

NAVIGATION THROUGH SPACE
DESIGNING A RECREATIONAL CENTER WITH THE PRINCIPLE OF NEUROSCIENCE

A Thesis

Submitted to the

Faculty of Miami University

In partial fulfillment of

The requirements for the degree of

Master of Architecture

Department of Architecture and Interior Design

By

Fateme shahiyani Bidgoli

Miami University

Oxford, Ohio

2023

Advisor: _____
Mary Ben Bonham

Reader: _____
Diane Fellows

Table of Content:

Abstract 3

Introduction4

Literature Review8

Precedents16

Research Methodology24

Contribution and Significance29

Context30

Program31

Appendix32

Bibliography53

[1] Abstract

Neuroscience is a field that explores the nervous system, while NeuroArchitecture is a relatively new branch that examines how environments and places impact our physiological responses. Our neural responses to our surroundings ultimately affect our behavior, and a rich environment can cause physical changes in the growing brain. One area where neuroscience and architecture can interact is spatial navigation. Although many articles discuss the benefits of incorporating neuroscience into architecture and the importance of spatial navigation, they do not sufficiently address the issue of designing particular circulation and navigation within a specific building type based on neuroscience and how it can impact users' brains and well-being. (Richard Jedon, R 2019)

Understanding how we navigate and respond to different environments and how other elements can impact our memory and feelings about those environments is crucial. Navigation directly impacts our sense of belonging and safety in space. Therefore, paying attention to the design of circulation in buildings and incorporating visible and invisible elements that impact navigation can enhance human well-being. (Djebbara, Z, Jensena, O, Paradac, F and Gramann, K, 2022)

This thesis aims to explore how the design of recreation centers can improve mental and physical health by incorporating best practices from neuroscience literature and conducting user surveys to better understand daily use and memorable spatial experiences. Recreation centers are leaders in improving overall health and wellness and can be structured to boost attention and minimize user stress. A work atmosphere encouraging independence can benefit performance, creativity, and collaboration.

The central concern of this thesis is the extent to which navigation in a recreational center influences the human brain and enhances well-being, using an approach grounded in neuroscience. The analysis of case studies of recreation centers will provide best practices that will be applied in the design of a hypothetical recreation center. By investigating how neuroscience can inform the design of recreational spaces, this thesis will contribute to a better understanding of the relationship between architecture and the human brain.

So according to the above, the main question is How can the design of outdoor and indoor spaces in a recreational center be optimized to promote physical activity, social interaction, and mental well-being, while utilizing neuroscience with the implementation of specific navigation?

Therefore, in this regard, the goal of this design is by understanding brain activity related to navigation through neuroscience Design a Rec Center with Specific circulation and navigation that guide people to go through the building (both inside and outside) and Engage their brain and body with spaces and events happening in the site with Paying attention to what directly and indirectly will impact on the both mental and physical health of users to provide them a good feeling and well-being.

Keywords: architecture, navigation, environmental psychology, neuroscience, space, movement behavior, well-being, feeling, brain, memory, attention, sense of belonging

[2] Introduction



Fig 01

In today's world of architecture and psychology, the effects of the environment and the world around humans on how they perceive and interact with the environment are also examined on a micro and macro scale because the impact of these spaces on humans is one of the most important. And is the essential dimension that is considered in the design of the environment and architectural spaces. Architect Sarah Goldhagan point out that “Humans need to obtain information from their surroundings to communicate and interact with the environment.” Further, she argues that “Humans are the source of architectural formation, and attention and their needs are essential principles in the design of buildings and various urban spaces.” Architects, considering these needs, consider the physical and psychological dimensions of users.

Our environment is full of information and stimuli that humans are always considered as recipients of this information and also as part of the environment. In the building blocks of architectural spaces and urban environments in today's world, architects and designers are looking for factors to design artificial spaces with qualities full of peace and comfort for space users. The quality of physical environments has significant effects on people's mental health. To this end, architects and designers, to establish a proper relationship between users and their surroundings, need to know how the elements of spaces affect humans. Also, designers today seek a better understanding of the interaction between users and architectural spaces than with conscious designs, according to the needs and requests of users, design spaces full of peace and joy for them.

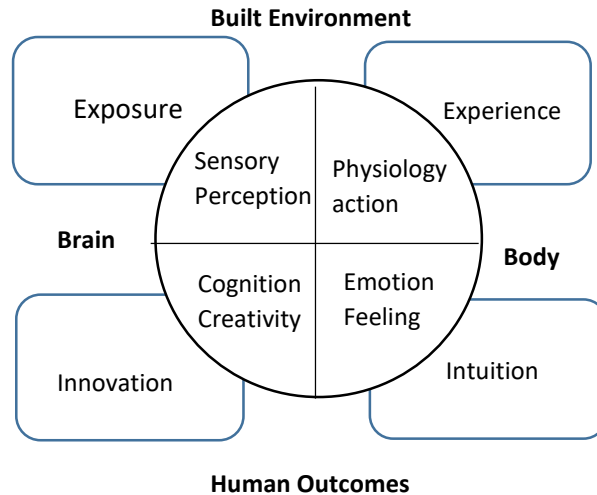


Fig 02: The Neuro Architectural process related all interaction between the brain, body, and buildings. credit: Mona Shoghi

Today, we are witnessing significant advances in the design of various buildings around the world and indeed throughout the design industry. But at the same time, not much attention is paid to Recreation Centers. Like other Building sports spaces certainly face various problems that need to be investigated and are generally ignored.

With the increasing age of the world's population, as well as the reduction of working hours and finding more time as leisure than in the past, and at the same time increasing the level of stress and anxiety among people, the need for Recreation centers to get away from real life problems increases. The reason why people pay more attention to physical health and especially its physical beauty is felt more than in the past. A good sports environment can have as much of an impact on a person's health as a hospitals and well-being centers. Therefore, using neuroscience as new science in designing a Recreation centers can be a good answer to many of its problems and have amazing effects. Especially since Recreation Center is a space that is used by a wide range of people. Therefore, it is important to consider how we should design a space that is useful for all different spectrums according to neuroscience and environmental psychology.

In recent years, neuroscience research has had a substantial and positive impact on sports psychology study. The use of brain imaging and motor cognition aids in raising knowledge of exercise psychology and the effect of locations where such activities occur, such as Recreational Centers.

"Human nervous and perceptual systems are responsible for establishing communication between humans and the environment" (Barati, Soleimani 1390). The environment affects the human mind through the human senses. This information and data are received through the sensory organs and transmitted to the brain for processing. After receiving information and stimuli from the brain, hormones are secreted in the body. They each evoke moods, feelings, and behaviors.

As Fredy Gage have mentioned on his book called architecture an neuroscience, Users of architectural spaces also know their surroundings through the features that exist in them, such as form, color, proportions, geometry, etc. The surrounding environments are full of visual stimuli; the visual receptors receive information. And they were transmitted to the nervous system. These perceptions are feelings, and what the atmosphere turns into semantic information is also called the perception of the domain.

Devices and equipment such as magnetic resonance imaging (fMRI), electroencephalograph (EEG), eye saccade and other instruments have made it possible to assess human conditions in different spatial situations and to accurately pay the most attention when placed inside and Outside a place, it focuses on observing and identifying which areas of the brain are activated by shapes, spaces, colors, and textures. By using interactive systems developed, we can shape ourselves or adapt to the mental frameworks and physical-psychological conditions of the user. This is necessary because we do not even know many of the things and forces that affect us more than others that we have not paid any attention to in our daily lives. In any case, they exist and affect us (Reda, 2011)

For instance, in one study, called "Identification of neural correlations," images of the modified environment through fMRI have tried to investigate the impact of the environment on human health. For doing this study, they have tried to show a horror film to 16 people without mental problems. Then showed images of environments with maximum use of nature and photos of other places with minimal use of nature during a five-minute time and started recording and evaluating the amount of stress using fMRI (Fig 03). Then, the areas in the brain that were activated during the display of each image were recorded (Fig 04 and 05).

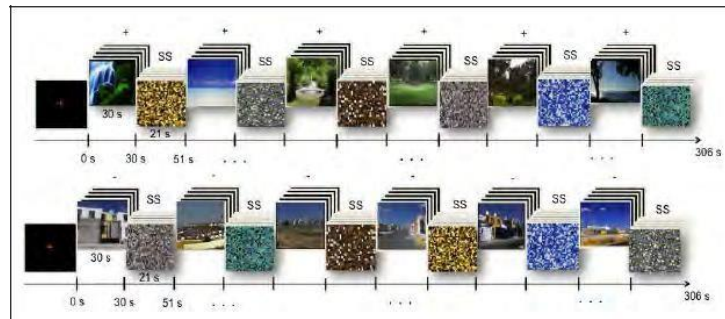


Fig 03: Images of natural and artificial environments displayed in the fMRI section (Martínez-Soto, 2012)

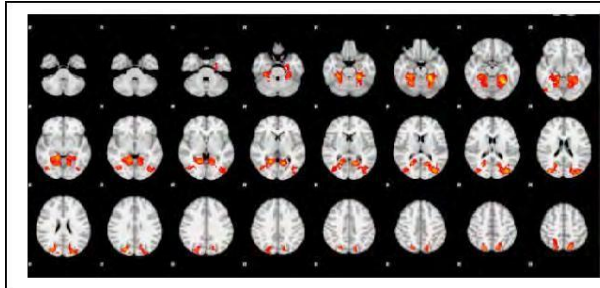


Fig 04: Activated brain areas by displaying the environment with a low nature

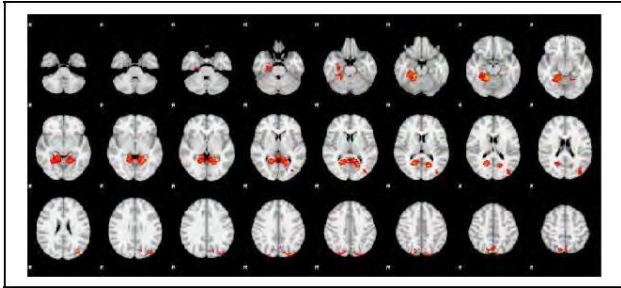


Fig 05: Activated brain areas by displaying a lot of nature environment

Visual processing areas of the brain, such as B19 / BA18 areas, show activity when contrasting emotional and neutral conditions are used. The results show increased visual attention for the more excellent perception of repetitive features. This area of the brain is activated while seeing images of nature. The folds of the folded part of the brain become most active when images of high-altitude landscapes are seen, such as natural landscapes and urban landscapes. Further activity in the Para hippocampal cortex of the brain results in a pleasurable experience, and training in this region results in incontinence selection in visual experiences. The lower occipital cortex plays an essential role in the processing of sensory perception. (Martínez-Soto, 2012)

[3] Literature Review

Mind and Architecture

The collective concern of architects regarding the psychological dimensions of space and its relationship with architecture has been the hypothesis of a scientific / research study since 2003 at a prestigious institute in the United States called Neuroscience for Architecture (ANFA). Among the topics studied in this institute is the effect of architecture on peace of mind and providing a platform for human growth.



Fig 05: The buildings of the Salk Institute Established in 1960 by Jonas Salk, California, US

Situated on a beachfront site in La Jolla, California, the Salk Institute for Biological Studies utilizes neuroarchitecture to create spaces that can adapt to technological advances and emphasize the well-being of the researchers who work there. "In 1994, when the Salk Institute received the American Institute of Architects twenty-five-year award, at the ceremony Dr. Salk told to the AIA Executive Board and suggested they explore the issue of how architectural settings influence the brain—and consequently behavior." John Paul Eberhard

According to Gage, the findings of the Academy (ANFA) claim that there is an effective link between architecture and neuroscience. The findings of this academy show that educational spaces can have the greatest impact on the brain of people (in adulthood and childhood). Because they have proven that our environment can modulate the function of brain cells, and eventually the structure of the brain can change in the environment, and as a result of changes in the environment, our behavior also changes, so the design of the environment can It changes the structure of our brain and as a result our behavior also changes.

Furthermore, according to Mind in Architecture book the impact of neuroscience on architecture is base 3 categories which are, Acquisition, Organization and Use. Indeed, its output has led to authoritative and scientific statements in the field of "lighting", "noise", "color", "movement", "orientation", "language", "and visual disturbances". (Robinson, 2015)

In fact, Sarah Goldhagen mentioned in her book , called “Welcome to Your World” that a single image of the environment is created in the mind of our brain, this integrated image from the moment we see, hear and smell, as well as what we think, touch, feel and do Give, take. This perception and experience is based on our sensory perceptions and inner thoughts, which together govern how we perceive the information that comes to us from being in the world. And when something happens in the world or in our mind, that "Something" is always in our body, at a certain time and place.

The Brain Responds to the Environment and Nature

According to Sarah Robinson on her book “Mind in architecture: neuroscience, embodiment, and the future of design.”, Examining the areas of the brain, it has become clear that in the brain there is a center of perceptions for every emotion such as a center of pleasure, a center of pain, a center of spirituality and perhaps a center of problems. The way the brain works is very different. The function of our brain goes beyond any explanation. (Robinson, 2015)

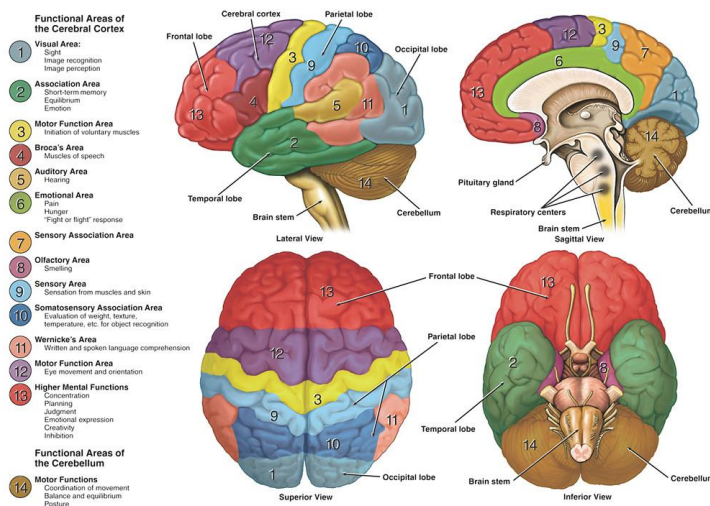


Fig 06: functional Areas in the brain

The long-term evolution of humans in different ecosystems with their unique climate and greenery has given us the feeling of being familiar with the features and interest in the patterns of specific environments and feeling close.

To comprehensively study the nature of cognition and its function inbuilt environmental experience, we must first acknowledge three precepts. To begin with, the human body shapes and influences our thinking in significant ways. Second, given that our bodies are fashioned by Furthermore, regarding to Sarah Goldhagen, the surroundings in which we live and have evolved, most of our internal cognitive life occurs outside of language and beyond the level of our conscious awareness. Third, these elements alter our perceptions of how humans interact with the world by making us less of the masters of our experiences that we frequently assume we are. We are deeply entangled with our surroundings. Our long evolution has imbued us with

sensitivities to and preferences for various environmental patterns and methods of being in the landscape, each with its climate, topography, and flora. People are drawn to enclosed spaces that provide a haven and views and access to the vast, expansive territory where they can "prospect" for opportunities.



