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Planting Life in Dead Spaces

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“There is no doubt whatever about the influence of Architecture and structure upon human character and action. We make our buildings and afterwards they make us. They regulate the course of our lives.”

Sir Winston Churchill



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0.0 Abstract

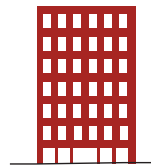
The winters in many places in the world especially the north are cold and gray. Light barely comes through the gloomy sky and the cold prevents humans from experiencing the outdoors; they transition into indoor spaces that are not always healthy environments. The human psychology is affected by our environment just as much as the humans affect and changes that environment. Using a modular hydroponic system embodying light, water and nature we can activate dead spaces in buildings resulting in healthier interior environments full of life promoting social interactions. By changing our interior spaces we can receive the benefits we need from nature, light, water and social interactions in the harsh cold winters.



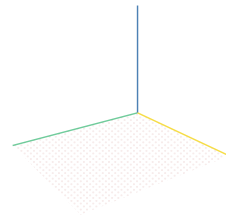
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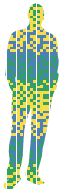
u r b a n



b u i l d i n g s



i n t e r i o r s



h u m a n s

1.0 Introduction

Early life of men involved being in groups of people spending majority of the time outside working, exploring, and hunting. They lived in open fields surrounded by nature, exposed to the sun, close to the earth and water to grow food and hunt. "Prehistoric hunter-gatherers often lived in groups of a few dozens of people, consisting of several family units."¹ The early hunter-gatherers adapted to their environment; as nature changed their habits and hunting methods changed as well.

Before advance technology, people relied on each other for company and interactions. They spent time with families outdoors. Now a days humans require more 'personal space' and 'privacy'. Generations together spend most of their time on their phones, tablets, computers 'socializing' when in reality it's isolating themselves. There is an exclusion from nature, people, and the world.

Humans get affected by the spaces they inhabit every day whether indoor or outdoor, bright or dark, small or large, as well as the amount of nature we are in tact with. Environments leave an impression on us. In human psychology there is a study of mood and emotions. The environment we are in can provoke feelings or nostalgia whether consciously or subconsciously. A small dark place could evoke a feeling of claustrophobia and a large white room could

evoke the feeling of being vulnerable and over exposed. The weather affects our psychology and our emotional patterns as well.

Architects used to be the master of all aspects of architecture but now there are engineers that specialize in parts. To design, construct and build a project now, architects work with different engineers, landscape architects, urban planners, contractors etc. All our buildings are designed for humans so why don't architects work with psychologist to understand what does a human need. Spaces can be manipulated to change our behavior. Many architects have begun to study human psychology after witnessing something not working. By understanding what humans need, spaces can be designed to respond to those needs.

Architecture plays a major role on our psychology. The buildings we inhabit everyday can change us. They affect our mental and physical well being. Architects and artist have designed buildings or installation pieces that discuss some of these issues. Many have found a fascination with light and the natural environment. James Turrell is an artist that designs installation pieces that are architectonic. He has designed

many spaces that frame the skyline in the center studying sky patterns. In all of them he emphasizes light; the natural light through the skyline being bare above and the artificial through the colored light surrounding the structures. Sound also plays a huge role in his installations. The spaces created are to only study light but can and should be used to study the connection and disconnection of humans to the natural environment surrounding them. Many, like him, have studied natural elements and their interplay with architecture and humans.

Most European cities have more public transportation and things are in closer proximity to one another. People are forced to be outside whether it's to wait for the bus or the tram, or walk from home to work. American cities tend to have wider roads and space out. Detroit, Michigan is especially spread out that the main transportation is the car. People experience the outdoors walking to their car or the parking garage.

Although humans have evolved and adapted to technology and the changes that came with it, we haven't lost our need for the natural environment. We need the benefits of nature, light, water and social interactions .



e n v i r o n m e n t

2.1 Environmental Psychology

Environmental Psychologists study the preservation and conservation of an environment as well as gather an understanding of human behavior and its effects on the earth. They study how human behavior and the environment go hand in hand. The environment can be a natural or a man-made, interior or exterior, a city or an office. Humans respond differently to different environments and some of those responses can help adjust the environment we are in for the better.

Through these studies, environmental psychologists have found what can cause human stress, loneliness, depression, discomfort, etc.³

Certain environments or spaces can cause many to go into depression, and experience a lot of discomfort. Architecture, sometimes, forgets to address the human that will inhabit the space for many years to come. Some spaces result in being dead, without life, unoccupied; they are empty spaces in buildings that could be utilized. Many suffer from other issues caused from the natural environment; the lack of and the excess of. When climates change drastically it can affect human psychology.

Environmental Psychology is the study of the influence the environment has on human behavior, mental stability, emotions, and ability to interact with the world. ¹

2.2 Seasonal Affective Disorder

What is it

Seasonal Affective Disorder is a form of depression that occurs when the seasons change. The most common cases are in fall/winter season but there are rare cases where it begins in spring and gets worse in summer time. As the winter comes about, the days get shorter and colder, light disappears rapidly each day, color from nature is gone, and humans cozy up in their homes. ² During the winter time, many slow down on exercise; due to the cold, motivation decreases. Seasonal Affective Disorder is classified as a major depression that tends to occur at the same time year after year as the season change. Winter Blues contain the same causes and symptoms but it's milder. It doesn't cripple the ability to get through life while the season is still going. More people are affected by Winter Blues than Seasonal Affective Disorder.

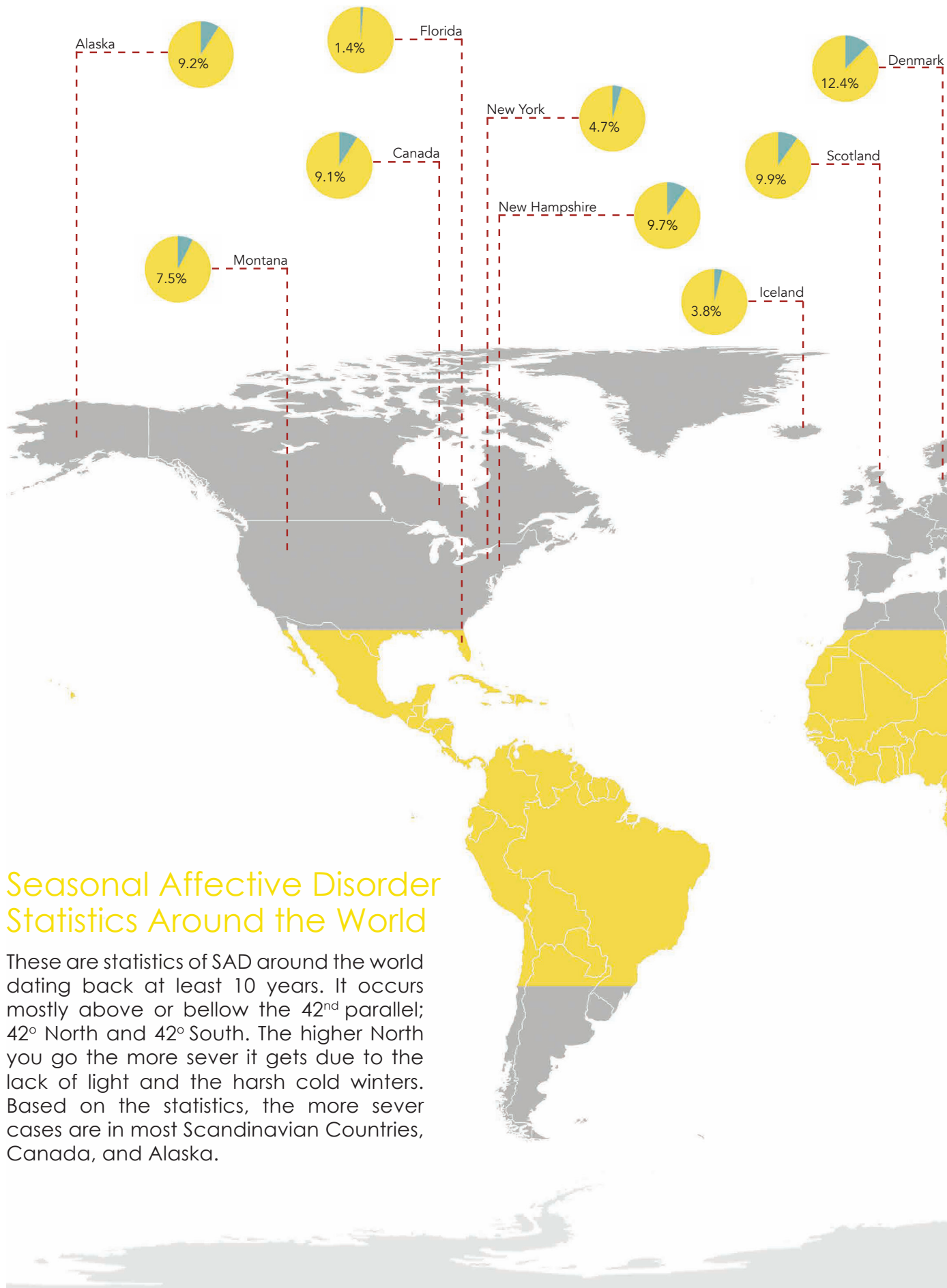
Who is at risk

Seasonal Affective Disorder is more common in the winter times than the other seasons. Many countries in this world experience harsh winters covered in snow and darkness. Anything above 42 degree North or South tend to be affected by Seasonal Affective Disorder. The winters can be so cold that it limits your time outside. The sun also comes from the horizon so architecture has to

be designed specifically for it. In some places, such as Scandinavian countries there are 5 hours of sunlight in the winter and those 5 hours are gloomy.

Depart from location, women are more likely to be at risk than men. SAD is more common in adults in their early 20's or anyone with depression running in their family.⁶





Seasonal Affective Disorder Statistics Around the World

These are statistics of SAD around the world dating back at least 10 years. It occurs mostly above or below the 42nd parallel; 42° North and 42° South. The higher North you go the more severe it gets due to the lack of light and the harsh cold winters. Based on the statistics, the more severe cases are in most Scandinavian Countries, Canada, and Alaska.



Causes

Although there is no specific cause to the disorder it is believed to come about in the winter times when light is scarce. Light is a major factor in our bodies and minds. When there is no light we experience a decrease in our levels of serotonin and melatonin. ² Both are chemicals that our bodies release when having access to light. The winter time's lack of light and overcome of darkness, and the cold that limits physical activity can cause the depression to take over our lives.

In Michigan we spent most of our time indoors going from home, to car, to work. The winter affects our ability to maintain the normal life we have through out the rest of the year.



Symptoms

Symptoms of Seasonal Affective Disorder can be mental, emotional and physical. Some experience unexpected weight gain and an excessive amount of eating of carbohydrates. Most experience longer hours of sleep and feeling tired constantly.² Due to the colder weather and lack of light, people will isolate in their homes. The

lack of interaction with others is a problem and necessary for us as humans. The lack of energy leads to less productivity. It gets hard to find the motivation to begin and complete the work/projects. A few do experience suicidal thoughts. Symptoms can start out mild but get more severe as the season goes on.



Treatments

The conventional treatments would include prescriptions of antidepressants, psychotherapy, and light therapy. Light Therapy can be very helpful because it provides the light that our brains are missing throughout the winter times. The lamp produces high voltage that tricks our brains to feel as if we are exposed to sunlight. You have to sit in front of the lamp for 30 minutes to 1 hour to receive the benefits. Many people in the Scandinavian countries rely on the light lamps for when winter comes.

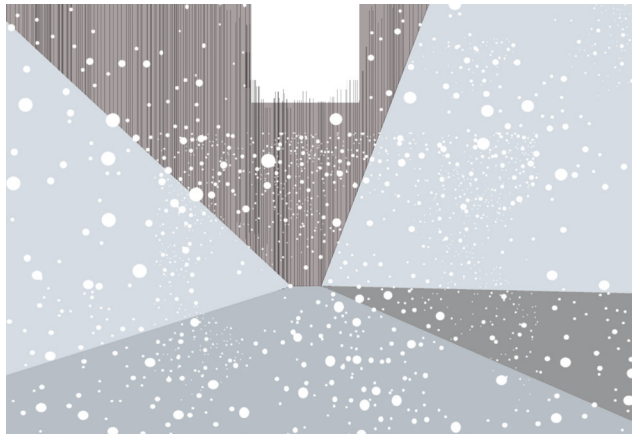
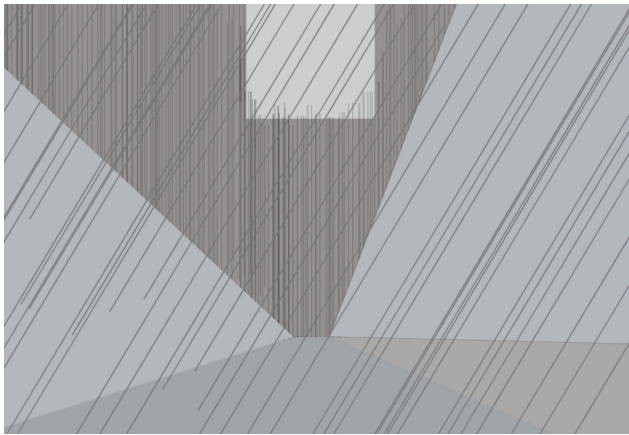
Another way that can help is maintaining a healthy life. Changing your daily routine to get better is beginning to get exercise, participate in social gatherings, eat healthier to fuel the body and mind, and experience outdoor activities. Getting enough exercise is not only good for the body but it's great for the mind. It releases chemicals called endorphines that help with mood. The endorphines released create happy feelings in your body and mind similar to affects caused by morphine. This can change our mood and look for a better outcome of the situation.

