NEUROSCIENCE INSTITUTE

YINGZHE DUAN

NEUROARCHITECTURE

NEUROSCIENCE INSTITUTE IN BENGHAZI

BY

Yingzhe Duan

CHAIR: Dr. Ahmed K. Ali

COMMITTEE: Dr. D. Kirk Hamilton

COMMITTEE: Dr. L. Gerard Toussaint

STUDIO INSTRUCTOR: Dr. Ray A. Pentecost

CLIENT: Dr. El-Nihum

Texas A&M University ARCH 608

DEDICATION

To my family

Thanks for your love and support.

“The life that I have, is all that I have and the life that I have is yours.

The love that I have, of the life that I have, is yours and yours and yours.”

- Violette Szabo

ACKNOWLEDGEMENT

I would like to express my gratitude to my chair, Dr. Ahmed K. Ali and Client Dr. El-Nihum, for providing this amazing project to me. This is a good opportunity to design a full functional Neuroscience hospital. I really appreciate Dr. Ali, he gave me lots of useful suggestions during my design process. Even though he pushed me very hard, but I believe this push is necessary when I think back to the whole process.

I would like to thank the members of the committee, Dr. Kirk Hamilton, and Dr. Gerard Toussaint. Your professional acknowledgment and experience help me a lot. Without your guidance, I couldn't finish my project perfectly.

I am also thankful to Prof. Ray Pentecost. I would never forget your encouragement and support to my project. Your gentle but sharp wards let me grow up.

Last but not least, many thanks go to my classmates and friends, thanks for your suggestions and support.

ABSTRACT

My final project is Neuroscience Institute in Libya. The concept of this project aims to explore how to combine the two disciplines: Architecture and Neuroscience to create a healing environment that could enhance the recovery of the pediatric patient. Research shows that after getting the neurological disease, the patient's behavior and mood will change due to the injury. The brain could recover by help from not only the clinical treatment but also the enhanced environment. The following concepts such as nature, daylight, cultural recovery and wayfinding show how to create the environment that will stimulate the patient's brain, and thus to achieve the purpose of shortening the recovery time. Additionally, the conclusion indicates what I learned from the process of the final design.

Keyword: Neuroscience Institute, Neuroscience, neuroarchitecture, nature, daylight, way-finding, evidence-based design, material, culture, recovery

BACKGROUND

My Master of Architecture final project is to design the first neuroscience institute for children in Benghazi, Libya. My client El - Naihum is a doctor who is working at Baylor Scott & White Medical Center in College Station Texas. Benghazi is his hometown, and there is no neurological facility for children. So the goal is to help the client to achieve his dream to build the first in Libya. The site is located in the suburb which is far away from the city center. Due to the narrow roads and the high density in downtown, the site is located in a quiet environment with low density and coastline. The Mediterranean sea will provide a peaceful environment and beautiful view to the patient. The wind comes from the north and brings the moisture.

For the convenience site accessibility, there are two highways near the site, one is directed to the city downtown, the other is to the airport. There are not so many people living around the site, but maybe in the future, with the exploitation of the neuroscience institute, the economy of its surrounding district will be developed.

For the medical treatment for the pediatric neurological disease, the hospital includes clinical department, emergency department, surgery department, ICU, and inpatient department. It also includes a rehabilitation center with different kinds of therapy.

CONTENT

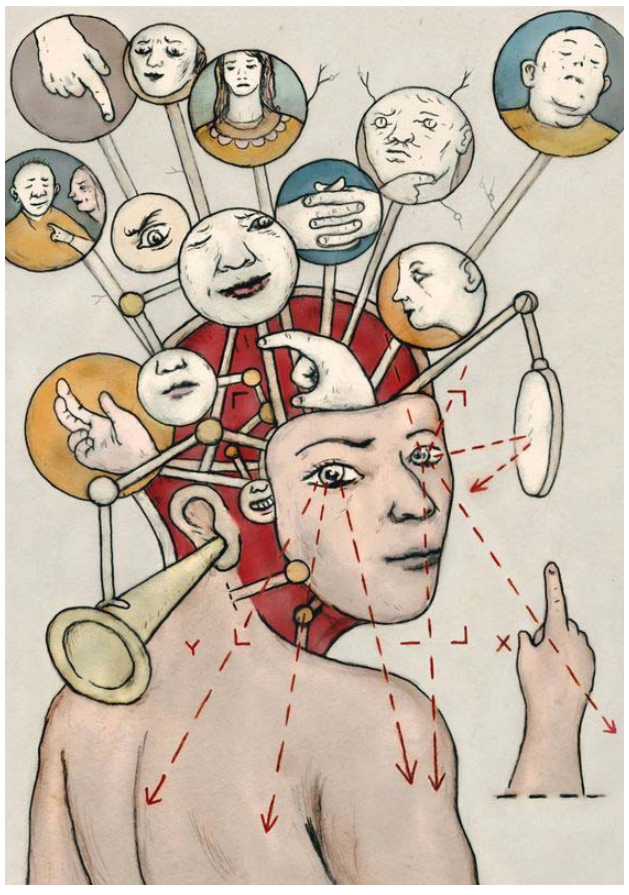
CHAPTER 1
RESEARCH

- *Picture from Dr Greg Dunn*

NEUROSCIENCE

Neuroscience is the scientific study of the nervous system. Nervous system includes the brain, spinal cord, and sensory nerve cells, advancing the understanding of human thought, emotion, and behaviors.