Fig 07: Mirror Cube (tree house hotel), Sweden, Designed by Tham & Videgård, 2010

Even if life today is designed to be accustomed to being far from nature, we are still known as an evolved Biophilic species! This means that human genetics are coded in such a way that our well-being is associated with maintaining a close connection with the natural world. At least one of the reasons why regular access to nature reduces crime and stress rates is that it improves people's cognitive abilities. (Goldhagen, 2017)

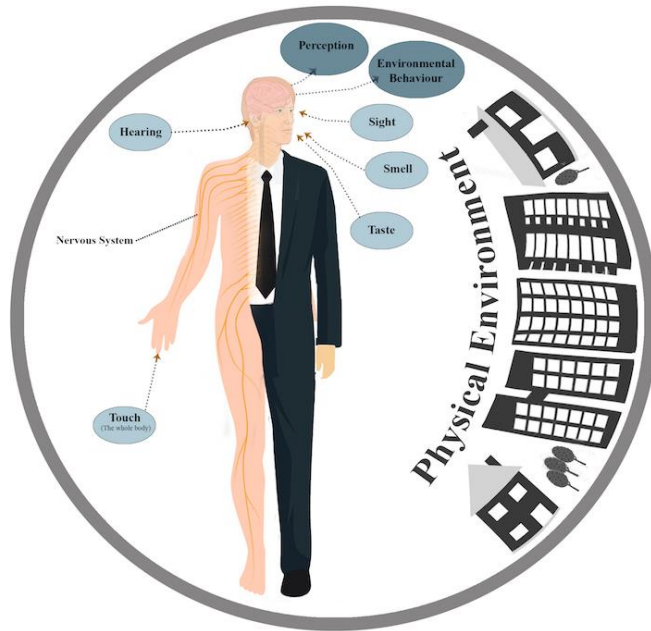


Fig 08: Human's brain and physical environment interaction

Physical factors and parameters related to space can be categorized as follows:

| Physical Factors | Subset of factors and their effect |
|--------------------|--|
| Light | light intensity, brightness, light reflection, color, direction, source |
| View | natural, abstract, internal, familiar, moving, dynamic, static |
| Smell and taste | Intensity and type. |
| Orientation | horizontal, vertical, and diagonal |
| Color | |
| Space | |
| Temperature | heat, and ventilation; Sound and its related factors, including sound intensity, frequency, and direction, phase |
| Material and Touch | brutal, roughness, texture, pattern |

Some of the brain processes that should be considered in neuroscience-based design are:

| Brain's Part | The role of the parts |
|------------------------------|---|
| Sensory systems | sight, hearing, smell, taste, touch, and balance |
| The brainstem | the nucleus and survival-related systems |
| The midbrain | includes parameters such as emotions, stress, hormones, and memory |
| Nervous systems | sympathetic and parasympathetic |
| The outer layer of the brain | Brain includes functions such as cognitive and perceptual analysis, learning, and memory. |

Some of the physiological functions of the brain that should be considered are:

- Chemical systems include hormones, immunology, and neurotransmitters.
- Cellular systems include biomechanical and biochemical. (Sternberg, 2004)

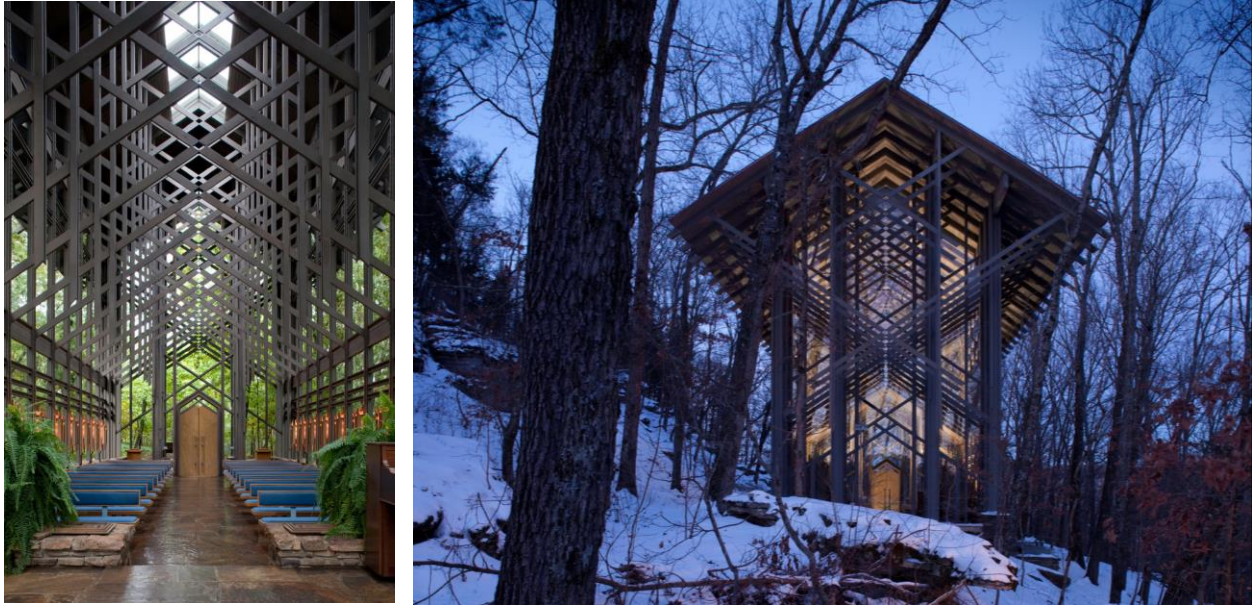


Fig 09: AD Classics: Thorncrowne Chapel / E. Fay Jones

So, what is needed is detail, a deep understanding of the neural infrastructure that directs human behavior as a result of environmental interactions. Upial Nanda mentioned in his article “Lessons from neuroscience: form follows function, emotions follow form” that What architectural environments and fMRI imaging experiments have familiar visual imagery. Architecture relies on visual stimuli to understand, design, present, and even experience environments. FMRI experiments use visual stimuli to induce optimal perception and emotional states to study neural infrastructure. Although there is ample evidence in environmental psychology and social psychology that graphical images, especially visual content with natural content, can transform negative emotions such as fear, pain, and anxiety into positive ones, it is not clear which visual characteristics in this Impact are involved. Suppose specific optical properties can correlate with specific emotional responses. In that case, they can be used as building blocks for design, not only as a function that reinforces the structure but also as elements that convey emotion. (Nanda, 2013)

Pattern, Beauty and Movement

One of the most significant aspects of space design is people's movement patterns and navigation behavior. It's critical to think about this in the design process, as it significantly impacts the visitor experience in a constructed environment. Understanding this issue and its

correlations, for example, might assist designers in forecasting the outcomes of their design decisions based on users' movement patterns while constructing a sports arena. In a developed environment, the best path isn't usually the shortest. People, on average, prefer to take a way that they are more familiar with or that gives them a sense of security. Pedestrians navigate through a built environment in 3 ways: travel to a known destination, travel to a new destination, and exploratory navigation. (Wang,Lo, and Liu 2017; Taylor 2009)

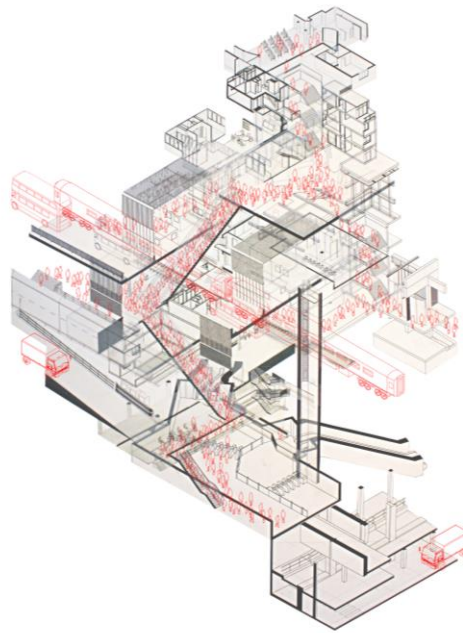


Fig 10: Movement diagram

Moreover, There are 2 different description about movement based what Adam Hardy explain in his article “the expression of movement in architecture” as “contained Movement” and “represented movement”. In the first definition, motion does not mean moving architecture, architecture does not move, but it is the body and its various moving parts like the eyes and the body and the mind and the forces in the body. And the second definition can be considered a moving architecture. However, different types of these movements are not separate from each other and find meaning and work together and together. Movement in architecture can be considered an organized system created from different types of movements and is stimulated by other parts of the architecture. These types of movements do include physical movements and movements specific to the mind and emotional reactions of a person in a particular space. And this is the part I want to focus on the most. A movement that forms in mind and affects the mind.

The influence of architectural designs on visitors' orientation and movement behavior can be seen in users' movement patterns in space, such as in Recreational Centers. The motor behavior of users also reveals where they spend the most time and where they do not wish to remain. Designers can quickly determine their direction and form by analyzing these movement patterns.

Also, Limited clinical research has been conducted on how the environment, architecture, and the human brain interact in recent years. This study points out that the argument that the environment affects human perception and behavior, and vice versa, is not new. What is needed is detail, a deep understanding of the neural infrastructure that directs human behavior as a result of environmental interactions. As Donald H. Ruggles explain that for centuries man has sought to express beauty in architecture and art. Recently, however, neuroscience has been helping to determine how and why beauty plays such an important role in our lives.

A recurring pattern, over thousands of years...

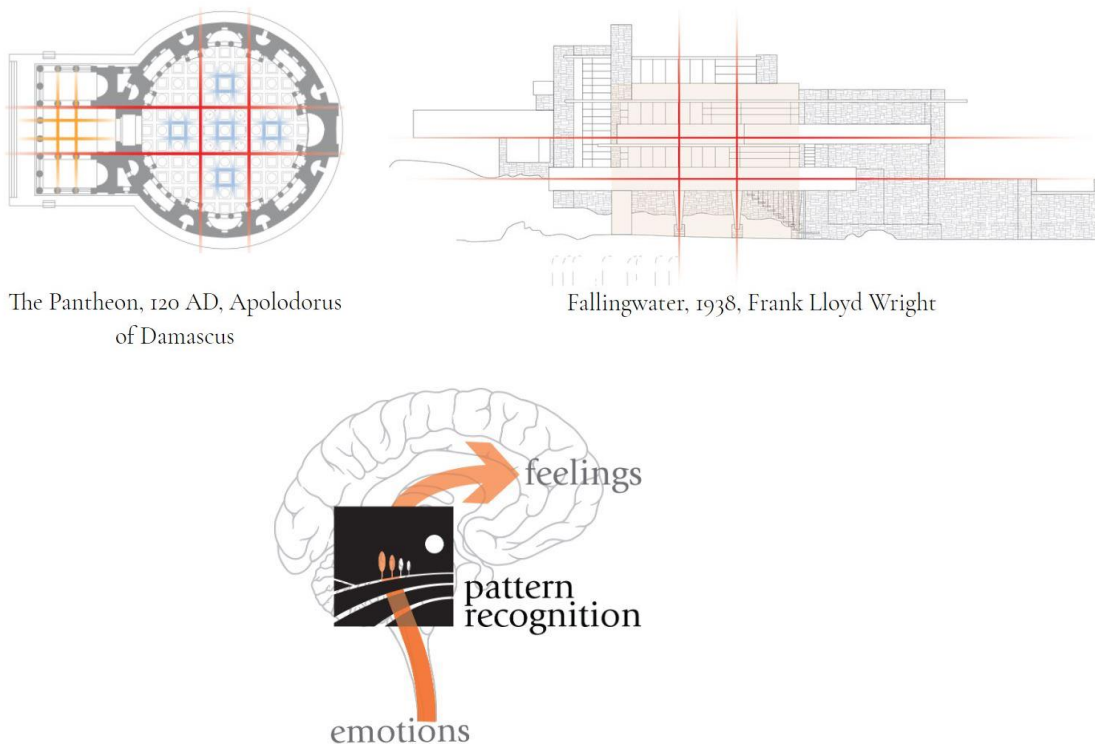


Fig 11: touches our lives through our unconscious, by Donald H. Ruggles, from his presentation about his book Beauty, Neuroscience & Architecture

For years, we have been using special beauties and patterns in our designs, and they can even be easily seen in designs made centuries ago. Nowadays, science and neuroscience can show us why these patterns and beauties have been used in design for years and how it can be used better and more correctly. According to Ruggles, Beauty has emotions and those emotions have an effect on human health and well-being. Our subconscious mind can recognize patterns and beauty based on what it has observed for years, and this is why sometimes we like to stay in space for a long time, for no apparent reason, or run away quickly. Therefore, recognizing and

examining these patterns that have been used from the past to the present and using them based on the effect it has on the user's brain can be a very helpful for design.

[4] Precedents

History of Recreational Centers in the United State

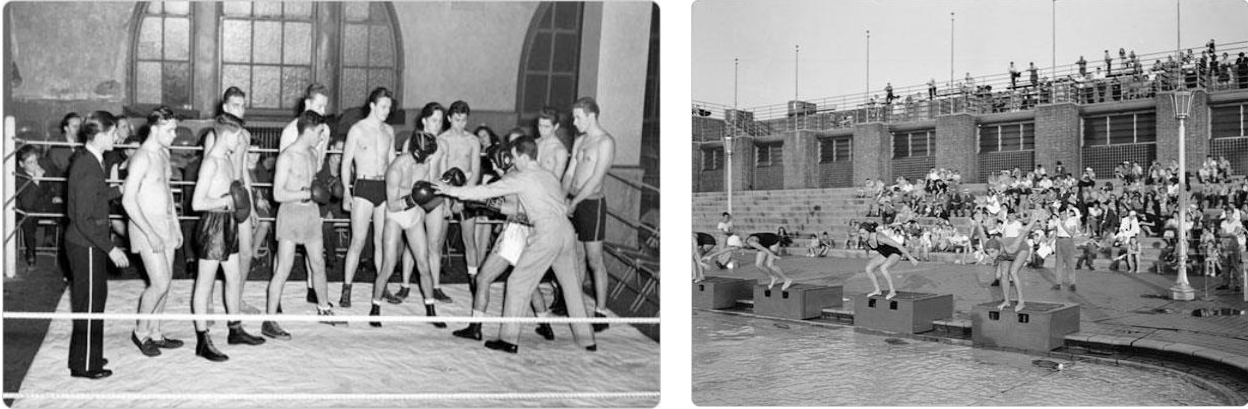


Fig 12: the First Recreational Spaces

There has been a very close and strong connection between physical health and public welfare since ancient times, or perhaps even earlier. Therefore, designers have been considering sports and recreational spaces for many years in order to solve many public and social issues. But in fact, the early movement in the United States for sports and entertainment goes back to the late nineteenth century. In fact, at that time, they tried to create such spaces in local baths. In other words, one of the goals at that time was to give such a positive and purposeful feeling to the working class by creating such lively spaces so that they could deal with social problems better.

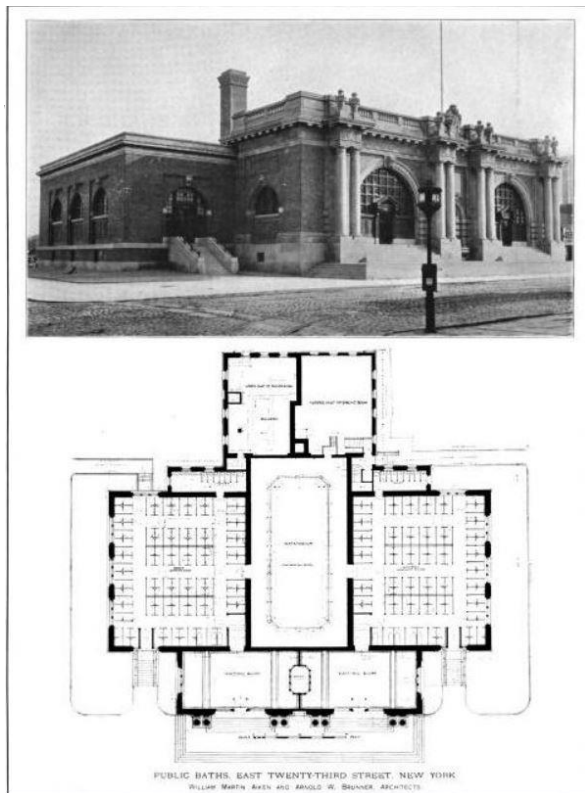
The Young Men's Christian Association (YMCA), on the other hand, was founded in London in 1844 in response to harmful social conditions in the great cities. This movement spread quickly throughout various countries, and it was brought to the United States by George Williams in 1850. The first complex was built in Boston, and the number of them quickly expanded across the country. However, those were the hangout spots for "Men only". Initially, it was a place where people could learn the bible, self-help, and parrying, but they began to focus on physical health and fitness after a while.

A similar atmosphere was then created for women As YWCA. It could be said that this movement was a little more revolutionary because sports were not very popular for women at that time. At the same time, since YMCA had become a space for sexual activity between men, it was practically losing its privilege. Because of the limited space for men only, it had the opportunity to become a meeting place for gay men and away from its main purpose. Because of the negative reactions, they decided to make it more family-oriented instead of just keeping it as a complex for only men, as well as creating conditions for children to use it. However, the YWCA was able to remain well in its original position and became more of a space working for women's rights.

After all of these movements and changes, the sports environment has evolved into a location that is easily accessible to people of all ages and genders. Today's men and women have far more free time than people in the past, and tomorrow will almost certainly have even more. (Karter,

1957). So, what can we do with this extra? What are the requirements for getting closer to the Recreational centers' major goals? And what role may neuroscience play in achieving this?

In this regard, in 1974, as an urban landmark, a recreation center called “Asser Levy” was designed by Brunner & Aiken in Manhattan, New York City. In this architecture, the style of ancient Roman baths was used and it was inspired by the “City Beautiful ” movement.



Ku.Be House of Culture in Movement / MVRDV + ADEPT

This structure is a commun Fig 13: Asser Levy Recreation Center 1 constructed so that users can administer it and create applications that are specific to their requirements and desires. The

designer has tried to create different spaces and reach a general division. In this way, larger spaces are known as the main spaces for the main activities. There are also smaller spaces that have been given sub-uses. In the meantime, between the primary and secondary spaces, the designer has created private spaces that generally have no specific user. The user can personally choose what that space is to be used and how the user can use that space. Use to meet a need that may not exist through pre-defined primary and secondary spaces.

Therefore, the entire is made up of six different volumes. Moreover, each has a unique function based on its size and location. The principal areas are split into three sections. Furthermore, the spaces that remain between them and connect the primary areas are, in fact, places where people can determine their usage. In fact, the designer attempts to alter people's daily experiences in a building.

The type of design and division of each place based on its form and color is attractive, but it may also make navigation much more straightforward. The use of color to separate rooms is visible even from the outside of the structure. Furthermore, the sense of belonging and ownership that the building provides to its users makes them feel more at ease in that environment when they believe they have some control over certain aspects. I try to focus on specialization and navigation the most in my work, and I believe that considering this kind of spatial planning might be beneficial.

