not the most public areas, they are still not the brightest. The louvers on the southern face of the transportation area reduce the visibility and constrict the light, therefore coinciding with the design of the building by restricting the visibility of the space from the exterior.
Conservatory & Transition area photos

Photos shown on the next page highlight how the conservatory area is slightly brighter than the northern edge. This is because it begins to have more southern exposure and has skylights in the roof allowing in light that is filtered by trees. The materials used in this area are mainly brick and wood. The heliodon photo shows how the light is filtered. In the mirror box test the light increases to 1,792.3 (lux). This shows that the more public area is brighter.
Conservatory area heliodon photo
Southern edge public spaces

The floor plans explain public areas. The most private part of the public areas becomes dense with wall divisions, similar to the northern edge. Diagrammatically this restricts the amount of light entering these spaces, although the light is still brighter in this southern edge. The wall density decreases in the most public areas, allowing more light to enter the space. The public side is not only more lit, its location and scale also correspond to the commercial buildings.
The southern edge is broken down into four main public areas: exercise/rehabilitation room, restaurant, library, and entrance. The library photos explain that the center of this space is the brightest and light decreases as a resident or visitor moves away from the center of this space, using the same principle as in the northern edge. In the private reading area of this public space, the rooms face east or west and only receive that light; the walls are brick and the desks are wood, further reducing the light through their minimal reflective qualities.

Library photos
The southern edge is broken down into four main public areas: exercise/rehabilitation room, restaurant, library, and entrance. The library photos explain that the center of this space is the brightest and light decreases as a resident or visitor moves away from the center of this space, using the same principle as in the northern edge. In the private reading area of this public space, the rooms face east or west and only receive that light; the walls are brick and the desks are wood, further reducing the light through their minimal reflective qualities.
The mirror box value is 1,981 (lux) in the most private area of the library. As the resident moves into the hallway, the light begins to increase and the space opens up to the outside with southern-facing glazing. The light is the brightest in the center of the room since it is the most public area. The main materials are gypsum board and sandstone. The ceiling in this area either reflects and/or diffuses light. The heliodon photos show that the light in this room is brighter than the northern edge or the transportation area. The mirror box readings are 2,582.4 (lux) in the most public area of the library. Once again this shows that the light in the most public spaces is the brightest.

Library heliodon and mirror box photos

The mirror box value is 1,981 (lux) in the most private area of the library. As the resident moves into the hallway, the light begins to increase and the space opens up to the outside with southern-facing glazing. The light is the brightest in the center of the room since it is the most public area. The main materials are gypsum board and sandstone. The ceiling in this area either reflects and/or diffuses light. The heliodon photos show that the light in this room is brighter than the northern edge or the transportation area. The mirror box readings are 2,582.4 (lux) in the most public area of the library. Once again this shows that the light in the most public spaces is the brightest.

Mirror box photo
Heliodon photo
Light sections
These sections illustrate the idea of how light needs to penetrate the space. It is easy to see that the north side of the building is darker, which encourages the residents to move toward the southern public areas that are brighter than the private areas. Each succeeding section improves with design.

In the first section (concept 2), it is evident that there was a struggle to have light enter the room. The light filtering system was not defined well and needed improvement. It is not convincing that light would be brighter in the library. The conservatory needed to expand; it seemed pinched and might not have allowed enough light to filter into the area.

This section illustrates how northern light could penetrate the center core of the library to provide ambient light that would allow for easy reading.
This section is a combination of studying material use and light penetration. This aided in further developing the library materials. It became apparent that the materials in the library were lacking in adding more light.

In this section the materials and quality of light changed. The ceiling accepts sunlight all day by filtering the light. The materials sandstone, gypsum, and wood enhance the qualities of light by allowing the light to saturate the room.
Southern edge exterior

The design process for the interior influence the exterior design as well, accomplished by using the same principles as used in designing the inside. For instance, the restaurant has booths, a secondary dining area, and a main dining area. Even though the booths are in the public area, they are still more private; so these areas shown on the exterior only have east or west-facing glazing, and the walls facing north and south are brick. This creates a less visible view of the area, portraying that it is more private. The secondary dining area is just off the more public main dining area. This second area opens up and has glazing to the south and also uses east or west light. The louvers create a less transparent view in and out of the building. The center is the most public. This area has open glazing facing the south and a ceiling that reflects light into the space inherently making the space brighter.
The most public section of the restaurant is very visible to the exterior by use of glazing and smooth material.