Michael Gazzaniga began his essay in Neuron (Gazzaniga, 2008) by saying, "scientists ask how the brain causes human beings to perceive, think, behave, reproduce, eat, drink, and all the rest. Enormous advances have been made toward this goal, and today, the excitement in the field is palpable."



Behavioral neuroscience - the study of the biological bases of behavior. Looking at how the brain affects behavior.

Cellular neuroscience - the study of neurons, including their form and physiological properties at cellular level.

Clinical neuroscience - looks at the disorders of the nervous system, while psychiatry, for example, looks at the disorders of the mind.

Cognitive neuroscience - the study of higher cognitive functions that exist in humans, and their underlying neural bases. Cognitive neuroscience draws from linguistics, neuroscience, psychology and cognitive science. Cognitive neuroscientists can take two broad directions; behavioral/experimental or computational/modeling, the aim being to understand the nature of cognition from a neural point of view.

Neuroscience has traditionally been classed as a subdivision of biology. These days, it is an interdisciplinary science which liaises closely with other disciplines, such as mathematics, linguistics, engineering, computer science, chemistry, philosophy, psychology, and medicine.

- *John P.Eberhard (2009) Applying Neuroscience to Architecture*
- *https://neuro.georgetown.edu/about-neuroscience*
- *Picture from Jonathon Rosen*

NEUROLOGY

The word neurology comes from combining the Greek terms neuron, which means "nerve," with logos, which means "study." Neurology is the field of medicine that focuses on disorders of the nervous system and the brain.

There are various diseases that affect the brain, spine and nerves in children, leading to lead complications including delay in normal growth and development. The key to successful management of neuro diseases in children is early detection.

- *http://www.wisegeek.com/what-is-a-pediatric-neurologist.htm*

Methods applied during the pediatric rehabilitation: Neurodevelopmental treatment approaches, physical therapy, orthesis applications, balance and coordination training, botulinum toxin applications, electrical simulation applications and other methods deemed fit by the expert physicians. Cooperation of the family and the comfort of the baby are primarily what is important with these applications. It must be ensured by the families and health professionals that the child perceives the treatment as a game thus participates completely.

- *http://www.rehalifeturkey.com/pediatrik-rehab-copy.html*
- *https://www.childrenscolorado.org/research-innovation/research-area/neurology-neurosurgery/dravet-syndrome-research/*

NEUROARCHITECTURE

Architecture and neuroscience were two disparate disciplines until it was found that brain was continuously remodeled by the environments we are living in. The collaboration finds a platform on health care, study and work environments. Focusing on healing environments, a well designed built environment with principles of neuroscience, reduces patient stay, and even plays a part in treatment such as retrieving old memory or brain stimuli. These principles get specialized when the target group is children. Children differ from adults in many ways, for memories, dimensions, concentration, learning abilities. Brain related situations requires more attention, therefore design is modelled considering desired or undesired behaviors.

Neuroscientists study behaviors and brain, and architects should use the inputs in design. Learning how our brain works with perception will lead to new developments on behalf of users in design. New treatments combined with architectural approaches give children a pleasant stay, shortens the healing process, and even can be involved with environmental treatment." (Cagil Kayan, 2011)

ANFA
The Academy of Neuroscience for Architecture

The Academy of Neuroscience for Architecture (ANFA) was created in 2003 to explore ways to link the research of neuroscience to the practice of architecture. What they studied in five areas of brain systems are:

Sensation and Perception (how do we see, hear, smell, taste, etc.?)
Learning and Memory (How do we store and recall our sensory experiences?)
Decision making (How do we evaluate the potential consequences of our actions?)
Emotion and affect (How do we become fearful or excited? Or what makes us feel happy or sad?)
Movement (How do we interact with our environment and navigate through it?)

Advances in neuroscience are now able to explain the ways in which we perceive the world around us and navigate in space and the way our physical environment can affect our cognition, problem solving ability, and mood. Thus, an understanding of the principles of neuroscience, particularly in the area of perception and spatial orientation, can inform the design of built spaces to include environmental features that minimize negative physiological, cognitive, and emotional effects (see the Commentary by Goldstein, page 243).

- *John P.Eberhard (2009) Applying Neuroscience to Architecture*
- *https://neuro.georgetown.edu/about-neuroscience*
- *Picture from Jonathon Rosen*

PEDIATRIC ENVIRONMENT

To provide a healing environment for the children, some positive stimulation such as interacting with other children, socializing, or improving their skills thorough plays and enriched spaces. In order to have an effcient therapy, the spaces should enable concentration, relaxation and disable stress, Therefore hospital environment should provide appropriate light, acoustics, way finding, needs for privacy and relaxation while avoiding stress.