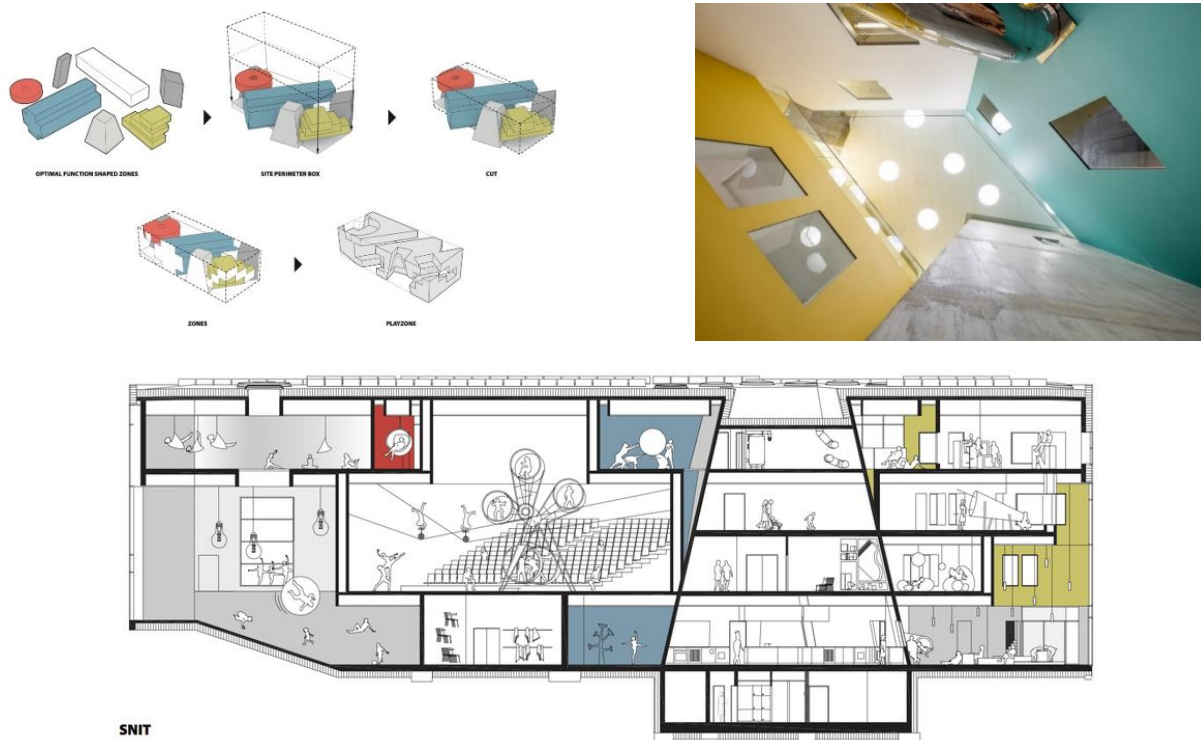


Fig 14: Ku.Be House of Culture in Movement / MVRDV + ADEPT

The Therme Vals

This area is designed by Peter Zumthor in Switzerland for those who want to experience the feeling of historic baths in a new setting. The designer attempts to create an interior space that intentionally directs users to specific areas, which has been carefully considered. Enjoy discovering the spaces of the pin that the designer of other areas will choose.

The space is designed so that users eventually reach the main pool because the path is rotating. The primary materials of the in-situ concrete building and barber gneiss are from a local mine, and cracks have been created in the roof, allowing narrow strips of sunlight into the space. The architect has tried to develop gaps in different lengths to break the light, which induces a greater sense of naturalness. The building is made of blocks that, in the first stage, it is felt that these blocks are directly separated from the surrounding mountains. At the same time, the architect has made them especially to create a sense of harmony with the environment in the user's mind.

Each place must be developed in the appropriate area and for a good group of people. The materials used in any location can have a psychological impact on the user. At the same time, the usage of light and a unique form of movement path in this project has given it a unique character. It causes a person to move more enthusiastically.

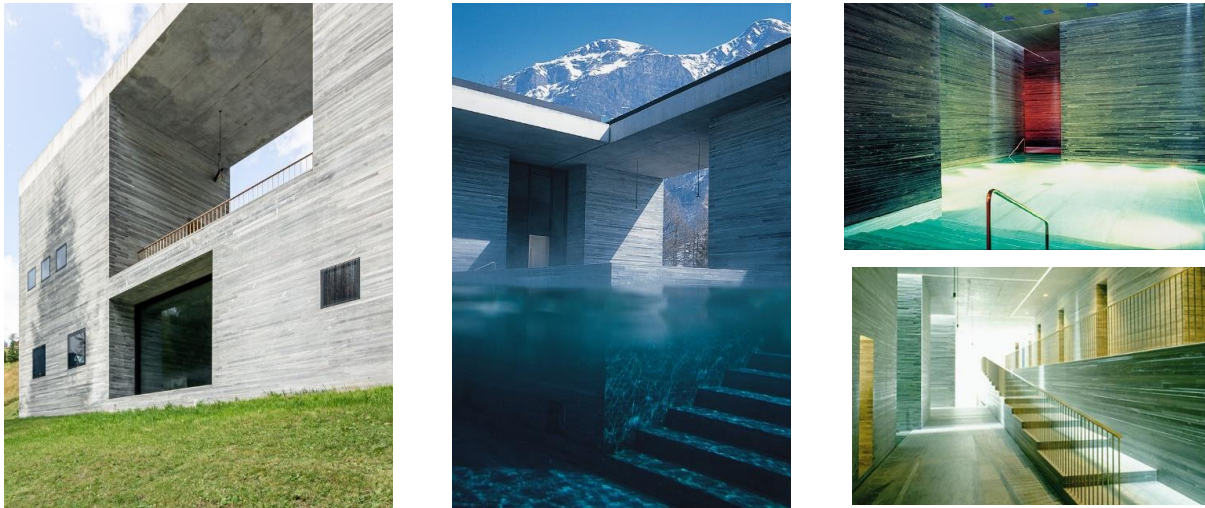


Fig 15: The Therme Vals, by Peter Zumthor in Switzerland

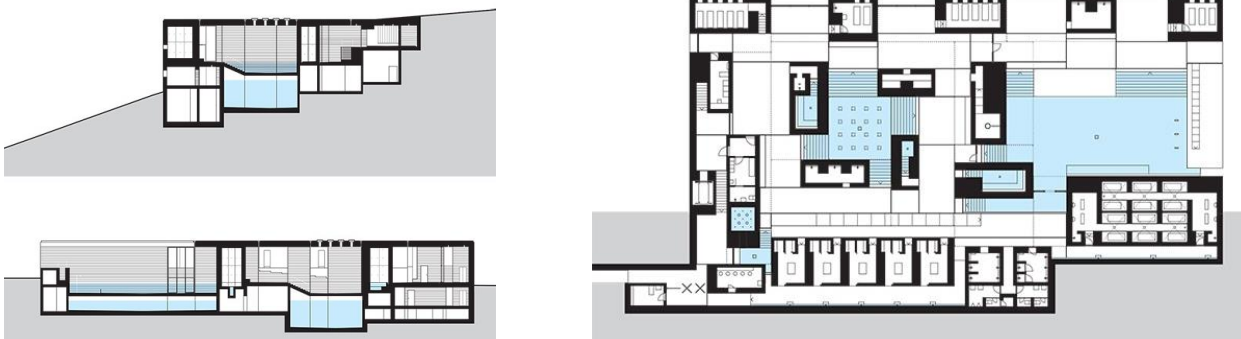


Fig 15: The Therme Vals, by Peter Zumthor in Switzerland

Maryland Heights Community Recreation Center

The project designed by cannon design in Maryland Heights, Missouri, United States is a sports building built near a busy highway. Annoyingly Libran - always rational, easily hurt emotionally, passionate, and maybe a little too intense. For this reason, the architect has tried in this project with materials and pages, mainly to prevent the annoying noise of the highway and create a calm atmosphere in which users can focus enough. The designer refers to this feature as "sound shadow." The type of material used for these plates is transparent tri-walled polycarbonate, which prevents disturbing noise from outside and does not block natural light from coming in from outside. I have decided that the site I choose is in a big city, so I predict I will have a problem with annoying noises outside the building. Therefore, the material used in this building can be a good solution.



Fig 16: Maryland Heights Community Recreation Center, designed by cannon design in Maryland Heights, Missouri, United States

The critical features in this building are the first type of material used, which I mentioned earlier. The use of curved and organic forms gives the building the quality of being a more relaxing space for people. Because according to an experiment on the human brain, it has been found that curved shapes and spaces convey a much better feeling to people. Another feature is the use of natural light in the maximum possible mode. The glass service in the club and providing enough light allow people outside to see that some people are active and may motivate them to visit the space and those who are indoors. Have a view of the outside of the park while exercising. The architect's focus in this building has been more on blocking the annoying sound and at the same time using natural light and green space outside the building as much as possible, and it has been quite successful.



Fig 16: Maryland Heights Community Recreation Center, designed by cannon design in Maryland Heights, Missouri, United States

East Oakland Sports Center

In the first stage, this project aims to create a sports space for people who have a lower income, and we have also tried to pay attention to all possible points in the design in terms of energy-saving and sustainability as much as possible. For example, one of the notable features is solar panels and their use to the heat pool water. Like the previous project, the use of a lot of glass to give a sense of invitation to those who see from outside the building and the use of natural light is another feature of the project. The use of colors, especially in glass and inside the building, is another building design feature. According to research, the eye is the first and most affected and accepts it among all the senses that a person has. So form and color can be very effective. Although I think the condition of the building could have been deemed more, there are still many points to be considered in this project that are very significant.



Fig 17: East Oakland Sports Center, designed by ELS Architecture and Urban Design, Oakland, CA, USA

In terms of space, the lobby is located so that when users enter, they can easily see what activities are done in this center and do not feel confused. The use of three green lights on the glass is another notable feature in the design. The green color gives the user a sense of calm, brings daylight to its maximum, and creates more radiance.



Fig 17: East Oakland Sports Center, designed by ELS Architecture and Urban Design, Oakland, CA, USA

URAM Indoor Extreme Park

This sports club designed by KOSMOS Architects + Legato Sports Architecture in Russia is mostly equipped to participate in outdoor sports. Skiing, cycling, and other activities come to mind. The relatively simple design of this sports facility, as well as the sort of material employed in it, are both noteworthy features of this structure. This club focuses on street sports, thus the ambiance has been designed to ensure that the user does not feel like they are mentally exercising in a strange setting and has a greater sense of belonging.

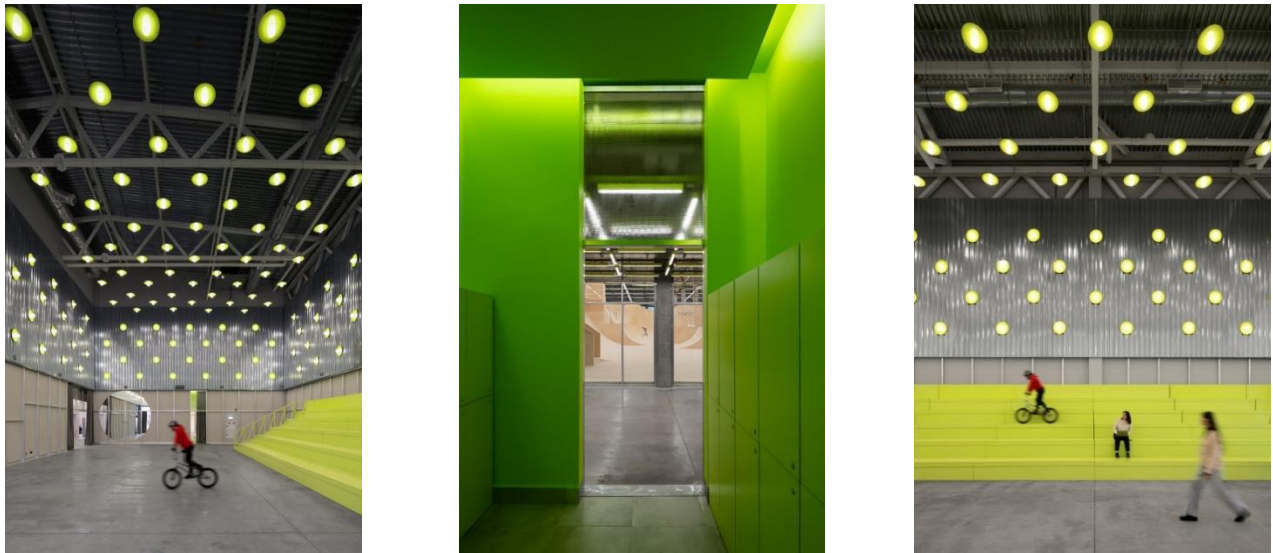


Fig 18: URAM Indoor Extreme Park, designed by KOSMOS Architects + Legato Sports Architecture, Russia

The usage of a specific color that, according to studies, attracts a lot of attention is something that is basic but quite successful in this project. Also, by using this color in specific areas, users will be able to see where the key spaces are and how much easier it is to stay on their main path. Routing is a key element in space design that has also been studied in neuroscience, and I believe it is one of the most significant factors to consider when designing a place.



Fig 18: URAM Indoor Extreme Park, designed by KOSMOS Architects + Legato Sports Architecture, Russia

Athletic Development Club

This structure designed by Studio VA on London, is a modest sports club that has attempted to create the impression that it is large enough in size and that the privacy of each space has been carefully maintained, despite the fact that the space is small. To partition the room, mirrors, wood, and light were used, as well as subtle adjustments in ceiling height. The use of various and unique lighting provides the user the impression that he is working in a more private place, and the spatial separation is excellent.

This is a design for a very little room, therefore it's not a large effort. The club is situated on a busy London street, and the designer, while attempting to offer athletes with a sense of solitude both inside and outside the structure, also attempted to create elements for people who pass by. They are able to attract their attention. As a result, constructing a smaller, more public space blurs the line between public and private space.

Previously, it was primarily attempted to use one color, especially in all places, but this time, it was attempted to use diverse colors appropriate to the spaces and their purpose, which has changed according to the scope of work.

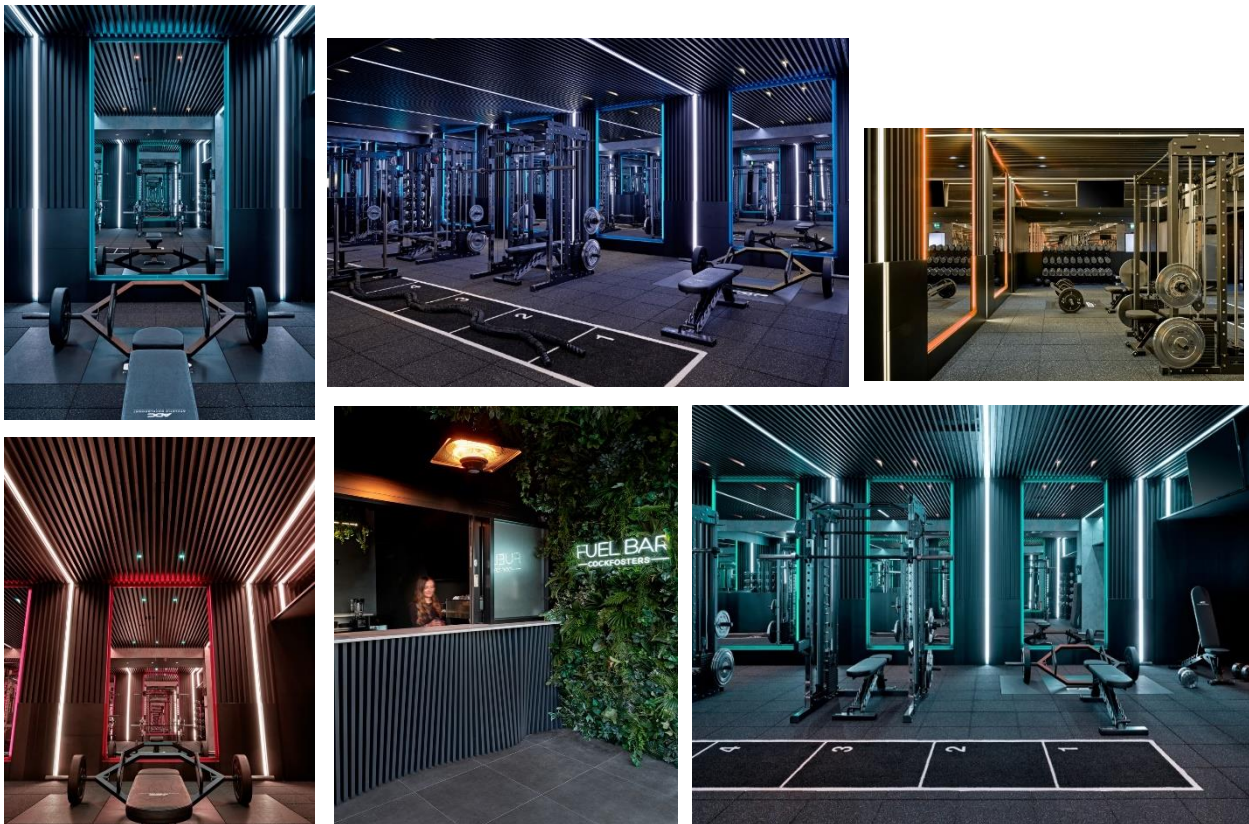


Fig 19: Athletic Development Club. Designed by Studio VA, London

[5] Methodology

Movement Analysis

As Sarah William Goldhagen in her book “How the built environment shapes our lives” begins by examining and contrasting various structures. Considering numerous structures with varying levels of spatial structure, in my opinion, can be pretty beneficial. These structures might be classified as recreation centers, hospitals, and well-being centers.

Movement and navigation in buildings are critical issues that can significantly impact human comfort and the brain. It might pique a person's interest in the area or allow them to flee from it. As a result, mobility analysis in various places can provide me with valuable space creation and routing information. What kind of design and feature of a building, for example, confuses the user or makes them more comfortable? Finally, the sum of these results can be an excellent solution to start designing.