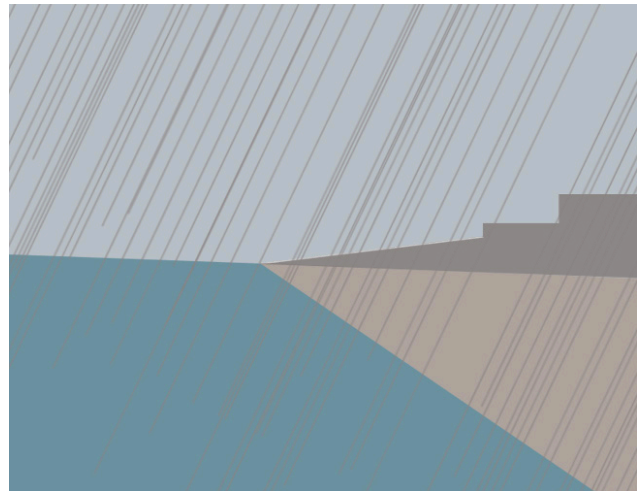
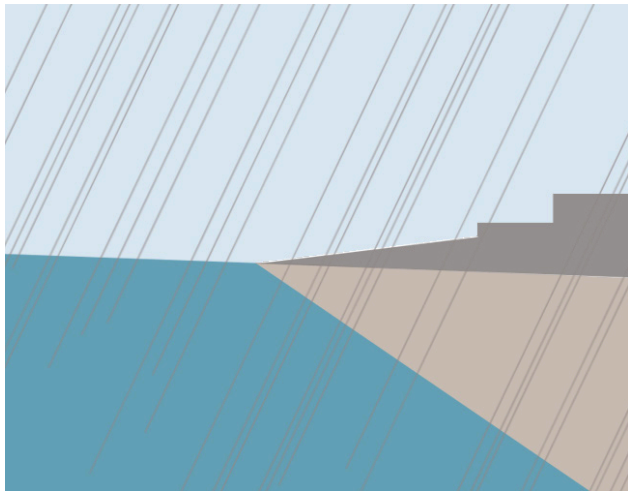
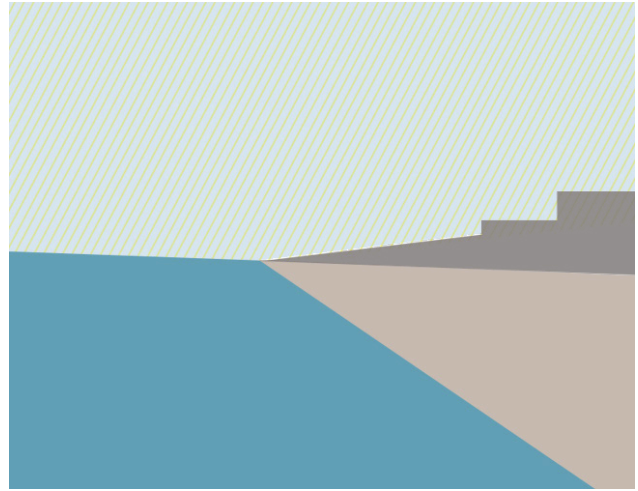


2.3 Weather and Color Study

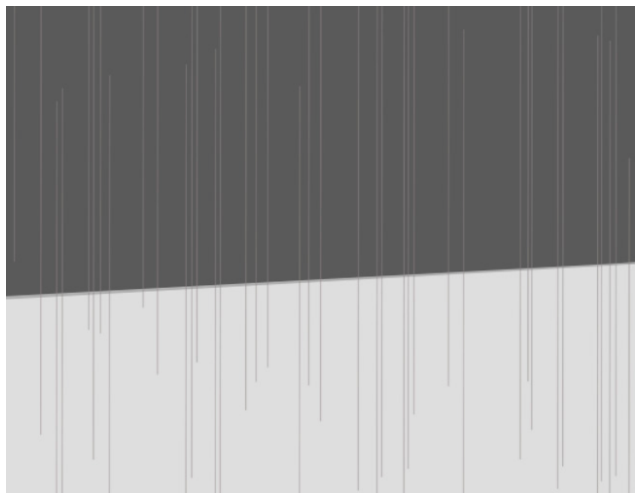
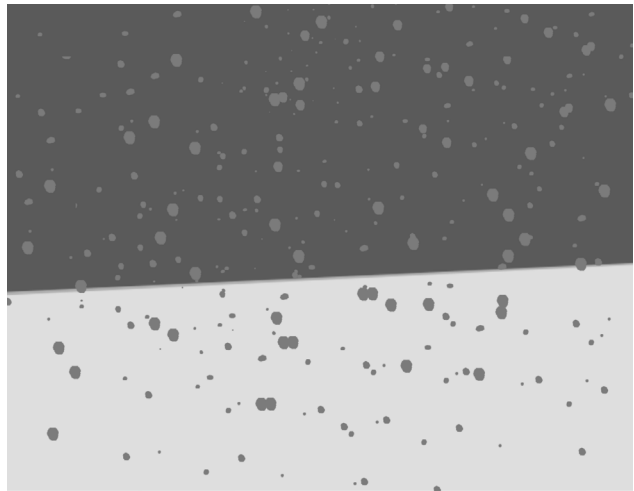
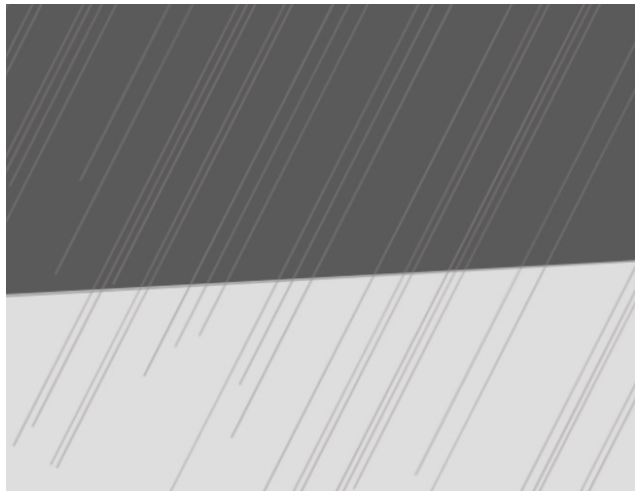
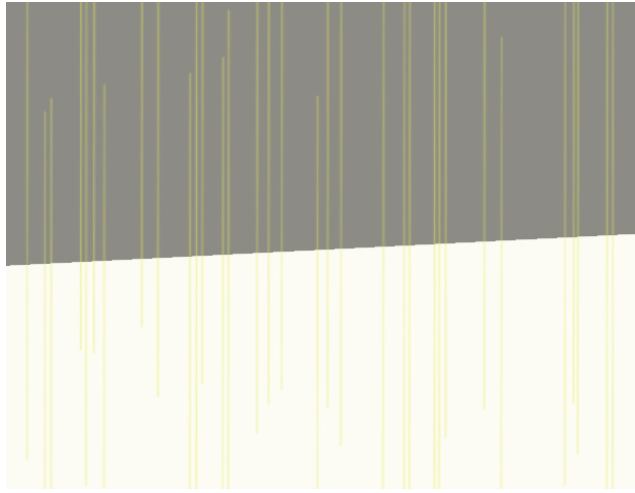
As mentioned, the natural environment affects humans mental, emotional and physical health. Weather changing too quickly can result in depressed mood, deprivation of physical activity, and can cause Seasonal Affective Disorder or Winter Blues.

In order to understand what element in each environment most attracts humans, this study simplifies different environments to basic colors. It adds a verity of patterns representing different weather and questions whether its the color that means something or what the color represents.

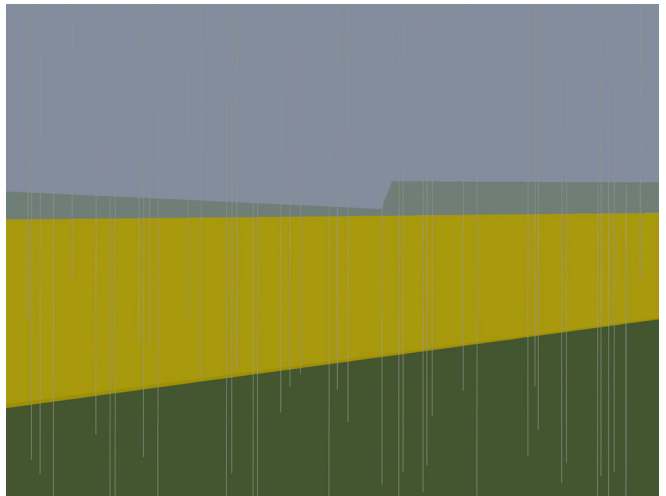
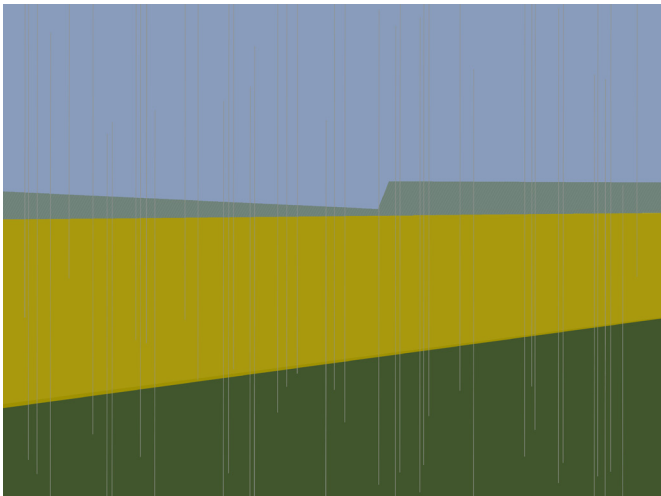
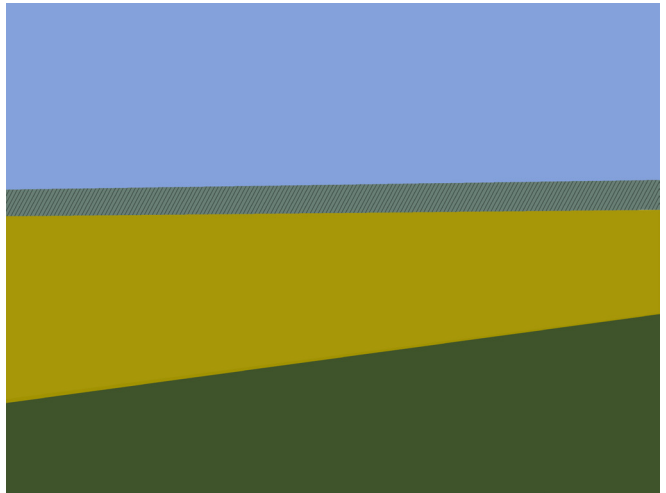


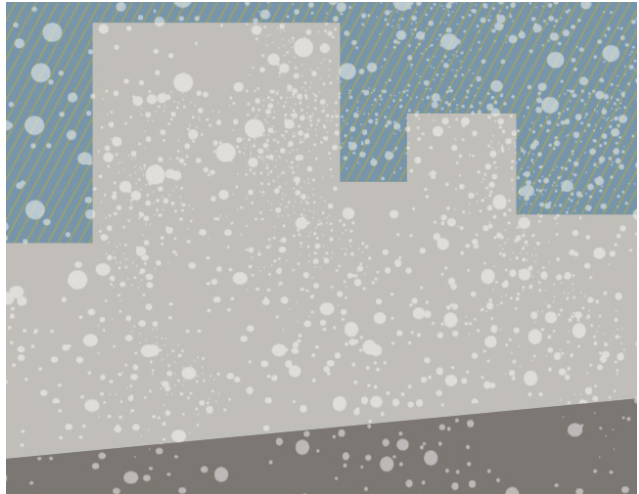
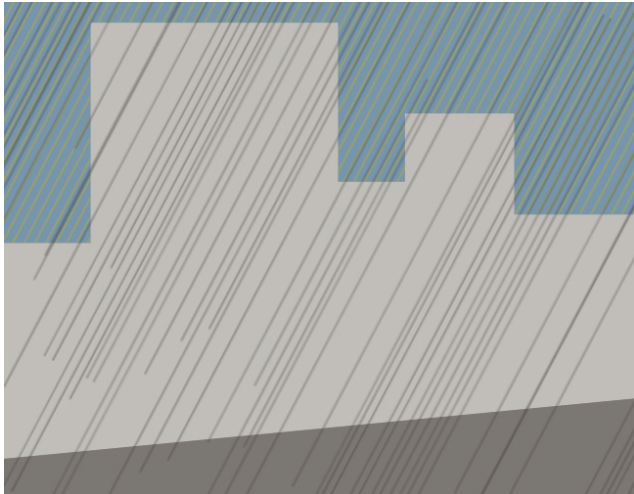


Does blue represent water or the sky? Is it the type of blue and it's position in the color palate? Or is it the combination of the colors together?



Would rain feel different if it was yellow? Does rain feel gloomy because sight is tempered with and the environment is gray?







u r b a n s c a l e



3.1 Scandinavian Countries

Scandinavians tend to pay close attention to their environment and how to maintain a strong connection to it. Majority of old towns in the cities of Scandinavian countries tend to be very colorful. In most of the cases you begin to see a strong connection to nature. Majority of the cities are located by water and nature is the backdrop. The styles of the traditional homes was designed for little light to enter. This wasn't done because there was no need for light but to allow less warm air to escape and less cold air to enter.¹⁰

In Iceland, traditional homes were designed with turf surrounding them, stone as foundation (on some), interiors of timber and bright colors on the facades (as shown on image 5 and 7 of northern Icelandic homes). Many cities and countries used the same tactic (homes in Norway on picture 9). In the cold climates of Iceland and other northern countries, the turf helped keep the homes warmer.¹⁰ The main issue that came about using turf on the homes was the isolation created.¹⁰ Many homes were stand alone homes or in small groups. The neighbor was too far away for socializing to occur. The residence began to notice



Denmark



Denmark



Iceland



Iceland



Iceland

this issue and stray away from it. They still maintained the bright and colorfulness of the homes, buildings and cities.