- *The Medical Jounal (2015) How to make a doctor's visit easier for kids*
- *https://childrens-hospital.lomalindahealth.org/our-services/pediatric-neurology*

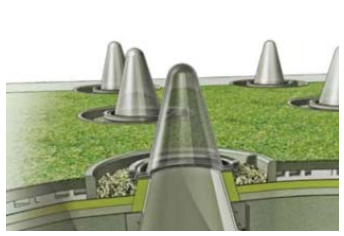
CASE STUDY-1

REHAB Basel is a highly specialised clinic for neurorehabilitation and paraplegiology in switzerland. It is a centre in which patients learn to live again through holistic rehabilitation. Architects Herzog & de Meuron designed a multifunctional, building with plazas, gardens, public facilities, and secluded residential quarters allowing the patients as much autonomy as possible.

When entering the REHAB Basel you get the impression of walking in a small town. After entering the complex through a large courtyard, various inner courtyards provide orientation and nature views. You proceed along them until you arrive at your destination. The different places vary considerably. The gym and the patients' rooms have large windows and views of the landscape.

- *http://www.us.laufen.com/en/references/health-and-care/ref_REHAB_Basel_Switzerland*

CASE STUDY-2



The Meyer Children's Hospital in Florence,Italy uses natural daylight as a key design element throughout the facility. Conical skylights pierce the roof, called "cappelli di Pinocchio" (Pinocchio's hats), that together with the 47 "solar tubes," provide the interiors with natural lighting. The solar tubes in-built in the ceilings are structured by polycarbonate spherical sections whose inner surface is characterized by Raybender and Light Interceptive Transfer Device (LITD) technologies which direct even the lowe angled sun rays into the extension channels, reducing light refractions.

The good climate conditions and the building orientation maximize natural light and the visual relationship with the landscape, leading patients to perceive its changes, the time and seasons passing by, and reducing one's sense of isolation. Quality of light and lighting play a fundamental role in the environmental and psychological well-being. In order to improve the integration between artificial and natural light sources, the design team has used automatic electronic systems able to record light changes and Lux levels. Design and technical solutions are therefore joined towards the single aim of utmost energy saving.

- *https://archello.com/project/the-meyer-childrens-hospital-in-florence*

CASE STUDY-3

The Crown Sky Garden is located in the heart of downtown Chicago, it is a sanctuary for patients, families, doctors and administrators within this 23 story Children's Hospital. Children activate the garden through direct engagement and orchestrate sounds of nature throughout this greenhouse space.

Situated within a glass greenhouse, this garden is defined by a series of interactive elements of light, and sound within the colored resin walls and the locally reclaimed wood elements. The garden incorporates a range of individual and collective spaces that meet the needs of children with immune deficiencies, while offering a place for discovery and innovative engagement.

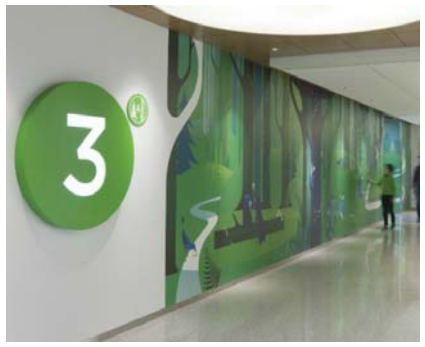
- *http://www.gooood.hk/the-crown-sky-garden-by-m-k.htm*

