



The Effects Architecture has on treating TBI

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Thesis Book Spring 2022



F01

SQUARE ONE REHABILITATION AND WELLNESS

THE EFFECTS ARCHITECTURE HAS ON TREATING TBI

A Design Thesis Submitted to the
Department of Architecture
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By
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North Dakota State University Libraries Addendum

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May 2022



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Thesis Abstract

Traumatic Brain Injury, TBI, is an injury that affects how the brain works. These injuries may impact individuals' behavior, mobility, memory, language, problem solving and empathy. TBI patients also tend to feel isolated because cognitive, physical, and social disabilities prevent them from engaging in their pre-injury activities in a normalized way. Depending on how severe one's injuries may be, one may recover from a traumatic brain injury. However, most will live with permanent effects from their injuries. Recovery at any level may involve years of relearning how to do daily tasks. Throughout a TBI survivor's recovery process, they will need substantial support to learn, live and work with their disability. Healthcare professionals along with community, family and friends can help the survivor regain confidence when returning to the outside world to live and work with their disability.

Through design, innovative rehabilitation methods are combined with connections to nature and community to create a holistic and supportive atmosphere for patients to recover from their traumas in this facility. A focus on overall community health and wellness is also provided to benefit a wider population and create space for interaction between TBI patients and the community to assist in breaking stigmas. TBI survivors, family, friends and the broader community will be able to interact and learn in an environment that encompasses whole body wellness.

Abstract

Thesis Narrative

Narrative

Today in the United States there is an estimated 5.3 million Americans that are living with the permanent effects of a traumatic brain related disability. A traumatic brain injury (TBI) can have an immense overwhelming impact on a person's life. One may recover from a traumatic brain injury; however, most will live with the permanent effects from their injuries, which may involve years of learning how to do daily tasks again. This thesis project aims to design a rehabilitation facility that promotes innovative brain recovery methods for people suffering from TBI. Creating atmospheres for patients to recover from their traumas through the performance of personal routines and activities.

Rehabilitation addresses the patients physical, psychological, and environmental needs. With TBI rehabilitation a group of healthcare professionals work together as a team to assess the physical, mental, and emotional effects of their patient's brain injuries. They develop a plan of action that helps their patients overcome, compensate, and cope with changes in their levels of ability. Because TBI patients may not recover from their injuries they learn new innovative ways to do their daily activities. Today's advancements in technology, are scientifically establishing the relationship between the mind body, and the built environment. TBI rehabilitation can integrate the mind-body relationship as well as the built environment which can potentially support functional ability.

The project focuses on designing a rehabilitation facility that encompasses whole body wellness for patients that suffer from traumatic brain injuries. Locating this facility in a unique location where patients will be able to come for short or long periods of time to focus mentally and physically on their healing process without the outside world distractions. Proven that nature elements promote healing this facility will encourage access to those elements within the built environment and with nature itself.

Thesis Narrative

Using innovated rehabilitation methods patients will learn how to do daily tasks and activities they love with the assistance of healthcare professionals. Giving patients the opportunities to try new outdoor activities while learning how to work with their disability will help to build confidence when they return home.

Community integration will help patients feel involved and confident in the outside world. It will also give the community knowledge on how to interact with TBI patients. Often people are unsure how to interact with a person who suffers from a TBI injury because it is outside of sociocultural norms. TBI patients tend to feel isolated because cognitive, physical, and social disabilities prevent them from engaging in their pre-injury activities in a normalized way. Patients will work with the community to overcome their mental and physical goals. Families will also have the opportunity to come learn with loved ones on how to live and work with the patient's disability so they can live life to its fullest.

Narrative

Project Typology

This project's typology is a rehabilitation and community wellness facility. Located on a lake in Minnesota this facility will have endless views a nature. The Facility will serve patients who have suffered a traumatic brain injury and are looking to create a new life living with their disability. Focused on TBI cognitive levels VI - X, patients will be able to come for short to long periods of time depending on how much help they will need.

Level VI - Confused, Appropriate: Moderate Assistance

|

Level X - Purposeful, Appropriate: Modified Independent

Rehabilitation Facility

Inpatient Rooms, Outpatient rooms, Therapy gyms, Therapy Labs, Nurse work stations, staff lounge and offices

Community Wellness

Open gym, community social areas / lounge, public pool, public lockers

Storage Facility

For all outdoor summer and winter activities. Personal storage for community guests. Warming house during seasonal weather.

Project Typology Precedents

Basel Rehabilitation in Switzerland
designed by Herzog and DeMeuron

Spaulding Rehabilitation Hospital in Boston,
designed by Perkins&Will

The Paimio Sanatorium in Paimio, Finland, de-
signed by Anio Aalto and Alvar Aalto

The Shirley Ryan Ability Lab in Chicago, Illinois,
designed by HDR, Gensler and Clive Wilkinson

Architects

Current
Chosen
Precedents

Major Project Elements

Rehabilitation

Outdoor based physical therapy solutions

Innovative Rehab

Seasonal Activities

Community Intergration

Traditional Physical Therapy

Bringing people experiencing similar challenges together-community

Community Wellness

Surrounded by nature

User/Client

Healthcare professionals include: Speech Pathologists, Physical Therapists, Psychologists, Psychiatrists, Occupational Therapists, Nurses, MAs, Spiritual / Mediative Guides, education spacialistes

People that are living with a permanent traumatic brain injury and are willing to learn how to work with their injury to improve everyday life.

The Community will have the opportunity to come how to interact with TBI patients. This will include family.

Janitorial, food service, hospitality, maintenace (building and equipment)

Healthcare Professionals

Clients

Community

Support Staff



Location: : Bemidji Minnesota; along Lake Shore Dr NE

Zoning Classification: LD

Zoning Description: Lake Oriented; development provide areas for a mixture of residential and commercial development that takes advantage of the recreational opportunities available within lakeshore areas

Size of Site: 309,436 ft2 (area) 2,424 (perimeter)

Surrounding Context:

Restaurants:

- Green Mill restaurant and Bar
- Qdoba Mexican Eats
- Keith's Pizza
- The Garden Grill and Pub
- The Tavern on South Shore

Living:

- South Beach Apartment / Home

Hotels:

- Double Tree by Hilton Hotel
- Country Inn and Suites by Radisson

Event Center:

- Sanford Center

Extra:

- Holiday Stationstores

Activities:

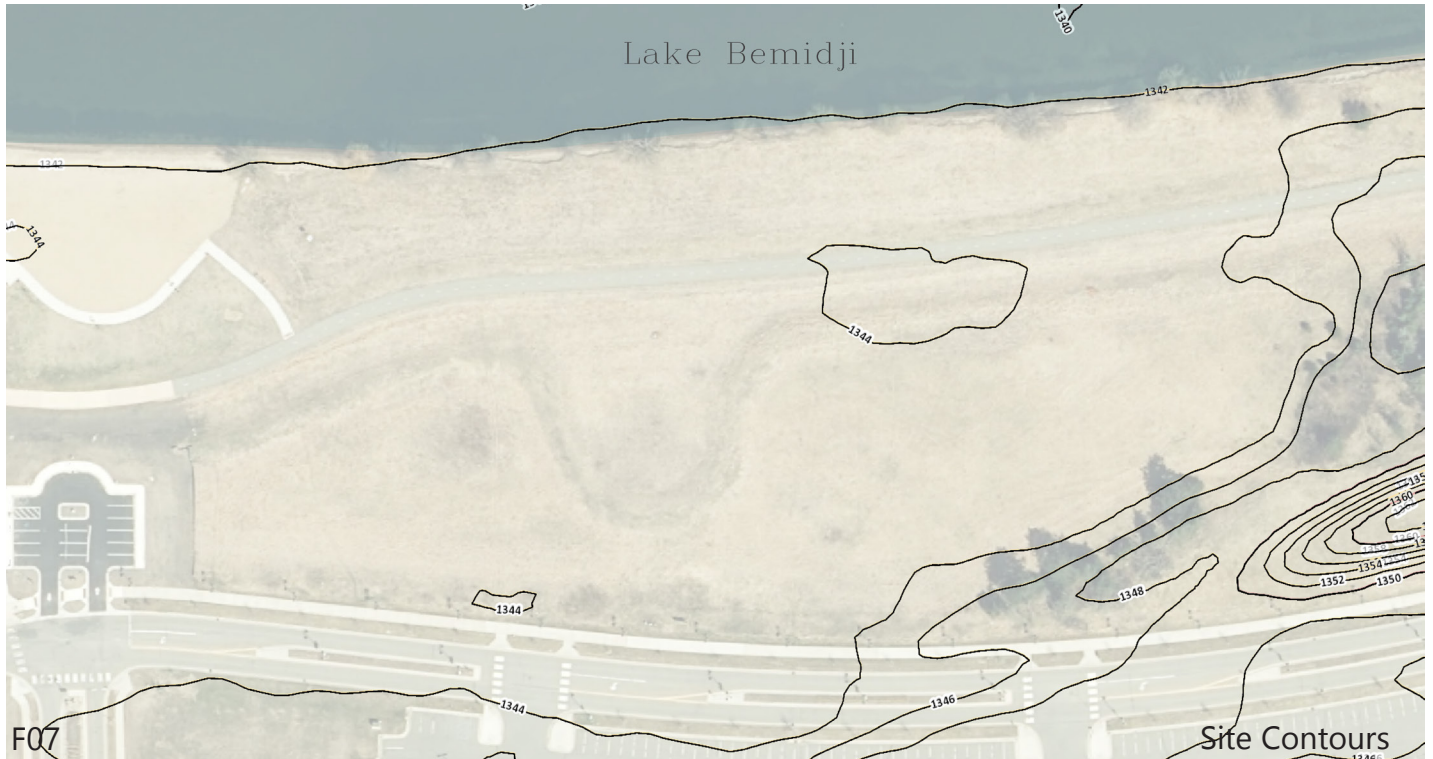
- Nymore Beach (Lake access and park) (Boat Ramp)
- Paul Bunyan State Trail
- Lake Bemidji

Amenity for respite (Park, Trail, Waterway)

Multisensory Stimulation (Sun, wind, water, earth, other living organisms such as birds, animals, and people)

Distant Views as well as neighborhood scale experience – provides more sensory diversity.

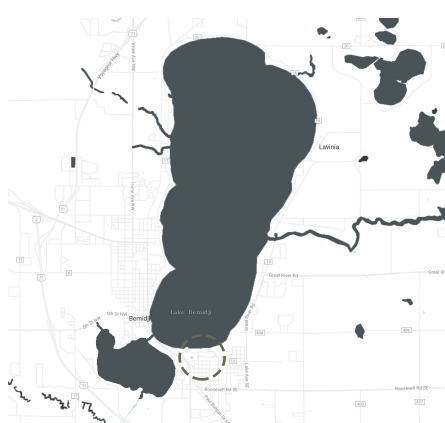
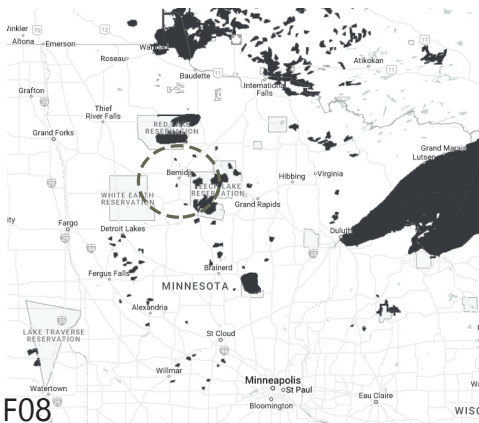
The Site



Location: Bemidji, Minnesota

Lake Shore Dr NE (South Shore Park - Nymore Beach)

The site chosen for this thesis is located on the south end of Lake Bemidji in Minnesota. Locating this facility along the lake will provide multiple views of nature along with having access to outdoor based therapies. These outdoor therapies will include fishing, kayaking, biking, hiking along with winter activities such as snow shoeing, cross country skiing, and ice fishing. Keeping this facility within Bemidji will benefit patients, and the community when traveling to the facility.



The Site



View from Street



Lake Shore Dr NE



Existing Parking Lot



F09

The Project Emphasis

The design of the project will focus on rehabilitation services for the users of the facility. Indoor and outdoor rehabilitation/physical therapy solutions will be a part of the project.

Allow for indoor and outdoor recreational opportunities including (hiking, fishing, biking, kayaking, cross-country skiing, etc.)

Surround by nature will increase health benefits also allow space for the outdoor activities.

The focus of every design element put into this project will advance one's health and healing

Community-work together as a community to overcome their mental and physical goals

Rehabilitation

Recreation

Nature

Health and
Wellness

Goals of the Thesis Project



Community Interaction



Innovative Rehabilitation



Nurse Support



Connection with nature



Accessibility

Goals of the Thesis Project

Community Interaction

Create spaces for community interaction as part of the physical and mental journey.

TBI patients tend to feel isolated because cognitive, physical and social disabilities prevent them from engaging in their pre-injury activities in a normalized way.

Facility will include the community where individuals will learn how to interact with TBI patients, (gym, pool, outdoor activities).

Innovative Rehabilitation

Innovation labs such as think & speak / arms & hands / legs & walking / strength & endurance will create space for TBI patients to recover from their traumas.

Outdoor-based therapy (kayaking, fishing, swimming, ice fishing, hiking, biking, etc..) will help patients connect with nature to increase healing process.

Computer assisted rehabilitation will give patients outdoor experiences in winter months.

Healthcare staff will give patients the opportunity to learn how to work with their disabilities.

Staff Support

Spaces that accommodate staff.

Designated areas for healthcare professionals to evaluate and develop plans for TBI patients.

Space the accommodates the many types of therapy

Connection with Nature

The Facility will create many views of nature with private green spaces that will be only have access within the facility.

Located along Lake Bemidji this facility will be able to use the lake for outdoor-based therapy and activities, and community activities.

Users of the facility will be able to access the Paul Bunyan State Trail that runs though the site. The trail will be used for outdoor therapies.

Connection with nature will help improve mental and physical healing

Accessibility

Due to TBI patients' disabilities all elements in design will need to be accessible.

Being able to access all points within the facility will make patients feel more comfortable when moving throughout the facility.

Definitions of Research Direction

Research will be managed by mixed methods, of qualitative and quantitative analysis. Correlation research, case studies and combined strategies will also be a part of the research. Evaluating how traditional facilities and rehab methods differ from a community-based facility and innovated rehab methods and how it may affect people with traumatic brain injuries heal and learn to live a new life with their disabilities.

A Plan For Design Methodology

Mixed Method Research – Quantitative and qualitative

Is a procedure for collection, analyzing and mixing both quantitative and qualitative research and methods in a single study to understand a research problem?