There is a lot to know about the impact of light, material, nature, movement, and color on the brain, which has already have done separately by other people. Of course, focusing on all of them individually by myself is not possible and takes too much time. So I would like to use the result of other studies for my project.

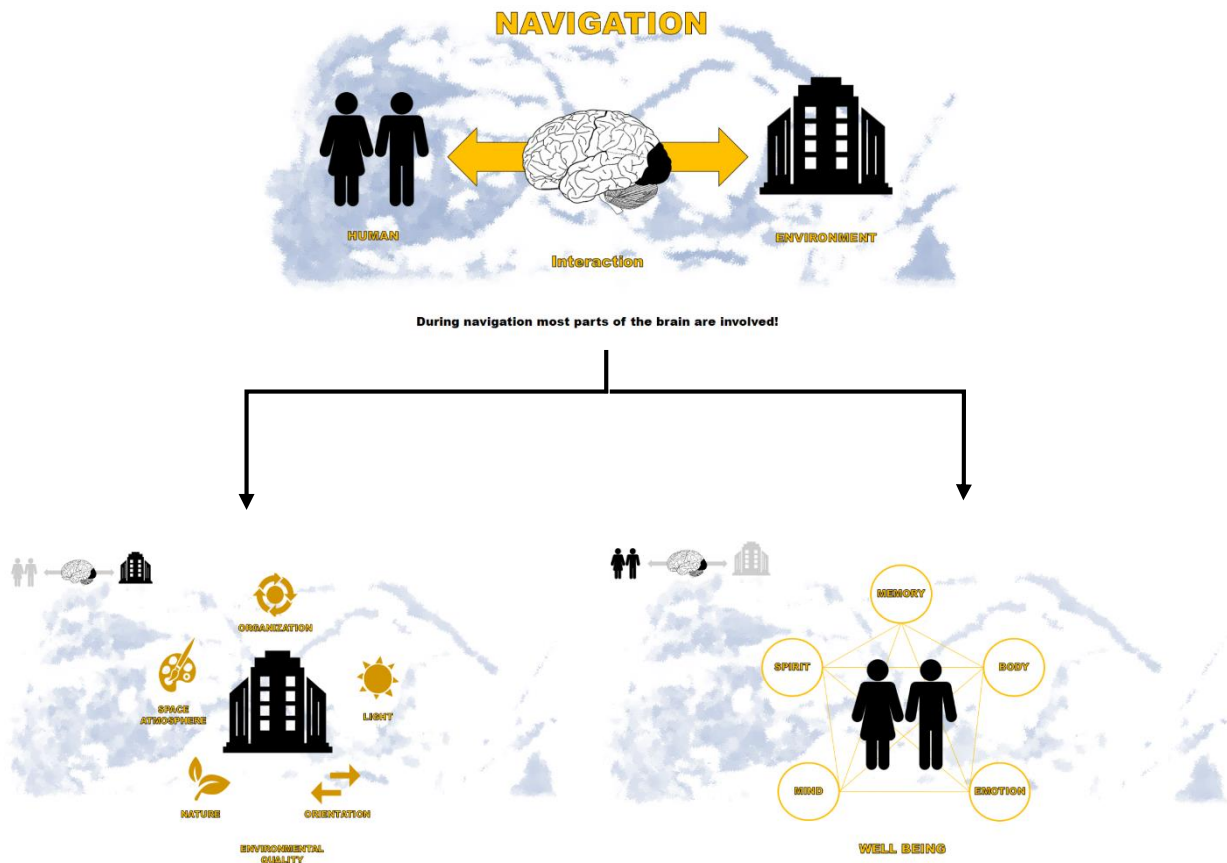


Fig 20: relationship between human and environment through brain based on navigation

Comparative Methodology:

In this regard, I would want to examine the findings of numerous papers and studies on the relationship between neurology and architecture and then apply the findings to their work. Compare similar articles with varied outcomes and employ them proportionally in the Recreational center I would want to create.

There has been research on light's impacts on the brain, muscle memory, material, and color's effects on the body's hormones and brain neurons. What impact do beauty and the environment have on our minds? What traits can have a beneficial or harmful impact on the human mind regarding paths? Much research has also been conducted to develop unique rooms for the disabled or blind. How materials and their sense of touch influence their orientation and emotions. Finally, I can create an application database that is entirely applicable and efficient based on scientific studies by reviewing and gathering data.



Neuroscience in Architecture Books



Neuroscience in Architecture Journals



Architects



Short- and long-term effects of architecture on the brain: Toward theoretical formalization

The expanding horizons of network neuroscience: From description to prediction and control

Building circulation typology and space syntax predictive measures

Neuroscience and architecture: What does the brain tell to an emotional experience of architecture via a functional MR study?

Cognitive control, motivation and fatigue: A cognitive neuroscience perspective

Neuroscience and architecture: Modulating behavior through environmental responses to the built environment

A New Architecture based AR for Detection and Recognition of Objects and Text to Enhance Navigation of Visually Impaired People

The neuroscience of social feelings: mechanisms of adaptive social functioning



Peter Zumthor

Juhani Pallasmaa

Steven Hall

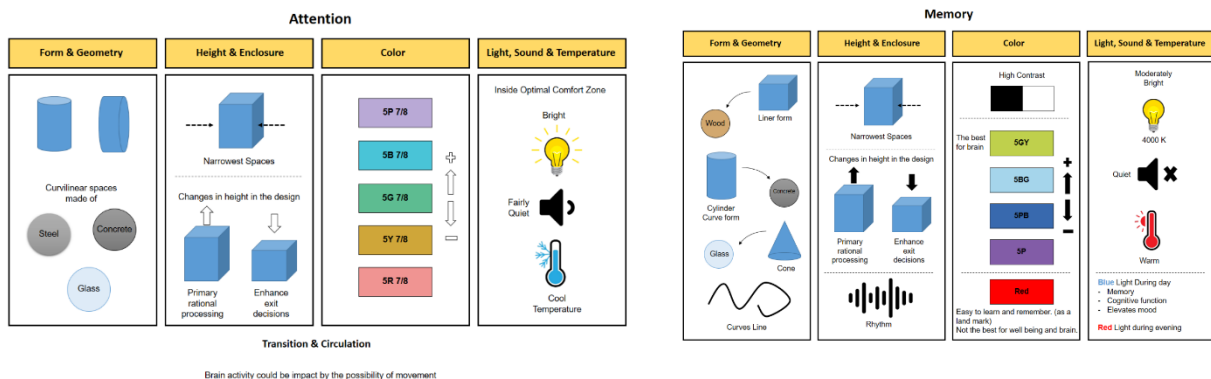


Fig 21: the impact of environment on the memory and attention of human during design based on neuroscience studies

Survey

In my project, the survey can be one of the essential parts. Because neuroscience is precisely related to the human brain's reactions, emotions, and how they look at space. I think having different polls in different age ranges can be very helpful. What features are significant for people in a sports space that will be different for other groups? What makes them stay in the clubs for a more extended period or even abruptly avoid going there? What facilities are vital to them, and what facilities are insignificant? What is the first thing that catches their eye after entering such an atmosphere? What makes them choose between exercising at home or at a public club? After spending almost two years away from the club due to COVID-19 conditions, what are the most influential features they did not notice before? Because many people prefer to continue exercising at home after Covid.

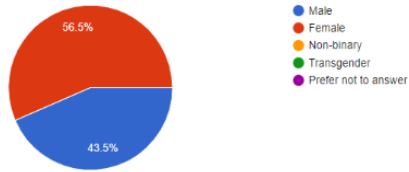
And at the end, I want to compare the result from the survey which I want to do with the studies that have been done by other people on portable EEG equipment. That measures the participants' brain activity while a video camera films the journey. EEG looks at how different people's brains react to their physical surroundings. This experiment aims to look into and examine the relationship between the physical surroundings and the sort of activity that is performed.

The result of this survey can be a chart or a table that shows which items should be prioritized.

Based on the survey results, 56.5% of the survey respondents were female and 43.5% were male, with the majority falling within the 25-34 age range. Physical exercise is a key concern for those who participated in the survey, with the majority engaging in physical activities both indoors and outdoors either 2-3 times a week or daily. Outdoor activities in the recreational center are preferred over indoor activities, and socializing is moderately important during this time. Participants reported difficulty navigating the rec center but found signage, landmarks, specific colors, and views helpful. Rooms and the swimming pool are the most frequently used spaces, and ease of access is a top priority. The availability of natural light, food court, indoor lighting, and ample space for various activities was also mentioned as key factors in improving comfort and satisfaction within the rec center. So I have incorporated these findings into my design.

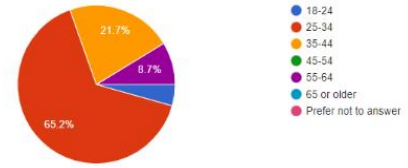
19. How do you identify your gender?

23 responses



20. What is your age in years?

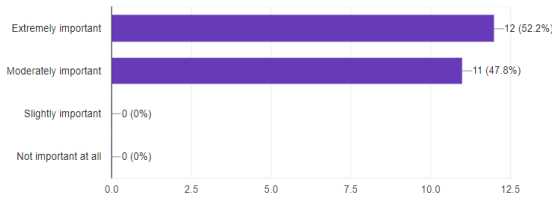
23 responses



01. How important is physical exercise to you?

23 responses

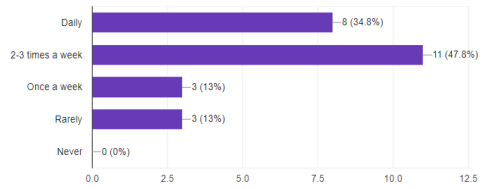
[Copy](#)



02. How frequently do you engage in physical exercise activities anywhere, indoors or outdoors?

23 responses

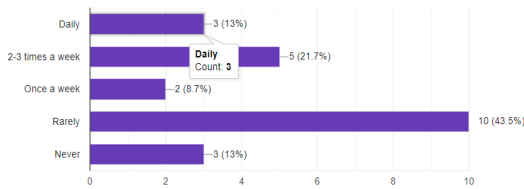
[Copy](#)



03. How frequently do you use a recreational center? (Rec center is defined as a public or private facility of any size that offers indoor and outdoor recreational activities.)

23 responses

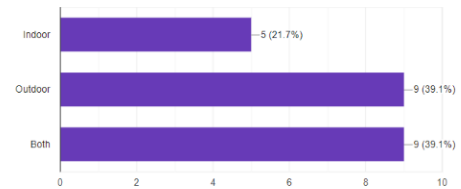
[Copy](#)



04. Do you prefer indoor or outdoor recreational activities?

23 responses

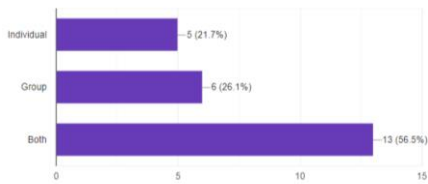
[Copy](#)



05. Do you prefer individual or group recreational activities?

23 responses

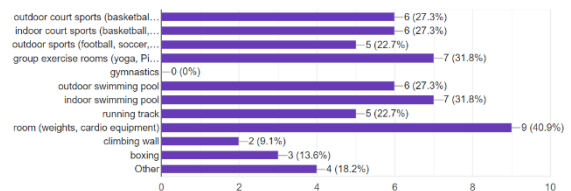
[Copy](#)



06. Which part of the facility do you usually use?

22 responses

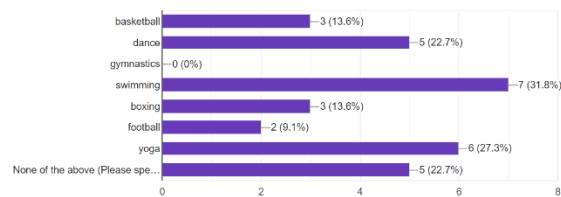
[Copy](#)



07. Which of these activities is your favorite and one that you frequently engage in?

22 responses

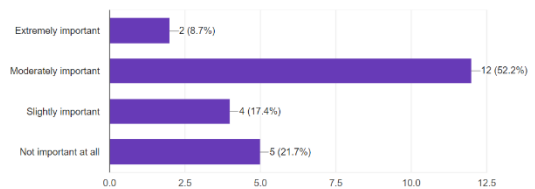
[Copy](#)



08. How important is socializing with others to you while engaging in recreational activities?

23 responses

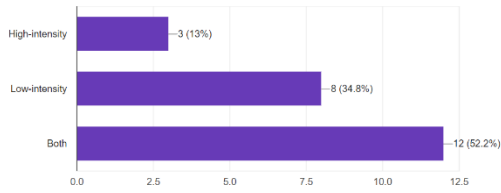
[Copy](#)



09. Do you prefer high-intensity or low-intensity recreational activities?

[Copy](#)

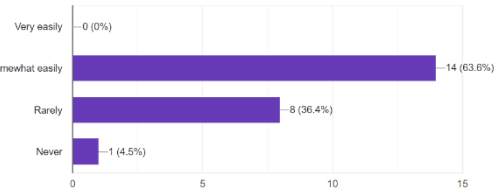
23 responses



10. How easily do you get lost in large recreational centers?

[Copy](#)

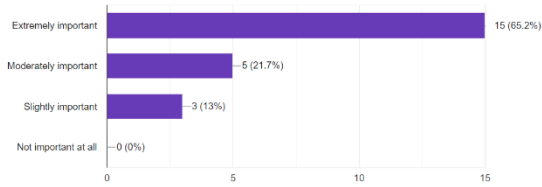
22 responses



11. How important is having clear signage in a recreational center to you?

[Copy](#)

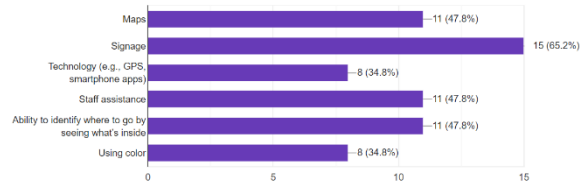
23 responses



12. Which of the following navigation aids do you prefer in a recreational center? (Check all that apply)

[Copy](#)

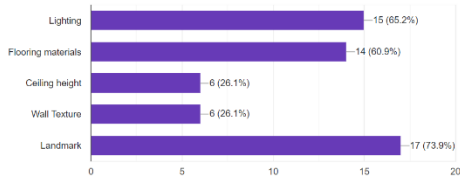
23 responses



13. Which of the following design elements do you find most helpful in aiding navigation within a recreational center? (Check all that apply)

[Copy](#)

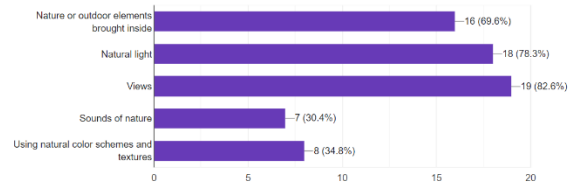
23 responses



14. How can a recreational center take advantage of the natural environment for a better design? (Check all that apply)

[Copy](#)

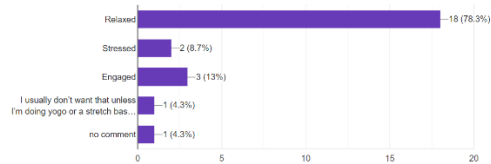
23 responses



15. How do natural sounds (like the sound of running water) in indoor spaces generally make you feel?

[Copy](#)

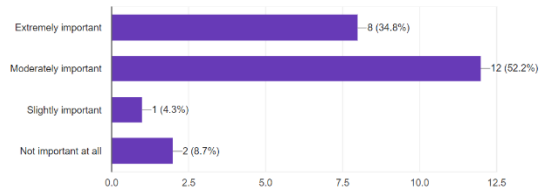
23 responses



16. How important are music and sound to you when using a recreational center?

[Copy](#)

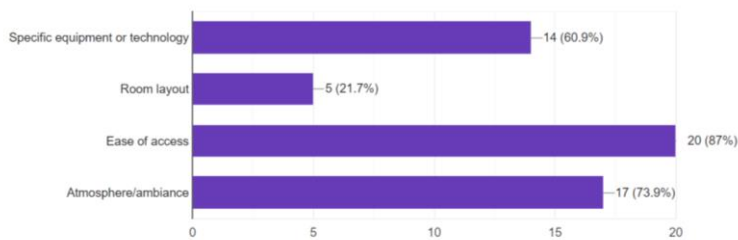
23 responses



17. Which of the following aspects of a recreational center are most important to you?

[Copy](#)

23 responses



[6] Contribution and Significance

Architecture and neurobiology influence how we view, imagine, interpret, and respond to structures. If we understand structures, we can create ones that give excellent user experiences. Recreation Centers, for example, can be designed to increase user focus and reduce stress.

Today, we are seeing significant advancements in the design of many buildings around the world and the design business as a whole. At the same time, Recreation Centers receive little attention. Sports facilities, like other structures, have a variety of issues that need to be addressed but are frequently overlooked. Because such a diverse group of individuals frequents the Recreation Center, it is critical to explore how we might build a valuable space for people from all walks of life. Architectural elements influence the mental and behavioral patterns of users in the environment. As a result, these visual features significantly impact the human nervous system.

Therefore, by bringing neuroscience and using its features and studies in designing such a space, we can consciously turn a Recreational center from a space that is used only for exercise or achieving physical health into an area that not only forms It affects people physically but also shapes their mind, plays with it and also provides mental health.

However, I do not think these behaviors and feelings need to be always positive. Or include Well-Bing. Sometimes being in an environment that allows us to experience feelings of anger, fear, danger, and excitement will indirectly have positive effects.