GOAL

NATURE

COLOR

ARTWORK



WAYFINDING

PRIVACY

INTERACTION

DAYLIGHTING

SOUND

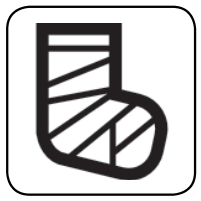
AIR

CHAPTER 2
DESIGN STRATEGY

- *Picture from Dr Greg Dunn*

PROGRAMMING


PEDIATRIC


EMERGENCY

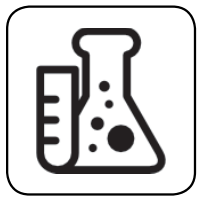

CLINIC


INPATIENT


REHABLITATION


MEDICAL STAFF

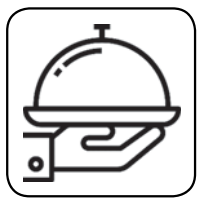

DIAGNOSTIC

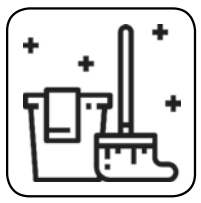

LAB


OFFICE


EDUCATION


STAFF

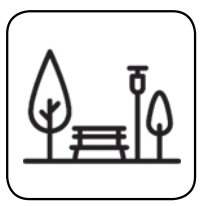

KITCHEN

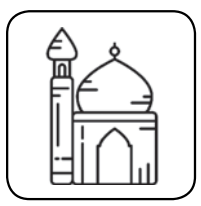

HOUSEKEEPING


LOADING


RECEPTION

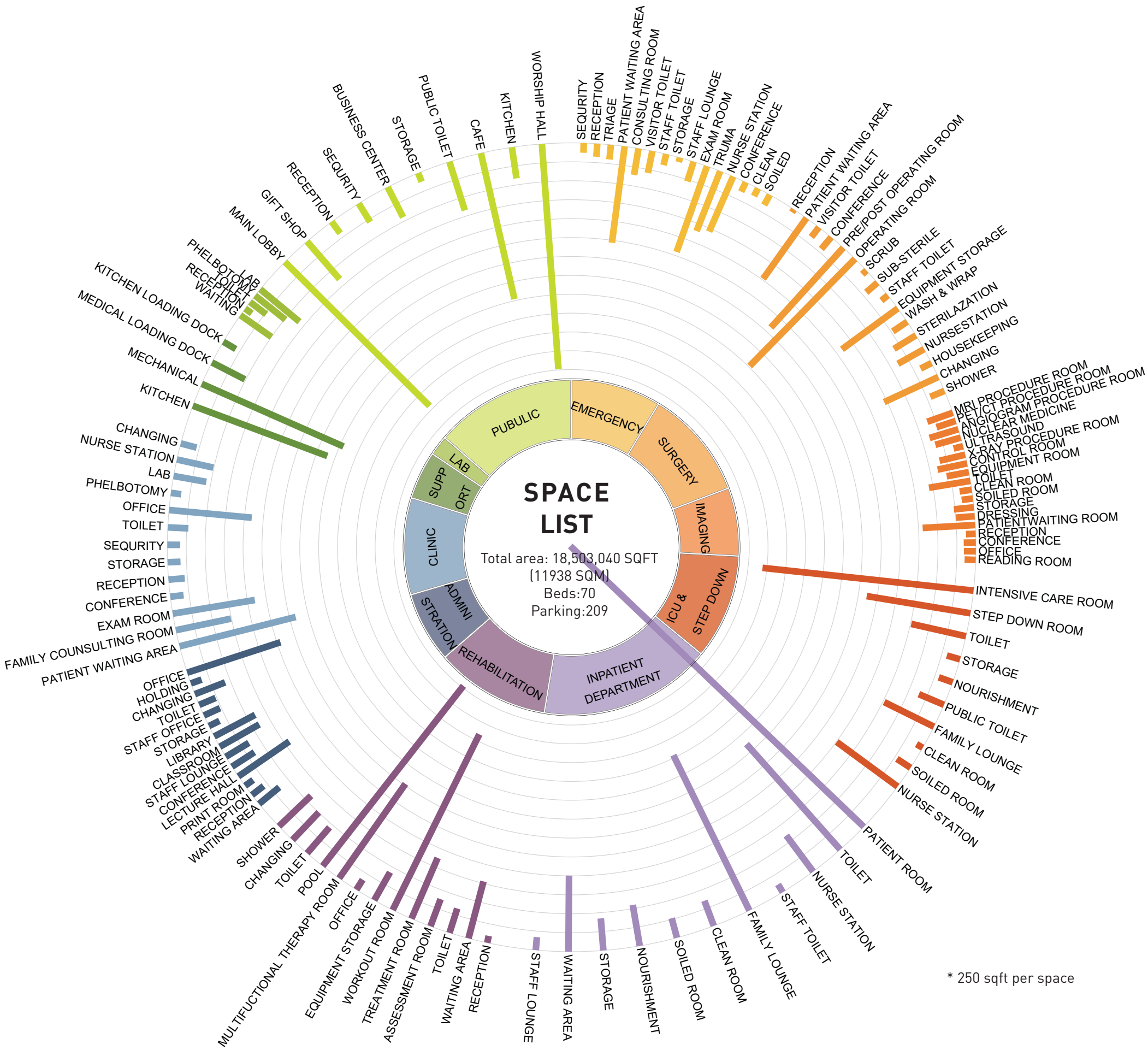

FAMILY


LANDSCAPE


RELIGION


CAFE