The color on Icelandic homes complemented the natural backdrop of the county. Mostly homes were painted in color and under turf although there were churches and a few other buildings as well. In the main city area some buildings would use color on the roof or as accent versus on the facade. If a building was of a higher status, the facade would be made of brick and typically be painted white.¹¹ White reflects sun and in the cold dark winter days/nights, that bit of light that comes reflects from the white to make the place a bit brighter.

The use of color came from many different reasons. Some say it was because it was the cheapest paint that was available: punamulta means red earth and keltamulta means yellow earth.¹¹ Due to most buildings being made of wood, coating them makes the wood last longer. Others think that the color was to help find buildings when things are covered in snow. Some believe that buildings by the water have a reflection of blue from the water, so the bright colors complement that.¹¹

The cities are bright and cheerful, All the moves that they made were responses to dealing with the environmental conditions surrounding them. These responses helped with dealing with Seasonal Affective Disorder for awhile.



Denmark



Iceland



Greenland



Norway



Norway

3.2 Narrative Diagrams

All the different types of research were simplified in the following graphics to get a better understanding of the issues and the relation to architecture. They describe seasonal affective disorder in various scenarios, environments (city vs suburb) and weathers: what we need and want vs what we have. They are simplified to roughly portray a city of different scales as well as human reaction and response to the environmental conditions occurring.

.01



.02



.03



.04



Bad vs. Good Weather

Summer times in Scandinavian countries get a lot of sun; twenty hours or more to be exact. Color is vibrant and makes the places more cheerful. There is a lot of vegetation on the roof. The winters on the other hand are mostly dark. Gray and white are the colors most visible in the winter times; gray covering all the land and white from the snow.







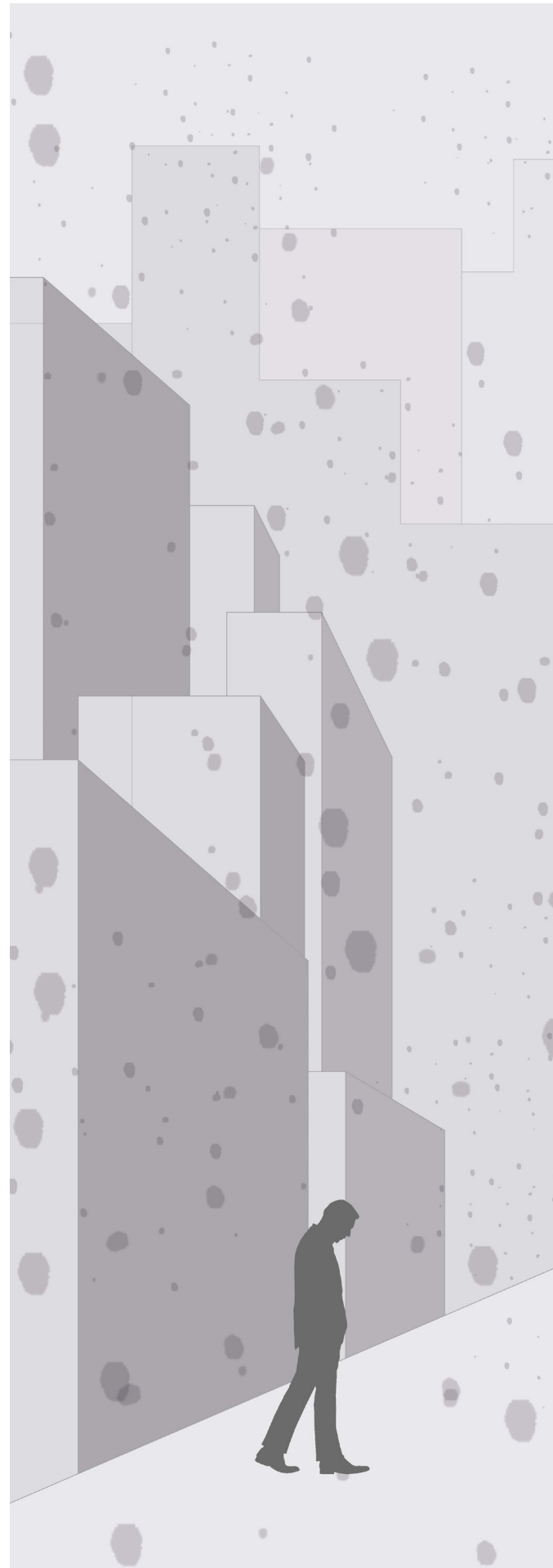


Active vs. Lazy

Being active is good for everyone's body, mind, and soul. When you are suffering with seasonal affective disorder, exercising can help dealing with the problems that come with it. In the warm summers most of the people in Scandinavian countries will find themselves walking and being outdoors. Despite the cold, they are more in touch with their environment and persist to stay outdoors even in the winter conditions. "In a meta-analysis of 10 studies, they found that getting outside—and moving—for as little as five minutes at a time improved both mood and self-esteem." – Robin Mejia, author of the study in the *Journal of Environmental Science and Technology*¹² But winter can be so harsh that it becomes unbearable and people then spend all their time inside of their home in front of the TV or sleeping (or in front of a light lamp to get better).

Isolation vs. Social Interactions

With 50 layers on our bodies to make up for the cold, many will run home to be cozy. Majority find themselves going from work or school straight home to only require peace from the busy scheduling. That creates an isolation in the world. Even in major cities where there could be thousands of people walking outdoors you can feel alone. Everyone is getting to their destination. Majority of the people in these countries find themselves gathering many family members and escaping somewhere warm. They will spend hours on the beach, socializing and enjoying the summer rays. They typically escape the warm winters by going to tropical places. "Being outside is also highly linked to better moods and better outlooks on life." ¹²



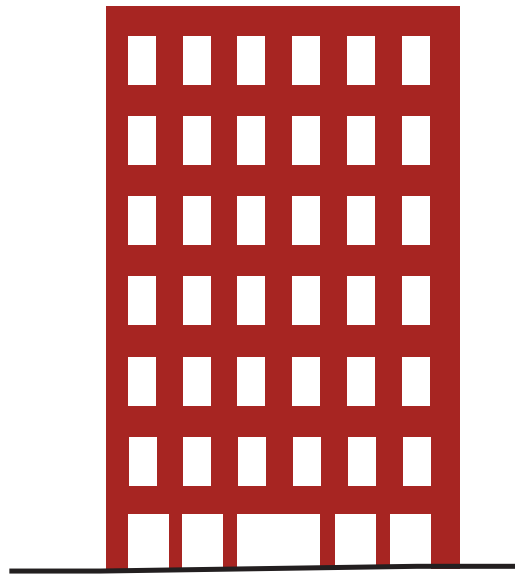






Inside vs Outside

Due to the cold, activity decreases, people isolate themselves and they spend almost all their days indoors. Even when they normally would be outside going to work or taking lunch break, when the cold comes things change. Being outdoors becomes a drag and inside is safe.



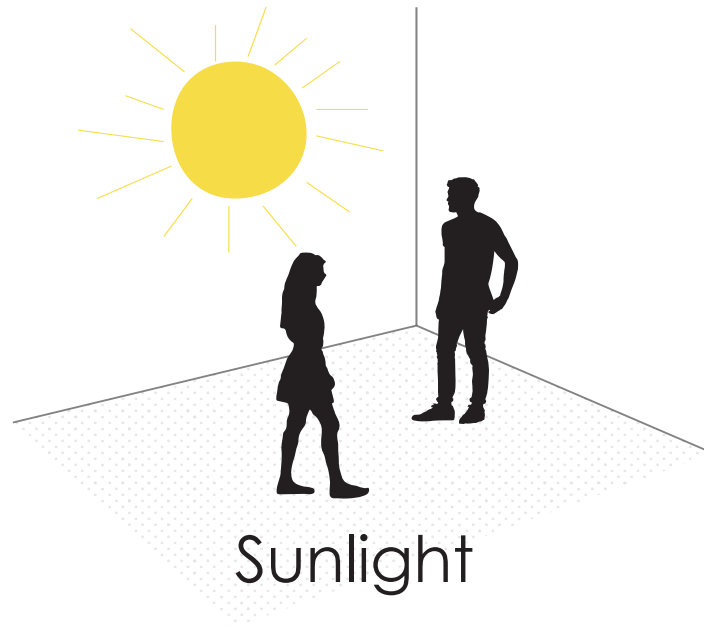
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4.1 Light

Why is it important

Light has been proven to be one of the most important factors of human life. Light is our biological clock; it tells us when to wake up or go to sleep. Melatonin levels drop to indicate that it is sleep time when the dark comes. When a country is in total darkness for majority of the day, people experience exhaustion and can lead to depression. Natural light has to be captured as much as possible and any artificial light used has to replicate it accurately to provide an environment that humans can live in. Henry Plummer says that, “[l]ight can touch depths that are perceptual and psychological/emotional and spiritual.”³ It has the largest impact on humans psychology, mood, emotions, mental health and sanity. Light in architecture is a human experience



Serotonin

Serotonin is a chemical that can be mostly found in the digestive system coming from amino acid tryptophan. The consumption of things like nuts, cheese, or red meats will provide the amino acid tryptophan; then producing serotonin.⁴ If there aren't enough traces of the serotonin in the body, people will experience mood disorders which have a large affect on mental and emotional health. Serotonin is one of the chemicals in our body that helps with sleep and digestion; a lack of it can cause the body out of balance causing physical health problems as well. Balanced levels of serotonin will help regulating anxiety, depression, and nausea. Besides a healthy diet and exercise, another factor that can help with the increase of serotonin levels is being exposed to the bright light of the sun or light therapy. It is extremely important to regulate the levels of serotonin in your body.⁴

Melatonin

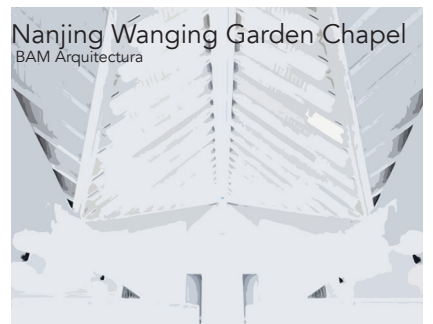
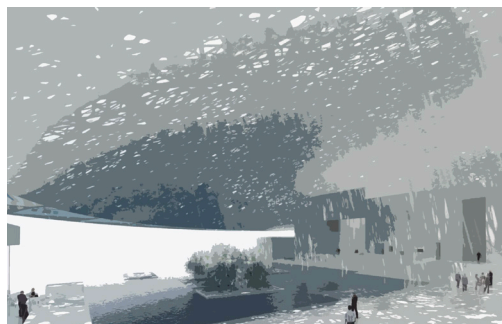
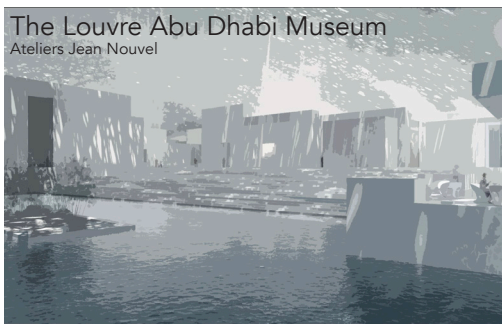
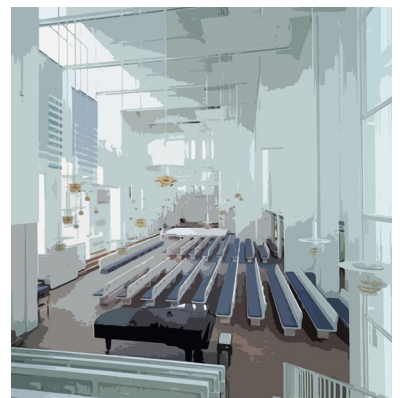
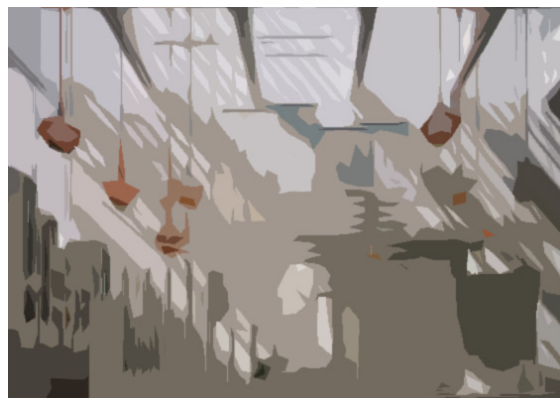
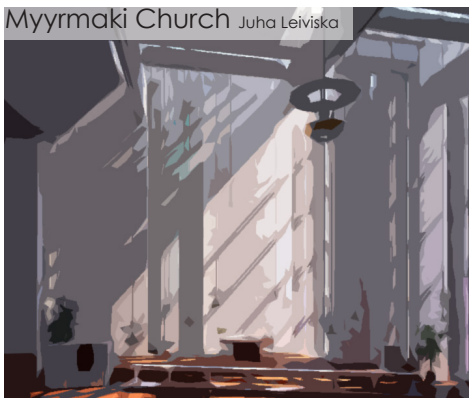
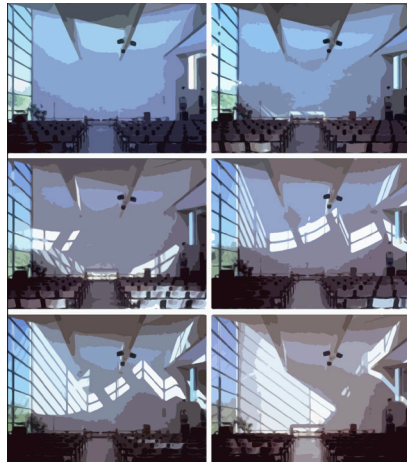
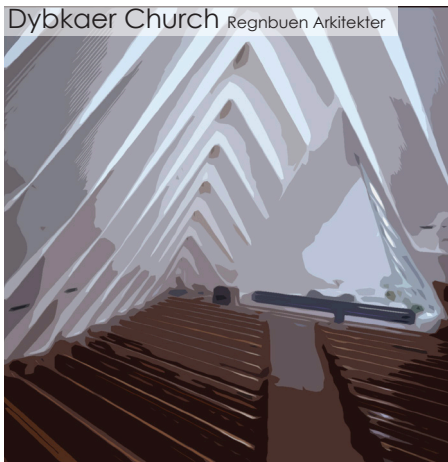
Melatonin is a hormone that is made by the pineal gland to monitor our sleep-wake cycles. Just like animals light helps us determine sleep time.⁵ Once the sun begins to set, our brains will produce more melatonin. As darkness overcomes the land, there can be a loss of productivity and energy. Unfortunately for Scandinavian countries, the rhythm goes off balance and problems can begin during the winter times. The sun rises around 9:30 and sets around 3 or 4; many people working normal hours of the week, will have no exposure to light apart looking through a window. When the body produces a larger amount of melatonin than normal, the human will begin to experience many issues that line up with Seasonal Affective Disorder; they can experience mood changes, lack of energy and fatigue. Besides light, different types of food you consume in the winter time could adjust your levels of melatonin as well. Food such as tomatoes, strawberries, olives and walnuts. In Scandinavian countries there is also the opposite affect. In the summer, due to the long hours of sunlight, your body produces less melatonin and can suffer from insomnia. Some that cannot adjust, are forced to take the melatonin drug to regulate sleep levels.⁵

What has been done

In Scandinavian countries light is scarce during winter times; in some of the countries it only appears for 4-6 hours a day. People will live most of their winter months in near to full darkness.