Qualitative – case study, ethnographic method, phenomenological method, narrative model, historical model, grounded theory method (interviews, focus groups, literature review, ethnography)

Quantitative – (statistical and scientific data) descriptive research, experimental research, correlational research (experiments, surveys, observations expressed in numbers)

A Plan for Documentation the Design Process

Compile Documentation:

Hand Drawing - Sketching / Modeling eventually will be scanned or photographed

Investigate through computer design software – Revit, Sketchup, AutoCAD

Represent through computer design software – Illustrator, Enscape, InDesign, Photoshop

Institutional Repository:

The project proposal, book, presentation, and boards will be available in the NDSU Repository

Project Presentation:

Oral and visual presentation of research and design results

Progress will be documented at the following intervals:

Data collection and analysis

Research results

Site inventory and analysis

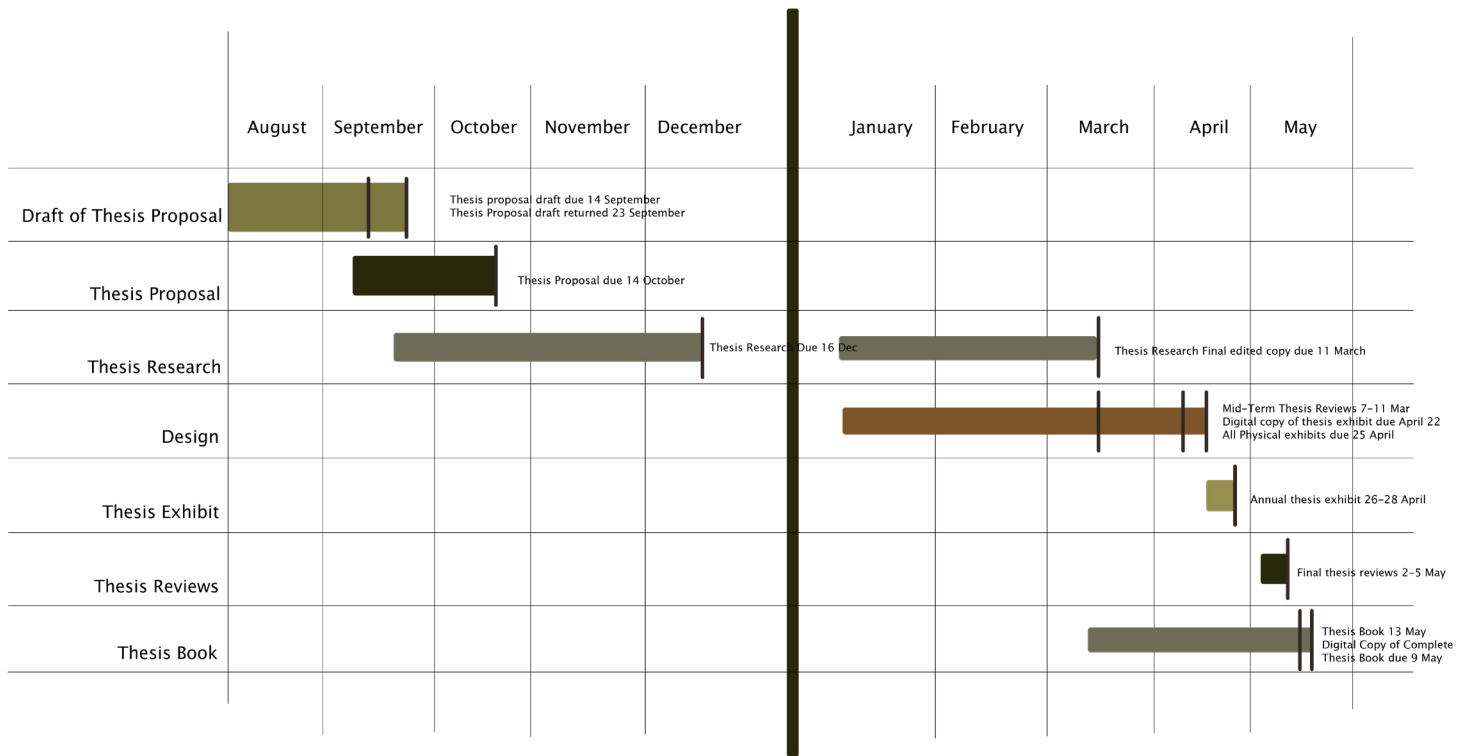
Conceptual design

Schematic design

Programming

Presentation graphics

Schedule



Propose

Program

Design

Present

Thesis Research

Theoretical Premise / Unifying Idea

A traumatic brain injury (TBI) can have an immense overwhelming impact on a person's life. One may recover from a traumatic brain injury; however, most will live with the permanent effects from their injuries, which may involve years of learning how to do daily tasks.

The project aims to design a rehabilitation facility that promotes innovative brain recovery methods for people suffering from TBI. Creating atmospheres for patients to recover from their traumas through the performance of personal routines. Looking deep into how the spaces we create can influence the brains recovery process for people suffering from TBI.

The topic of research will include designing an efficient rehabilitation facility that focuses on innovative brain recovery methods for people suffering from TBI. The design will combine the needs for a rehabilitation facility and community integration that will influence and promote brain healing for the TBI patients.

The program for this facility will be defined though conducted research. Looking at what type of spaces will be used to give TBI patients an innovative healthcare experience.

Unifying Idea: How can healthcare architecture promote brain recovery for patients suffering from a traumatic brain injury?

Goal #1 Creating atmospheres that influences whole body healing.

Goal#2 Reducing stress within a rehabilitation facility, to promote healing and focus on a sense of security.

Goal #3 Community involvement within the rehabilitation facility and community.

Design as a Rehabilitative Tool for people with Acquired Brain Injury: Mapping the Field

Dianne Smith, PH.D. and Jane Macdonald, BPsych(Hons.), Curtin University

“As one reaches adulthood independence is a natural goal... All too frequently, families expect that discharge from a hospital or completion of a rehabilitation program indicates the person is “well” or “cured.” Finding the proper balance between control by the family and gradual relinquishing of control are the stepping stones to greater independence, with many families finding the journey can be a satisfying partnership.”

– Rocchio, 2000

Many times, TBI patients will complete a rehabilitation program and be expected to continue life as it was before their injury, however this is not the case. Patients that have suffered immense overwhelming injuries will need support of family and friends along with healthcare professionals to continue learning how to do daily tasks again, depending on their injuries. Most patients will spend a great length of time within a rehabilitation facility. It is very evident that the environment is very important for people who have suffered a traumatic brain injury (TBI). With a desire to have more knowledge that can inform the conceptualization, design, and construction of the places that people may occupy throughout their journey.

Restoring Independence: The Goals and Movements of Rehabilitative Design

This section of the literature review focuses on meaningful activities during everyday situations or improving functionality, although, rehabilitation is discussed in many ways. Being able to adapt to maintain meaningful occupation in activities as part of TBI patients’ daily life is essential for successful rehabilitation. Occupational adaptation (continuous adjustment to personal and environmental variable) aims to reduce the misalignment between what a person with TBI can do compared to what they wish to do. “The difference between ability and desire is linked to executive abilities and to motor skills.... The concept of rehabilitation in the context of severe injury that necessitates extended occupancy in a care facility is debated.” For example, if someone with TBI who is immobile and deemed to be in lifelong care undergoing rehabilitation? “Traditional models of cognitive rehabilitation dwelt on task proficiency. More recently, neurorehabilitation models focus on the “patient’s changed abilities to participate when planning and implementing rehabilitation efforts”.

People who are less competent are more readily impacted upon the environments in which they occupy. The Joines’s 2009 study investigated the environments for those with neurological disorders by applying different design principles. “The environment mediates relationships between the person within a social space so the individuals can use their abilities (senses, strength, coordination, reflexes and sensation) to accomplish tasks.” Eriksson 2006 study identifies that familiar and meaningful environments are required for rehabilitation to reduce the gap. This gap can be reduced through five strategies, they are as follows:

Literature Review

Design as a Rehabilitative Tool for people with Acquired Brain Injury: Mapping the Field

Dianne Smith, PH.D. and Jane Macdonald, BPsych(Hons.), Curtin University

- Improving the performance of activities
- Acquiring new way to perform
- Modifying the social environment
- Modifying the physical environment

These are very important strategies when thinking about the design of rehabilitation facilities. TBI patients social and physical environments will be modified depending on their cognitive level. TBI injuries can affects a person's ability to gasp sensory problems which may include persistent ringing in the ears, difficulty recognizing objects, impaired hand-eye coordination, blind spots, or double vision, a bitter taste, skin tingling or trouble with balance or dizziness. Diagnosing their sensory problems and finding activities that they enjoy will acquire new ways to perform these activities. In the next part of the literature review it talks more in depth about sensory perception.

Impairment-Centered Approach and Design & Sensory Quality

A common view of the environment in rehabilitation is from the starting point of impairment, Rehabilitation therapies typically focus on either recovering impaired skills or circumventing disability by compensation for impairment. Cognitive impairments associated with TBI affect areas such as memory, navigation, coordination, planning and organization and often impede function and safety within the physical environment. TBI can also limit mobility, motor dysfunction, and movement disorders. "Physical impairments pose ongoing challenges, particularly when access to objects and environments is restricted. For example, high storage shelves, narrow hallways and sharp corners are a few features of the physical environment that may hinder functionality for a person with impaired mobility." (Kiser & Zasler, 2009)

TBI patients experience emotional changes which may include Depression, anxiety, mood swings, irritability, lack of empathy for others, anger, and insomnia. They can also experience changes in behaviors that may include difficulty with self-control, lack of awareness of abilities, risky behavior, difficulty in social situations, verbal or physical outburst. In some of these cases these changes stem directly from tissue damage. Personality and behavioral are also factors to consider. "The aforementioned impairments can be a source of extreme frustration, anger, and sadness. They serve as barriers to independence and separate the individual from their pre-injury goals and visions. Aggressive behavior is often observed among ABI survivors in inclusive care, typically triggered by environmental stressors or restrictions to independence during treatment. The emotional and behavioral changes associated with ABI can have long-term consequences, particularly if they impede treatment compliance, socialization, or community integration.

Design as a Rehabilitative Tool for people with Acquired Brain Injury: Mapping the Field

Dianne Smith, PH.D. and Jane Macdonald, BPsych(Hons.), Curtin University

The degree of stimulation is important because too much can trigger aggression. Huisman, Morales, van Hoof, and Kort report in (2012) that the environment (such as views) can provide distraction, but there is other way in which other modes can have a positive impact on a person suffering from TBI. Virtual reality, multi-sensory rooms, blank TV "rather than daytime shows", nature tapes "can improve disability (physical, psychological, and recreational), sleep, coping, and sickness impact. However, Dieet, Lechtzin, Haponik, Devrotes and Rubin's (2003) study found that "nature-distracted patients did not report improved anxiety and satisfaction. Multi-sensory environments are integrated into rehabilitation the basis that exposure to frequent and various sensory stimulation with facilitate dendritic growth and improve synaptic connectivity in those with damaged nervous systems."

- Design with color
 - o Color can be used purposefully in therapeutic environments to enhance the experience of those using the hospital or healthcare environment. "Brain injury has also been associated with high levels of neuropsychiatric disorders, such as depression and suicide, compared to the general population. Colors can positively influence mood and cognition, as well as healing, in combination with light."
- Designing with Light
 - o There are two types of lighting natural and artificial both essential to good design in healthcare environments, including rehabilitation. "Lighting design is linked to vision capabilities, eyestrain or discomfort, arousal and stress, circadian rhythms and sleep, depression, ability to undertake daily activities, and the general impact of disability."
- Nature, Views and Windows
 - o Views of nature serve as a distraction that evokes positive emotions, counteracting stress and enhancing pain management.
- Layout, Exits, and Entries
 - o "When designing for people with cognitive impairments such as BI or dementia, the spatial layout is important, as choices to assist with orientation and wayfinding are ongoing. Therefore, to ensure that people are not lost or disoriented, the complexity and scale of facilities are important."

Literature Review

Healing Spaces (The science of Plance and Well-Being)

Esther M. Sternberg, M.D.

“There is a turning point in the course of healing when you go from the dark side to the light, when your interest in the world revives and when despair gives way to hope”

– Esther M. Sternberg M.D

Atmosphere plays an important roll when designing for the health and well-being of patients within a healthcare facility. During this review there will be multiple studies discussed in Healing Spaces that show how space and atmosphere can influence the healing process in healthcare architecture. Taking this literature review and applying it to how this may affect patients that suffer from TBI.

TBI (Traumatic Brain Injury) is usually caused by a blow or other traumatic injury to the head or body. Depending on the degree of the injury will also depend on if one can heal from such injuries. Some people may heal from their injuries however most will live with the permanent effects from their injuries. The most common traumatic brain injury includes falls, vehicle-related collisions, violence, sports injuries, explosive blast, and other combat injuries. Many people that suffer a significant brain injury will experience changes in their thinking (cognitive) skills. Traumatic brain injury can result in problems with many skills including cognitive problems (memory, leaning, reasoning, judgment, attention, or concentration), executive functioning problems (Problem-solving, multitasking, organization, planning, decision-making, beginning or completing tasks).

1984 Ulrich Study

Based on long tradition in modern architecture Ulrich wanted to test whether views of nature where calming, and whether, by reducing the stress of hospitalization, they could in turn improve the health and wellbeing of patients.

Roger Ulrich’s 1984 study showed that window views could affect healing. In this study he chooses forty-six patients (30 women, and 16 men), whose beds either looked over a grove of trees or a brick wall. “Ulrich had recorded each patient’s vital signs and other indicators of health, including dosages and types of pain medication and length of hospital stays. He’d found that patients whose beds were located beside windows with views of small stand of trees left the hospital almost a day sooner than those with views of a brick wall. Not only that, but the patients with nature views required fewer doses of moderate and strong pain medication. The results were dramatic and statistically significant. Ulrich had selected only forty-six patients to study because he was controlling for variables that could affect recovery, such as age, sex, whether the patients were smokers, the nature of their previous hospitalizations, the year of their surgery, even the floor their room was on. Each pair of patients – view of nature, view of a brick wall – had been cared for by the same nurses, so differences in nursing care could not account for the difference in the speed of recovery. Even doubters had to sit up and talk a notice.”

Healing Spaces (The science of Plance and Well-Being)

Esther M. Sternberg, M.D,

Patients that had a view of nature had more success in healing, so is there something about the structure of a scene that might be intrinsically jarring or relaxing that could change a person's mood or the affect of healing? "Indeed, there is a pathway at the base of the brain that leads from the visual cortex to the parahippocampla place area – from the region where signals from the retina are first received to where they are finally constructed into a scene. The nerve cells along this pathway express an increasing density of receptors for endorphins – the brain's own morphine-like molecules." At the University of Southern California in Los Angeles, Professor Irving Biederman has found that when people view scenes – such as a beautiful vista, a sunset, or a grove of trees "the nerve cells in the opiate-rich pathway become active."

It is obvious that nature is important to healing, it's been around for a thousand of years. Looking back to classical times, when the temples to Asclepius (the Greek God of healing) were built far from town, high up on hilltops overlooking the sea. However, in the late twentieth century, state of the art hospitals was generally designed to accommodate state of the art equipment. This is the problem we face today with healthcare architecture; we design for function and not for patients' health and wellbeing.

Neuroscience and Architecture

How do we use the tools of neuroscience and immunology to inform the field of architecture, and in turn promote healing?

The Wood Hole conference of 2002 preformed a workshop that spilt into working groups where each group was co-chaired by a neuroscientist and an architect. "Rodger Ulrich chaired the "Windows" group. These smaller sessions were meant for brainstorming. The "Windows" group would use the time to speculate freely about how windows might promote healing, and also to come up with ideas about what each discipline could measure." Some questions that were asked included:

- Why and how could window view affect healing?
- Was it because they provided more natural light?
- More airflow?
- Access to the sounds and smells of nature?
- Awareness of the rhythms of day and night?
- Did they simply distract patients from the monotony of days trapped in bed?

The architects and neuroscientist gave their answers:

The architects could measure the light intensity, wavelength, the color; temperature; airflow and levels of activity in the scene being viewed. "They went through the list of all the qualities that on could measure with sophisticated instruments in minute detail, to quantify every imaginable characteristic of physical space.

Literature Review

Healing Spaces (The science of Plance and Well-Being)

Esther M. Sternberg, M.D,

This list would make it possible to design a study where research could measure and control these variables, in order to work out which factor or factors might explain the window' effects." The neuroscientist could monitor areas in the brain that became active when the patient was looking at a scene. "They could measure physiological responses such as stress and relaxation. They could measure stress hormones in saliva, and changes in heart-rate variability and breathing. And they could measure general indicators of health such as immune responses, dosages of pain medications prescribed, and length of hospital stays."

Overall, the group concluded that by combining the most advanced tools of neuroscience, architecture, and engineering, one could dissect and measure each feature of a patient's physical environment, and the way each of those stimuli was received by the patient's brain and body. Research might then be able to identify elements in the physical environment that help people heal. "Perhaps the most important thing a window does is provide a portal – an escape from the frightening, painful reality of disease, or a way of accessing memories of a better time and place. Maybe windows exert their effect by allowing a patient to step into a space of meditation – a reverie that brings not just distraction but relief. And relief could bring healing, through all those beneficial chemicals that flow from the brain through the body and change illness into wellness."

TBI patients suffer extreme loss when initially getting their injuries. It takes years of therapy (physical, speech, etc.) to regain some of their abilities that they may have had before their injury, however as stated before that's not the case for most TBI patients. Most TBI will live with the permanent effects from their injuries, which will mean learning how to live with their disability. Patients usually feel extreme isolation or stress when going through this, and more than likely want to escape the situation they are in. "Perhaps the most important thing a window dose is provide a portal." Windows will be a key element when designing for any healthcare architecture project. One key thing to keep in mind when designing for TBI patients is the lighting and how that may affect them and their injury.