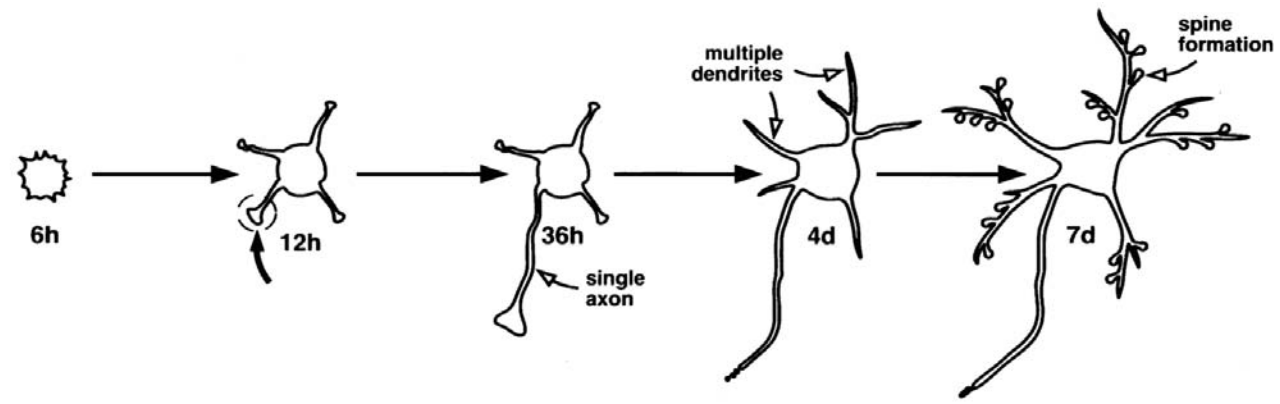

GIFTSHOP



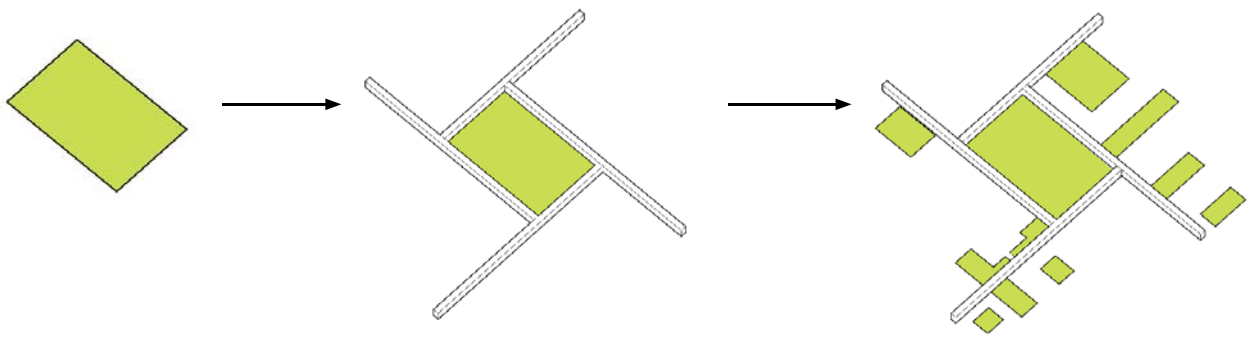
* 250 sqft per space

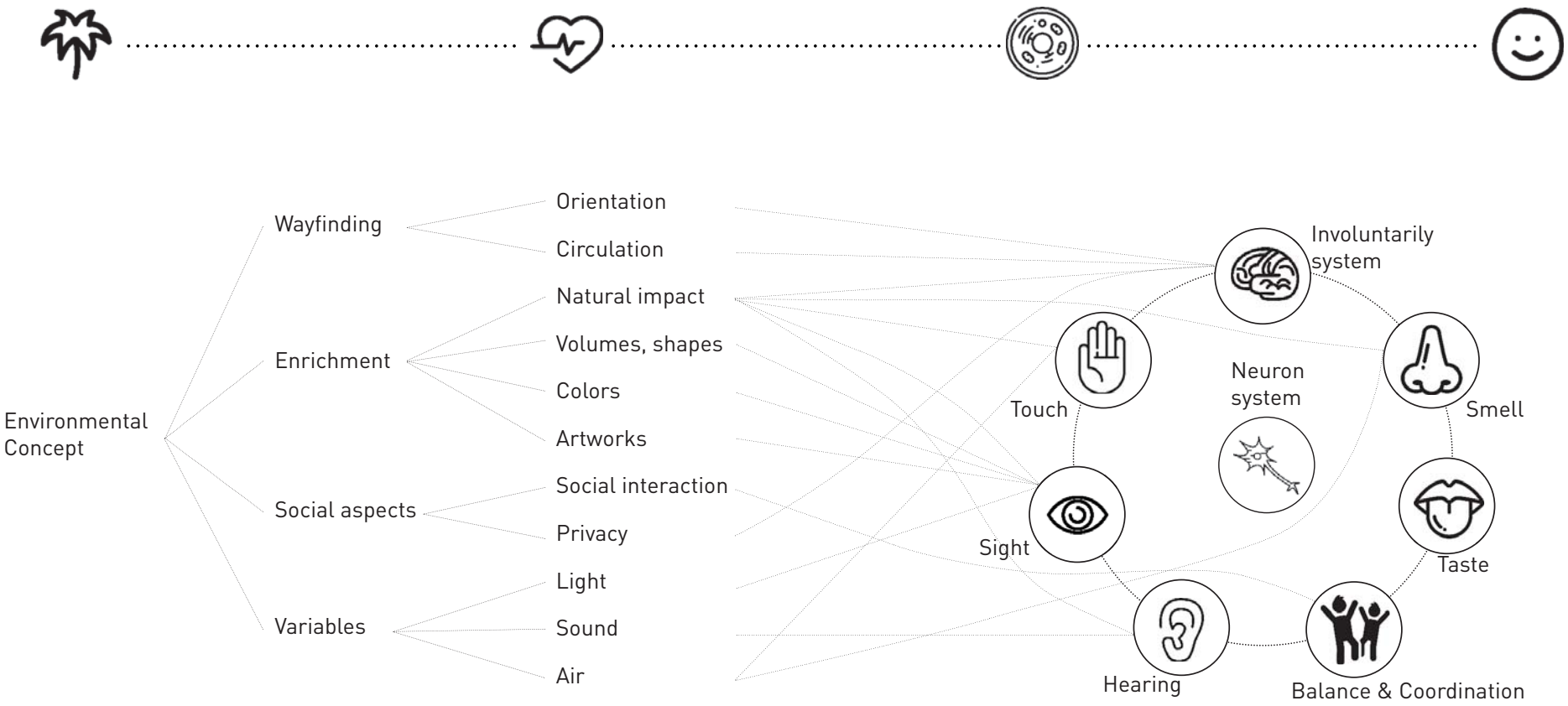
CONCEPT

The building develops process is inspired by the neuron development. The axon and multiple dendrites are developed from the core.



The central garden as the core of the building. Four main axis pathway around it. The building form is easy for the future extension. The other small courtyards are connected to the main corridors.





The design concept is handled with 4 aspects that involves/reveals/stimulates brain in different ways. Each aspect handles different parameters, to be studies individually.