Sweden, Norway, Denmark, and Finland all change in topography but light problem is the same. Architects have begun to study all aspects of light and how to capture it in a building at all times of day. They have learned that due to the sun's position during the winter time, the shadows are grand and daylight comes in the space from the horizon. The manner in which the architects have captured the light makes an interior brighter than the exterior. "Whiteness" is used in interiors because that will allow for a blank canvas that helps with the capturing of light. White rooms tend to help the light create a brighter environment. "White used in interiors dates back to medieval churches in Denmark. " ³

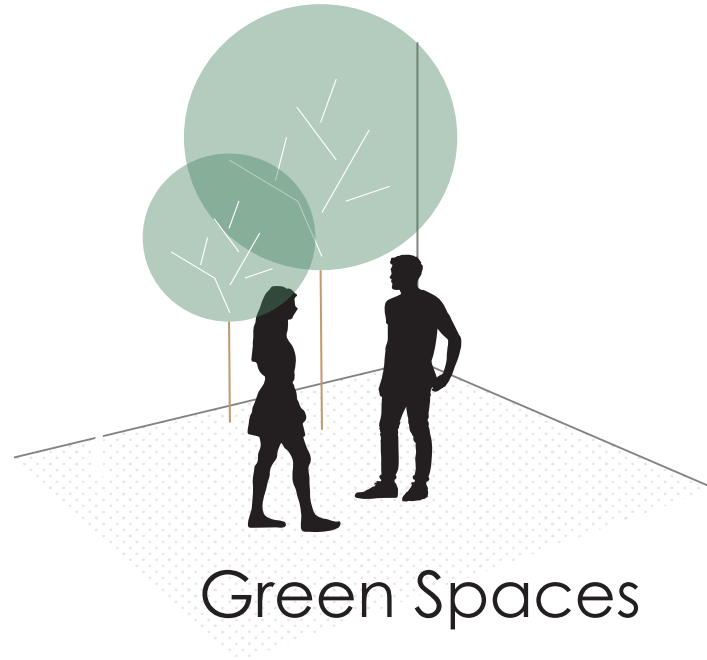
Many architects in the Scandinavian Countries used light as their tool to design. They studied light patterns and the sun positions in various models to allow for maximum light to enter spaces.



4.2 Nature

Since the beginning of time, humans always interacted with nature. We grew as a human species with the help of the natural environment. As times evolve we become removed from our natural environment. Many studies have been done to test humans reaction with nature and it always ends up being positive. One study tested the healing rate of patients that stared at a brick wall versus trees out their window.⁹ Those looking at nature healed faster than the others. Nature can reduce stress, improve mood, and cognitive performance.⁸

Most humans tend to live a hectic and busy lifestyle. Constantly being surrounded by technology and task after task. One thing that nature helps with is directed attention.⁸ Directed Attention is a type of attention you need to complete cognitive tasks. Focusing this hard for long period of times can create fatigue especially after long periods of time of mental activity. Being in the natural environment provides a break.⁸ The brain receives relief from the busy schedule that we are faced with. Undirected attention allows for nature to restore your mental health and mood. Not only do we breath better air when we are



surrounded by the natural environment but there is a bacteria in the soil that can actually make humans happier by promoting cognitive performance as well as resistance to stress.⁹ The bacteria helps the brain release neurotransmitter serotonin and providing better mood. There are more positive affects if people are immersed in nature because that “will always produce stronger sensory responses than looking at a picture”⁹

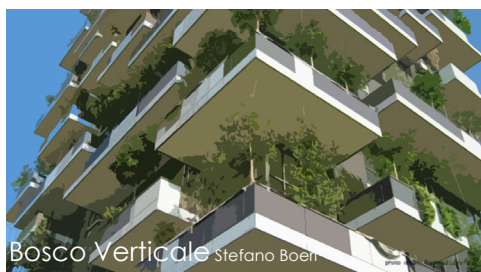
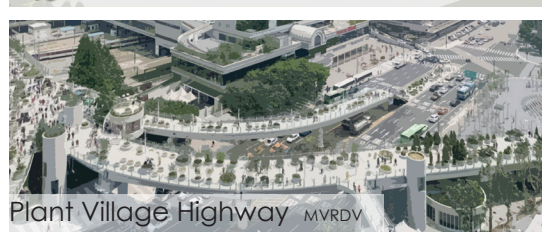
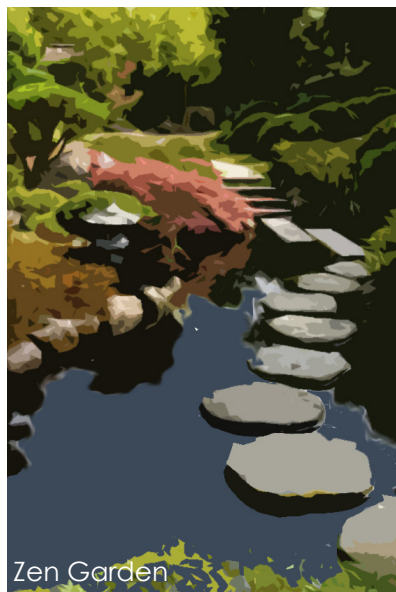
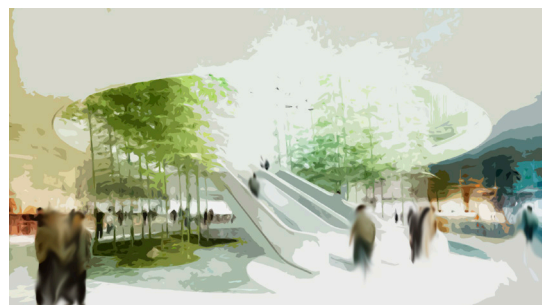
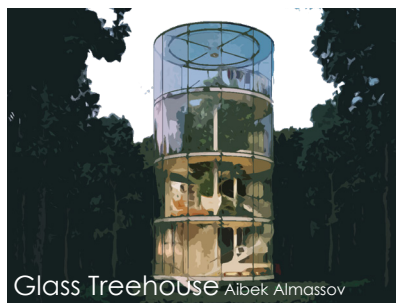
Being in the natural environment can help humans function better. If you living in an urban environment it is crucial to go and be exposed to the natural environment. While living in the city we use so much of our direct attention we need to allow the brain to fascinate and breath. Nature helps with

decision making and clear of distractions, and restoring mental clarity.⁸

Psychologist Rachel Kaplan, PhD studies the benefits of the environment to the human brain.⁸ While doing her research she switched jobs and transfered to the University of Michigan , Ann Arbor office. She realized she began to feel a lot better in her new office because she finally had a view of trees out of her window. While her days are busy with work, she can stare out the window and provide her brain with some relief. These types of environments are called restorative environments. Another thing that nature helps improve is social relationships as it promotes social interactions.⁸

What has been done

Nature is something that many have realized they need more of. Many have begun to not only work on public parks but they have begun to introduce them indoors. When you live in the suburbs you have the luxury of a backyard and a front yard (the size may vary). In apartment building sit is a lot harder to incorporate these elements but many have begun to take a step in that direction. The MeMo house allows for people to have a garden in their home to relax. Buildings like Bosco Verticale and many others like it have brought nature to every single apartment on the balcony. It is build to withhold large tree roots so everyone has their own backyard even on the 20th floor. Architects really do pay attention to the needs of humans now more than before and carefully design spaces to better the well-being of those who inhabit them.



MeMo House BAM Arquitectura

Glass Treehouse Aibek Almassov

MeMo House BAM Arquitectura

Glass Treehouse Aibek Almassov

Plant Village Highway MVRDV

Bosco Verticale Stefano Boeri

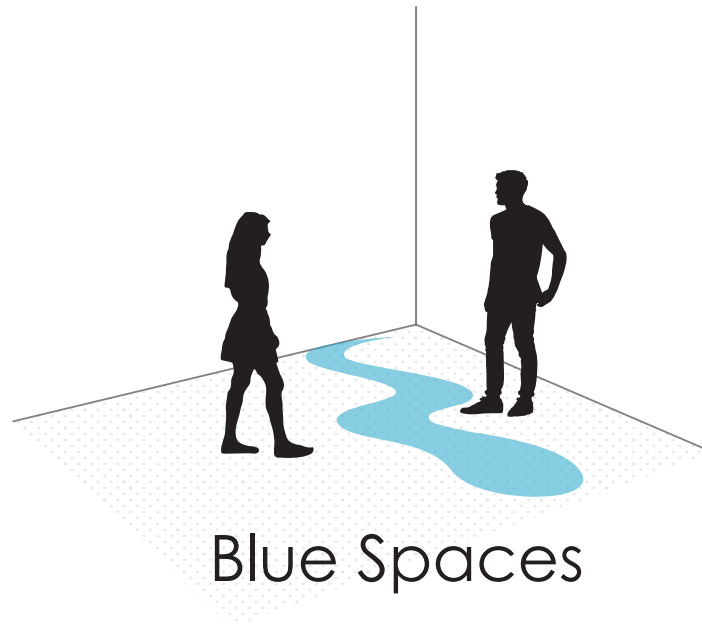
Zen Garden

Serpentine Gallery Pavillon Peter Zumthor

4.3 Water

From the beginning humans formed societies by water as well as used the water for transportation and trade. It was part of being a successful society. As time went by humans tend to drift away from water into more land. Other means of transportation became available as well as new ways to trade. Water has many benefits that are desirable to humans mental, physical and emotional health. Research of blue spaces has decreased in the recent years because people are far more interested on the affects of technology, coffee, drugs, etc. on human brain than water.¹⁶ Environmental psychologist Mathew White began doing research in the Uk on people's psychology affected by water. The data revealed that humans that lived closer to the shore were mentally healthier.¹⁵ According to Dr. Wallace J. Nichols, "Scenes containing water are associated with higher perceived restorativeness than those without water."¹⁶ Being around water has a lot of health benefits for the human psychology. It gives humans feelings of wellbeing, more alertness, decreased depression, increasing pro-social behavior, more mental energy, and better sleep.

A lot of issues with health have come because of stress. If we can reduce the stress levels through introducing an element like water, we can ultimately reduce some of the sicknesses. Dr Kjellgren discusses the sicness that are caused by stress while there being no ways of finding relief. ¹⁵



Blue Spaces

The more physical benefits of water are to reduce joint stress and tension in muscles, keep our bodies hydrated, keep skin moisturized, and hair shiny.¹⁵ Many organizations try to heal people mentally and physical with water. Many focus on veterans who have lost limbs or kids whose mental abilities are not as strong on land but can develop in water.¹⁶

Salt water is especially important in the body because it preserves serotonin, melatonin and tryptamine that help with Seasonal Affective Disorder and other depressions.¹⁵ During sleep is when our brain restores everything that it has processed through the day and when melatonin is in balance, the brain receives a boost.¹⁴ The senses in humans are very important to understand the world around us. One of the most important senses is hearing because sound can evoke memories, nostalgia, emotions,

etc. The sound of the oceans waves are a white noise which can help wash thoughts away and clear the mind.¹⁴ It can block distracting sounds, feeling relaxed, and help with sleep. For many years water has been used as a tool for relaxation of the mind to restore it back to health.¹⁴ The ocean can offer humans ways to de-stress and find balance. Being by the sea has different affects. "Minerals in the sea air reduce stress; negatively charged ions in the sea air combat free radicals, improving alertness and concentration"¹⁵

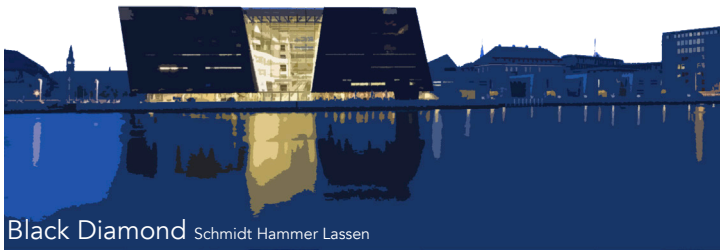
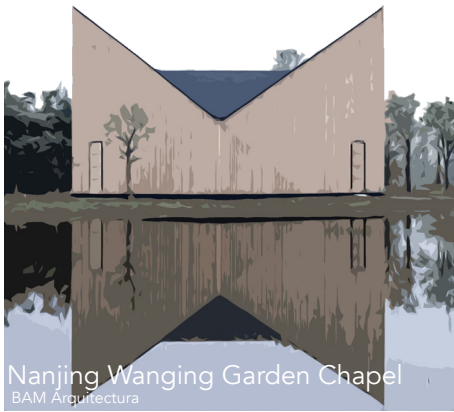
Ways to receive these affects when you don't live by water can be a lot more challenging. Because the sound of water is so strong, listening to the sound of waves or buying a water feature can help bettering mental health.