Conclusion

TBI patients suffer extreme injuries, that may take years to heal or may be permanent. Ulrich's 1984 study shows not only is it important to have a window within a patient room but to have a scene in that window. Patient rooms that looked out a scenic area vs. looking at a brick wall had more success in their healing due to mind set. A window can act as a portal, an escape from the reality of living with a permanent injury. Windows could also allow a patient to step into a space of meditation, a place that will relieve stress and encourage healthy healing.

Rancho Los Amigos Cognitive Scale Revised

Levels of Cognitive Functioning

Level VI - Confused, Appropriate: Moderate Assistance

- Inconsistently oriented to person, time and place.
- Able to attend to highly familiar tasks in non-distracting environment for 30 minutes with moderate redirection
 - Remote memory has more depth and detail than recent memory.
- Vague recognition of some staff.
- Able to use assistive memory aide with maximum assistance.
- Emerging awareness of appropriate response to self, family and basic needs.
- Moderate assist to problem solve barriers to task completion.
- Supervised for old learning (e.g. self care).
- Shows carry over for relearned familiar tasks (e.g. self care).
- Maximum assistance for new learning with little or no carry over.
- Unaware of impairments, disabilities and safety risks.
- Consistently follows simple directions.
- Verbal expressions are appropriate in highly familiar and structured situations.

Level VI

Cognitive of TBI

Rancho Los Amigos Cognitive Scale Revised

Levels of Cognitive Functioning

Level VII - Automatic, Appropriate: Minimal Assistance for Daily Living Skills

- Consistently oriented to person and place, within highly familiar environments. Moderate assistance for orientation to time.
- Able to attend to highly familiar tasks in a non-distraction environment for at least 30 minutes with minimal assist to complete tasks.
- Minimal supervision for new learning.
- Demonstrates carry over of new learning.
- Initiates and carries out steps to complete familiar personal and household routine but has shallow recall of what he/she has been doing.
- Able to monitor accuracy and completeness of each step in routine personal and household ADLs and modify plan with minimal assistance.
- Superficial awareness of his/her condition but unaware of specific impairments and disabilities and the limits they place on his/her ability to safely, accurately and completely carry out his/her household, community, work and leisure ADLs.
- Minimal supervision for safety in routine home and community activities.
- Unrealistic planning for the future.
- Unable to think about consequences of a decision or action.
- Overestimates abilities.
- Unaware of others' needs and feelings.
- Oppositional/uncooperative.
- Unable to recognize inappropriate social interaction behavior.

Level VII

Rancho Los Amigos Cognitive Scale Revised

Levels of Cognitive Functioning

Level VIII - Purposeful, Appropriate: Stand-By Assistance

- Consistently oriented to person, place and time.
- Independently attends to and completes familiar tasks for 1 hour in distracting environments.
- Able to recall and integrate past and recent events.
- Uses assistive memory devices to recall daily schedule, "to do" lists and record critical information for later use with stand-by assistance.
- Initiates and carries out steps to complete familiar personal, household, community, work and leisure routines with stand-by assistance and can modify the plan when needed with minimal assistance.
- Requires no assistance once new tasks/activities are learned.
- Aware of and acknowledges impairments and disabilities when they interfere with task completion but requires stand-by assistance to take appropriate corrective action.
- Thinks about consequences of a decision or action with minimal assistance.
- Overestimates or underestimates abilities.
- Acknowledges others' needs and feelings and responds appropriately with minimal assistance.
- Depressed.
- Irritable.
- Low frustration tolerance/easily angered.
- Argumentative.
- Self-centered.
- Uncharacteristically dependent/independent.

Level VIII

Cognitive of TBI

Rancho Los Amigos Cognitive Scale Revised

Levels of Cognitive Functioning

Level VIII - Purposeful, Appropriate: Stand-By Assistance

- Able to recognize and acknowledge inappropriate social interaction behavior while it is occurring and takes corrective action with minimal assistance.

Level IX - Purposeful, Appropriate: Stand-By Assistance on Request

- Independently shifts back and forth between tasks and completes them accurately for at least two consecutive hours.
- Uses assistive memory devices to recall daily schedule, "to do" lists and record critical information for later use with assistance when requested.
- Initiates and carries out steps to complete familiar personal, household, work and leisure tasks independently and unfamiliar personal, household, work and leisure tasks with assistance when requested.
- Aware of and acknowledges impairments and disabilities when they interfere with task completion and takes appropriate corrective action but requires stand-by assist to anticipate a problem before it occurs and take action to avoid it.
- Able to think about consequences of decisions or actions with assistance when requested.
- Accurately estimates abilities but requires stand-by assistance to adjust to task demands.
- Acknowledges others' needs and feelings and responds appropriately with stand-by assistance.

Level VIII
Level IX

Rancho Los Amigos Cognitive Scale Revised

Levels of Cognitive Functioning

Level IX - Purposeful, Appropriate: Stand-By Assistance on Request

- Independently shifts back and forth between tasks and completes them accurately for at least two consecutive hours.
- Uses assistive memory devices to recall daily schedule, "to do" lists and record critical information for later use with assistance when requested.
- Initiates and carries out steps to complete familiar personal, household, work and leisure tasks independently and unfamiliar personal, household, work and leisure tasks with assistance when requested.
- Aware of and acknowledges impairments and disabilities when they interfere with task completion and takes appropriate corrective action but requires stand-by assist to anticipate a problem before it occurs and take action to avoid it.
- Able to think about consequences of decisions or actions with assistance when requested.
- Accurately estimates abilities but requires stand-by assistance to adjust to task demands.
- Acknowledges others' needs and feelings and responds appropriately with stand-by assistance.

Level IX

Cognitive of TBI

Rancho Los Amigos Cognitive Scale Revised

Levels of Cognitive Functioning

Level X - Purposeful, Appropriate: Modified Independent

- Able to handle multiple tasks simultaneously in all environments but may require periodic breaks.
- Able to independently procure, create and maintain own assistive memory devices.
- Independently initiates and carries out steps to complete familiar and unfamiliar personal, household, community, work and leisure tasks but may require more than usual amount of time and/or compensatory strategies to complete them.
- Anticipates impact of impairments and disabilities on ability to complete daily living tasks and takes action to avoid problems before they occur but may require more than usual amount of time and/or compensatory strategies.
- Able to independently think about consequences of decisions or actions but may require more than usual amount of time and/or compensatory strategies to select the appropriate decision or action.
- Accurately estimates abilities and independently adjusts to task demands.
- Able to recognize the needs and feelings of others and automatically respond in appropriate manner.
- Periodic periods of depression may occur.
- Irritability and low frustration tolerance when sick, fatigued and/or under emotional stress.
- Social interaction behavior is consistently appropriate.

Level X

Typological Research

Basel Rehabilitation in Switzerland
designed by Herzog and DeMeuron

Spaulding Rehabilitation Hospital in Boston,
designed by Perkins&Will

The Paimio Sanatorium in Paimio, Finland, designed by
Anio Aalto and Alvar Aalto

The Shirley Ryan Ability Lab in Chicago, Illinois, designed
by HDR, Gensler and Clive Wilkinson Architects,

Typological Research

Basel Rehabilitation

Architect: Herzog and De Meuron

Located: Switzerland

Year Built: 2002



Figure 10

Takes a different approach to encourage movement – rather than emphasizing paths of movement, the plan districts/departments are differentiated through landmark courtyard to facilitate wayfinding throughout the building. According to the architects, this design is experientially analogous to exploring a small town, with courtyards creating streets and plazas in front of smaller residences. The courtyards introduce natural light and views to the core of a multistory deep floor plate. As indicated in the plan, the courtyards are dispersed across the floor area, with some connecting in plan to exterior areas, while others remain completely enclosed by interior space.



Figure 11

The largest courtyard indicates the main entrance from the south façade creating a recessed front porch entry. Each courtyard has a unique character which facilitates their usage as wayfinding landmarks. The therapy pool, though enclosed. Also acts as a landmark through its unique qualities of contrasting geometry and material at roof level. One courtyard is filled with water. The French Garden on the north side also serves as a landmark for the facility's central open stair. At the Basel rehab, the entry courtyard provides not only connections to daylight from the interior, but also has an overhang which affords patients movement on an outdoor wood deck area in a setting with access to plants, daylight, and outdoor air. A garden plot in the center of the courtyard has been replanted multiple times with different plants.



Figure 12



Figure 13

Typological Research

Spaulding Rehabilitation Hospital

Architect: Perkins&Will

Located: Boston

Year Built: 1971



Figure 14



Figure 15



Figure 16



Figure 17

Spaulding rehabilitation Hospital in Boston designed by Perkins + Will provides green respite space accessible to patients and staff on upper building levels on an urban site through a rooftop cafe with plantings that overlooks Boston Harbor. Spaulding Rehabilitation Hospital is designed with screened operable windows throughout the facility, including patient rooms, lobbies and therapy areas, not only for passive survivability in care of sheltering in place during power loss, but also to provide control for building users to allow more variable air quality conditions as well as sounds from the harbor.

The clinical therapy gym at Spaulding rehabilitation hospital facilitates social support and stress relief in addition to accommodating a variety of clinical therapy equipment. The therapy gym has large windows allowing expansive harbor views with pieces of equipment oriented to look out the windows. In accordance with anthropologist Edward Hall's research of proxemics in American culture, the equipment layout reflects the allowance of less intrusive social interaction between patients (4-12 feet of separation) while also providing sufficient visibility and proximity to allow for social learning and support. Sufficient space in the personal distance zone (1-4 feet away) allows for family and staff to provide more direct support. Another strategy for integrating therapy throughout the facility is to improve the accessibility and therapeutic aspects of non-clinical spaces.

Typological Research

The Paimio Sanatorium

Architect: Alvar Aalto

Located: Finland

Year Built: 1933

**“Building art is a synthesis of life in materialized form. We should try to bring in under the same hat not a splintered way of thinking, but all in harmony together”
– Alvar Aalto**

The former tuberculosis sanatorium, Paimio sanatorium was completed in 1933. The project has been canonized as an internationally recognized masterpiece of modern architecture and is other considered has Finnish architect, Alvar Aalto breakthrough. In 1960, the building was converted into a general hospital. The Paimio Sanatorium, built in Finland in the early 1930s designed by architect alvar Aalto demonstrates many of the strategies aligning with the goal of Authenticity. With the goal of architecture as a healing element and helping tuberculosis patients recover in the pre-vaccine era, the building design reflects the health care practices of its time, which included hygiene, fresh air, and sunlight an isolated site selection limited the potential spread of contagion. Indoor surfaces were selected to be hard, durable, and easy to keep clean. The building was laid out with a primary elongated east-west linear wing to maximize patient exposure to sunlight throughout the day, including the south facing rooftop terraces where finish material colors selected in collaboration with artist Eino Kauria were not based in fashion, but rather with specific goals to reinforce desired patient activity, such as with the darker muted ceiling paint colors in restful spaces, using different patient wing corridor colors to assist with wayfinding, and elevating patient energy levels such as with the use of a bright yellow rubber floor in activity areas. Image of the library illustrates the custom furniture, lighting, and use of a muted green color in the ceiling with views to nature and plenty of sunlight.



Figure 18



Figure 19



Figure 20

Typological Research

The Paimio Sanatorium

Architect: Alvar Aalto

Located: Finland

Year Built: 1933

Authenticity

Strategies for architectural authenticity include:

Expression of invariants in optic flow through order, regularity, hierarchy, and modularity in the visual field to assist in the accurate perception of scale and distance (avoid optic illusions and assist with measuring)

Legibility of zones, departments, entrances, etc. Clarity and hierarchy in form and spatial transparency (form follows function)

Reflectiveness of and responsiveness to context in time and place, such as sustainability approaches to site, water, energy, materials, and quality, health, resilience and technology (for example, not falsely making a new building look like a historic one)

Architectural usage and expression of materials that match their nature (for example tile that looks like a cast stone material rather than imitation a wood plank)

Material colors or finishes that align with their anticipated architectural lifespan (for example, use patterns and colors in fashion for interior wall paint or chair fabrics expected to last 5-10 years but use natural stone cladding expected to last 100 years for exterior cladding)

Figure 21

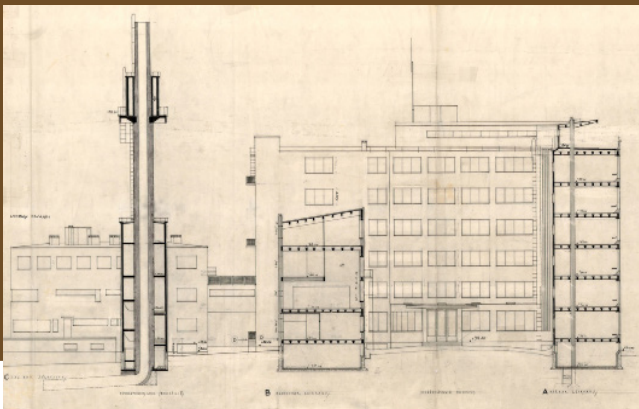
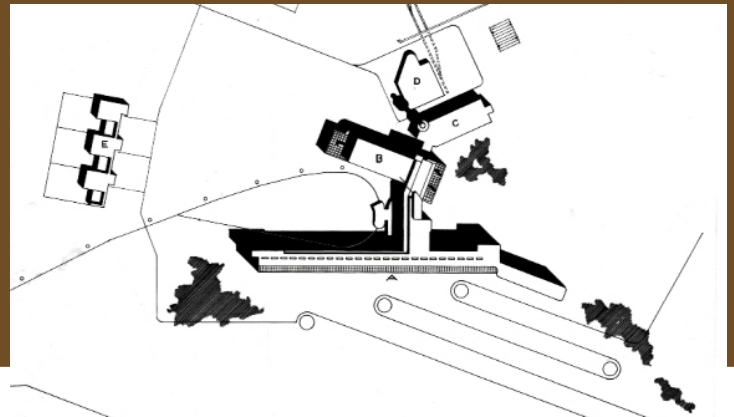


Figure 22



Typological Research

The Shirley Ryan Ability Lab

Located: Chicago, IL

Year Built: 1951 (Founded)

The Shirley Ryan Ability Lab in Chicago, Illinois, designed by HDR, Gensler and Clive Wilkinson Architects, takes a particular approach with the use of color finishes throughout the facility to encourage movement. At the entry, contrasting floor and ceiling elements delineate colorful sinuous pathways through open spaces to encourage exploration. Different coloration is also used for seating areas at different ends of the corridor to differentiate them as landmarks. Color coding and shapes also help with wayfinding through their association with specific departments. Each floor has an association with a department related to a type of therapy. Softer colors are used in the "Think and Speak" area, while stronger colors are used in the "strength and endurance areas". At the Shirley Ryan Ability Lab, overhead lifts above an open stair facilitate a more functional therapeutic experience for patients to supplement the clinical therapy equipment. Physical and occupational therapy can occur in general non-clinical spaces, such as under a stair with the proper furnishings and support.

Encourage of Movement TBI

Rehabilitation facilities should encourage patients and building users to increase physical activity through exploration and moving throughout and around the facility. Providing engaging destinations and stimulating paths, entrances, porches, and terraces where patients, families and staff see and hear each other.