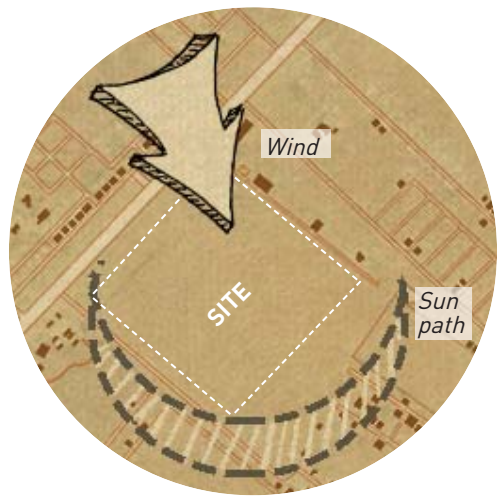
All the environment stimulation have influence on human's behaviour and emotion. Those are related to human's neuron system.

SITE ANALYSIS

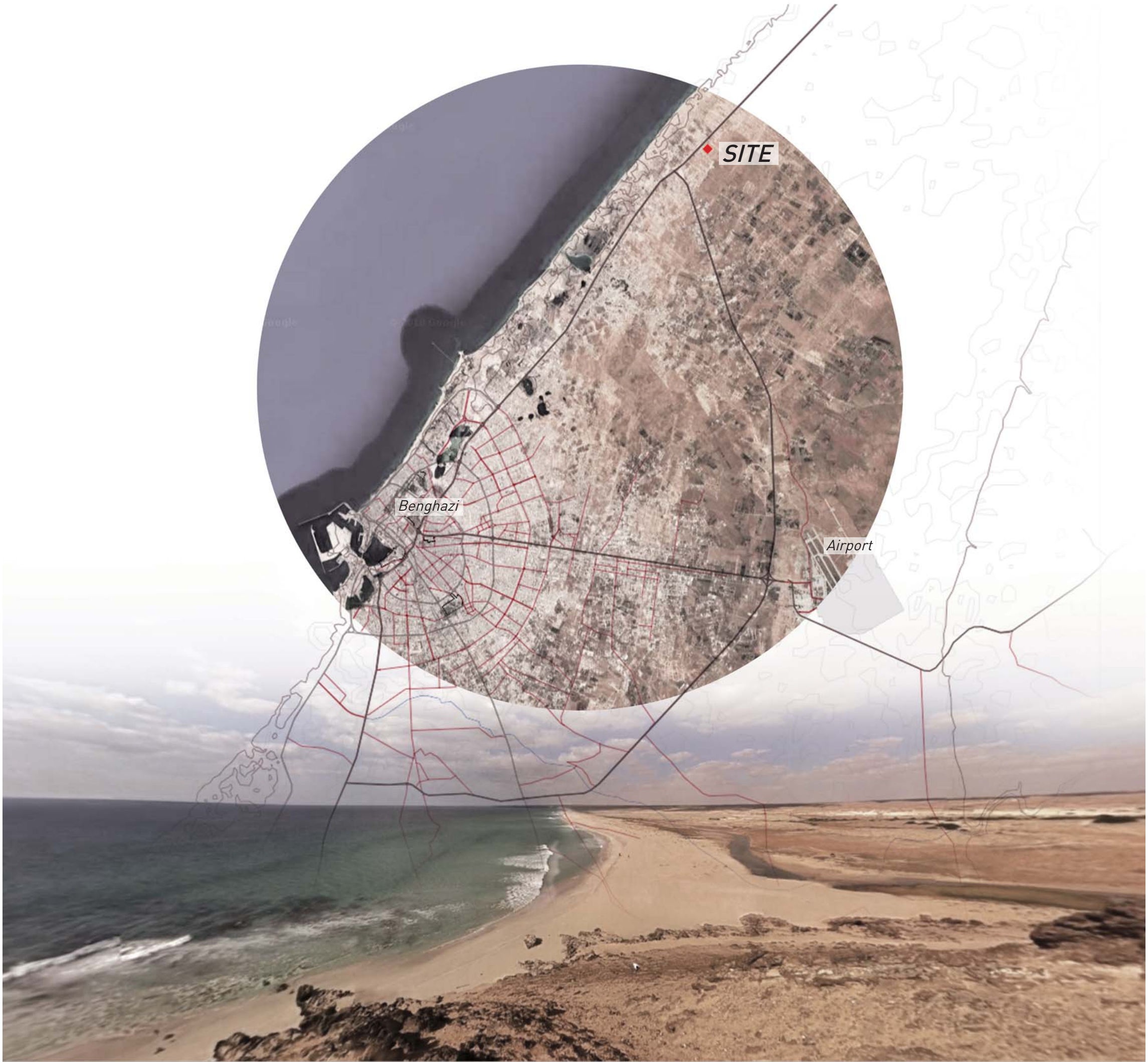
LOCATION

TRAFFIC

SEA VIEW



WIND & SUN

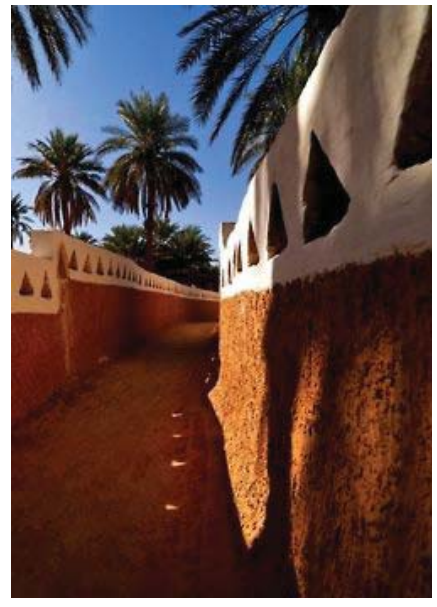

SITE
Benghazi
Airport

CULTURE

Libya is a North African country along the Mediterranean Sea. It is bordered by Egypt to the east, Sudan to the southeast, Chad and Niger to the south, and Algeria and Tunisia to the west. The Libyan culture is a blend of many influences, due to its exposure to many historical eras. Its culture involves roots in Berber, African, Turkish and Arab cultures. Libya was also an Italian colony for about three decades, which had a great impact on the culture. Libya has managed to keep its traditional folk culture alive to today.

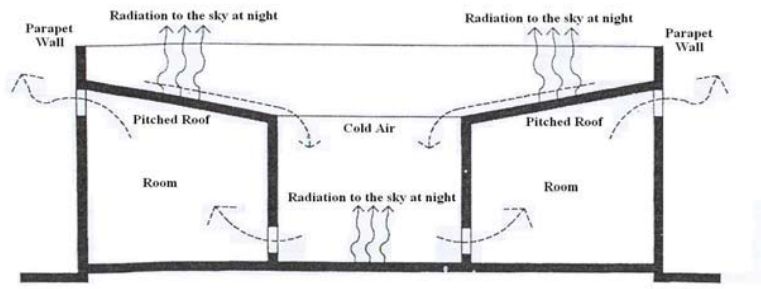