Water can help renew the mind.

What has been done

Many examples in architecture tend to design buildings by water instead of around water. Examples like Black Diamond by SHL or Nanjin Wangin Garden Chapel are placed by the water front and developing the area around the building for people to utilize. The Black Diamond allows for people to sit and socialize in front of the building while enjoying the water. Many occupy the space even in the cold but not as much as they would in the summer.

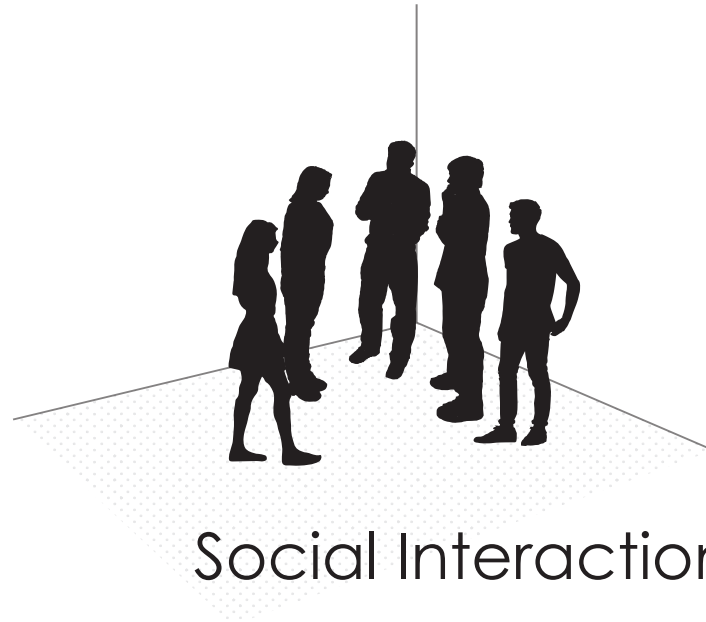
Spaces like Toshiba Milano Salone or the National Museum of African American History and Culture have introduced water features inside for people to come and gather. The National Museum has more space for people to come and socialize as well as learn from the museum. The Toshiba Milano Salone use more of an art installation. Although these buildings do include water and people can receive their benefits, they lack other elements that when put together can provide a stronger relief.



4.4 Social Interactions

Social interactions are very important to the human mind. "The way we perceive ourselves in relation to the rest of the world influences our behaviors and our beliefs. The opinions of others also affect our behavior and how we view ourselves."⁷ Social Psychologist study our connection with others and what affect that has on us. It can help them understand how other humans affect our mood, emotions, and attitudes. Studies show that social interaction has an affect on our physical health as well as our mental health.²⁵ Being social and active helps maintain Interleukin-6 levels which, "is an inflammatory factor implicated in age-related disorders such as Alzheimer's disease, osteoporosis, rheumatoid arthritis, cardiovascular disease, and some forms of cancer."²⁵ A study done shows grandparents find themselves healthier when they are taking care of their grandchildren due to the interaction. They also become more active helping their physical health. Isolation has been linked to not only harm our mental health but also have higher systolic blood pressure.²⁵

With the increase use of technology and social media, people feel they are socializing with others when in reality they are isolating themselves. It has become



Social Interactions

easier to feel connected with family and friends all around the world through a call or text. In reality face to face interaction is far more valuable than one in a phone. People that have healthy relationships with family and friends have been found to be healthier and happier as well as live longer.²⁶

Many studies have been done to test the results of social interactions to physical health. One study done at in 1984 by Health Insurance Plan of Greater New York tested the health of men who had survived heart attacks and their life after 3 years. The study showed that man that had interaction after their heart attack, had a quarter of the risk of dying than those who didn't have any

interactions.²⁶

Another study in Alameda County, California took 7000 women and men and studied the results of social interactions on their lives. The study began in 1965 and lasted for along period of time. It showed that people with very little interactions ended having shorter lives than the others.²⁶

While studying green, light, water and social interactions, there is a strong connection amongst them all. They are all intertwined. By bringing all three elements together you can create spaces for social interactions as well as quality alone time to restore and relax the brain.

What has been done

Roman Atrium Homes were excellent at bringing nature back to the home while providing gathering spaces for people to socialize. The front of the home had an atrium where there was a water pond collecting rain water. People would gather in these spaces and socialize. The back of the house would have a garden where the home owners would go work on the land and socialize together. Using all three elements together we can create great environments for people to socialize and receive all the benefits they need.

The Paddington Reservoir Gardens is a restoration project that took an old reservoir and brought it back to life. They made it a garden that is exposed to natural light with water reservoirs providing spaces for people to gather. At night time it is well lit so people can still experience it. It increases social interactions in the natural environment.

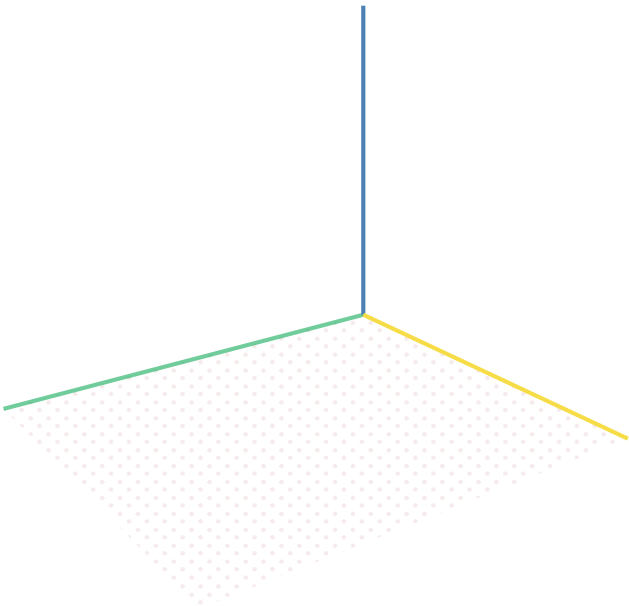


“According to the Environmental Protection Agency (EPA), the average American spends **93%** of their life indoors. **87%** of their life is indoors, then another **6%** of their life in automobiles. That’s only **7%** of your entire life outdoors. That’s only one half of one day per week outdoors”¹²

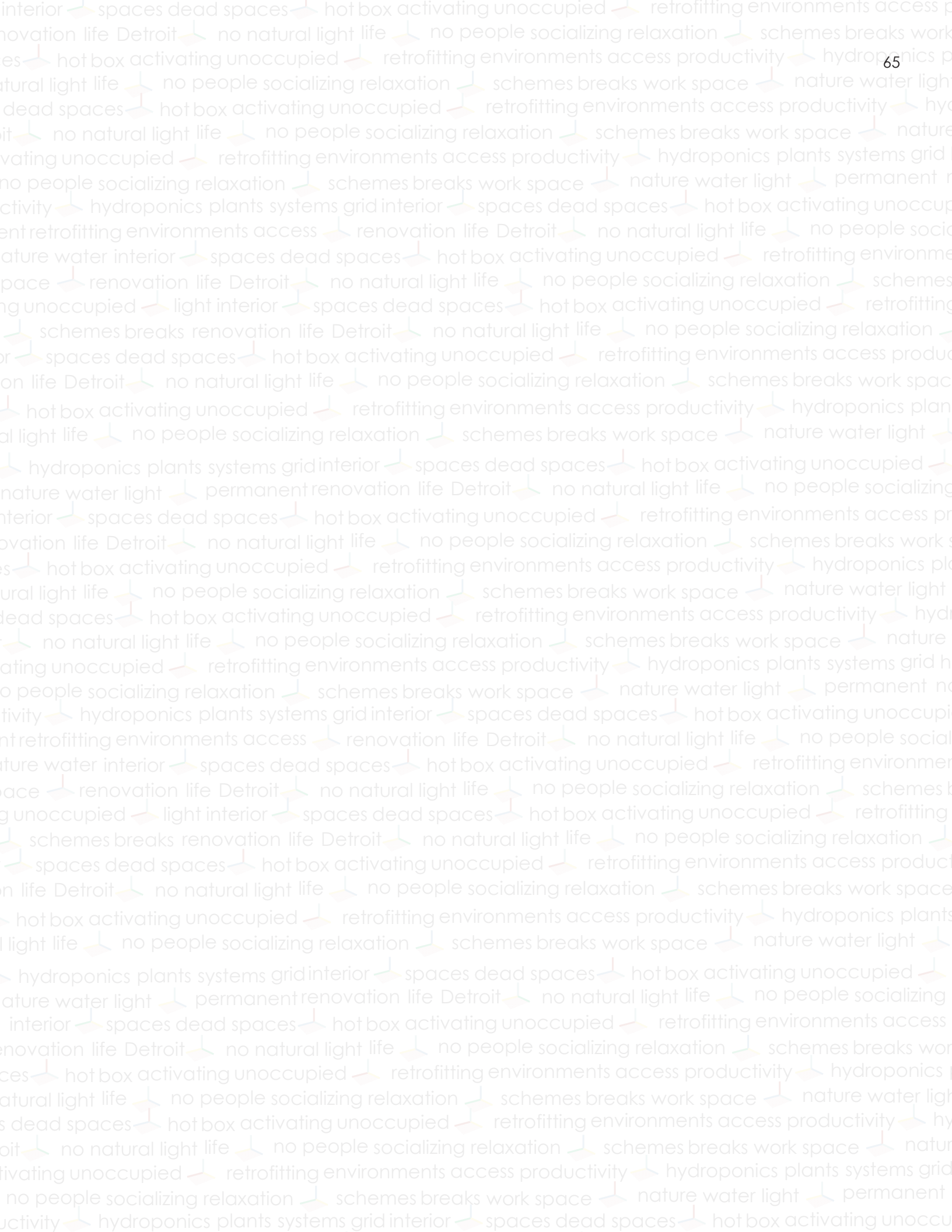
Most of our time is truly spent indoors where there are more pollutants than there are outside.¹³ According to the EPA-Environmental Protection Agency- some pollutants are far more concentrated indoor than they are outdoor.¹² Many people believe that they get sick in the winter time due to the weather changes but majority of the time is because we spend so much time indoors where there are more pollutants in the air such as the flu/ viruses.¹² We need to change our focus to indoor spaces rather than large outdoor spaces due to majority of humans life being indoors.

This is when the thesis shifts from exterior urban environments to interior environments focusing on the human specifically.

Spaces can have a large affect on humans mood. Designing the spaces with natural elements in mind can produce spaces that are relaxing and can increase productivity.



i n t e r i o r s c a l e



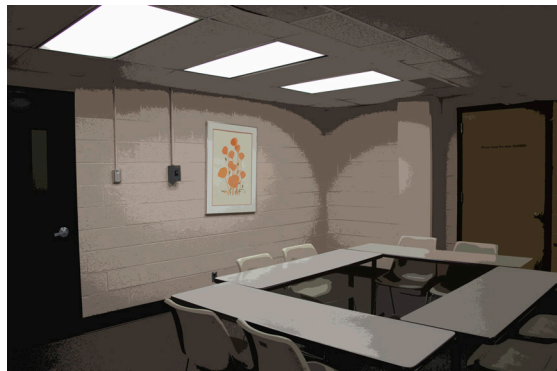
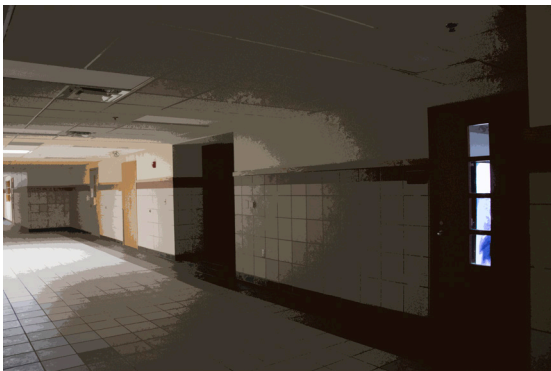
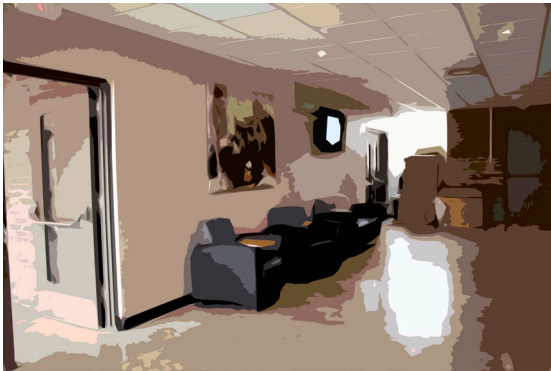
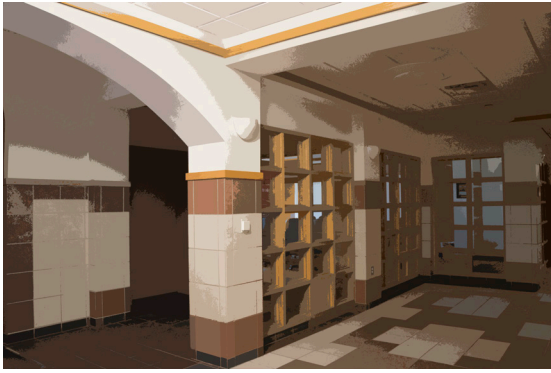


5.1 Dead Spaces

A lot has been done to new structures and new buildings that allow for humans and nature to coexist, but not many are retrofitting the existing buildings.