[7] Context

The city of Cincinnati, Ohio, is known for its beautiful riverside location, and 2335 Riverside Dr. is one of the prime locations in the area. The site is situated right beside the Ohio River, offering stunning views of the water and surrounding landscape. The proximity to the river is not the only draw to the location, as there is already a small rec center on the property that has been designed primarily for individuals with disabilities.

The existing rec center includes several amenities, such as a basketball court, a small fitness room, a spinning room, and a small activity room with an outdoor pool. These facilities are designed to provide a safe and accessible space for people with disabilities to engage in physical activity and exercise.

Given the prime location and the existing facilities, the decision was made to keep the original building and construct another rec center nearby. However, this new rec center would incorporate neuroscience features in its design to enhance the user experience and promote well-being.

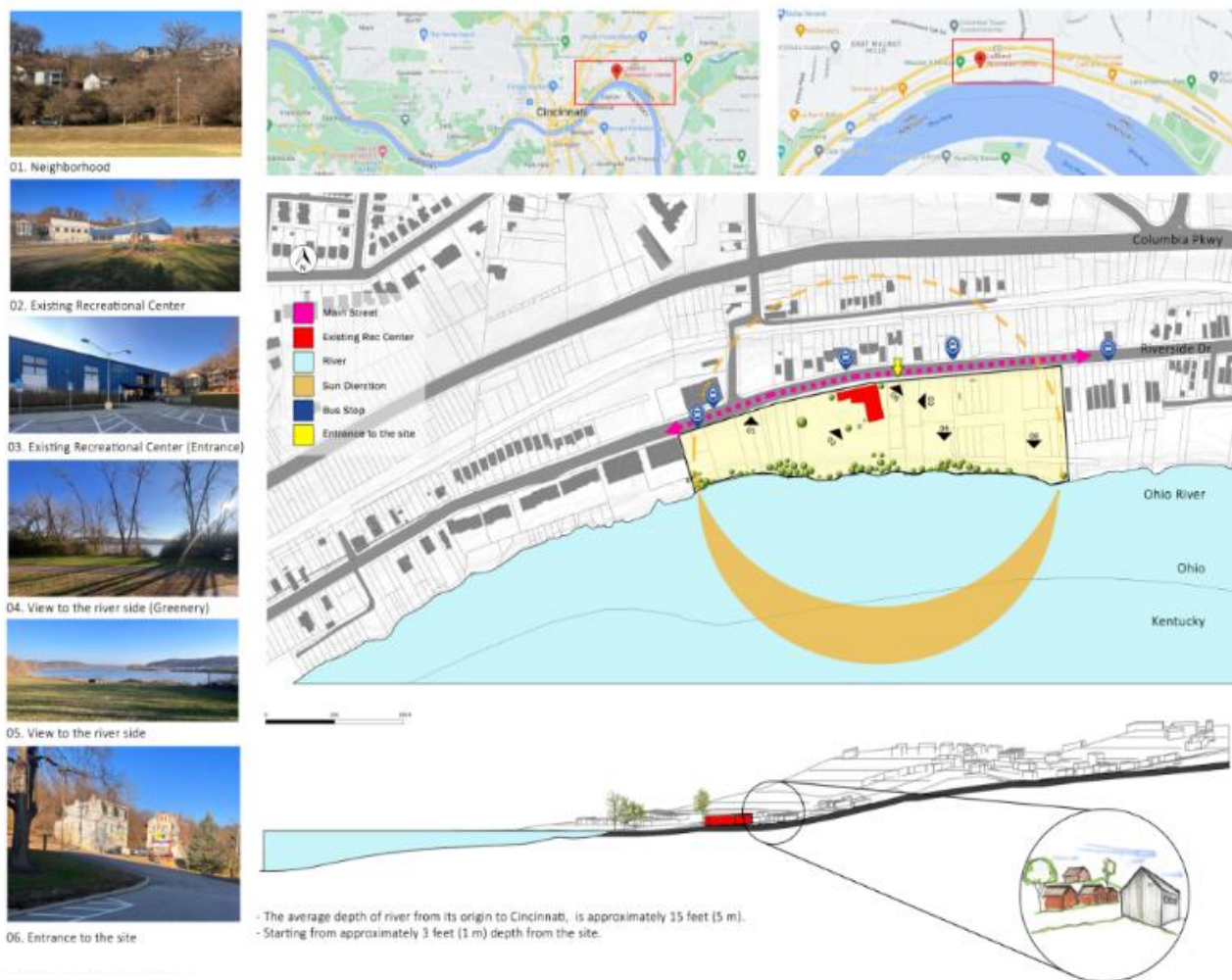


Fig 22: site analysis and existing area and buildings

[8] Program

A sports facility should be suitable for people of various ages. As well as a variety of skills. As a result, everyone may make proper use of the area. Moreover, there should not be too much separation between the disabled sports space and the rest of the people's sports space, or it should be entirely distinct. As a result, everyone has access to the same facilities. Furthermore, it provides the impression of superiority or being less different from others. Also, some spaces where people can choose what kind of activity they want to do there give them a feeling of belonging.

The space should be designed so that everyone can have access. Also, perhaps the location designated for meditation should not be one that one wants to use. So why not give them the space they require?

Rec Centers do not always have to be a location where we can unwind and relax or just do some physical activity; sometimes, we need to channel our energy in a different way for mental health reasons. Like the different types of experiments in different contexts. It can be either relaxing or make people excited. This is not simply for those of a certain age bracket. Even for youngsters, however. Children must also be exposed to some perils and risks.

So we can divide these programs into four parts according to what we said:

- Different ages
- Crowded and quiet
- Public and private
- Open and close

[9] Appendix

Case Studies and analysis:

- Recreational Center of Miami University:



Fig 23: Photos of exterior and interior of the recreational center



Fig 24: Memorable place and rich environment in the Miami University Recreational Center

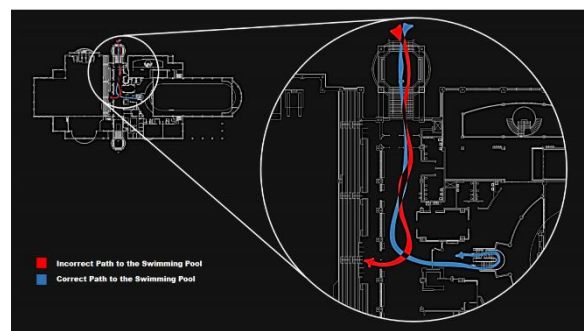
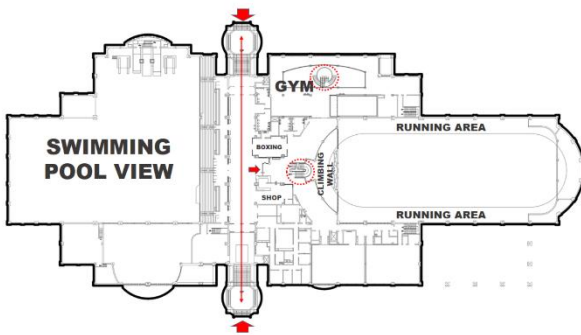


Fig 25: First floor plan

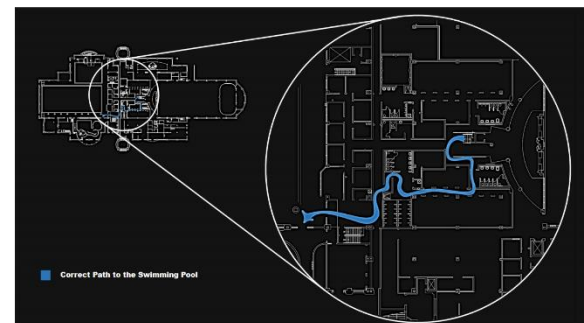
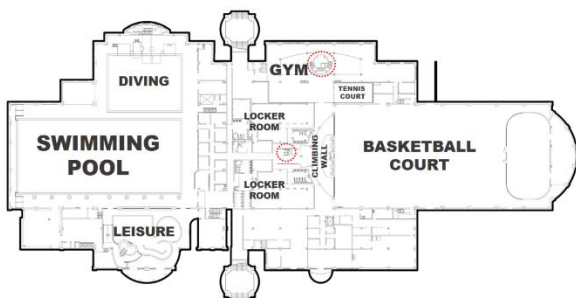


Fig 26: ground floor plan

- Seattle Central Library

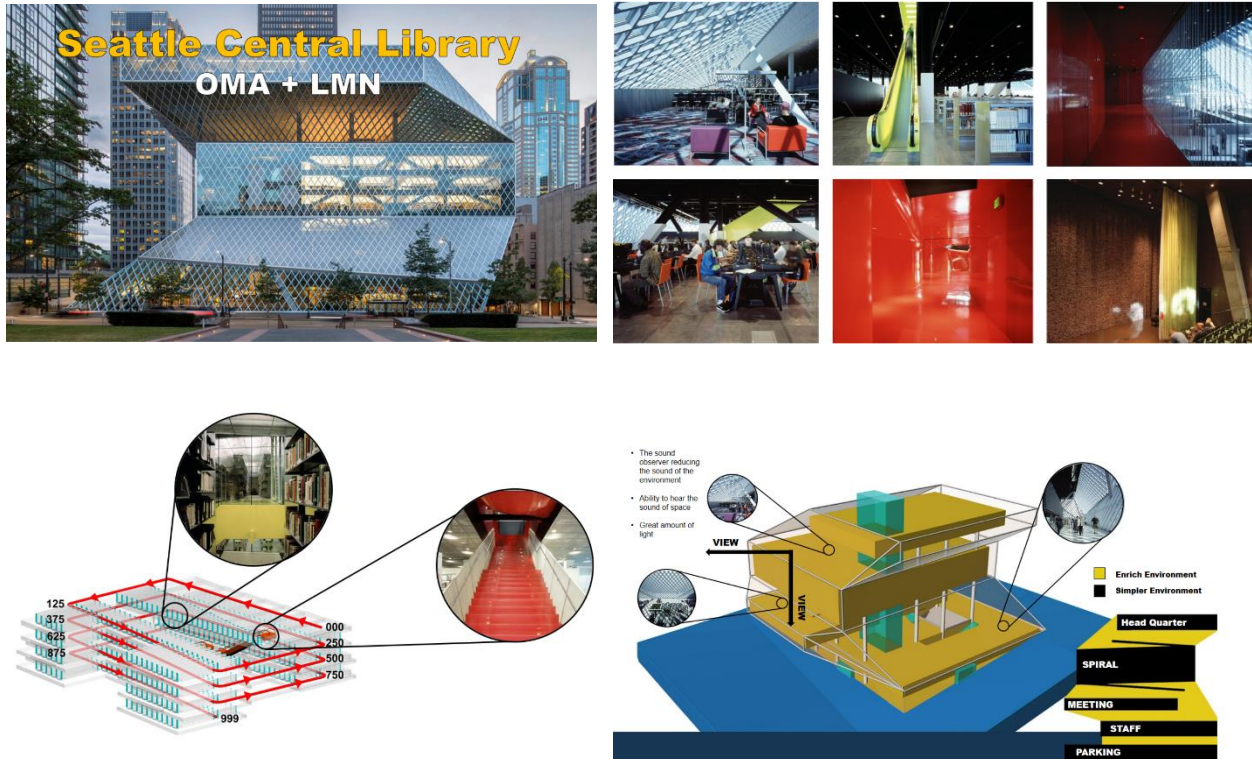


Fig 26: analysis of Seattle Central Library

The Seattle Library is a case study in effective navigation design. Initially, visitors may feel overwhelmed and unsure of where to begin their journey through the building. However, the library's unique design allows for a smooth and intuitive navigation experience that quickly leads to a sense of comfort and familiarity.

One of the key factors in this successful navigation design is the use of landmarks throughout the building. These landmarks serve as visual cues that help visitors orient themselves and understand their location within the library. This type of environmental enrichment can be beneficial for visitors, as it creates a sense of familiarity and allows them to feel more comfortable and at ease within the building.

Additionally, the Seattle Library's design features a gradual increase in complexity, allowing visitors to become more comfortable with their surroundings as they explore the building. This gradual increase in complexity is essential for creating a positive user experience, as it allows visitors to build confidence and competence as they navigate the space.

Design process:

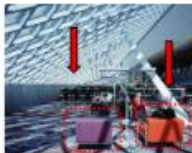
Based on the studies, and also analyzing different case studies I have identified key ideas to focus on, during my design process in order to achieve my goal.

Key ideas based on studies:

- Specific Movement
- Landmarks
- Rich environment
- Different or unexpected events happening in the same place
- Way-finding elements
- Engaging people in the area that they should experience
- Curves form and Curves lines, inside and outside
- Having contrast in terms of forms, height and design elements, and color
- Engaging nature with the design
- Using the path as a hub
- Using specific colors based on neuroscience studies both inside and outside
- Open spaces
- Using rhythm
- Creating a sense of belonging

- Analyzing the key ideas and result studies on the different case studies:

01 Seattle Central Library



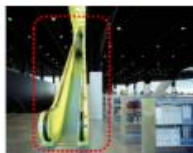
- Purple and Red for attention
- Enough natural light
- Different height ceiling



- Object in Object
- Bright light at night



- Red color as a landmark and showing path way to better remember



- Volt color (perfect for brain, memory, well being)



- Volt color (Bright- Green yellow)
- porosity



- Narrowing path
- Glass and steel as material



- Rhythm
- The sound observer reducing the sound of the environment

02 Powerhouse Company tops reception building



- Transparency
- Visual communication with nature



- Curve forms and lines
- Narrowing path
- Different height
- Rhythm
- Enough Natural and artificial light
- Red color



03 URAM Indoor Extreme Park



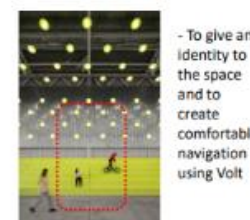
- Create a new kind of experience.
- Engaging with nature and water
- Curves path and form
- Playing with height
- Rhythm
- Concrete

04 URAM Indoor Extreme Park



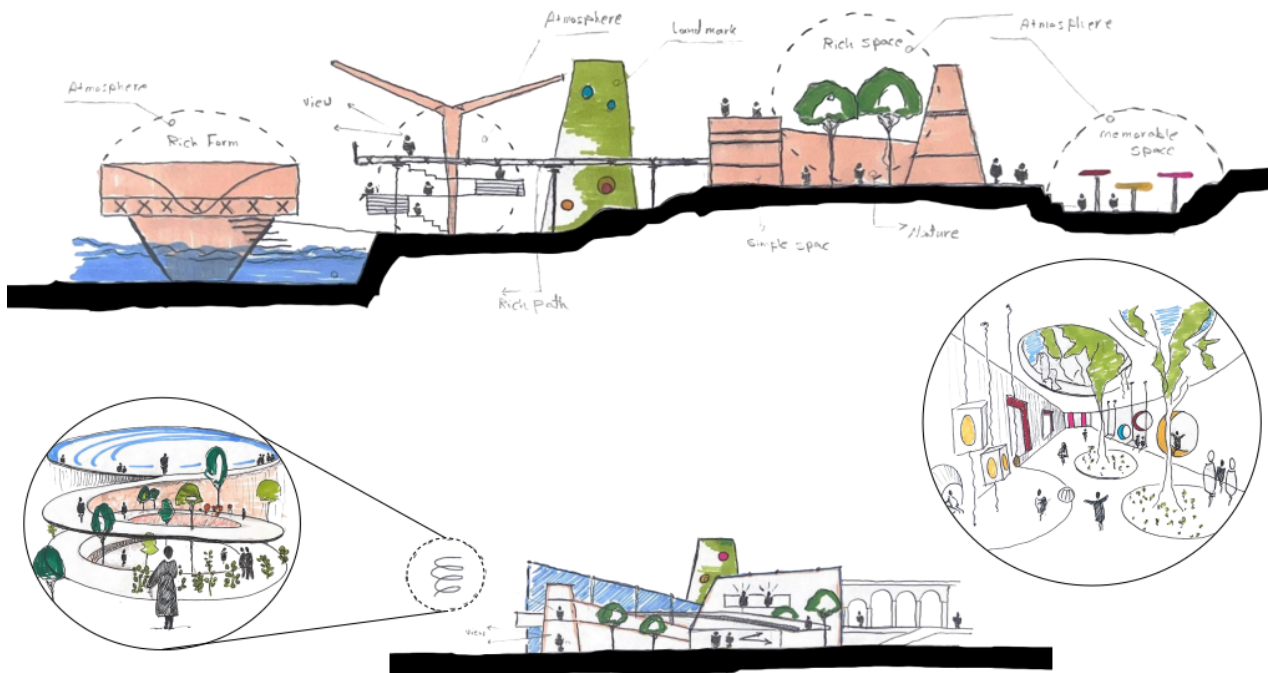
- This color is most noticeable to the human eye and therefore is so actively used in street and road navigation to ensure safety.