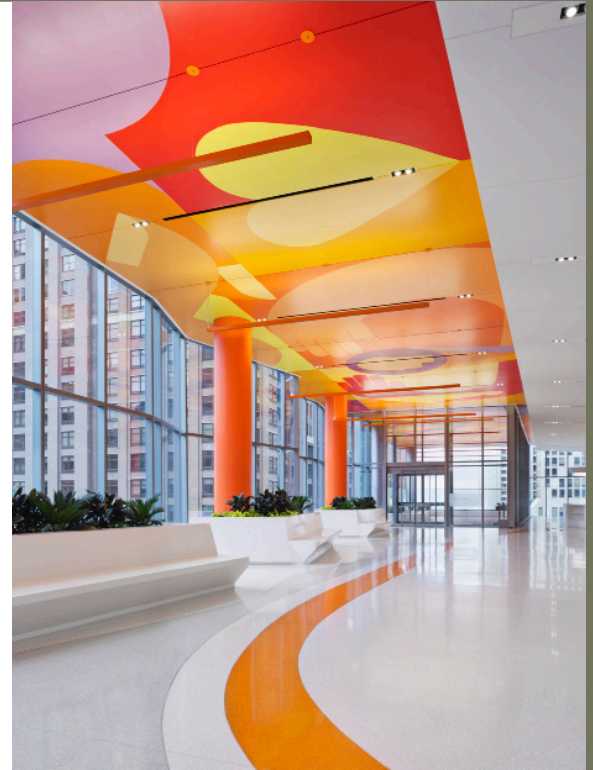


Figure 23



Figure 24

Typological Research

The Shirley Ryan Ability Lab

Located: Chicago, IL

Year Built: 1951 (Founded)

Make wayfinding easy and intuitive. Research indicates that physical exercise has a positive effect on cognitive performance and brain plasticity (related to healing). TBI patients can have issues with wayfinding due to lack of memory, reduced concentration, and perceptual impairments such as double vision or loss of hearing. To invite movement as part of the goal of rehabilitation, leaving the room and moving to different spaces needs to be incentivizing, legible, safe, and comfortable. Ullrich's theory of supportive design proposes specific strategies that provide safety, comfort, and positive distractions. To alleviate difficulties with wayfinding Kevin Lynch's research indicates that paths, edges, districts, nodes, and landmarks provide experiential legibility. Experiential wayfinding shows preference for landmark cues by seniors, often who suffer from cognitive decline. Research also shows that wayfinding is faster and easier to circulation paths which align and meet at orthogonal corners. Transparency between spaces allows building users to see into a space before they enter, reducing worry about entering the wrong space. Strategies for encouraging movement can be applied at multiple scales. Site selection which considers locating the facility in a walkable pedestrian district with desirable destinations allow the rehabilitation experience to extend beyond the property



Figure 25

Typological Research

The Shirley Ryan Ability Lab

Several leading firms collaborated on the new hospital's construction, design and experience:

HDR, Inc. planned the organization of the building, conceived the operational framework for clinical and research programs, and designed the Biologics Lab and clinical areas such as inpatient units, patient rooms, outpatient spaces, exam rooms, the pharmacy and the radiology department.

Gensler designed the 27-floor building, interior environments for public and staff use, hybrid administrative office spaces, the chapel and complex mechanical systems.

Clive Wilkinson Architects (CWA) developed the design language for the five ability labs, custom furniture and equipment, the Ground and Sky Lobby, patient hubs, vistas, café lounge and entrance and exit wayfinding strategies.

EGG Office worked closely with CWA to design the graphics that adorn the hospital's entrance, Sky Lobby, ability labs, ambulance bay and café. It also designed all signage inside and outside of the facility, including donor and room signage.

Power Construction managed the hospital's construction.

Arcadis served as the owner's representative in overseeing the project.

Art Agency, Partners, led by Allan Schwartzman, helped to identify artists and select or procure commissioned art for public spaces and patient areas within the hospital.

Color

The colors on each floor have a therapeutic purpose. For example, the Legs + Walking Lab is bright orange, red and yellow; by contrast, the top floor of the Brain Innovation Center creates a soothing "skyscape" featuring a whispering transition from pale peach to soft blue. Patients with recent traumatic brain injury need to be protected from too much stimulation.

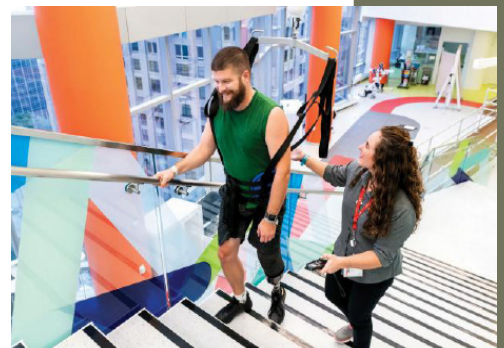
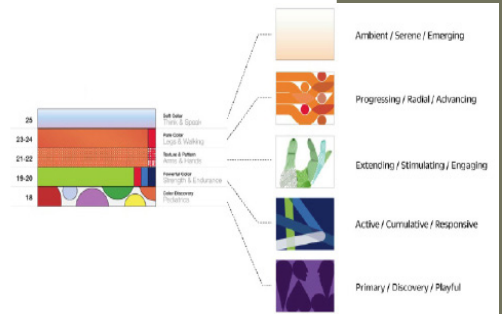


Figure 26

Project Justification

This project is focused on how healthcare architecture can affect someone suffering from TBI (Traumatic Brain Injury). Personally, I am passionate towards healthcare architecture and learning how architecture can create atmospheres that can help with the healing process. TBI is very interesting to me because most the time patients who suffer from TBI live with the permanent effects from their injuries. This project goal is to design a rehabilitation facility that promotes innovative brain recovery methods for people suffering from TBI.

Why is it important to do this project at this stage of your professional development?

Throughout school we have been exposed to many different design typologies and with my experience of working in a firm now for 4 years I have been exposed to many different projects. When thinking about my career in architecture I lean towards healthcare architecture and how we can make it more inviting, with a more personal experience. It is important for me to do this project now as my thesis to get a better understanding on how to design healthcare facilities in the future and to learn and understand the knowledge that is already out there.

How is the project going to add to your knowledge base?

This project will add to my knowledge of healthcare architecture, just getting a job in a firm that works a lot with healthcare I believe it will be very beneficial to look deeper into how healthcare architecture can create atmospheres that can shape a patient's healing process. Also looking at how architecture can create innovative spaces for one's brain recovery.

How is the project going to add to your set of skills?

It will add knowledge when designing in the future. I will be able to use this knowledge throughout my whole career and I believe it will help me grow as a designer and architect.

Project Justification

Why is doing the project important for the profession at this time?

I think hospital in general need to take a more biophilic design option right from the start of a schematic design phase which is not what we do now. We design space for function, and not for beauty when it comes to hospitals. This project will aim to consider both the function but also most importantly the health of the patients and staff.

Why is the project important as an academic exercise at this time?

I believe it to be important to me as an academic exercise currently while I'm still in school and gaining a base knowledge. I know that once I am out in the profession that I will have real world experience, which I've already had, but it will give me time to get a basic understanding.

Is the technology to be used in your project justified considering all its aspects?

Technology that will be used in my project will be innovative rehabilitation devices as well as anything the rehabilitation facility will need to help their patients achieve their goals.

Why is the project important to be implemented in its social context?

This project will enhance TBI patients' day to day rehabilitation services. Most patients suffering from TBI live with the effects of their injuries the rest of their life. Designing spaces that create atmospheres for patients suffering from TBI will influence the brains recovery process.

Would your project contribute to the advancement of the profession?

This project will contribute to the profession in healthcare architecture. Throughout my research I am going to try and define in what way we can design for the patients and staff's mental health through architecture instead of just designing or function.

Project Justification

Is working on your project an imperative, or is it just an option?

I believe this project to be very important not just for my understanding on healthcare architecture but to others as well. My knowledge will bounce off me and on to others on how we can create the spheres that benefit the patient's health. Design focused on healing instead of function.

Can your project be left for someone else in the profession to solve? If so, why should you solve it?

Everyone in an architecture firm can have an impact on how to solve this problem. For example, electrical could control dynamic or diffused lighting. Interior could control colors, biophilic surfaces. But overall architecture is the one that can look deep into how atmospheres/spaces can improve one's recovery. It could be left to someone else however I believe that space that is created is the upmost important.

Historical, Social and Cultural Context

Historical Context

While ancient writings indicate that brain injury was a recognized condition prior to the 20th century, it was usually fatal. The first dedicated brain injury rehabilitation programs were created after World War I for veterans in Germany and Austria to reduce early retirement. These centers developed detailed evaluations and treatments for neuropsychological issues with the goal of teaching strategies to compensate for impairments and help the injured region employment. Based on the principles of Gestalt psychology (which emphasizes perception), so of the test for visual-spatial perception and reasoning are still in use today. Less TBI – specific treatment progress occurred in the U.S. as rehabilitation was operated by state vocational system outpatient services.

General health care for U.S. veterans was provided by state run homes following the Civil War, where veterans also received incidental medical and hospital care. General medical and surgical treatment began to be provided for injured veterans in the U.S. with the Treasury Department bill in 1917, but inadequate facilities existed to meet the needs of veterans in World War I. Following World War I, Congress established new benefits for veterans which included vocational rehabilitation, and new hospitals for treatment of neuro-psychiatric conditions. New 1950's VA hospitals had group patient wards which were more open and had almost no privacy except what could be afforded by a curtain around the bed, such as the one from Ann Arbor indicated in figure 11.

The next significant advances in the field of traumatic brain injury rehabilitation occurred after World War II. Increasing research led to the development of a multidisciplinary team approach which included not only physicians, but also psychologists and speech-language pathologists.



Figure 27 : Post WWII VA Hospital Ward

Historical, Social and Cultural Context

Historical Context

Advances in research also supported the development of new strategies in motor planning, visual perception, executive function, and language disorders. Additionally, the fields of physiatry, occupational therapy, physical therapy, psychology, speech-language pathology, and vocational rehabilitation developed rapidly to meet the needs of veterans. The dominant form of care was custodial, either in general hospital facilities or neuro-psychiatric hospitals for those with cognitive or behavioral issues.

The 1970's brought an expansion of TBI rehabilitation outpatient programs for civilians due to an increase in injuries related to high-speed vehicle accidents. One of the first specialty head injury acute care inpatient treatment units in the U.S. was established at Rancho Los Amigos Hospital near Los Angeles, along with special programs for cognitive rehabilitation. A significant contributor in this field, Dr. Ben-Yishay, along with his colleague Leonard Diller at Rusk Rehabilitation at NYU Langone Health, developed programs for brain-related rehabilitation after Israel's Yom Kippur War and continued for over four decades starting in 1978 at the NYU Rusk Holistic Day Program

In the 1980's, TBI rehabilitation was established as a subspecialty of rehabilitation medicine and the Committee for Accreditation of Rehabilitation Facilities developed dedicated accreditation standards, along with other private sector expansion of practice standards, ethical guidelines and respect for patients' rights. The Facility Guidelines Institute makes a standard typically required by authorities having jurisdiction for facility requirements for rehabilitation departments in hospital and outpatient facilities. While a few hospitals developed specializations in rehabilitation medicine, rehab programs for TBI were primarily contained within general acute care hospital facilities.

In the 1990's, major shifts in U.S. health care delivery changed rehabilitation care emphasis to efficiency, cost control, and reduced rehabilitation time. This necessitated a change to more accelerated and targeted treatment and the development of functional rating scales specifically for TBI patients to better define and justify services to third party payers.

Historical, Social and Cultural Context

Historical Context

It also impacted research because lengths of stay are not long enough to allow historical levels of study to be conducted. Because of the complexity of patient characteristics, injuries, and issues, the translation of narrow evidence-based standards into practice is a major issue. Since multi-modal interventions are required in clinical practice for the highly specialized needs of patients, it has been difficult to develop clear evidence for clinical interventions.

A proliferation of specific narrow rating scales reflecting actual targets of treatment, such as the Community Integration Questionnaire, helped uncover the diversity of TBI effects and led to many measures needing co-calibration. However, researchers recognize that subjective experiences of patients must be considered along with functional measures. The cost and complexity of research to prove effectiveness of different types of therapy for brain injury has limited the ability of the research community to provide decisive randomized control trial studies, but several less-complex studies do provide growing evidence in support of inpatient TBI rehabilitation programs. Strong evidence to inform rehabilitation program and facility design needs development.

Social Context

TBI Rehabilitation hospitals should have an accessible inviting space open to the public for the community to interact with brain injured patients, families, and staff in a safe and comfortable environment where a patient experiences a non-stigmatizing social interaction with a member of the community by engaging in informal activities such as a light meal, beverage, and/or an event (such as a patient art exhibit or live music). For example, Rancho Los Amigos National Rehabilitation Center supports public art shows or work developed by patients in rehabilitation (figure 42) and other events such as a wellness fair on the grounds of the rehabilitation center (figure 43) TBI patients and families often suffer from loneliness and isolation because cognitive, physical, and social disabilities of TBI patients prevent them from engaging in their pre-injury activities in a normative way. Individuals in the community are often unsure how to interact with TBI patients because their behavior is often outside of sociocultural norms.

Historical, Social and Cultural Context

Social Context

Building the community's familiarity with TBI patients through direct contact has been demonstrated to improve understanding and benevolence towards disabled patients more than disengaged informational programs. Regular community members in a shared environment start to recognize each other and gain a better understanding of each other. Ulrich's theory of supportive design research indicates that humans react positively and pay attention to caring or smiling human faces. As posited by the Theory of Social Learning, observing public behavior in others also helps TBI patients to learn about sociocultural norms.

Affordances for community interaction start at the level of context and extend into the design of the site, building space, and details. Initial site selection involves consideration of a site where the community infrastructure and context support direct personal interaction. Mixed use districts support this goal as they enable the unmediated direct contact of pedestrians in the public realm (sidewalk, parks, plazas, etc.) Many suburban and rural contexts do not enable direct interaction because although they may occupy a common space physically, the automobile acts as a buffer to the environment.



Figure 28 : Art show of the Rancho Los Amigos National Rehabilitation Center

Performance Criteria

Performance Measurements:

Brain Injury Rehabilitation hospitals provide medical and rehabilitation inpatient services through a multidisciplinary care team that assesses and delivers the scope and intensity of care determined in collaboration with the patient. The needs of TBI patients depend on their cognitive level, which will determine and compose the care team needed for that specific patient. Patients are dependent upon health care staff for a variety of activities as they transition to improve functionality.

This project will require a variety of different design measurements for analysis. Making sure that all design elements meet the goals of creating an efficient healthcare facility that influence brain recovery methods for patients suffering from TBI. Literature reviews along with analysis of when elements in design are most effective when designing for TBI patients.

Social and environmental impact will also be analyzed to see how they influence the healing process in a positive way. TBI can have a feeling of isolation along with stress caused from their injuries. The feeling of isolation is created because TBI, depending on their injury can not continue doing their daily activities in the normal fashion that they use to, thus being left out or feeling like a burden.

Measurement Sources

I will be using a variety of sources to develop my project and research. These program will include Excel to track space allocation along with what type of healthcare professionals will be needed for this rehabilitation facility. Excel along with classic note taking will be used to record information on the patients this rehabilitation this facility will serve depending on the TBI patients cognitive level, this will also depend on what type of healthcare professionals will be needed. Revit will be used to design the layout and spaces needed for this type of healthcare facility.

Performance Analysis

The goal of this project is to develop a rehabilitation facility that promotes brain recovery in patients suffering from TBI. To calculate and analyze the measurements for the desired criteria, there will be a series of simulations and digital models throughout the length of this project. Simulations of the layout of the facility along with the space and adjacency requirements for each patient's room and walkable distances.

Performance judgement

To judge whether the project meets the performance criteria and is beneficial to the staff and patients within the rehabilitation facility, I will be comparing it to other healthcare rehabilitation facilities. Precedent models will be used to see how their designs have impacted patients within the healthcare environment. Also, looking at how community involvement will impact patients.

Performance Criteria

Space Allocation

Inpatient rooms

Inpatient rooms are typically separated from other areas of the hospital, either on a dedicated floor or separated zone, and may be locked off for patient safety. Overhead lifts are common in these rooms as patients often require mobility assistance, at least initially. Since these rehabilitation patients are typically medically stable, less headwall support infrastructure is required compared to an acute care hospital room. These rooms also must meet FGI standards such as having handwash sinks, windows at eye level, and four feet of clearance minimum around the patient bed. Inpatient rooms are designed with the goal of helping patients to feel comfortable, but it is often difficult to balance with institutional needs for durable cleanable materials and operationally efficient medical equipment such as paper dispensers.

Inpatient Floor support spaces

Along with inpatient rooms, support spaces such as nurse stations, supplies, meds, nourishment, laundry, and soiled utility room are also required. To maximize patient room access to daylight, corridors and support spaces for staff are often located in core areas with little or no access to natural lighting. In these conditions, the use of bright colors in finishes is often used to add visual stimulation, but colors often date an older facility. Where possible, alcoves are often used as places to store wheelchairs and gurneys to avoid equipment sitting in the corridor. Other staff work areas are often enclosed for acoustical reasons, but it may mean there is no access to daylight. Because some patients have severe mobility limitations, additional therapy and family spaces also provide needed support on inpatient floors. Often therapy is done in the rooms or corridors of the inpatient wing, so special attention to the design of these spaces for therapy can enhance the quality of staff and patient experience. As indicated previously spaces for families to live, work, and play may also help influence the ability of family to provide valuable additional support during rehabilitation.