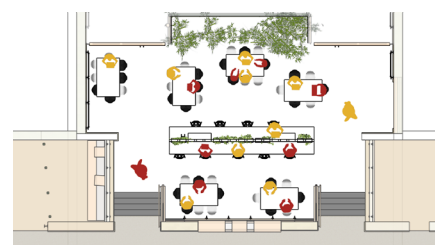
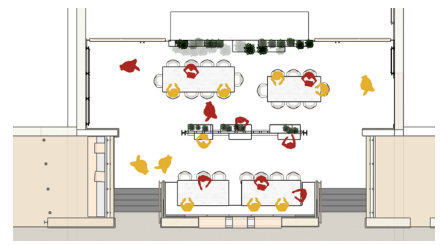
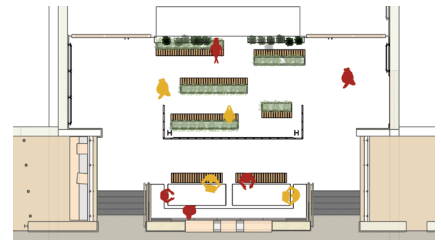
In a city like Detroit, there are many buildings that are already existing and abandoned. Many are being renovated to take on new program and enter the 21st century but there are many other buildings where an owner doesn't have the budget to renovate the building to allow more natural light nor to hire maintenance teams to take care of plants. How can we activate these spaces without a large budget? Many buildings have a or many dead spaces. A dead space is a space that has no people, no access to sunlight, and no plant life. Using a hydroponics system that embodies light, water, and nature can be another way of renovation that can provide a social space for humans that also provides relief from their suffering.

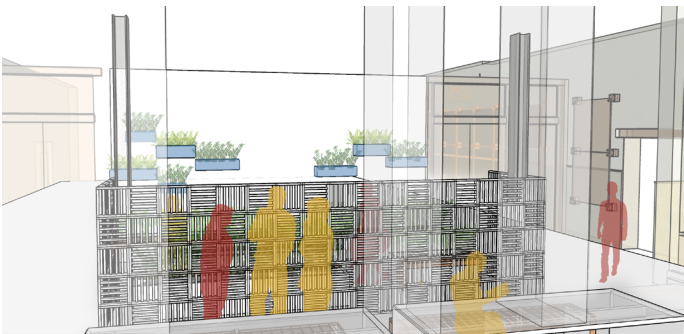
This system is not meant as an excuse for people not to fix buildings permanently nor that there should be a promotion of bad design. This system is meant to provide temporary relief for people and bring life to a dead space in a building that otherwise wouldn't have that same access.

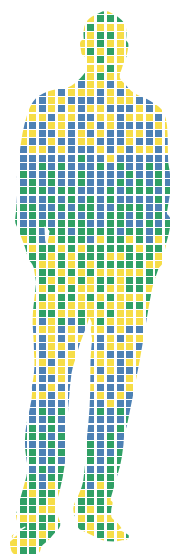


5.2 Activating the Hot Box

The hot box is a space at the school of University of Detroit Mercy that is never activated. It has no access to natural light and no people. It was intended to be a critique area or a work station but no one finds it useful. What if we could break the walls of the hot box down, and open the space to the pit (the area adjacent to it where people tend to gather)? There could be a wall that stays in place to differentiate the spaces and maybe the new “hot box” space could be used for relaxation, working space or critique area. These schemes show a variety of heights, uses, and styles all using hydroponics embodying light and water to ensure that plants last longer.





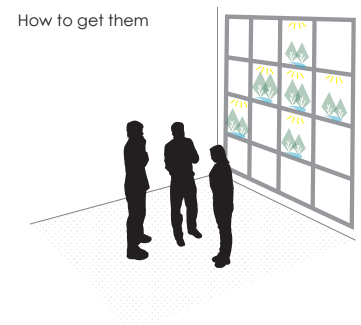
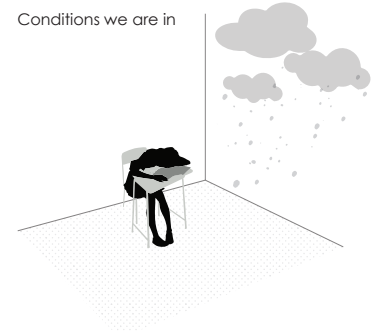


h u m a n s c a l e

6.1 Hydroponic Systems

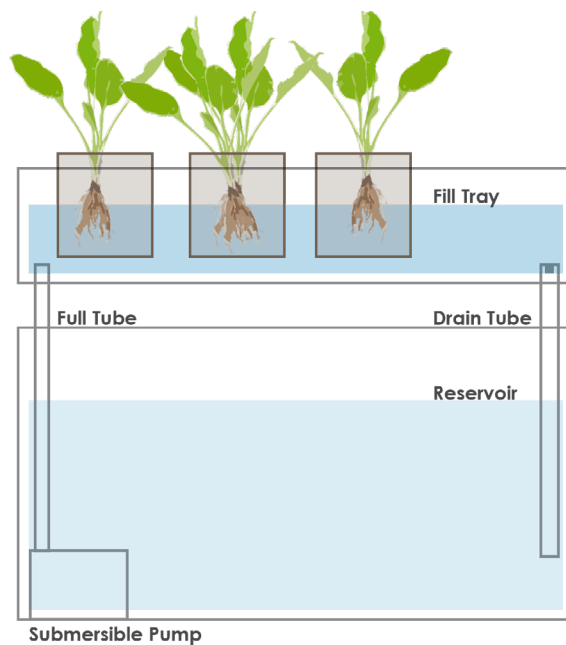
A hydroponic system allows for plant life to grow with artificial light in any space available; it can bring life into dead spaces. Majority of hydroponic systems remove the need of soil and rely on nutrient filled water alone. There are systems that do use both mixed but they do require more hands on work.

What is needed for a hydroponic system is a reservoir to hold the nutrient filled water to be later pumped from a submersible pump to a fill tray. The fill tray holds the greenery in a rafter made of styrofoam cut to the right size of the reservoir; plants are in net pots and placed in each whole in the rafters. There is a drain tube that drains water through gravity back to the reservoir to be reused. All the different systems need light in order to grow and the light needs to produce a high amount lumen's. With a hydroponic system you can grow any plant, flower, herb, fruit, or vegetable you want. Knowing what you want to grow will adjust the type of system you use as well as the size of the tray you need.



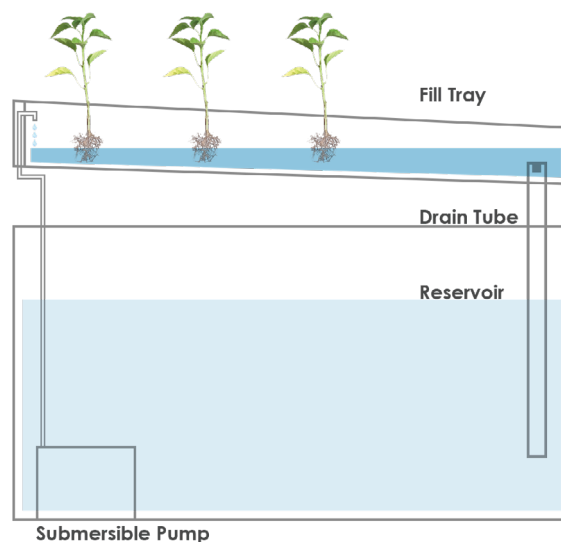
Ebb and Flow System

The Ebb and Flow system can grow any plant that has small roots; the plants can change if you can change the size of the fill tube. The system has a reservoir that holds all the nutrient filled water necessary for the plants, herbs, vegetables, or flowers you want to grow. The plants are in net pots in the fill tray and receive water through the fill tube. The submersible pump pumps water through the fill tube to the fill tray until it reaches the roots of the plants. Water is pumped 5-12 times a day, through a timer, based on the amount of water necessary for the plants. Once the roots have received all the nutrients, through gravity, the water is drained back down to the reservoir with the drain tube allowing for the roots to dry up and get oxygenated. The water needs to be changed once a week and refilled with nutrients. The size of the tray may vary depending on what type of plant or vegetable growing.¹⁹



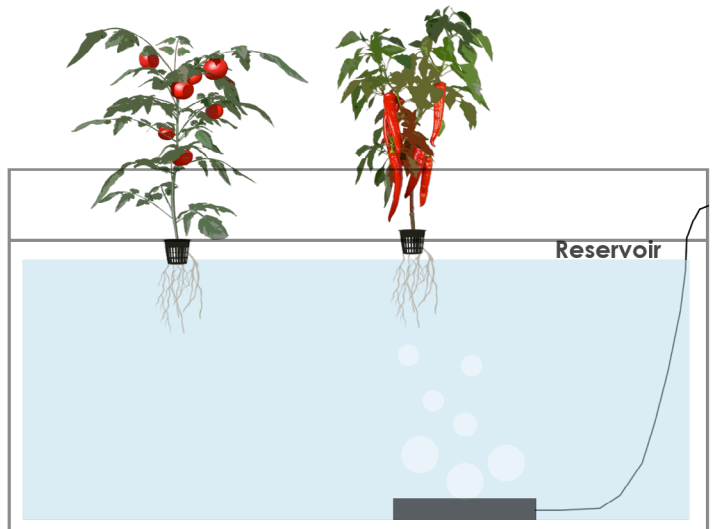
Nutrient Film Technique

The Nutrient Film Technique is very similar to the Ebb and Flow system. There is a submersible pump helps pump the water up to the fill tray and it gets drained by the drain tube back in the reservoir. The only difference is that the fill tube is constantly dripping water over the roots in the fill tray instead of on a timer. The solution water is constantly going up to the roots and the tray being tilted, allows for the water to drain constantly in the reservoir. The bottom part of the roots touches the water and the top part remains dry to get oxygen. This system is great to salads and herbs as well as most plants from the house.²⁰



DWC : Deep Water Culture

The DWC system works well with fruit plants like tomatoes or peppers where their roots are totally submerged in water. In some cases this can only handle lightweight plants such as lettuce and herbs. The roots grow in the reservoir tank which needs to be 1 foot deep for the roots to grow and expand. There needs to be an air pump (an aerator) in this system as well in order for there to be oxygen pumped on the roots so they don't drown. The aerator is necessary not only to provide oxygen to the roots but also to make sure there is movement in the water because once it goes still it can kill the plants. The air pump pumps the air almost constantly so the roots get oxygenated.¹¹ The reservoir cannot be in a glass box because algae can grow when the water is exposed to light. The reservoir container needs to be very sturdy to hold all the plants.²¹



6.2 Vegetation

Having greenery, in a space can absorb up to 87 percent of volatile organic compounds (VOCs) that hide in ordinary products such as paints, carpets and ink.²⁴ Most people spend 90 percent of their time indoors so incorporating these plants will better mental and physical health.²⁴ The bigger the leaf is on a plant the better it is because they can produce more oxygen. More oxygen in a space can help reduce anxiety.¹⁷ Some plants have the ability to even remove heavy toxins from the air that are dangerous to inhale. Research shows that heavy toxins in a space can



raise anxiety and depression.¹⁷ An example would be a plant like lavender which is also vibrant in color and smell. By absorbing more carbon dioxide, they clean the air in any space producing a healthier environments that people want to work and live in. Through transpiration, plants can release water vapor in the air that can help with coughs or sore throats.¹⁷ Some plants also release a chemical called photocindes that can help with mood.¹⁷ Kusby says that, "These phytoncides are emitted by plants as a defense against diseases, and can be effective at boosting human immunity and

protecting us from harmful germs. They're also responsible for the pleasant aromas of essential oils, and for the healing qualities of aromatherapy."¹⁷

Even without a hydroponic system many of these plants and flowers can last during the winter. They need a lot of care to make sure they don't die. Flowers like camellia plants are considered the winter rose. They bloom in the winter time and can survive in partially shaded sun. The hydroponic system is necessary for larger spaces especially going vertical in a space and without major renovation.