RELIGION

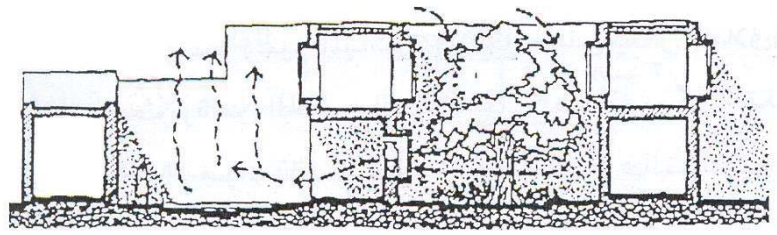
- *Jeff Kennel (Tripoli, Libya)*



The residential clusters' design of the old city of Tripoli and the other old-style houses around the city are characterized by the courtyard, which is a common element in most traditional houses in the Mediterranean region. Sometimes, the courtyard is fitted with a fountain that serves as a focal point for family activities. The courtyard also provides cool, fresh air for the interior rooms.

The courtyard is a regulator of air movement within the house. Fathy (1998), illustrated the air movement by convection heat transfer where the density of the warm air is less than the moderate cold air, hence, it rises high were an air switching situation happened between the light density (warm air), and the heavy density (moderate cold air), where it makes an air circulation. This theory explains the function of the courtyard.