Space Allocation

Physical and Recreational Therapy

Physical therapy and recreation spaces in older inpatient rehabilitation settings are unfortunately often located in hospital interior and/or basement spaces designed for other clinical uses. These spaces often have low ceilings and lack windows and space needed for connection to nature and social support to motivate stressed patients. Physical therapists often use large and heavy specialized equipment to facilitate therapy. Planning for these requires special considerations in terms of structure and clearance. Noise control is needed as the physical therapy space usually accommodates multiple patients and trainers undergoing louder activities.

Special Therapy Spaces

Therapy spaces with special equipment include large and small simulation spaces, pools, and ADL (Activities of Daily Living) spaces which allow for engagement of a variety of real or simulated activities such as residential living, cooking, driving, etc. Aquatic therapy spaces may be larger or smaller spaces with energetic finishes, daylight and views, climate control for year-round use and specialized equipment such as lifts and platforms that provide comfort and mobility assistance to patients. Simulation spaces help patients practice movements such as getting in and out of real cars or even airplane seats, and even art and music spaces that feel more like a lounge than an institutional space. Simulated residential kitchens and laundry spaces allow patients to practice food preparation and laundry with guidance from therapists.

Respite Spaces

Patients with brain injury often report sensitivity to light and noise. Additionally, emotional control may be difficult. Respite spaces for reduced stimulation provide a sanctuary for staff, family, visitors, and patients during a time of stress. They often have connections to nature for positive distraction and stress reduction. Respite spaces should allow for small groups or individuals.

Performance Criteria

Space Allocation

General Public spaces and waiting

Between therapy sessions, patients rest, socialize, or engage in other informal activities until their next scheduled appointment. Returning to the patient room is not generally encouraged, so facilities offer a variety of space types to accommodate in-between times. These spaces often also serve as lobbies and entry atriums where patients can see visitors without going into patient rooms. At Rancho Los Amigos, art installations such as this ten-foot mandala provide a unique type of stimulation. Smaller seating groups are preferred, even if they are within larger spaces. An effective public space might be a space for walking, observing, or sitting to rest.

Clinical Spaces

Clinical offices and meeting spaces accommodate individual and group meetings with a variety of specialists such as psychologists, speech therapists, etc. Clinical assessment spaces with equipment are for measuring various functions such as hearing, vision, or advanced brain imaging. Because of complex requirements related to infrastructure, acoustics, vibration and light control, these spaces are often interior rooms with no windows. However, windows are preferred in these spaces for daylight and views for the benefit of both staff and patients. While larger facilities offer imaging services, those associated with a larger hospital campus control costs by utilizing central campus imaging departments in other facilities.

Dinning

Central dining facilities are often easier for health care providers to maintain than distributed small cafes, so they are a common feature in rehabilitation facilities. There is an opportunity for rehabilitation hospitals to learn from commercial cafes in improving patient and staff satisfaction with varieties of dining settings with distinct attributes of scale, lighting, furnishings, etc.

Space Allocation

Facility Support

Facility Support Spaces are required such as loading dock, building systems spaces, generators, housekeeping, food service, storage, and waste. These are separate from patient and public areas and should be connected via a network of staff corridors and elevators to provide service to all areas of the hospital. These spaces are typically located in basements and roof penthouses, but in flood-prone areas, newer hospitals are locating these spaces on intermediate floors. Areas overlooked by patient areas require screening from view. Large hospital systems may need truck access, or if part of a medical campus, loading for related facilities may be accessed for smaller trucks and vans the work from a central medical campus hub.

Vehicles Access and Parking

Patients arrive at rehabilitation hospitals by ambulance or transportation by caregivers. Main patient entrance areas for public lobbies may be near admissions, or a separate entry can better accommodate ambulance heights and patient gurneys. A separate path to access the patient floor for gurneys should be provided for patient and family arrival. The relationship of a covered drop off to the main entrance is a key adjacency and is necessary for weather protection as many patients require more time and assistance transitioning from vehicles.

Space Allocation Table

Program Summary

TBI Rehabilitation					
Functional Space Program Components					
Area					Area Total
Public / Outpatient Support					4,200
Facility Support					4,908
Therapy and Clinical Support					36,650
Staff Support					4,813
Administration Support					4,813
Patient Care Units					5,067
Green Spaces					2,200
TOTAL NSF					59,823
#	AREA	Qty	NSF/Room	Proposed Total NSF	Area Total
	Public / Outpatient Support				4,200
	Education Conference	1	250	250	
	Patient Registration	3	50	150	
	Coffee Shop / Café	1	400	400	
	Conference / Meeting	2	250	500	
	Reception / Copy / Fax / Printer	2	50	100	
	Waiting	2	300	600	
	Open Lounge / Cubbies	1	200	200	
	Storage / Warming House	1	2,000	2,000	
	Facility Support				4,908
	Information Technology	1	800	800	
	Culinary	1	1,000	1,000	
	Dinning	1	1,500	1,500	
	Environmental Services	1	108	108	
	Mech / Elec / Plumbing	1	1,500	1,500	
	Therapy and Clinical Support				36,650
	Pool	1	600	600	
	Gym	3	1,050	3,150	
	Pharmacy	1	1,000	1,000	
	Outpatient services	8	300	2,400	
	Clinic / Procedures	1	2,500	2,500	
	Imaging	1	8,000	8,000	
	Labs	4	3,000	12,000	
	Inpatient Care Unit	1	7,000	7,000	
	Staff Support				4,813
	Staff Lounge	1	500	500	
	Staff Nourishment Alcove	1	43	43	
	Toilet, Staff	5	54	270	
	Staff Lockers	2	2,000	4,000	
	Administration Support				5,067
	Administration	1	118	118	
	Volunteers	1	65	65	
	Human Resources	1	43	43	
	Research	1	300	300	
	Nursing Education	1	43	43	
	Dieticians	1	118	118	
	Follow-up Services	1	75	75	
	Marketing	1	120	120	
	Patient Care / Support				1,985
	Clean utilities	3	120	360	
	soiled utilities	3	75	225	
	Nurse Workstations	2	400	800	
	Supply / Norish / Equip	2	300	600	
	Green Spaces				2,200
	Therapeutic Gardens				
	Outdoor Therapy Deck	1	1,000	1,000	
	Private Green Areas	2	600	1,200	
	TOTAL NET SQUARE FEET				59,823

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Space Allocation Table

TBI Rehabilitation

Functional Space Program Components - Based on Cognitive Level VI - Level X

AREA	POR Program			Area Total	Comments
	Qty	NSF/Room	Total NSF		
Inpatient Care				6,430	
	Inpatient Rooms	12	300	3,600	Patient rooms, shall provide comfort, privacy, security, therapeutic tools and opportunities to practice daily living
	Nurse Stations	8	50	400	
	Occupational / Physical Therapy	1	500	500	
	Clean Utility	2	120	240	
	Soiled Utility	2	75	150	
	Community / Activity Area	1	600	600	
	Private Green space / Meditation	1	600	600	
	Supply / Nourish / Equip	1	300	300	
	Public Toilet	2	40	40	
Outpatient Care				6,458	
	Exam Rooms	8	150	1,200	
	Staff Workstation	16	50	800	
	Private Gym	1	1,000	1,000	
	Waiting	1	300	300	
	Office Space	5	150	150	
	Support Spaces	2	204	408	
	Pharmacy	1	800	800	
	Private Green space / Meditation	1	1,000	1,000	
	Supply / Equip	1	300	300	
	Family Room	1	500	500	
Community				9,700	
	Gym	1	2,500	2,500	
	Pool	1	600	600	
	Lockers	2	1,000	2,000	
	Open Lounge with Cubbies	1	400	400	
	Reception / check-in	1	200	200	
	Warming House	1	3,000	3,000	
	Gardens	1	1,000	1,000	
				-	
Labs				6,870	
	Think - Speak	1	300	300	
	Arms - Hands	1	300	300	
	Legs - Walking	1	800	800	
	Strength - Endurance	1	800	800	
	Nursing Station	4	50	200	
	Staff Office	4	120	480	
	Research	2	120	240	
	Patient Registration	2	75	150	
	Toilet	4	50	200	
	Storage / Equip	1	400	400	
	Green Space for Labs	1	500	500	
	Therapy Deck	1	800	800	
Dietary				1,700	
	Dishwash / Return	1	300	300	
	Dinning	1	250	250	
	Nutrition Services Storage	1	450	450	
	Cafeteria	1	500	500	
	Serving	1	200	200	
		-	-	0	
TOTAL NET SQUARE FEET				31,158	

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Design Response

Process Documentation

Documentation of all types of research, including case studies, TBI related research and Therapy research will be documented in the proposal portion of this thesis book. By doing this it was easy to look back into the research when starting to make decision on the design process. Also keeping my goals listed in the proposal was extremely beneficial when starting the design process. These goals were formed from my research on case studies, TBI and therapy, they are as listed:



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West Elevation

Community Interaction

Create spaces for community interaction as part of the physical and mental journey.

TBI patients tend to feel isolated because cognitive, physical and social disabilities prevent them from engaging in their pre-injury activities in a normalized way.

Facility will include the community where individuals will learn how to interact with TBI patients, (gym, pool, outdoor activities).

Innovative Rehabilitation

Innovation labs such as think & speak / arms & hands / legs & walking / strength & endurance will create space for TBI patients to recover from their traumas.

Outdoor-based therapy (kayaking, fishing, swimming, ice fishing, hiking, biking, etc..) will help patients connect with nature to increase healing process.

Computer assisted rehabilitation will give patients outdoor experiences in winter months.

Healthcare staff will give patients the opportunity to learn how to work with their disabilities.

Staff Support

Spaces that accommodate staff.

Designated areas for healthcare professionals to evaluate and develop plans for TBI patients.

Space the accommodates the many types of therapy

Connection with Nature

The Facility will create many views of nature with private green spaces that will be only have access within the facility.

Located along Lake Bemidji this facility will be able to use the lake for outdoor-based therapy and activities, and community activities.

Users of the facility will be able to access the Paul Bunyan State Trail that runs through the site. The trail will be used for outdoor therapies.

Connection with nature will help improve mental and physical healing

Accessibility

Due to TBI patients' disabilities all elements in design will need to be accessible

Being able to access all points within the facility will make patients feel more comfortable when moving throughout the facility

Project solution documentation



Traumatic Brain Injury, TBI, is an injury that affects how the brain works. These injuries may impact individuals' behavior, mobility, memory, language, problem solving and empathy. TBI patients also tend to feel isolated because cognitive, physical, and social disabilities prevent them from engaging in their pre-injury activities in a normalized way. Depending on how severe one's injuries may be, one may recover from a traumatic brain injury. However, most will live with permanent effects from their injuries. Recovery at any level may involve years of relearning how to do daily tasks. Throughout a TBI survivor's recovery process, they will need substantial support to learn, live and work with their disability. Healthcare professionals along with community, family and friends can help the survivor regain confidence when returning to the outside world to live and work with their disability.

Through design, innovative rehabilitation methods are combined with connections to nature and community to create a holistic and supportive atmosphere for patients to recover from their traumas in this facility. A focus on overall community health and wellness is also provided to benefit a wider population and create space for interaction between TBI patients and the community to assist in breaking stigmas. TBI survivors, family, friends and the broader community will be able to interact and learn in an environment that encompasses whole body wellness.

Square One Rehabilitation and Wellness Center

The Effects Architecture has on treating TBI



Community Interaction

Create space for community interaction as part of the physical and mental journey. TBI patients tend to feel isolated because cognitive, physical, and social disabilities prevent them from engaging in their pre-injury activities in a normalized way. Facility will include the community, where individuals will learn how to interact with TBI patients, (sign, post, outdoor activities).

Innovative Rehabilitation

Rehabilitation labs such as Think & Speak, Arms & Hands, Legs & Walking, Strength & Endurance will create space for TBI patients to recover from their traumas. Outdoor covered therapy (swimming, climbing, walking, cycling, golf, fishing, biking, etc.) will help patients connect with nature to increase healing process. Computer-assisted simulations will give patients outdoor experiences in indoor rooms. Healthcare staff will give patients the opportunity to learn how to work with their disabilities.

Staff Support

Spaces that accommodate staff. Designated areas for healthcare professionals to evaluate and develop plans for TBI patients. Space that accommodates the many types of therapy.

Connection with Nature

The facility will create many views of nature with private green spaces that are only five acres within the facility. Outdoor along Lake Bemidji this facility will be able to use the lake for outdoor-based therapy and activities, and community activities. Views of the facility will be able to access the Paul Bunyan Statue Trail that runs through the site. The trail will be used for outdoor therapy. Connection with nature will help improve mental and physical health.

Accessibility

Due to TBI patients' disabilities all elements in design will need to be accessible. Being able to access all parts within the facility will make patients feel more comfortable when moving throughout the facility.

Innovative Therapy Labs

- Think and Speak Labs** will work on oral ability to think, reason, perceive, realize, act, talk and interact with others.
- Arms and Hands** will work on recovering and strengthening complex hand skills used in working, heavy picking up or moving, putting on or removing.
- Legs and Walking** will focus on advanced trunk, pelvic, and leg function along with movement and balance.
- Strength and endurance** will focus on high level activities of daily living such as walking, climbing, gardening and sports.

Outdoor Therapy Area

Great program building, Bridge Pavilion and Boat dock to eat, relax and look. Also a view of the area including water for fishing, and much. It is used to reduce pain, especially when walking long distances and from all work. Many colors are used for people to feel more relaxed and comfortable.

USER GROUP
TBI Survivors, family members and the community

This facility will serve cognitive TBI levels: W (Confused), Appropriate, Moderate Assistance (A), X (Purposeful), Appropriate, Modified Independent (I).

Level 1: Confused, Appropriate, Moderate Assistance
Users require constant supervision and assistance. They are unable to perform any self-care activities. They are unable to walk without assistance. They are unable to communicate. They are unable to understand. They are unable to follow directions. They are unable to recognize people. They are unable to recognize objects. They are unable to recognize colors. They are unable to recognize shapes. They are unable to recognize sizes. They are unable to recognize textures. They are unable to recognize smells. They are unable to recognize tastes. They are unable to recognize sounds. They are unable to recognize lights. They are unable to recognize shadows. They are unable to recognize reflections. They are unable to recognize refractions. They are unable to recognize diffractions. They are unable to recognize polarizations. They are unable to recognize interferences. They are unable to recognize diffractions. They are unable to recognize polarizations. They are unable to recognize interferences.

Level 2: Purposeful, Appropriate, Modified Independent
Users require minimal supervision and assistance. They are able to perform self-care activities. They are able to walk with assistance. They are able to communicate. They are able to understand. They are able to follow directions. They are able to recognize people. They are able to recognize objects. They are able to recognize colors. They are able to recognize shapes. They are able to recognize sizes. They are able to recognize textures. They are able to recognize smells. They are able to recognize tastes. They are able to recognize sounds. They are able to recognize lights. They are able to recognize shadows. They are able to recognize reflections. They are able to recognize refractions. They are able to recognize diffractions. They are able to recognize polarizations. They are able to recognize interferences.

Accessibility

All program rooms and along the north side of the building, outdoor views of Lake Bemidji, natural outdoor, and outdoor program spaces, provide health and wellness opportunities.

Users require minimal supervision and assistance. They are able to perform self-care activities. They are able to walk with assistance. They are able to communicate. They are able to understand. They are able to follow directions. They are able to recognize people. They are able to recognize objects. They are able to recognize colors. They are able to recognize shapes. They are able to recognize sizes. They are able to recognize textures. They are able to recognize smells. They are able to recognize tastes. They are able to recognize sounds. They are able to recognize lights. They are able to recognize shadows. They are able to recognize reflections. They are able to recognize refractions. They are able to recognize diffractions. They are able to recognize polarizations. They are able to recognize interferences.