Majesty Palm Cateracterm Palm ZZ Plant Kimberly Queen Fern Burgundy Rubber Plant Spathiphyllum Mass Cane Dieffenbachia Camille



Baby's Breath Winter Jasmine Aster Wild indigo Camelia Camelia Kalanchoe PELARGONIUM QUALITY LINE VICTOR IMPROVED Anthuriums Cyclamen

6.3 Modular Hydroponic System

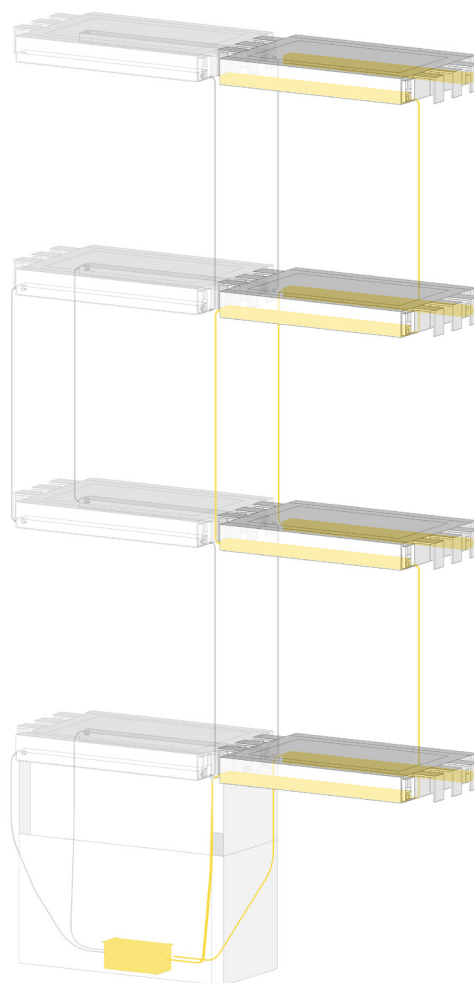
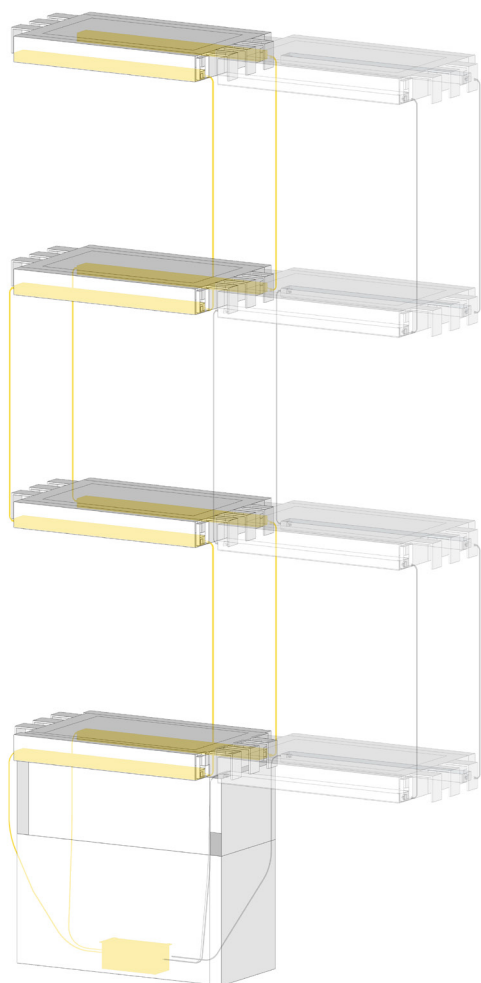
This hydroponic system is made modular so it can transform into any space and can transform any space. If you plan to grow the system or move plants around you can move them without making a mess. They can be rearranged easily to transform a space again and again. The system comes with a reservoir at the bottom that can supply water to more than one fill tray. The fill trays vary in size from 6" to 1' or deeper. The reservoir starts at 1 foot and can go deeper depending on how many fill trays it needs to supply water to. There are water tubes to fill and drain water that go in the columns and can be connected to other ones if you grow the system for more plants. At the bottom of the reservoir there is a separate box that holds the transformer. The transformer has cables that also can connect with others if you expand the system. Depending on how many lights you have the transformer changes in size. On the image to the right, the system is placed in the hot box at the University of Detroit Mercy school of architecture. The original walls of the hot box are removed. The spaces are split with the hydroponic system and they can be used as people want. The left side is the pit and people tend to gather to work and socialize. The other side (behind the system) becomes the new open "pit" that people can occupy for more quiet work or for more socializing.





Light

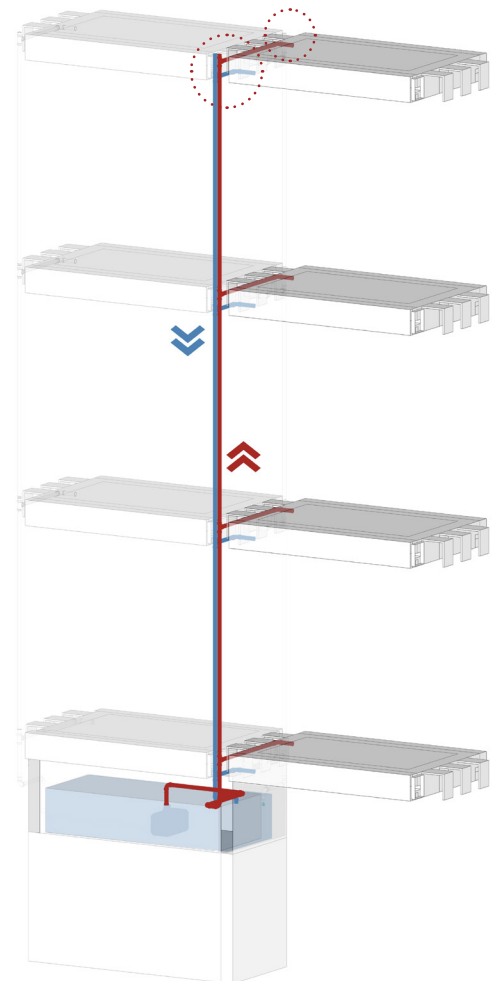
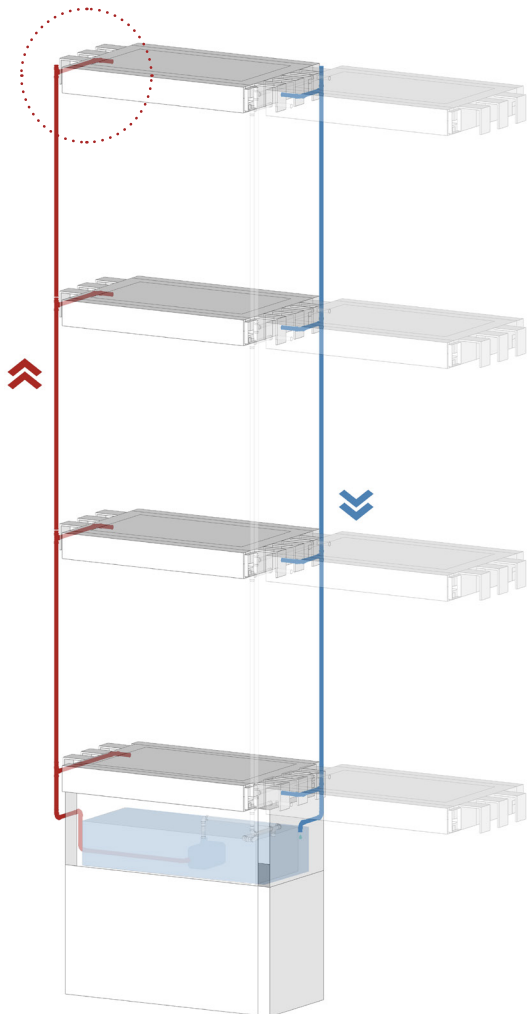
One transformer can power two vertical systems or more horizontally. The beams are made so the tubes and cables can fit inside each and connect with others. There are 16 led lights that are shining light on the fill tray. Due to the lights being on the horizontal beams, they are tilted to shine the light directly on the plants. The fill trays are 18" wide so to make sure it is structurally sound there are two systems that go up; in the front and in the back.



Water

There are two sets of water pipes, the supply (in red) and return (in blue). The supply is connected to the submersible pump that allows water to be pumped into the fill trays at set times. The best scenario is for the tubes to be on opposite sides from one another; the fill tube can be on one side of the tray and the drain tube on the other side. This allows for the water to fill the tray and have time to drain instead of immediately draining it. When you have

two systems hooked up on one reservoir you can connect the fill and drain tube on the same side for one vertical system. There are spots for the tubes to be far apart from one another. As shown on the image below on the top right side, the fill tube (red) is to the far right side of the fill tray and the drain tube (blue) is on the left side of the fill tray. Farther away from each other will help with not draining quickly.



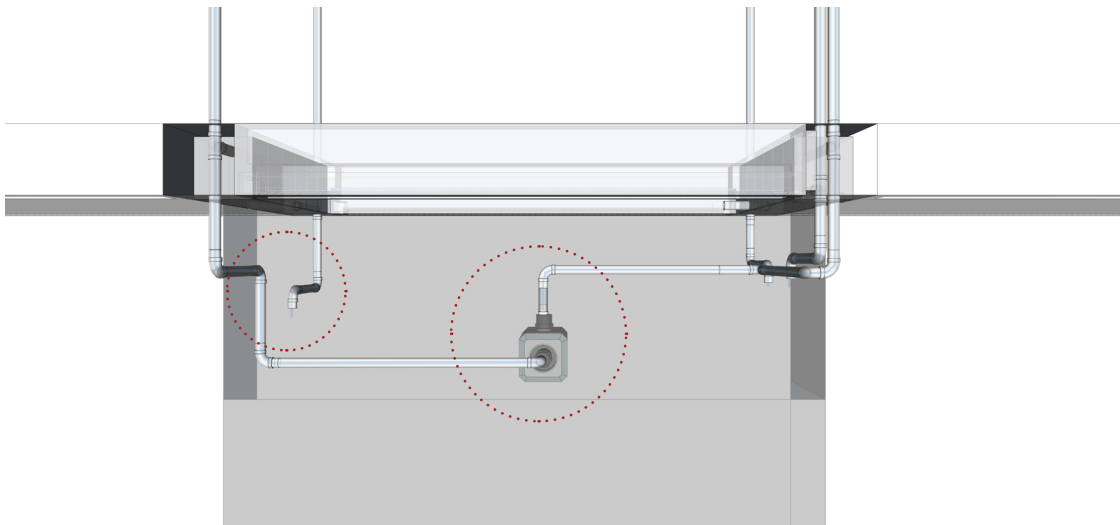


Figure 1: Fill tubes connected to the submersible pump to pump water. The drain tubes are draining the water back to the reservoir to be reused. The system is very quiet and doesn't disturb you from working.

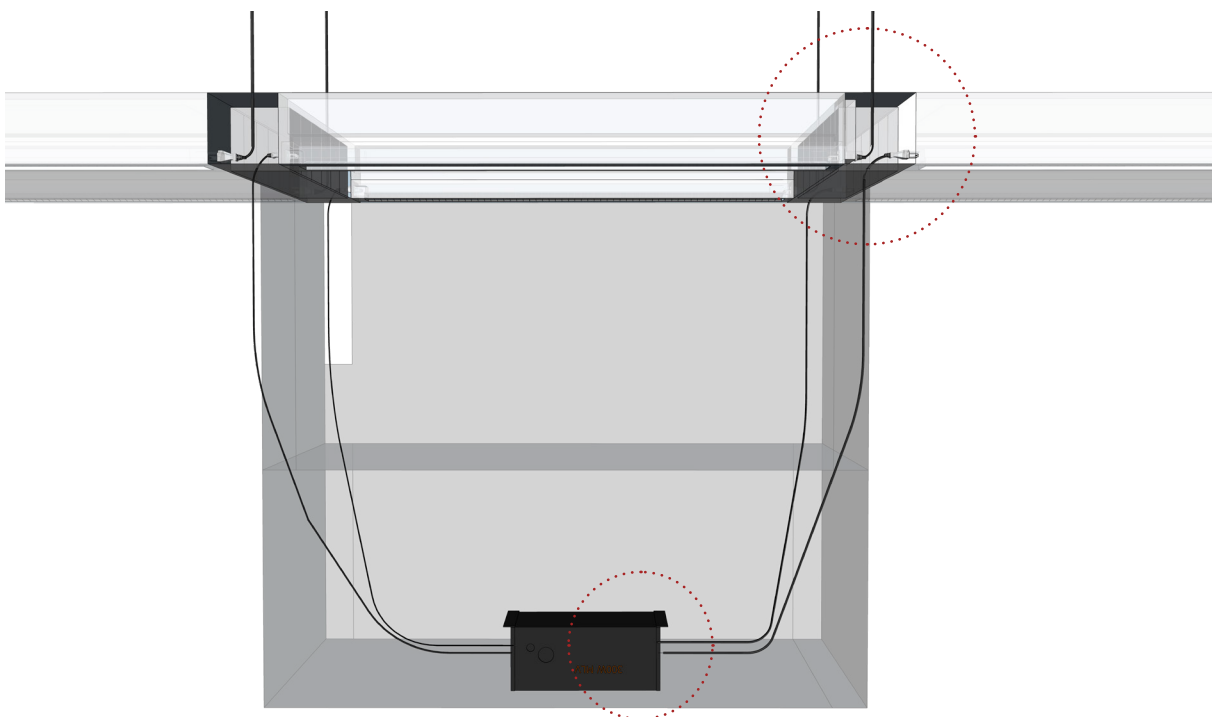


Figure 2: The transformer is large enough to power the 16 led lights for both systems. It has a spot where it comes out onto the column and then goes up to connect to the lights.

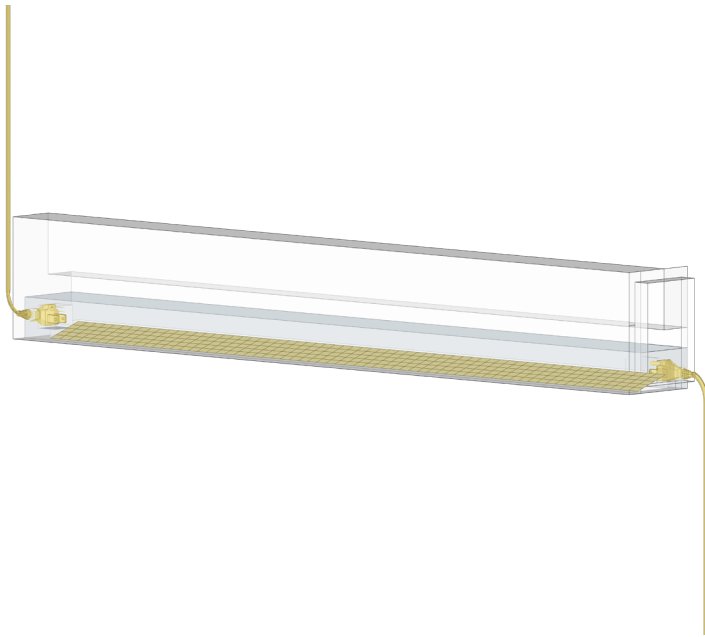


Figure 3: Tilted lights to illuminate the plants on fill trays.