- Specific color denotes the most important areas in the building and guides visitors on the way to go.
- Contrast (gray and volt)



- To give an identity to the space and to create comfortable navigation using Volt

Design ideas:



- Giving choice to people to choose being outside or inside while still enjoying nature and river
 - Sound of Water
- (porosity)



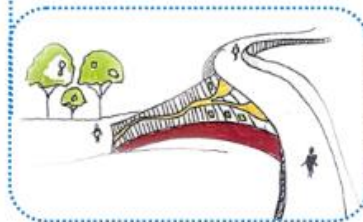
- Steps as a path and a way of activity
- Rhythm
- Using as a path, seating, give people view to see what's happening inside

(porosity) (activity)(rhythm) (curiosity)



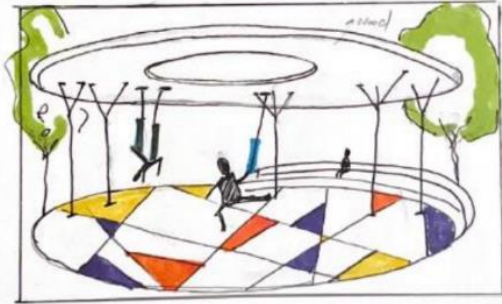
- Having activity (like climbing) while their walking
- Make them more cruise to experience more during their path
- Make their way more enjoyable

(activity) (curiosity)

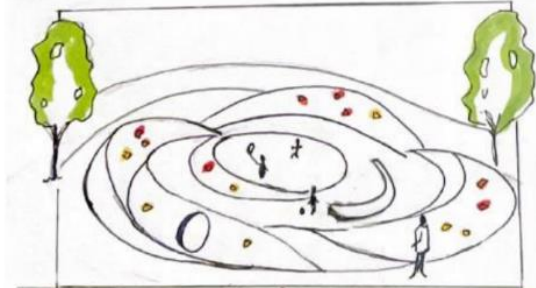


- Using color to guide them through long or short way

(activity)(rhythm)



- Activities like Gymnastic or dance in a open area

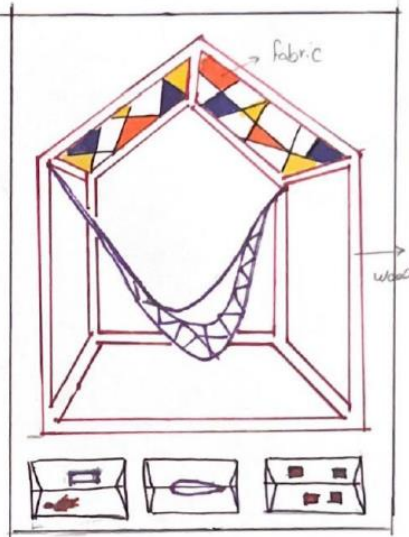
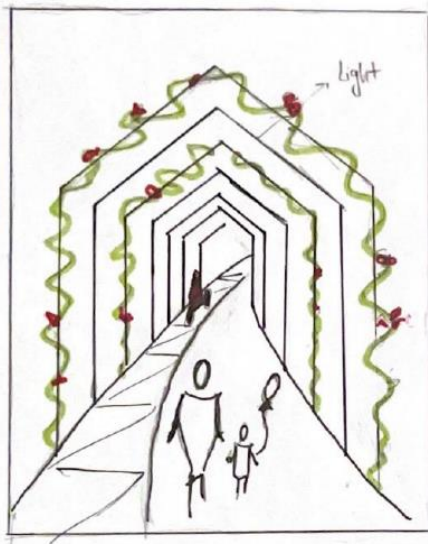


- Play ground for children with light feathers and mini climbing wall

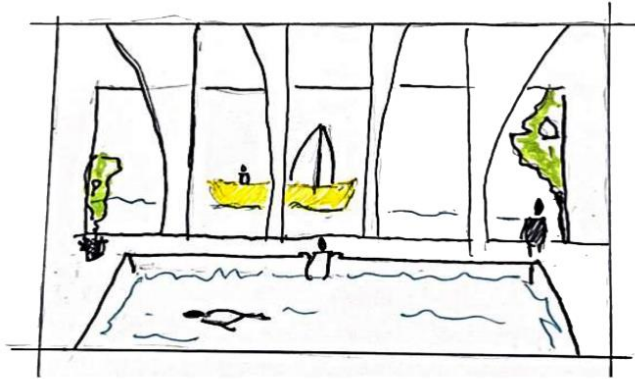


- Adult play ground and gathering!

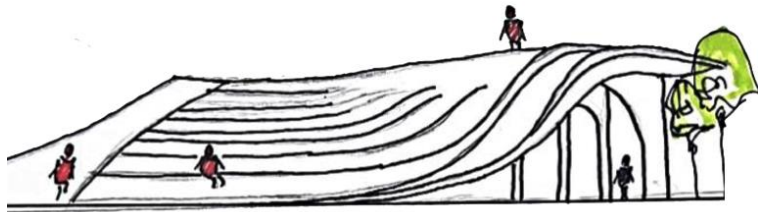
- Path way with the reflection of neighborhood and existing rec center to provide a interesting path way and light at night.



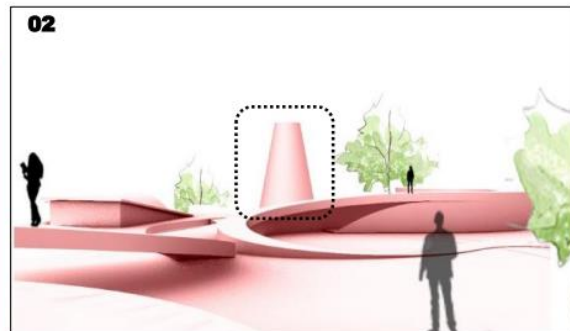
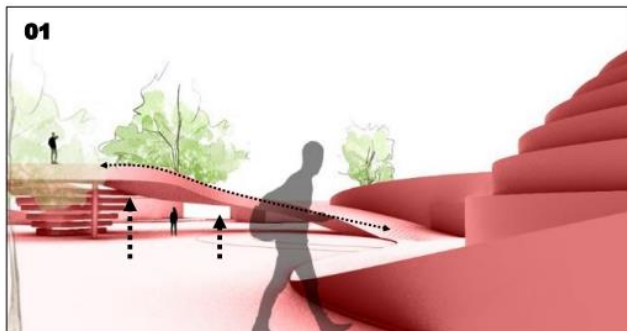
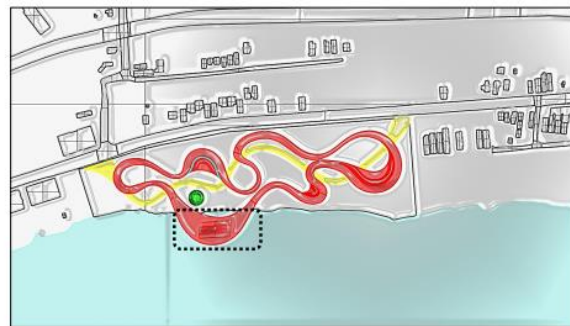
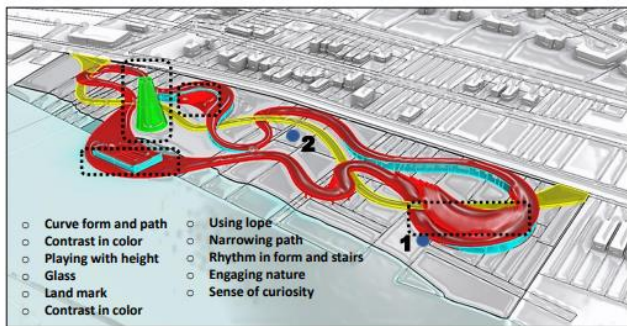
- Providing these small places around children play ground so parents can chill and watch their children instead of just seating on the chair. Using like a half-private picnic area



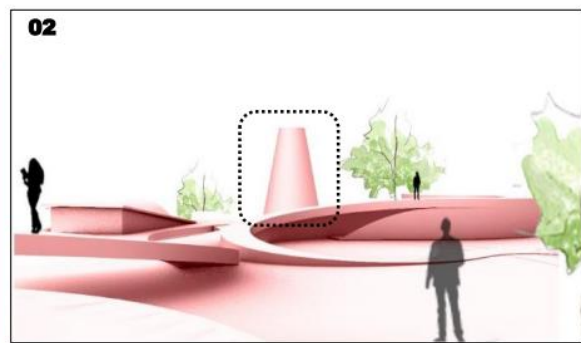
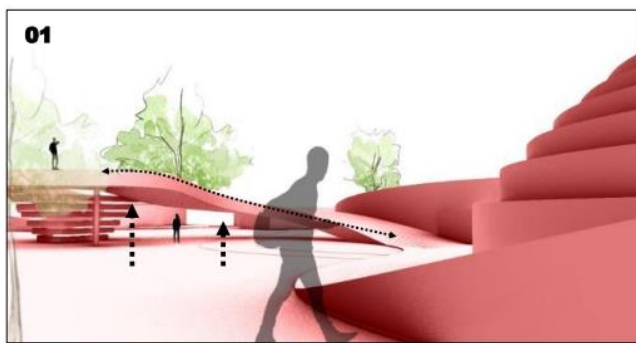
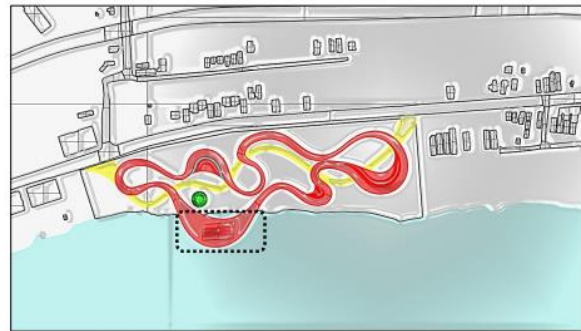
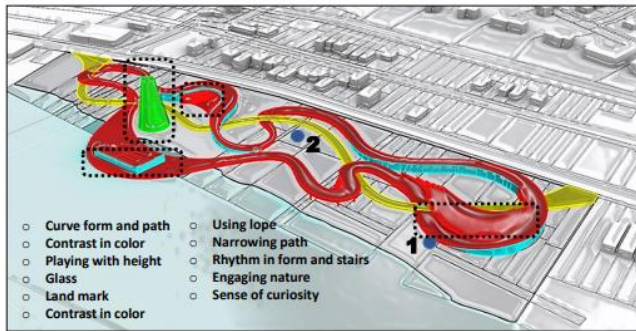
- Giving choice to people to choose being outside or inside while still enjoying nature and river.
- Free spaces / Unexpected events
- Playing with levels of the paths
- Curiosity
- Enrich environment
- Sound and view of river
- Experience different feeling



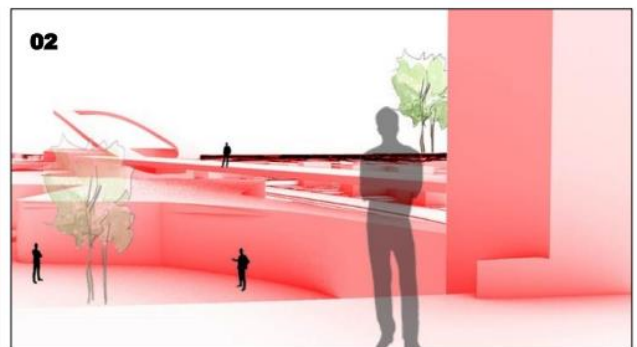
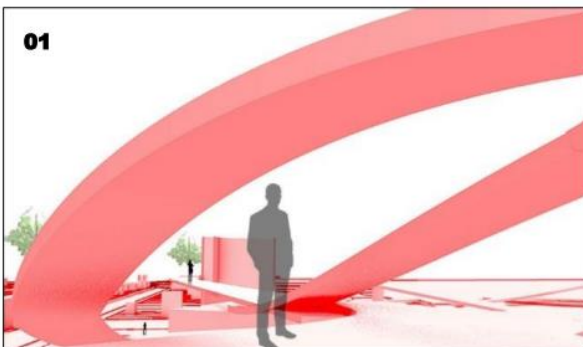
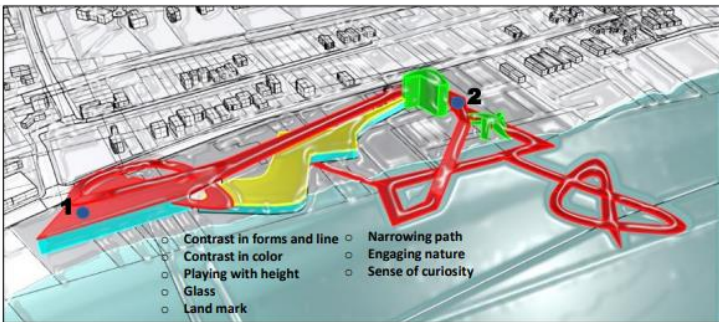
Mass Model 01:



Mass Model 02:



Mass Model 03:



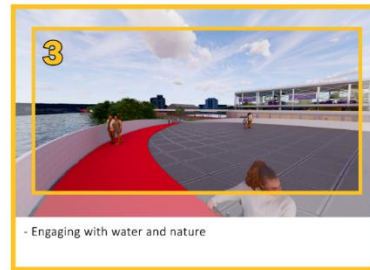
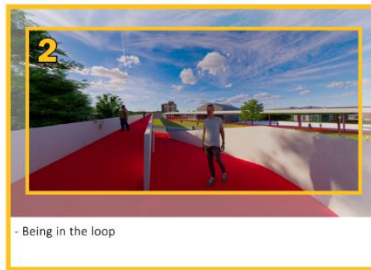


Site experience:



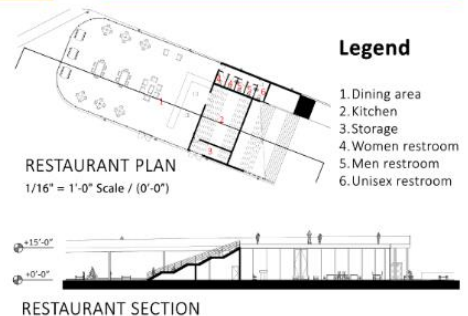
SOUTH SITE ELEVATION (VIEW FROM OHIO RIVER)

1/32" = 1'-0" Scale



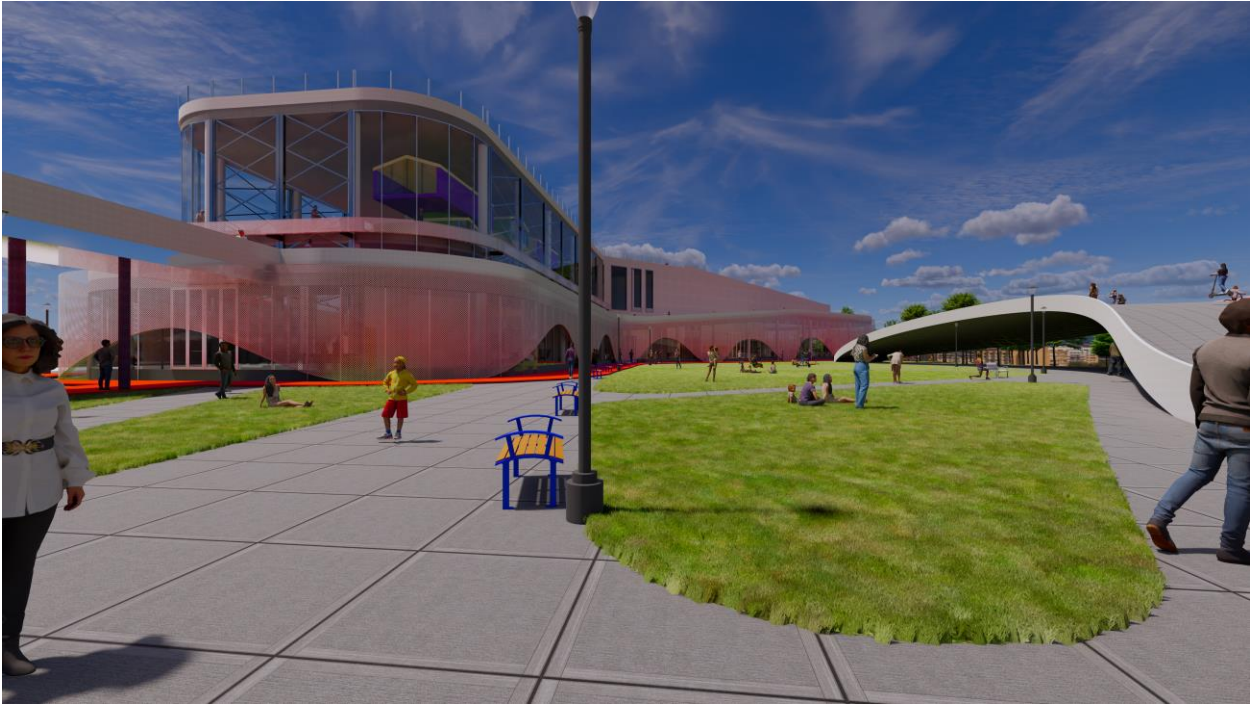
NORTH SITE ELEVATION (VIEW FROM RIVERSIDE DR)