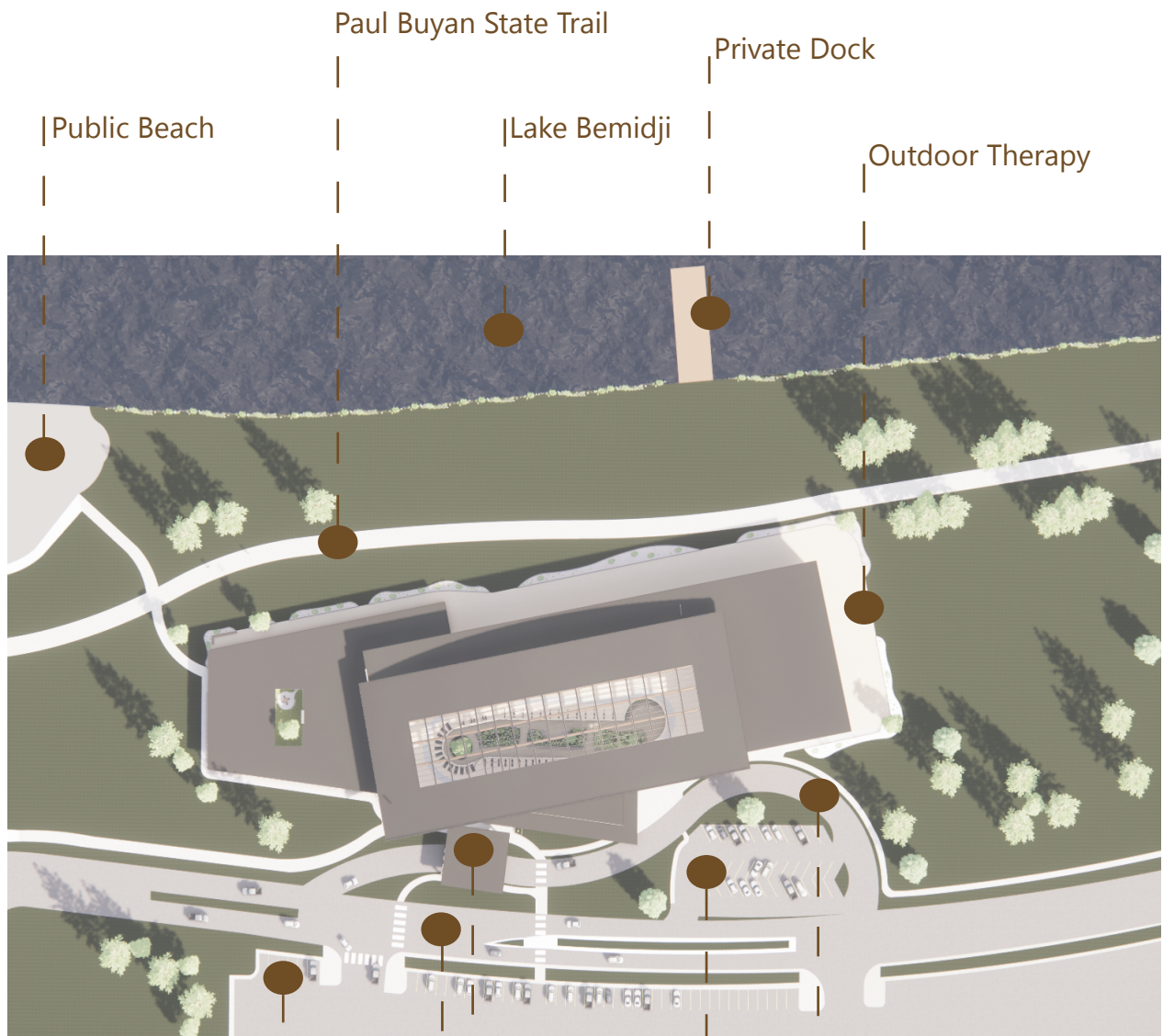
Location: Bemidji, Minnesota

Lake Shore Dr NE
South Shore Park - Nymore Beach

The site chosen for this thesis is located on the south end of Lake Bemidji in Minnesota. Locating this facility along the lake will provide multiple views of nature along with having access to outdoor-based therapies. These outdoor therapies will include fishing, kayaking, biking, hiking along with winter activities such as snowshoeing, cross-country skiing, and ice fishing. Keeping this facility within Bemidji will benefit patients, and the community when traveling to the facility.

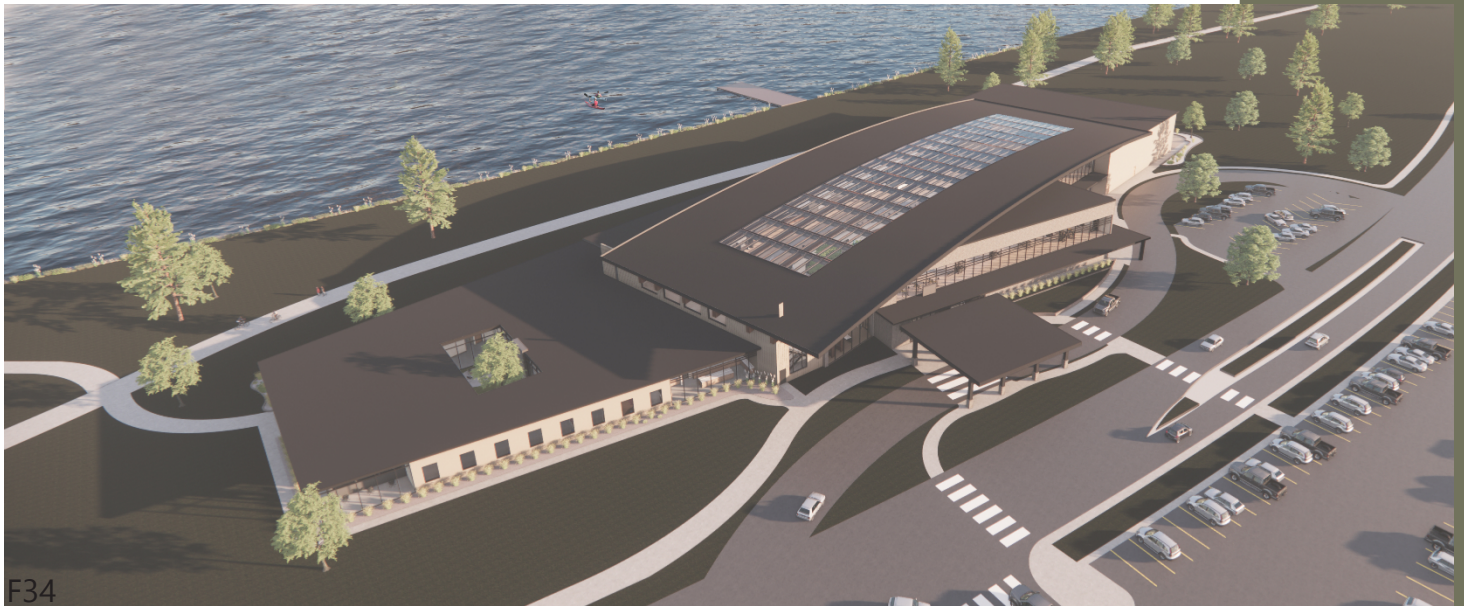
Performance Analysis - Site

The site chosen for this thesis is located on the south end of Lake Bemidji in Minnesota. Locating this facility along the lake will provide multiple views of nature along with having easy access to outdoors therapy. These outdoor therapies will include fishing, kayaking, biking along with winter actives such as snow showing, cross country skiing and ice fishing. Keeping this facility within Bemidji will benefit patients, and the community with traveling to and from the facility.

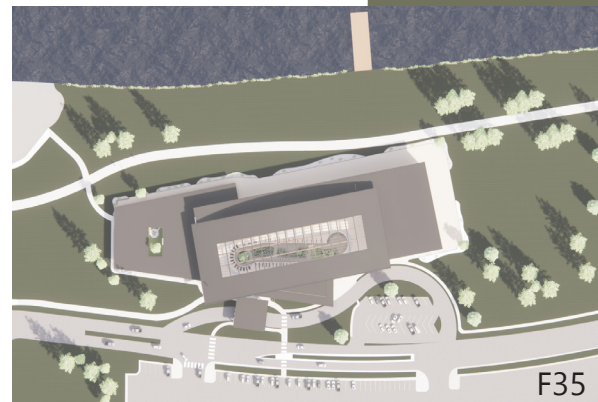


Performance Analysis - Site

Locating this facility in Bemidji will encourage community involvement by being the only community wellness center in the Bemidji area. The Site will have access to all outdoor based therapies, whether they are summer or winter-based activities. All the outdoor therapies, connection to the lake and Paul Bunyan trail will be great connections to nature. The outdoor therapy deck will be accessible for everyone in the facility. Not all patients may be able to enjoy all of the outdoor features due to accessibility. This therapy deck will ensure that all patients will be able to enjoy the outdoors.



The proposed site plan would include the addition of a rehabilitation and wellness center. Surrounding the south and east sides of the center would be an outdoor therapy deck, which will be used for meditation, gathering space, and light therapy excises. Users of the facility will have easy access to the Paul Bunyan State Trail which is just north of the center. The Main entrance, patient parking, existing parking and the main road into the facility will all be to the south.



Performance Analysis - Site



Locating this facility in Bemidji will allow easy access when traveling to and from the facility for the community.



Being located along Lake Bemidji this facility will have access to all outdoor therapies. This therapy deck will include activities such as meditation, social interaction, and light therapy exercises.



Nurses' locker and lounge will have independent access when going outdoors onto the therapy deck, or when heading down to the lake.



The site chosen will give the facility endless opportunities when accessing the outdoors.



With including the therapy deck it will insure that ill users of the facility will have access to the outdoors.



E36

Performance Analysis

Research through case studies form my project goals for this thesis project. The Shirley Ryan ability lab, formerly the Rehabilitation institute of Chicago, is a physical medicine and rehabilitation research hospital. What I took from this precedent is the centers approach to innovative rehabilitation methods. Integrating research into the clinical setting is just one of the innovations that sets the Shirley Ryan ability lab apart from any other rehabilitation facility. At this facility they have different types of ability labs that each focus on specific functional outcomes. With being an interdisciplinary team, this provides full range of therapeutic services and develop new research-based insights to help patients gain function, achieve better outcomes, and enjoy greater independence.



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Innovative Therapy Labs

Think and Speak - will work on one's ability to think, reason, perceive, swallow, eat, talk and interact with others

Arms and Hands - will work on recovering and strengthening complex hand skills such as turning a key, picking up a pen, putting on a sweater.

Legs and Walking - will focus on advanced trunk, pelvic and leg function along with movement and balance.

Strength and Endurance - will focus on high level activities of daily living such as cooking, dressing, gardening and sports.

Performance Analysis

Basel rehabilitation in Switzerland focuses on designing a multifunctional, diversified building, almost like a small town with streets, plazas, gardens, public facilities, and more secluded residential quarters where people take different paths to move from A to B. The diversified design of this building has achieved places where one can retreat and be alone, and others in which to enjoy company. There are also places not assigned to a specific function, small spaces for the times in-between treatments, for conversations with a relative, or for staff members during their breaks.



Community space in clinic. This space will be used for family members, or healthcare professionals to interact with patients upside of the patients room

There will be a large atrium that break up the administration zone from the therapy zone. This area will provide a sense of balance architecturally and psychologically. Every user of this facility will be able to interact with this green space. Seating areas will be incorporated into its design, to make this space an area of relaxation and social interaction.



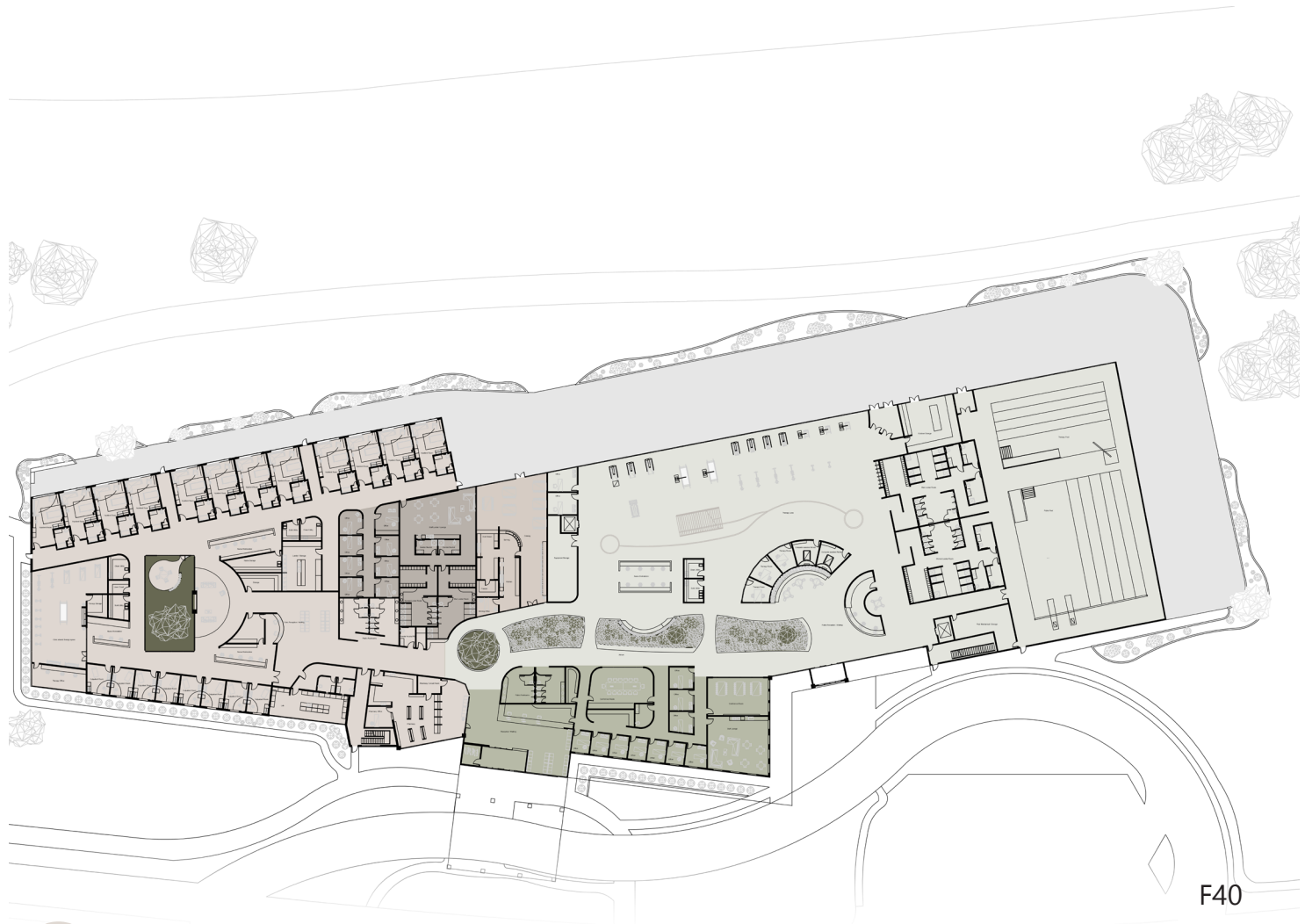
F38

Performance Analysis

Through research I have formed goals to base my design response off of. Community interaction goals would include creating spaces for community interaction as part of the physical and mental journey. TBI patients tend to feel isolated because cognitive, physical, and social disabilities prevent them from engaging in their pre-injury activities in a normalized way. By bringing in the community individual will learn how to interact with TBI patients, some of these spaces of interaction will include a wellness center, pool, and outdoor based activities. Innovative rehabilitation will include innovative therapy labs such as think & speak / arms & hands / Legs and walking / strength and endurance along with outdoor based therapy's. Computer assisted rehabilitation will give patients outdoor experiences in the winter months. Healthcare staff will give patients the opportunity to learn how to work with their disabilities. Staff Support will be all about creating spaces the accommodate staff and the many types of therapy. These spaces will include designated areas for healthcare professionals to evaluate and develop plans for TBI patients. Connection with nature, being located along Lake Bemidji in Minnesota this facility will be able to use the lake for outdoor based therapy and activities along with community activities. The facility will create many views of nature with private green spaces that will only be accessed within the facility. Overall, the connection with nature will help improve mental the physical healing. Accessibility will be crucial, due to tbi patients' disabilities all elements in design will need to be accessible. Being able to access all points within the facility will make patients feel more comfortable with moving throughout the facility.