Figure 4: Lights connected vertically.

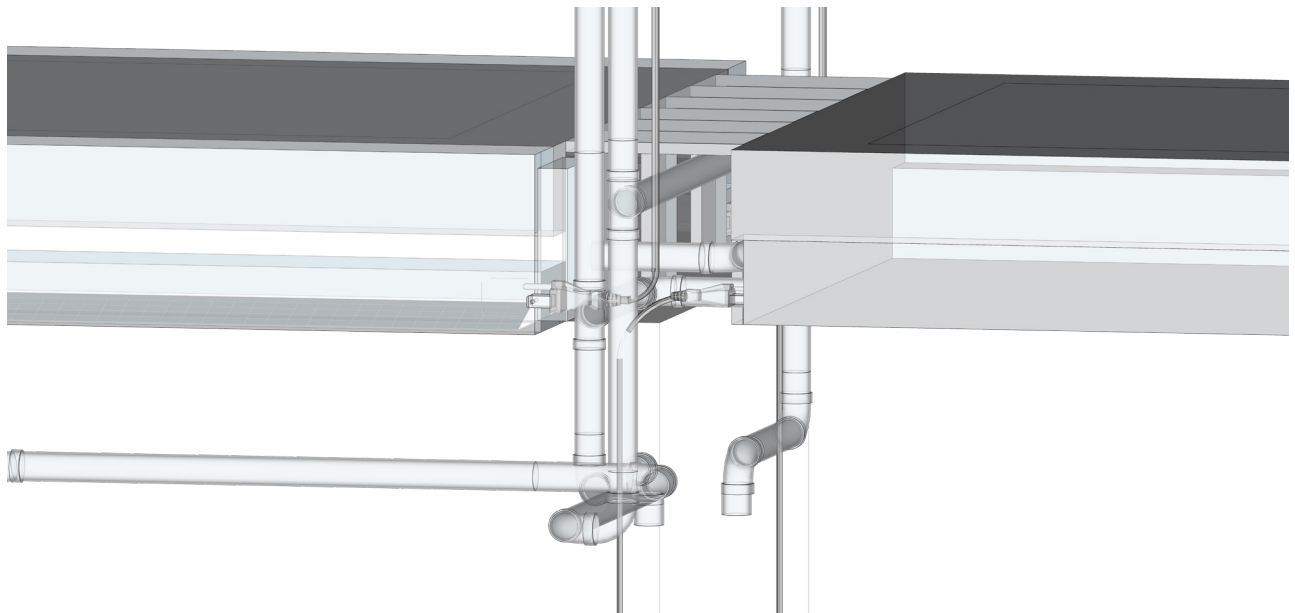


Figure 5: This close up of how the systems coexist within the beams within the fill trays. You can see a close up of the tubes and the cables connecting the lights.

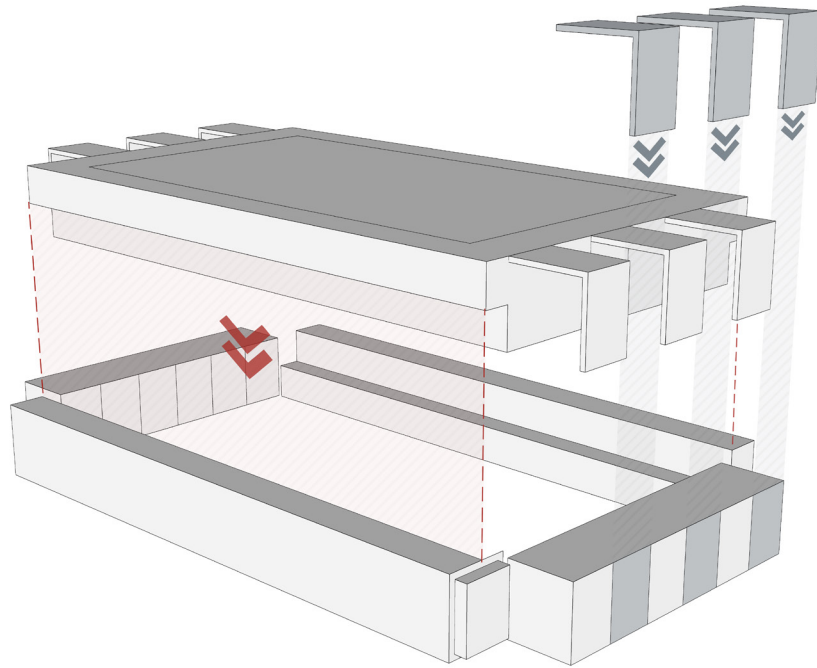


Figure 6: Connection detail of the fill tray to the beams. The trays have an I shape side so they can fall on the beams perfectly to support them. They also have handles on the side that slide right onto the beams. If it is the end piece of the system. There are 3 pieces you can buy to place right on there so it looks completed.

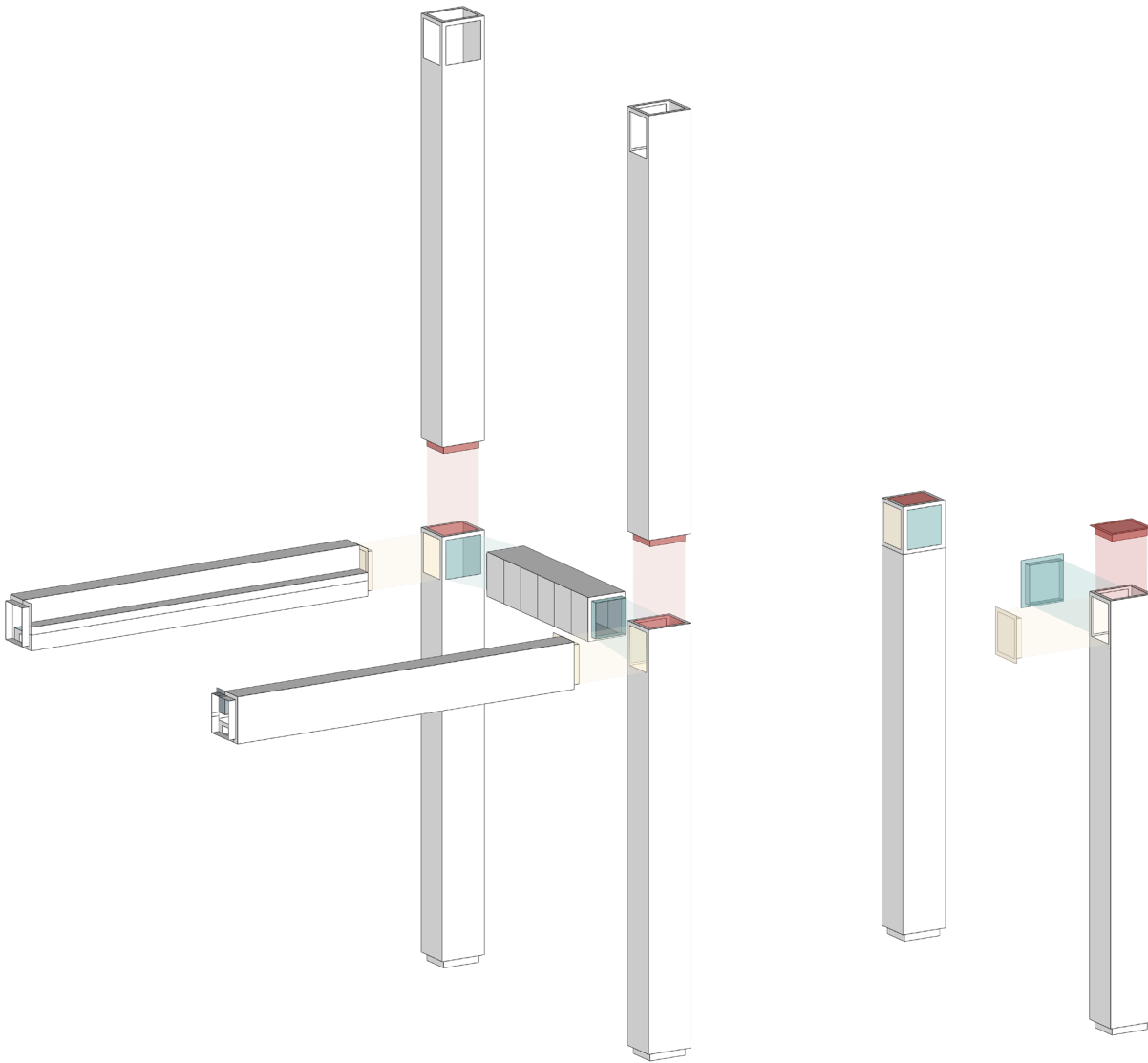


Figure 7: Connection detail of the column and beam connections. They are 3" by 2 1/2" and hollow inside to allow for the tubes and cords to have room to fit. They are offset by 1 inch and come out another inch to slide into one another and click. If it is the top piece or you are going to leave a gap, there are caps to close them so everything is flush.

They hydroponic system can provide a relaxing environment that increases productivity and/or social interactions. You can receive all the benefits from light, the sound of water and plants subconsciously. You don't have to stare at a light lamp to get better or suffer in the winter time. The system has timers and knows when to pump water or for the lights to get brighter. Once it gets darker outside, the lights become brighter so you are filled with the light you need.

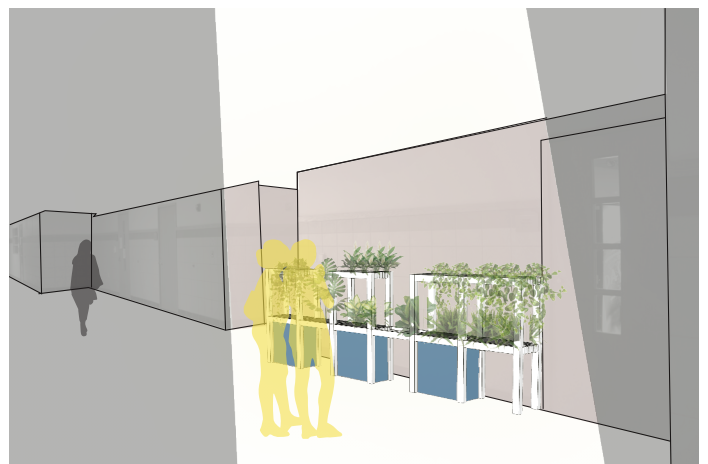
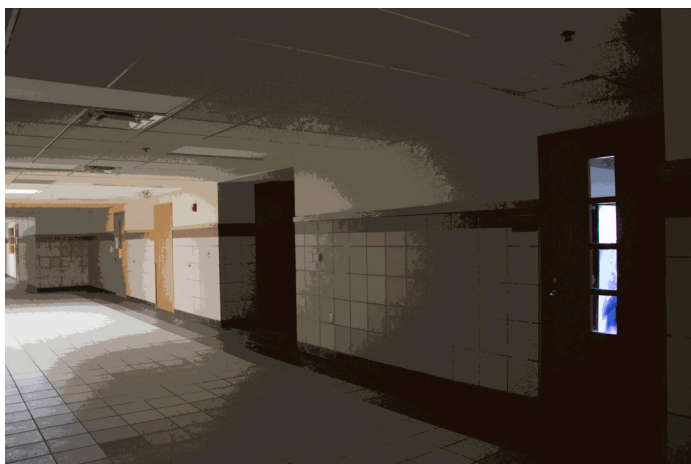
Any space in a building that is dead or unoccupied can be brought back to life with people and this system. The hydroponic system is NOT a reason for people to not renovate spaces NOR a solution to Seasonal Affective Disorder but a manner in which people can find some relief in better interior spaces.

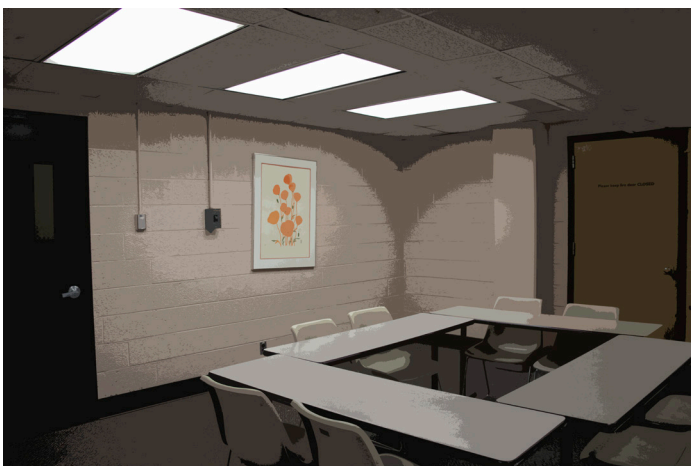




6.3 Activating Dead Spaces

These dead spaces are located all around the University of Detroit Mercy campus. They are unoccupied spaces but have the potential to be used. The hydroponic system can go in any of them and bring the space back to life for people to sit and enjoy or work.





7.0 Conclusion

The hydroponic system was developed as a response to a need within already existing buildings. Within these buildings there are unoccupied spaces that could become a temporary relief space. The hydroponic system embodies all natural elements that are lacking in the winter time. These elements: light, water, and nature: provide relief to the symptoms caused by Seasonal Affective Disorder. There are many benefits that all three elements produce such as better mood, reduce stress and anxiety, and help with the well being of a human; they can better the humans mental, physical, and emotional health.

The hydroponic system is not a solution to the real problem that is caused by Seasonal Affective Disorder. It is one possible way of providing relief to the problem. Architecture cannot fully resolve a problem that is caused by the natural environment but it can provide better spaces for humans to inhabit to receive the benefits they require.



5.2 Footnotes

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