1/32" = 1'-0" Scale

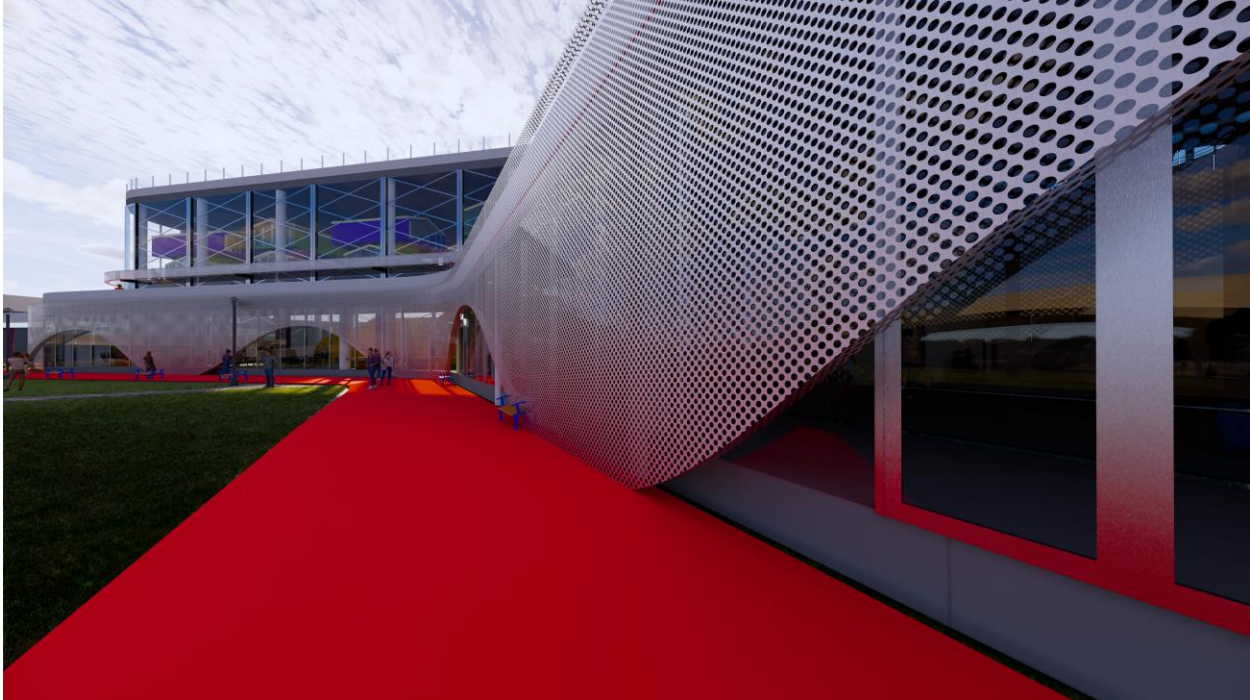


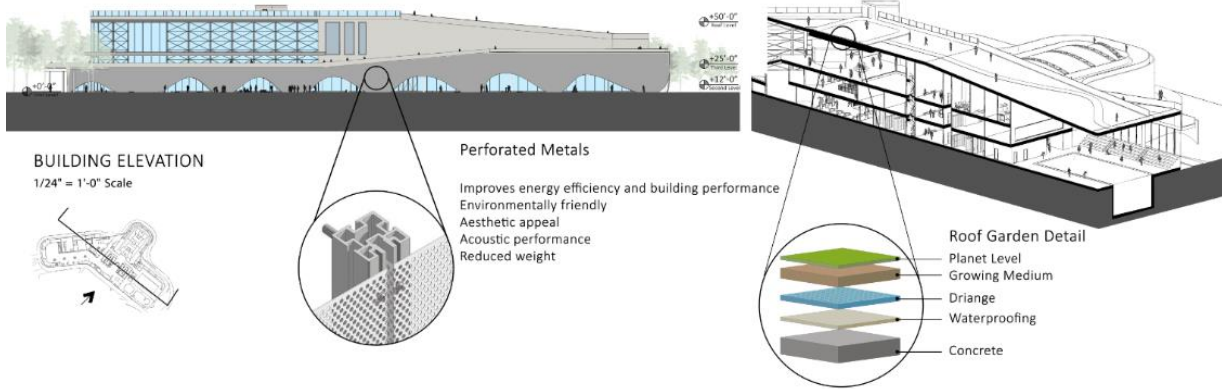
Final Renders of the main entrances:

- West Entrance



- South Entrance

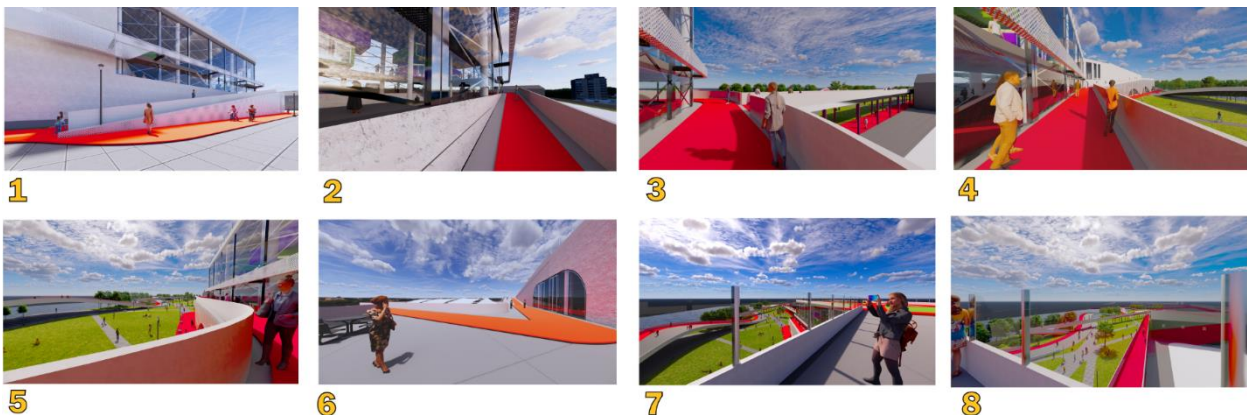


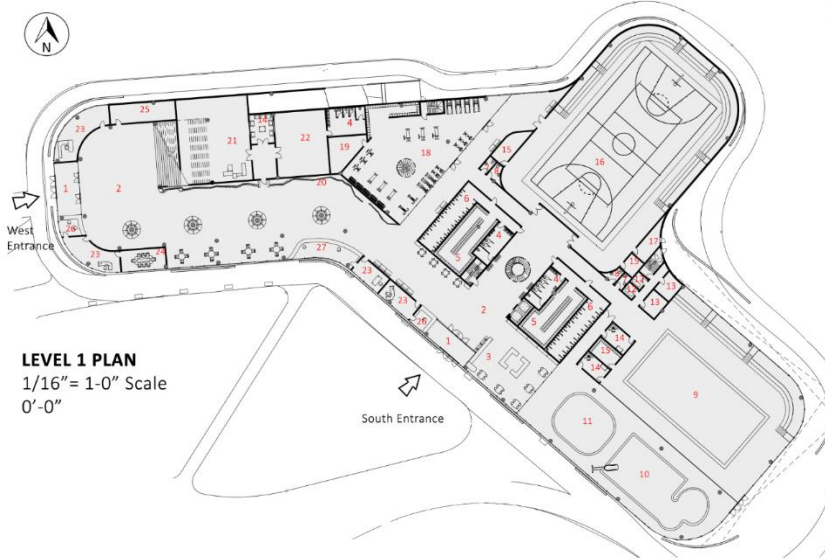


Building experience:



The path is not just a way to get around the site, it's also a big part of it. It connects to the main rec center and lets people see what's happening inside even if they don't go in. This helps them feel connected and understand how navigation and circulation inside work.

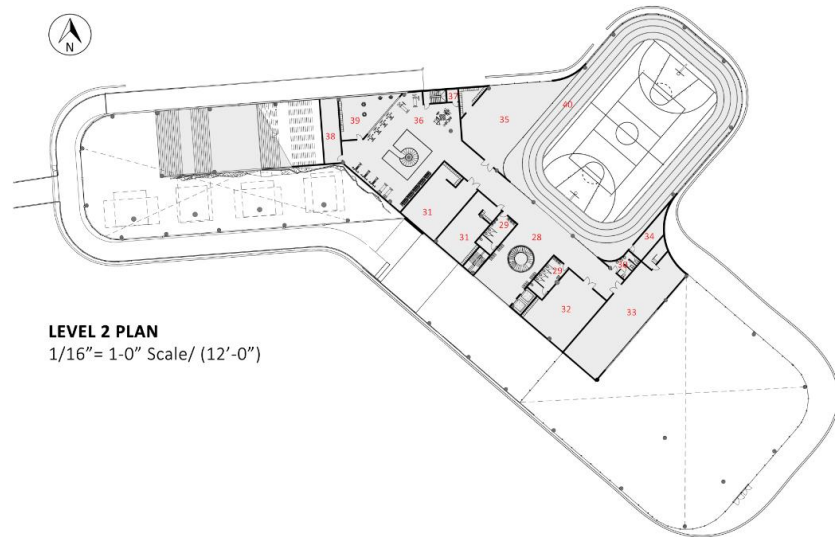




LEVEL 1 PLAN
 1/16" = 1'-0" Scale
 0'-0"

Legend

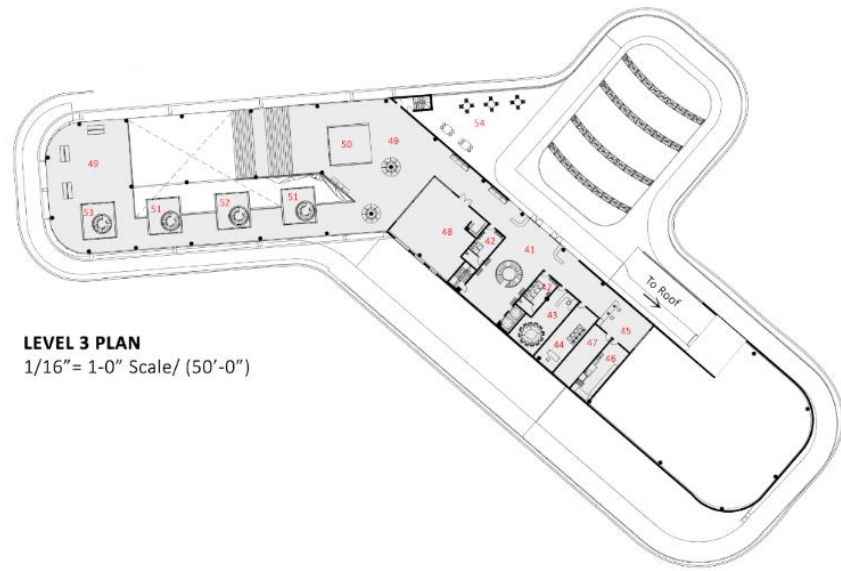
- | | |
|---------------------------------|------------------------------|
| 1. Entrance | 15. Equipment room |
| 2. Lobby | 16. Basketball court |
| 3. Pro shop | 17. Mechanical room |
| 4. Restroom | 18. Fitness room |
| 5. Locker room | 19. Group exercise room |
| 6. Shower room | 20. Climbing wall |
| 7. Unisex restroom | 21. Children playground room |
| 8. Family restroom | 22. Baby room |
| 9. Swimming pool | 23. Office |
| 10. Leisure and children's pool | 24. Conference room |
| 11. Hot tub | 25. Electrical room |
| 12. Message room | 26. Checking |
| 13. Jacuzzi | 27. Front desk |
| 14. Control room | |



LEVEL 2 PLAN
 1/16" = 1'-0" Scale/ (12'-0")

Legend

- | | |
|-------------------------|--------------------|
| 28. Lobby | 35. Gymnastic |
| 29. Restroom | 36. Fitness room |
| 30. Unisex restroom | 37. Storage room |
| 31. Group exercise room | 38. Equipment room |
| 32. Dance studio | 39. Boxing room |
| 33. Multi activity room | 40. Running track |
| 34. Mechanical room | |



LEVEL 3 PLAN
 1/16" = 1'-0" Scale/ (50'-0")

Legend

- | | |
|-----------------|-----------------------|
| 41. Lobby | 48. Senior room |
| 42. Restroom | 49. Free space |
| 43. Office | 50. Physical therapy |
| 44. Staff room | 51. Relaxing room |
| 45. Coffee shop | 52. Yoga room |
| 46. Kitchen | 53. Multipurpose room |
| 47. Storage | 54. Roof Garden |

Climbing Wall:



Basketball court:



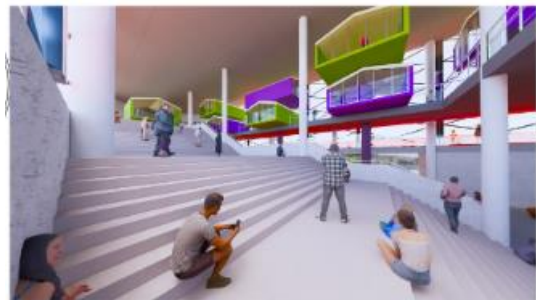
Swimming pool:



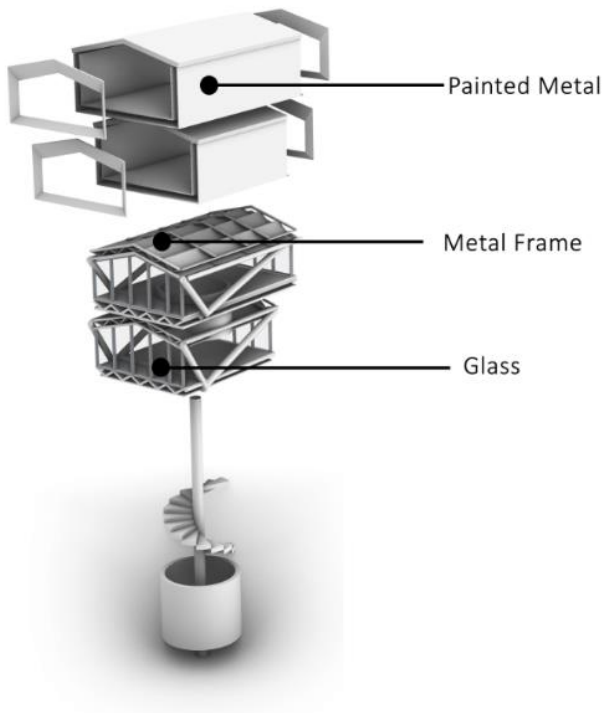


Bringing the Reflection of the neighborhood to the design.

It helps people feel more familiar and comfortable. When they see similarities inside and outside the building, it sticks in their memory and gives them a sense of belonging.

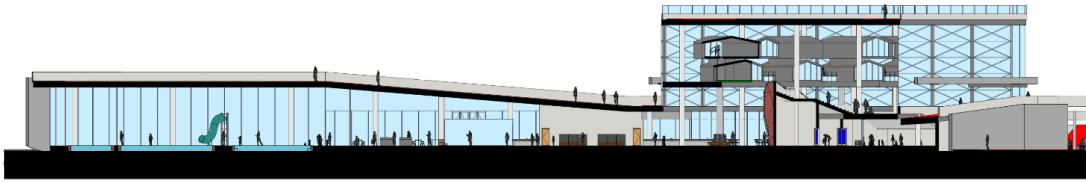


Gathering space

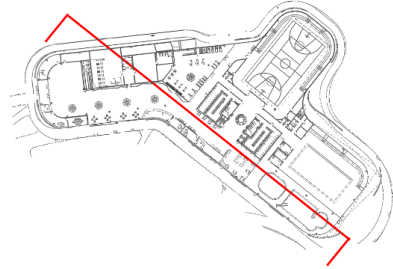


View from Level 3 to the west lobby

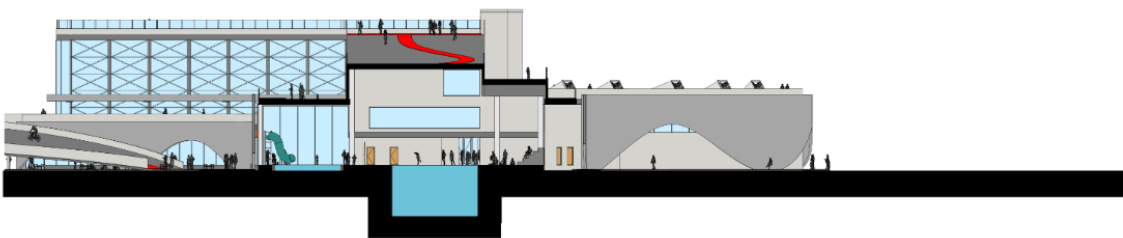
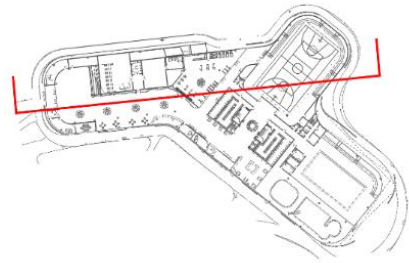




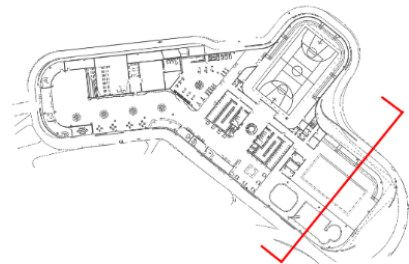
SECTION - LOBBY
1/16" = 1-0" Scale



SECTION - CLIMBING WALL & BASKETBALL
1/16" = 1-0" Scale



SECTION - SWIMMING POOL
1/16" = 1-0" Scale



Navigation Through Space, Designing a recreational center using the principles of neuroscience

Neuroscience is a field that explores the nervous system, while NeuroArchitecture is a relatively new branch that examines how environments and places impact our physiological responses. Our neural responses to our surroundings ultimately affect our behavior, and a rich environment can cause physical changes in the growing brain. One area where neuroscience and architecture can interact is spatial navigation. Although many articles discuss the benefits of incorporating neuroscience into architecture and the importance of spatial navigation, they do not sufficiently address the issue of designing particular circulation and navigation within a specific building type based on neuroscience and how it can impact users' brains and well-being.

Understanding how we navigate and respond to different environments and how other elements can impact our memory and feelings about those environments is crucial. Navigation directly impacts our sense of belonging and safety in space. Therefore, paying attention to the design of circulation in buildings and incorporating visible and invisible elements that impact navigation can enhance human well-being.