Performance Analysis



- Clinic Zone
- Nurse Zone
- Therapy Zone
- Administration Zone

Performance Analysis

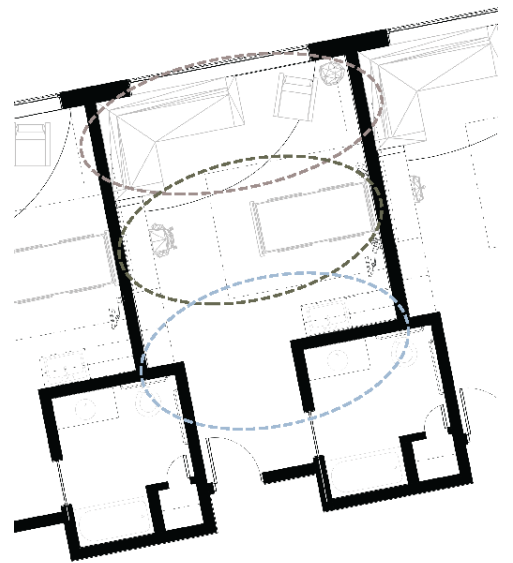


The clinic will have inpatient and outpatient room, along with shared therapy spaces for TBI survivors to support each other in their recovery process. The clinic zone will also have lab, pharmacy and dining survives, along with community areas. Another part of the clinic would include healthcare professionals' office space and staff locker and lounge.

Performance Analysis



There will be 12 inpatient rooms that run along the north side of the clinic. These rooms will be used for patients to come for short to long periods of time depending on their injury's recovery process. It was important in the design that all room have views of nature. These rooms will all have views of Lake Bemidji, provided by large windows that will have natural ventilation. The use of natural material in patient rooms will improve the well-being an expedite healing. All inpatient rooms will be divided into three different zones, a family / visitor zone where there will be comfortable seating for guests, patient zone, and a nurse zone for staff at the entrance of the room. This will foster efficiency in performing their task, while providing the least impact on occupants.



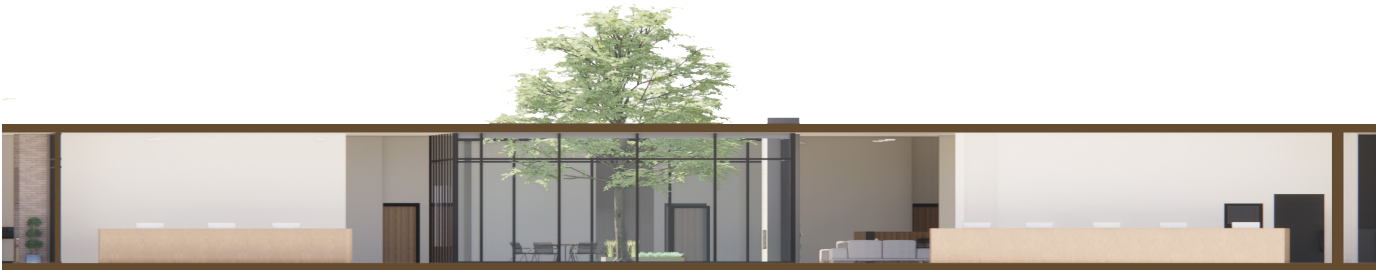
Performance Analysis

The community area within the clinic will have indoor and outdoor access. The space will give patients, family, friends, and healthcare professionals a relaxing and comfortable area to interact with their loved ones or patients outside of the patients' room. During summer months users will be able to use the green area, but during winter month the indoor area will have warm comfort with this area surrounding a fireplace.



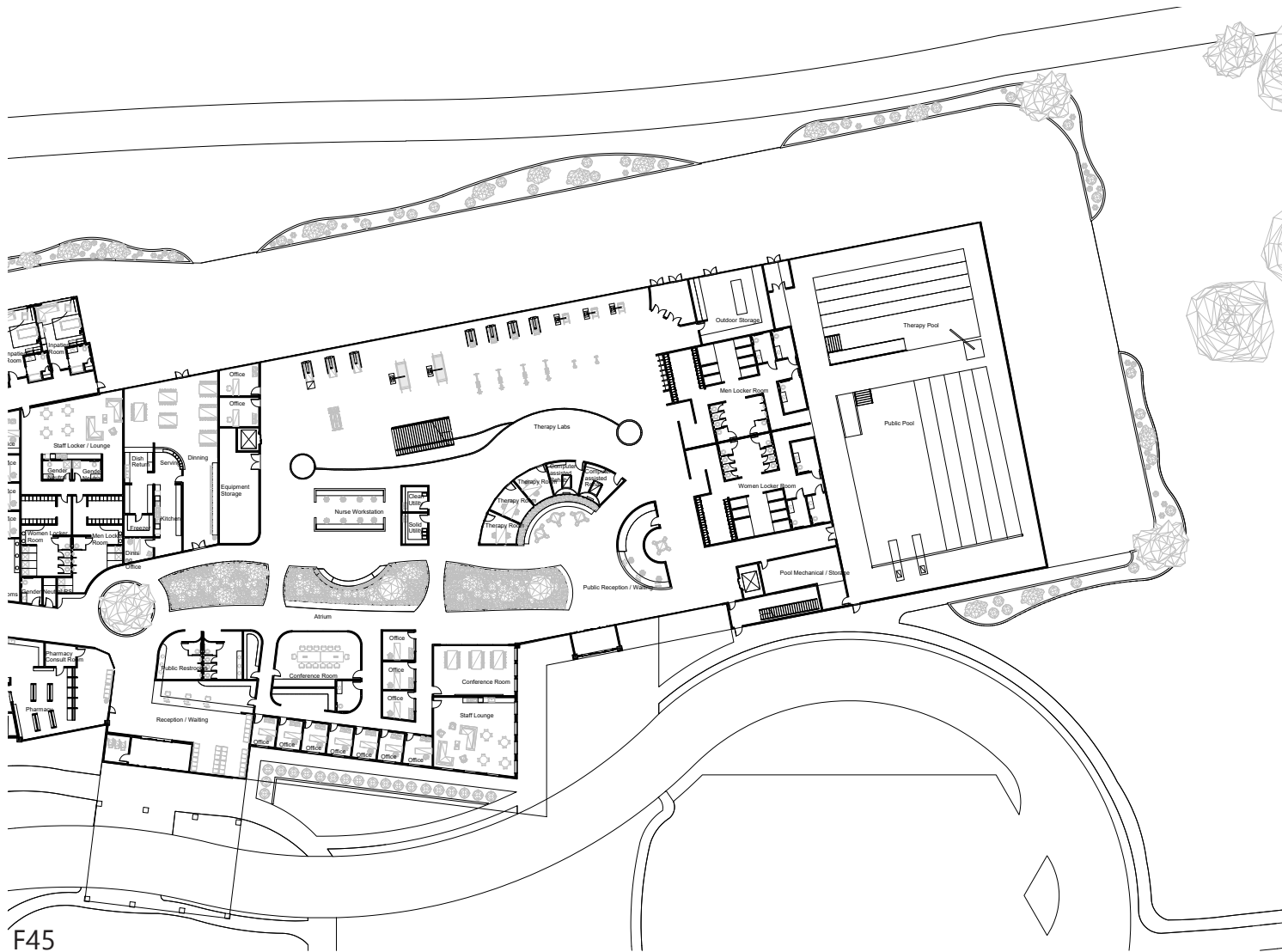
F43

Performance Analysis



Nurse workstation will be located along the inpatient and outpatient corridors. These spaces will surround the community green area, giving them natural light and views of nature. It is also important in this design that not only the health of patients and community are considered but also that healthcare professionals are given the same design response when designing for the health and wellbeing of the staff. Staff locker and lounge will have views of the lake, and healthcare office spaces will have diffused natural lighting from the community area and windows at the end of corridors.

Performance Analysis



Administration and office spaces will include conference rooms, education conference, staff lounge and office space. All spaces within the administration zone will have views of nature, whether through an office window or into the large atrium space the runs along the north side of the administration zone. This area is also where public reception and locker rooms will be located. Locker rooms will have changing areas, showers, and restrooms. There will be private changing rooms for individual if they choose to use those but will mainly serve those who need help getting ready for therapy or wellness center exercises.

Performance Analysis



F46

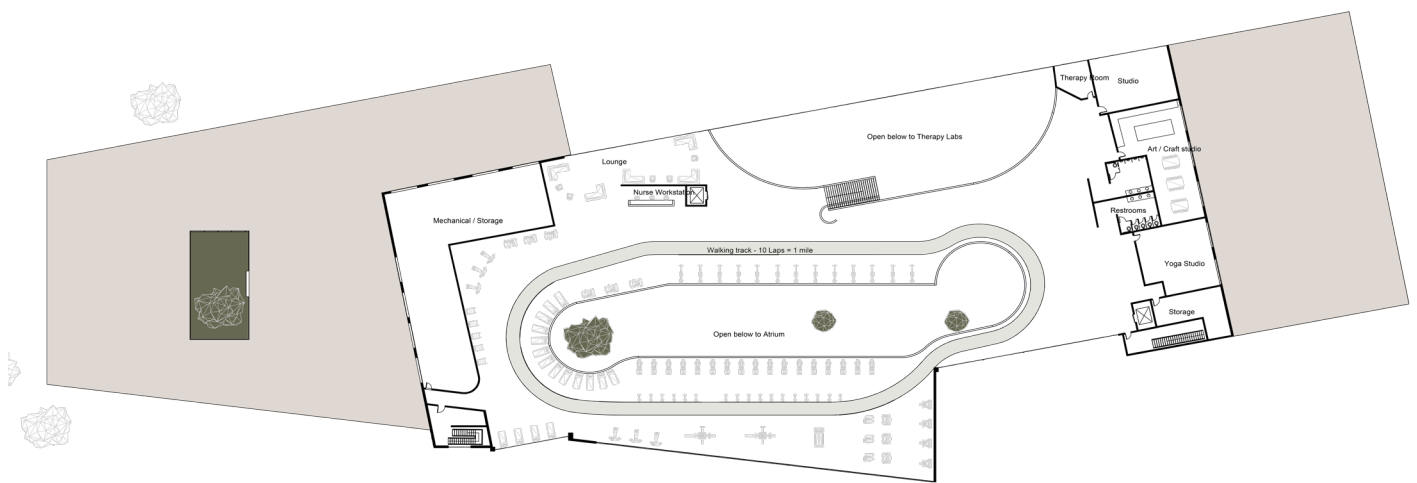
Innovative therapy labs will include think& speak, arms & hands, legs & walking, strength & endurance. Think and speak labs will work on one's ability to think reason, perceive, swallow, eat, talk, and interact with others. Arms and hands will work on recovering and strengthening complex hand skills such as turning a key, picking up a pen, and putting on a sweater. Legs and walking will focus on advancing truck, pelvic and leg function along with movement and balance. Strength and endurance will focus on high levels of daily living such as cooking, dressing, gardening, and sports. These labs will be broken up from large open therapy areas to small individual therapy rooms where healthcare professionals will be able to work one on one with patients in a controlled area. Nurse workstations will be located along the atrium to the north.

Performance Analysis



There will be a large atrium that break up the administration zone from the therapy zone. This area will provide a sense of balance architecturally and psychologically. Every user of this facility will be able to interact with this green space. Seating areas will be incorporated into its design, to make this space an area of relaxation and social interaction.

Performance Analysis



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Second floor will be the main community wellness area along with break out space for workout classes and an arts and crafts studio. This floor will have a nurse workstation due to patients who will come to the facility for appointment or individuals who will need extra support when working out. The nurse workstation is right next to the second-floor lounge area, where people will be able to rest before and after workouts.

Performance Analysis



F49

The second floor will overlook the atrium area along with the first-floor open gym space. One cool feature about the indoor wellness center is that there is a walking track that flows around the open atrium space. The curvature of the track is to influence the idea of an outdoor walking trail instead of a fundamental oval walking track, intensifying the idea of being outdoors. Another factor to design, enhancing the feeling of being outdoors would be the skylight that flows over the atrium space.

Performance Analysis



North Elevation



West Elevation



South Elevation



F50

East Elevation

Exterior elevations show the curvature of the skylight roof, and the length of the building. The building is designed so that there are as many views of the lake as possible. As stated earlier inpatient rooms will all have views of the lake, but along with inpatient room, the open therapy space, pool area, dining and staff locker and lounge will have views of the lake.

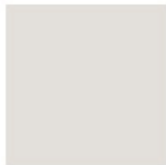
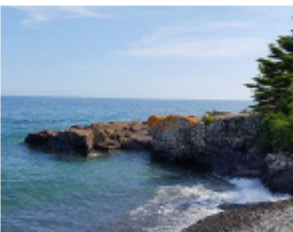
Performance Analysis



Idaho Drystack



Minnesota Fieldstone - Huron



The use of Natural material, looking into biophilic design has been found to support cognitive function, physical health and psychological well – being. According to an article written by SAO architects blue is one of the most calming colors for healing and such, it is used to relieve pain. Green is also used to promote healing; the color green brings



F51

Native MN Grass



Blue Stem Grass

Critique of applied research

The methods of research used in helping the design arrive at a solution were:

Case Studies

- Cases studies helped design a solution for this project by understanding examples of executed solutions for the project similar to the one created in this thesis. By doing this I got a clear picture of the pros and cons of the designs that influenced how I designed my rehabilitation center.

TBI Research

- Stories
 - Diving deep into survivors' stories gave me a better understanding on the behavior and challenges TBI survivors will face
- Cognitive levels
 - Understanding the cognitive level of TBI patients determined the healthcare professionals that will be needed to support patients.

Therapy Research

- Outdoor based therapy

A study cited by psychology today found that outdoor treatment programs were more effective than alternative treatment. Research suggests that for certain patients' outdoor treatment can have a positive impact on a person's recovery process and overall wellbeing. These therapies may include beach therapy which is nature therapy that takes place on or near the water. Horticulture and gardening therapy will encourage patients to interact or tend to plant life as a part of their therapy. Recreational therapy will involve organized outdoor activities or sports. Nature meditation, which is more holistic for of outdoor therapy that centers around mindfulness strategies in a natural setting. Adventure therapy is one talked about in the article but doesn't portray to this project and that is treatment that revolves around a long trip or outdoor expedition.

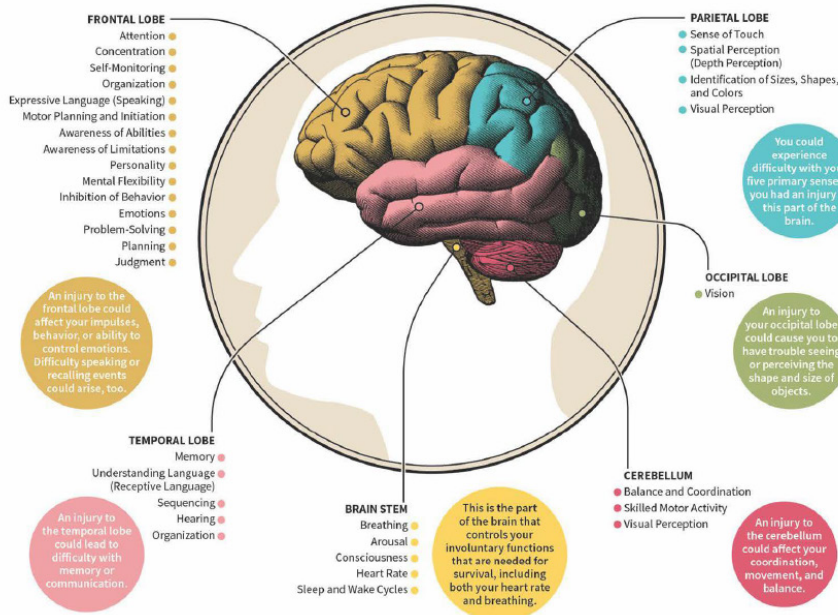
The Effects Architecture has on treating TBI (Traumatic Brain Injury)

Emma Dietrich

In what ways can architecture create atmospheres that promote brain recovery for patients suffering from TBI?