The space that is increasingly closer to the center is more public, and becomes more visible to the exterior through southern light and wood louver screenings.

The more private area of the public space is designed with east or west light and uses brick to further dull the light.
Exterior of library
Exterior of exercise area
During the projects' timeline there was a lot of research, testing, experimenting, and designing. The written research helped answer the questions that pertained to the healthful variety of light in the nursing home. The written answers helped determined the set of parameters that would be used in the building design. These parameters evolved and became more focused as the project progressed. They ranged from photo definitions to lighting devices and materials used in the building. The experience of light depicted through this project shows that a building can accomplish what was asked in the guiding questions of the project. This meant that the designs of the interior rooms needed to be tested in the heliodon and mirror box. This confirmed whether or not each concept was successful. The designs that entered the heliodon and mirror box became increasingly more complex as time went on. The first models were very simple and the rooms had one type of light entering the space - they also had no consideration of materials. Towards the end of the project the rooms had at least two separate qualities of light and the model materials began to define what the building materials would be. Where the heliodon models left off in material, the 3D renderings picked up. The photos illustrate what the space would look like with finished materials.

The exterior of the building originally lacked continuity with the interior of the building. The exterior and interior seemed divorced at the start of the thesis. At the beginning of this last semester the connection of the variety of light in the interior was also defined on the exterior. The more private an area is, the less visible it became, and the more public an area is, the more visible it became.

The site continually evolved as the project progressed. The landscape went from having a loose connection to the building, to becoming a device used to enhance the buildings overall quality and variety of light. This really helped to infuse the landscape and the buildings with healthful variety of light. The building increasingly became connected to the surrounding context. As the semester progressed the building began to follow the grid of the neighborhood and the hierar-
There are a few things to reflect on from my final presentation. The first is in the interior, specifically the residents' quarters. In this area there is brick near the bed. Some people questioned the sanitation of this, due to the risk of bodily fluids coming into contact with it and not being able to be properly cleaned. After discussing this issue with a few people, I am sure that brick can still be used. However, I would adjust the height at which it starts.

It was also suggested that the southern edge of the building might need to become tied to the river more closely, or I could create more outdoor areas for the residents to engage in. This would be the better option since the river appears more like a ditch from this location. The southern area does have certain areas of engagement, but it can still be improved by adding an outdoor concert area, conversation rooms, or activity areas tied to the corresponding part of the building it is near.

This was not mentioned during the critique, but I wonder how the variety of light would change during the night time. Would the light intensities be similar vary in similar ways at night as during the day? Would the light be toned down and switch so that the residence area is brighter than the public area, promoting a natural transgression back to the residence area?

When interviewing Kathy Segrist, (Associate Director, Fisher Institute for Wellness and Gerontology) she made some good suggestions to me. In the resident's quarters, there could be a couple of rooms devoted to married people. There could be a stream going through the conservatory because people like listening to water. She liked the idea of using exercise areas and a restaurant to attract the public to become involved, and thought a pool would be another way to do this.
When interviewing David Spoiler (Administrator of Parkview nursing center), he thought that the brick in the residence quarters should be moved up higher, along with moving the wood up higher. He also said that the resident’s quarters need call-assistant buttons and suggested that side rails are usually eliminated from the beds. Lastly, he advised that the library should have internet connection.

This project helped me to understand how to research and develop future designs. It also showed that when working on a project of this magnitude it pays off to step back and look at the overall picture of what one is trying to accomplish. It is very easy to get off track and get lost in the details of the project. I feel that all projects should go through this rigorous research process, if time permits, in order to produce quality architecture.
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