GOAL OF DESIGN

By understanding brain activity related to navigation through neuroscience

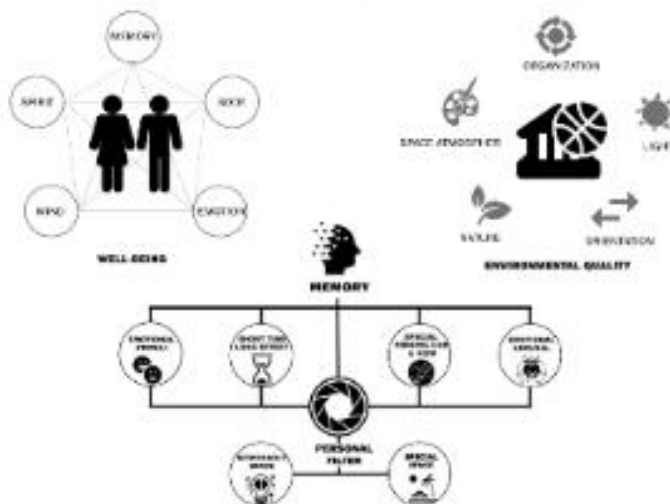
- 1. Design a Rec Center with Specific circulation and navigation that guide people to go through building (both inside and outside)
- 2. Engaging their brain and body with spaces and stimuli happening in the skin.
- 3. Paying attention to what directly and indirectly will impact on both mental and physical health of users to provide them a good feeling and well being.

THISIS QUESTION

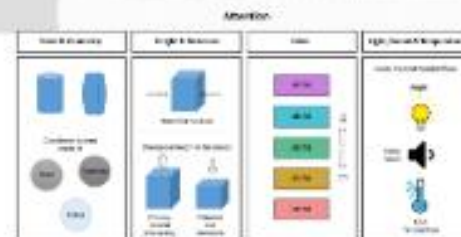
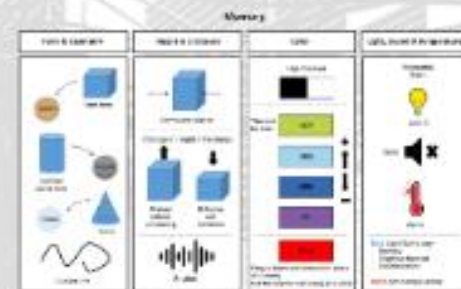
How can the design of outdoor and indoor spaces in a recreational center be optimized to promote physical activity, social interaction, and mental well-being, while utilizing neuroscience with the implementation of specific navigation?



During navigation most parts of the brain are involved



Fatema Shahiyen | M.Arch Candidate 2022
Basid 01



Key ideas based on studies:

- Specific Movement
- Landmarks
- Rich environment
- Different or unexpected events events happening in a same place
- Way finding elements
- Engaging people in the area that they should experience
- Curves forms and lines, inside and outside
- Having contrast in terms of forms, height and design elements, and color
- Engaging nature with the design
- Using the path as a hub
- Using specific colors based on neuroscience studies both inside and outside
- Open spaces
- Using rhythm
- Creating sense of belonging



Mass Concepts Idea:

- Curve form and path
- Contrast in color
- Playing with height
- Glass
- Land mark
- Using slope
- Narrowing path
- Rhythm in form
- Rhythm in stairs
- Engaging nature
- Sense of curiosity

General Design Idea:

- Steps as a path and a way of activity
- Rhythm
- Give people different view to see what's happening inside.
- Giving choice to people to choose being outside or inside while still enjoying nature and river.
- Free spaces / Unexpected events
- Playing with levels of the paths
- Curiosity
- Enrich environment
- Sound and view of river
- Experience different feeling

Fatema Shaheen | M.Arch Candidate 2023
Board 02



SITE PLAN
1/32" = 1'-0" Scale / 03/19/21

SITE EXPERIENCE

SOUTH SITE ELEVATION (VIEW FROM OHIO RIVER)

1/32" = 1'-0" Scale



NORTH SITE ELEVATION (VIEW FROM RIVERSIDE DR)

1/32" = 1'-0" Scale



Legend

- 1. Dining area
- 2. Kitchen
- 3. Storage
- 4. Women restroom
- 5. Men restroom
- 6. Unisex restroom



Fatemeh Shafiqi | M.Arch Candidate 2023
Room 03



View approaching from West Entrance



View approaching from South Entrance

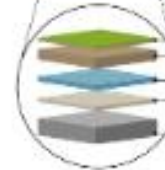


BUILDING ELEVATION
1:60" = 1'-0" Scale



Perforated Metal

- Improves energy efficiency and building performance
- Environmentally friendly
- Acoustic appeal
- Acoustic performance
- Reduced weight



Roof Garden Detail

- Plant Level
- Growing Medium
- Drainage
- Waterproofing
- Concrete

BUILDING PASS EXPERIENCE



The path is not just a way to get around. It's also a big part of it. It connects to the outdoor center and lets people see what's happening inside when if they don't go in. This helps them feel connected and understand how things operate and circulation inside work.



Bringing the reflection of the neighborhood to the design. It helps people feel more familiar and comfortable. When they see similarities inside and outside the building, it sticks in their memory and gives them a sense of belonging.



1



2



3



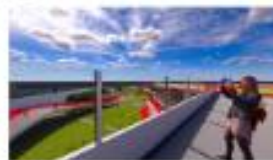
4



5



6

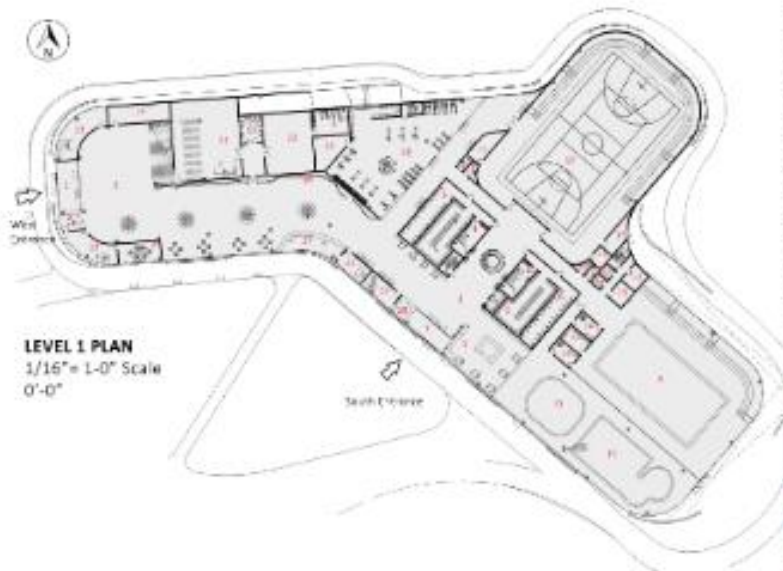


7



8

Filippo Sironi | MARCH 2023
Road 54



LEVEL 1 PLAN
1/16" = 1'-0" Scale
0'-0"

Legend

- | | |
|---------------------------------|------------------------------|
| 1. Entrance | 15. Equipment room |
| 2. Lobby | 16. Basketball court |
| 3. Pro shop | 17. Mechanical room |
| 4. Restroom | 18. Fitness room |
| 5. Locker room | 19. Group exercise room |
| 6. Shower room | 20. Climbing wall |
| 7. Unisex restroom | 21. Children playground room |
| 8. Family restroom | 22. Baby room |
| 9. Swimming pool | 23. Office |
| 10. Leisure and children's pool | 24. Conference room |
| 11. Hot tub | 25. Electrical room |
| 12. Massage room | 26. Checking |
| 13. Jacuzzi | 27. Front desk |
| 14. Control room | |



Lobby (West side)



Climbing wall (In the west Lobby)

- | | |
|------------------------|--|
| - Landmark | - Specific color |
| - Rich Environment | - Different events happening in a same place |
| - Way-finding elements | - Manual light |
| - Rhythm | |



SECTION - LOBBY
1/16" = 1'-0" Scale



SECTION - CLIMBING WALL & BASKETBALL
1/16" = 1'-0" Scale



Basketball court



Swimming pool



SECTION - SWIMMING POOL
1/16" = 1'-0" Scale



Leisure and children's pool

- | |
|-------------------------------|
| - Engaging with nature |
| - Curve Lines |
| - Landmark |
| - Controlling light and sound |

Fateme Shahryar | M.Arch Candidates 2022
Board 05



LEVEL 2 PLAN
1/16" = 1-0" Scale/ (12'-0")

Legend

- | | |
|-------------------------|--------------------|
| 28. Lobby | 35. Gymnastic |
| 29. Restroom | 36. Fitness room |
| 30. Unisex restroom | 37. Storage room |
| 31. Group exercise room | 38. Equipment room |
| 32. Dance studio | 39. Boxing room |
| 33. Multi activity room | 40. Running track |
| 34. Mechanical room | |



Running track

- Natural light
- View to the outside



Gathering space

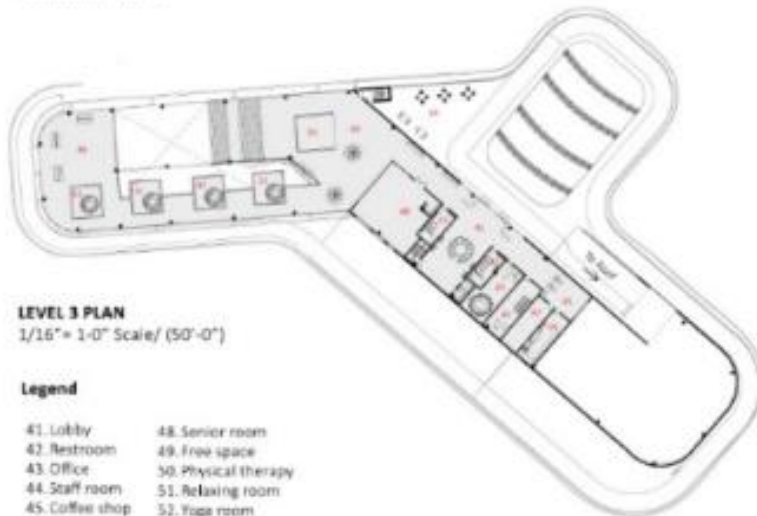


View from Level 3 to the west lobby



Relaxing and Free area

- Sense of belonging
- Reflection of neighborhood
- Using specific color
- Landmark
- Tech environment
- Natural light
- Rhythmic
- Way-finding elements



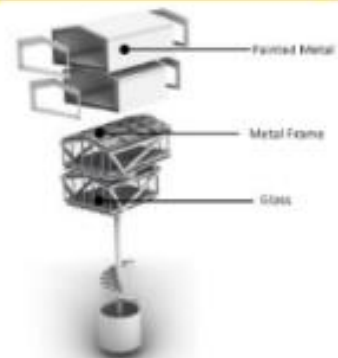
LEVEL 3 PLAN
1/16" = 1-0" Scale/ (50'-0")

Legend

- | | |
|-----------------|-----------------------|
| 41. Lobby | 48. Senior room |
| 42. Restroom | 49. Free space |
| 43. Office | 50. Physical therapy |
| 44. Staff room | 51. Relaxing room |
| 45. Coffee shop | 52. Yoga room |
| 46. Kitchen | 53. Multipurpose room |
| 47. Storage | 54. Roof Garden |



SECTION- GATHERING STAIRS TO THE SMALL CUBES
1/16" = 1-0" Scale



[10] Bibliography

- Paivaa, A, Richard Jedon, R. “Short- and long-term effects of architecture on the brain: Toward theoretical formalization” Volume 8, Issue 4, December 2019, Pages 564-571
- Djebbara, Z, Jensena, O, Paradac, F and Gramann, K. “Neuroscience and architecture: Modulating behavior through sensorimotor responses to the built environment” Volume 138, July 2022, 104715
- Khaleghimoghaddam, N, Alkan Bala, H, Ozmen, G and Ozturk, S. “Neuroscience and architecture: What does the brain tell to an emotional experience of architecture via a functional MR study?” February 2022
- Gage F, “Brain landscape the coexistence Neuroscience and architecture”, national convention & expo, Sandiego California, p:2,2003. <http://www.anfarch.org/pdf/2004-02-01%20Fred%20Gage%20Lecture%20AIA%2003%20compressed.pdf>
- Goldhagen, S. W. “Welcome to Your World”. HarperCollins. Retrieved from. 2017. <https://www.perlego.com/book/597518/welcome-to-your-world-pdf>
- Hardy, Adam (2011) the expression of movement in architecture, The Journal of Architecture, 2011. 16:4, 471-497, DOI: 10.1080/13602365.2011.598698
- Linaraki, D, and Voradaki, G. “The Interaction of Space with the Human Nervous System and Its Impact on Human Psychology” Academy of Neuroscience for Architecture, 2012.
- Martínez-Soto, J. et al.(2012),Exploration OF Neural Correlates OF Restorative Environment Exposure Through fMRI, <http://www.anfarch.org/documents/Martinez-SotoPoster.pdf>
- Nanda U. et al, Lessons from neuroscience: form follows function, emotions follow form, Intelligent Buildings International, 2013. <http://www.tandfonline.com/doi/pdf/10.1080/17508975.2013.807767>
- Reda J. “Neuroscience for architecture”, International student conference, book of abstracts, Brussels & Ghent, p: 7, 2011. http://www.sintlucasfragile.be/wpcontent/uploads/BOOK_OF_ABSTRACTSA51.pdf
- Ricci, Natalie, "The Psychological Impact of Architectural Design". CMC Senior Theses, 2018. https://scholarship.claremont.edu/cmc_theses/1767
- Robinson, S. Pallasmaa, J. “Mind in architecture: neuroscience, embodiment, and the future of design.” Cambridge, Massachusetts: The MIT Press, 2015.
- Ruggles, Donald H. Beauty, Neuroscience & Architecture: Timeless Patterns and Their Impact on Our Well-being. Illustrated. Fibonacci LLC, 2017
- Sternberg E. Fundamental Neuroscience and Architecture Workshop: Summary, the Dana center, Washington dc, 2004.<http://www.anfarch.org/pdf/2004-04-0%20Dana%20Workshop%20Summary%20Report.pdf>
- Taylor, P. “Taxonomy of Human Wayfinding Tasks: A Knowledge-Based Approach Taxonomy of Human Wayfinding Tasks: A Knowledge-Based Approach Access details: Access Details: [subscription number 906465279] 2009.
- Wang, W. L., S. M. Lo, and S. B. Liu. “A Cognitive Pedestrian Behavior Model for Exploratory Navigation: Visibility Graph Based Heuristics Approach.” Simulation Modelling Practice and Theory 2017. 77: 350–366. doi:10.1016/j.simpat.2017.07.002.

Figures:

Figure 01: <https://journal.urbantranscripts.org/article/applied-neuroscience-research-place-negar-ahmadpoor/>

Figure 02: Martínez-Soto, J. et al.(2012),Exploration OF Neural Correlates OF Restorative Environment Exposure Through fMRI, <http://www.anfarch.org/documents/Martinez-SotoPoster.pdf>

Figure 03: Martínez-Soto, J. et al.(2012),Exploration OF Neural Correlates OF Restorative Environment Exposure Through fMRI, <http://www.anfarch.org/documents/Martinez-SotoPoster.pdf>

Figure 04: Martínez-Soto, J. et al.(2012),Exploration OF Neural Correlates OF Restorative Environment Exposure Through fMRI, <http://www.anfarch.org/documents/Martinez-SotoPoster.pdf>

Figure 05: <https://www.artsandmindlab.org/building-the-field-of-neuro-architecture/>

Figure 06: <https://dana.org/article/neuroanatomy-the-basics/>

Figure 07: <https://www.designcurial.com/news/biophilic-design-and-architecture---10-of-the-best-biophilic-buildings-4527750/>

Figure 08: <https://journal.urbantranscripts.org/article/applied-neuroscience-research-place-negar-ahmadpoor/>

Figure 09: <https://www.archdaily.com/533664/ad-classics-thorncrown-chapel-e-fay-jones>

Figure 10: <https://dipfifth.wordpress.com/author/dipfifth/page/8/>

Figure 11: <https://neuro-architectology.com/>

Figure 12: <https://www.nycgovparks.org/about/history/recreation>

Figure 13:
https://en.wikipedia.org/wiki/Asser_Levy_Recreation_Center#/media/File:Asser_Levy_Recreation_Center.jpg

Figure 14: https://www.archdaily.com/794532/ke-house-of-culture-in-movement-mvrdv-plus-adept?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=other-user

Figure 15: <https://www.archdaily.com/13358/the-therme-vals>

Figure 16: <https://www.archdaily.com/926109/maryland-heights-community-recreation-center-cannondesign>

Figure 17: <https://www.invisionapp.com/inside-design/design-for-the-human-brain/>

Figure 18: https://www.archdaily.com/972376/uram-extreme-park-kosmos-architects-plus-legato-sports-architecture?ad_source=search&ad_medium=projects_tab

Figure 19: https://www.archdaily.com/976577/athletic-development-club-studio-va?ad_source=search&ad_medium=projects_tab

Figure 20: Made by the author

Figure 21: Made by the author

Figure 22: Made by the author

Figure 23: Made by the author

Figure 24: Made by the author

Figure 25: Made by the author

Figure 26: Made by the author

Link to the animation of the design:

Navigation through Space,
Designing a recreational center with the neuroscience approach



<https://www.youtube.com/watch?v=J2zjbfR8xQ>