Digital Presentation

TBI Research



GLENROSE REHABILITATION HOSPITAL

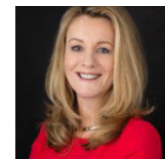
What Happens When You Get a Brain Injury in Different Areas?
 SmartAdvocate®. "What Happens When You Get a Brain Injury in Different Areas of Your Brain?" Accessed December 11, 2020.
<https://www.smartadvocate.com/News/Blog/what-happens-when-you-get-a-braininjury>.

USERS

USER GROUP
 TBI Survivors, Community, Family

- Level VI - Confused, Appropriate: Moderate Assistance
- Level VII - Automatic, Appropriate: Minimal Assistance for Daily Living Skills
- Level VIII - Purposeful, Appropriate: Stand-By Assistance
- Level IX - Purposeful, Appropriate: Stand-By Assistance on Request
- Level X - Purposeful, Appropriate: Modified Independent

Original Rancho Los Amigos Cognitive Scale co-authored by Chris Hagan, Ph.D., Denise Melham, M.A., Patricia Durham, M.A., Rancho Los Amigos Hospital, 1972. Revised 11/15/74 by Denise Melham, M.A., and Kathryn Swenson, O.T.R.



Shan was crossing a road when a car hit her and left her with a 6% chance of survival.



At 11 years old, Joshua was involved in a major bike accident and was told he would never walk or talk again.



At 17, Megan was the victim of a serious road traffic collision.



In 2015, David suffered from a TBI when a car collided with his bicycle.

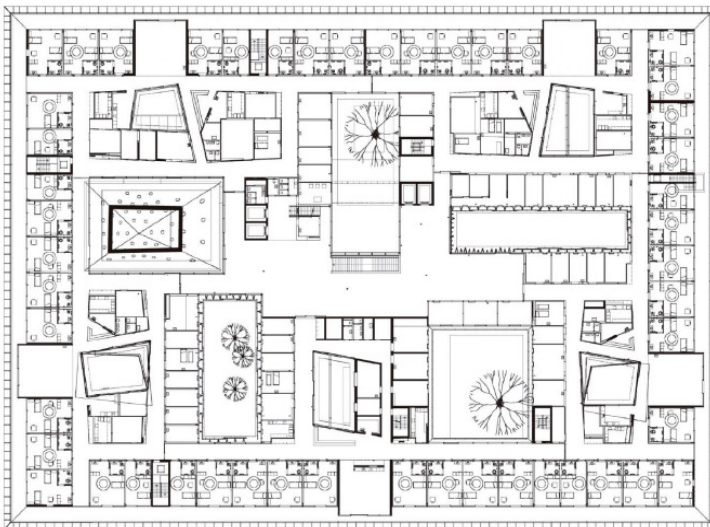
SURVIVORS STORIES

Digital Presentation

TBI Research

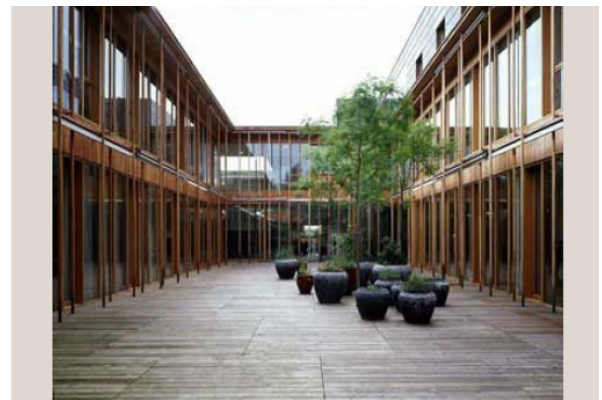


TBI Research



Planta primera First floor plan

Shirley Ryan Ability Lab



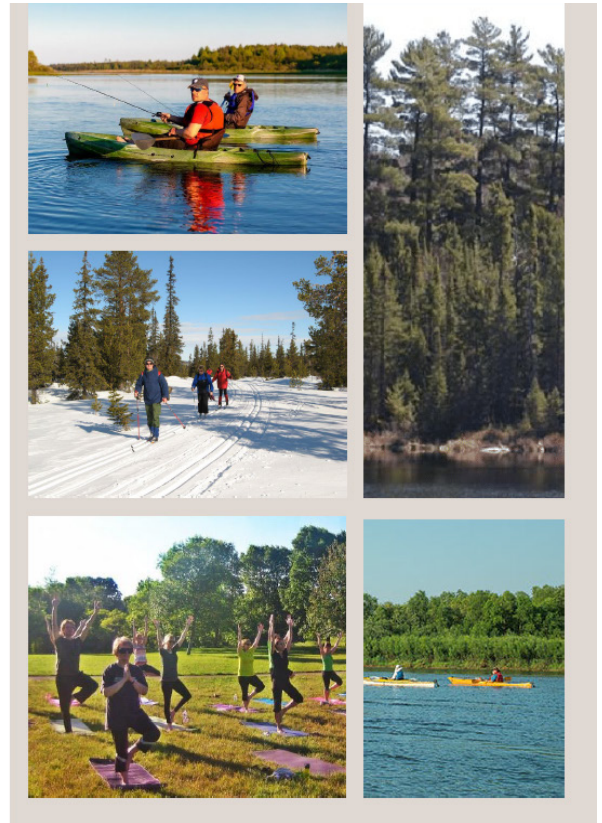
BASEL REHABILITATION

<https://aniprcturawh.com/works/centro-de-rehabilitacion-rehab-basel-10>

Digital Presentation

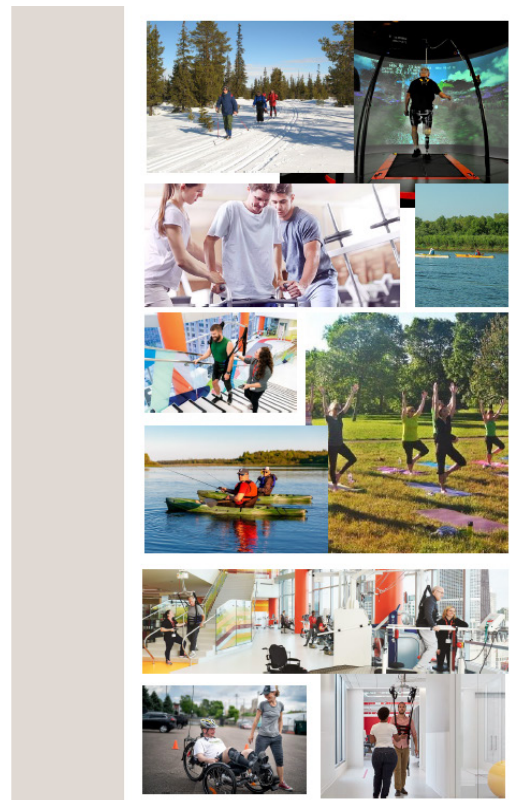
OUTDOOR BASED THERAPY

Beach Therapy
Horticulture / Gardening Therapy
Recreational Therapy
Nature Meditation
Adventure Therapy



RESEARCH / GOALS

-  Community Interaction
-  Innovative Rehabilitation
-  Staff Support
-  Connection with Nature
-  Accessibility



Digital Presentation

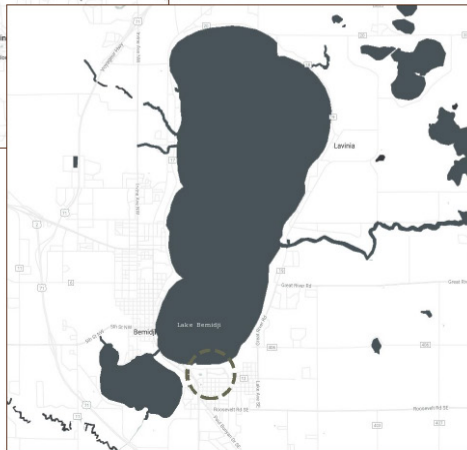
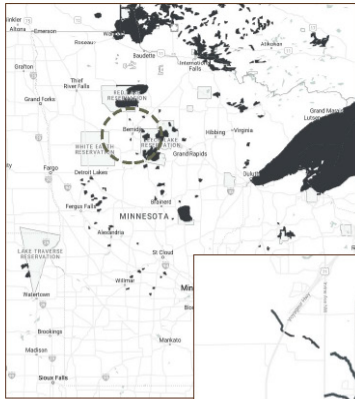


Design Response

Through design, innovative rehabilitation methods are combined with connections to nature and community to create a holistic and supportive atmosphere for patients to recover from their traumas in this facility. A focus on overall community health and wellness is also provided to benefit a wider population and create space for interaction between TBI patients and the community to assist in breaking stigmas. TBI survivors, family, friends and the broader community will be able to interact and learn in an environment that encompasses whole body wellness.

Digital Presentation

SITE LOCATION



SITE LOCATION



- Private Dock
- Lake Bemidji
- Paul Bunyan State Trail
- Outdoor Therapy Deck
- Rehabilitation and Wellness Center
- Main Entrance - covered
- Patient Parking
- Lake Shore Dr NE
- Existing Parking

Digital Presentation

SITE LOCATION - bird-eye view



FIRST FLOOR PLAN

- Clinic Zone
- Nurse Zone
- Therapy Zone
- Administration Zone

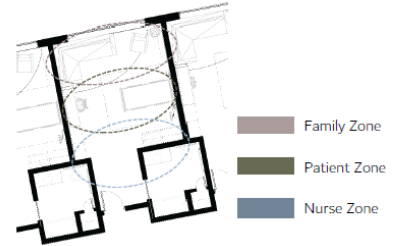


Digital Presentation



INPATIENT ROOM

Digital Presentation



INPATIENT ROOM



COMMUNITY AREA



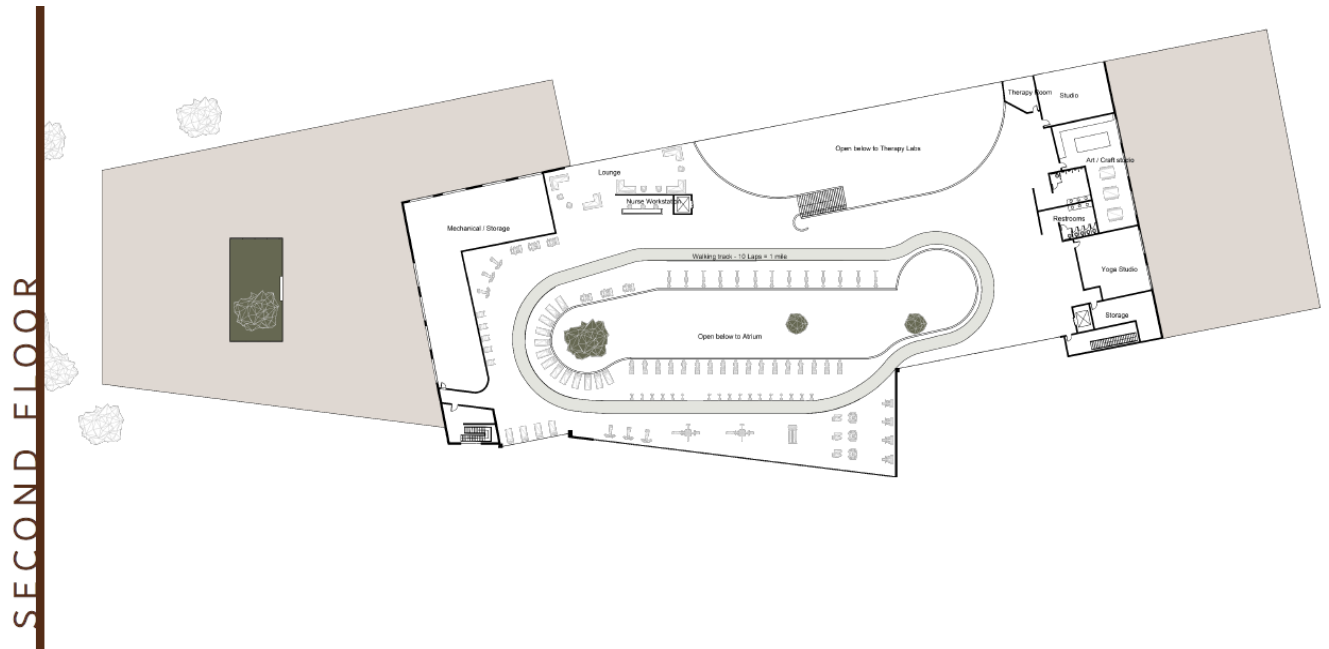
NURSE WORKSTAT



Digital Presentation

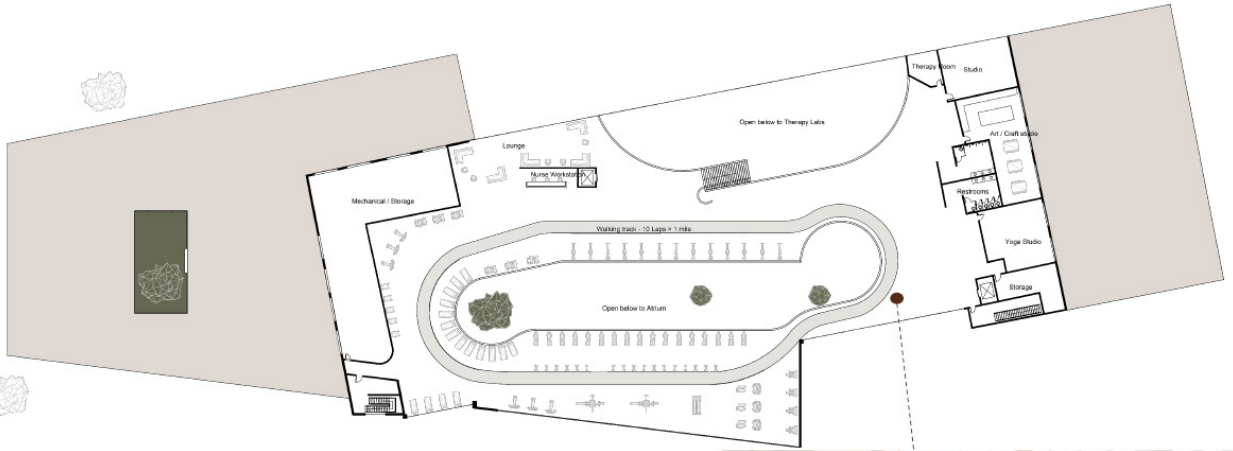


Digital Presentation

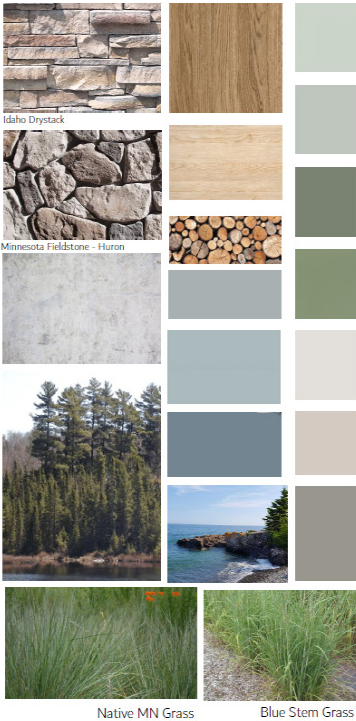


Digital Presentation

Second Floor



Materials / Elevations



North Elevation



West Elevation



South Elevation



East Elevation

Digital Presentation



SquareOne Rehabilitation and Wellness Center



THANK YOU



Digital Presentation



BOARDS

Installation Public Exhibition



Thesis Appendix

Appendix

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Studio Experience

2nd Year

Term:	Fall 2018	Spring 2019
Professor:	Milton Yergens	Amar Hussein
Projects	Meditaiton House Boat House	Dwelling Mised Use Housing

3rd Year

Term:	Fall 2019	Spring 2020
Professor:	Paul Gleye	Niloufar Alenjery
Projects:	Visitation Center Student Mixed Use	Concrete Music Retreat Office Building Steel

4th Year

Term:	Fall 2020	Spring 2021
Professor:	Cindy Urness	David Crutchfield
Projects:	Capstone High-rise	Marvin Windows Urban Redesign

5th Year

Term:	Fall 2021	Spring 2022
Professor:	Bark Aly Ahmed	Jennifer Brandel
Projects:	Community Wellness Center	Thesis