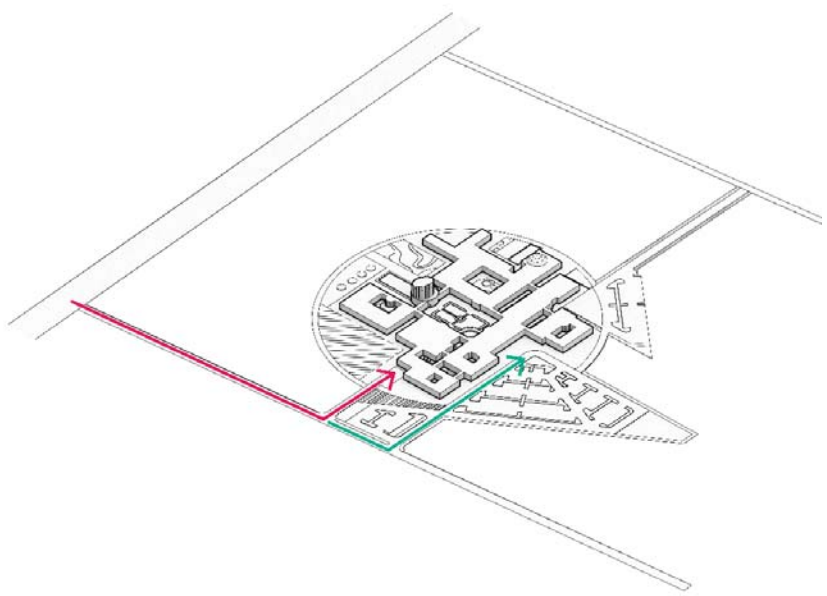




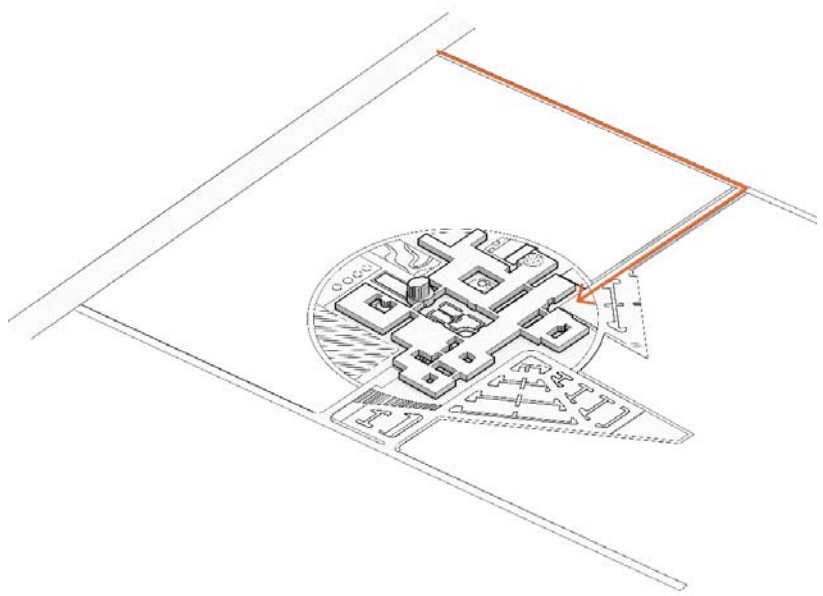
Presence of vegetation in the court provides a pleasant air to the house.

- *Wazeeri, 2002.*
- *Nahla Adel Elwefati (2007) Bio-Climatic architecture in Libya*
- *http://karl-justaguy.blogspot.com/2017/03/virtual-world-tour-stop-23-tripoli.html*
- *https://www.flickr.com/photos/mytripsmypics/1898966507*
- *Ghadames, Libya.*

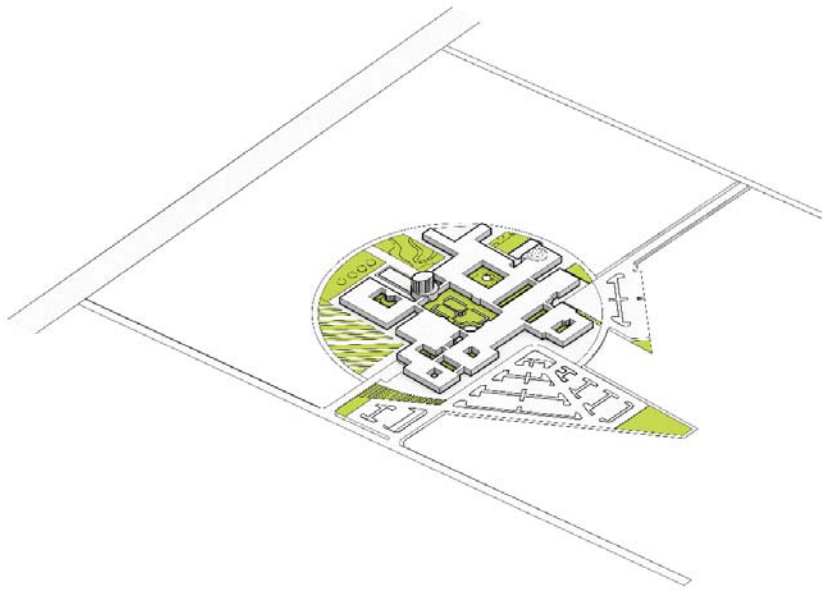

⑤
⑤
②
①
③
④
⑥
①
①
1. Parking lot
2. Staff Apartment
3. Central garden
4. Green buffer zone
5. Family garden
6. Transition path



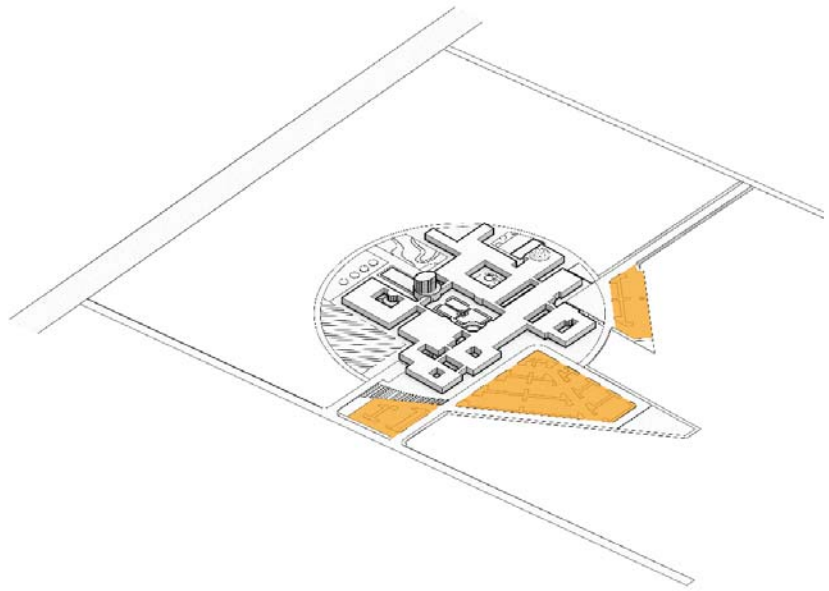
PATIENT ENTRANCE



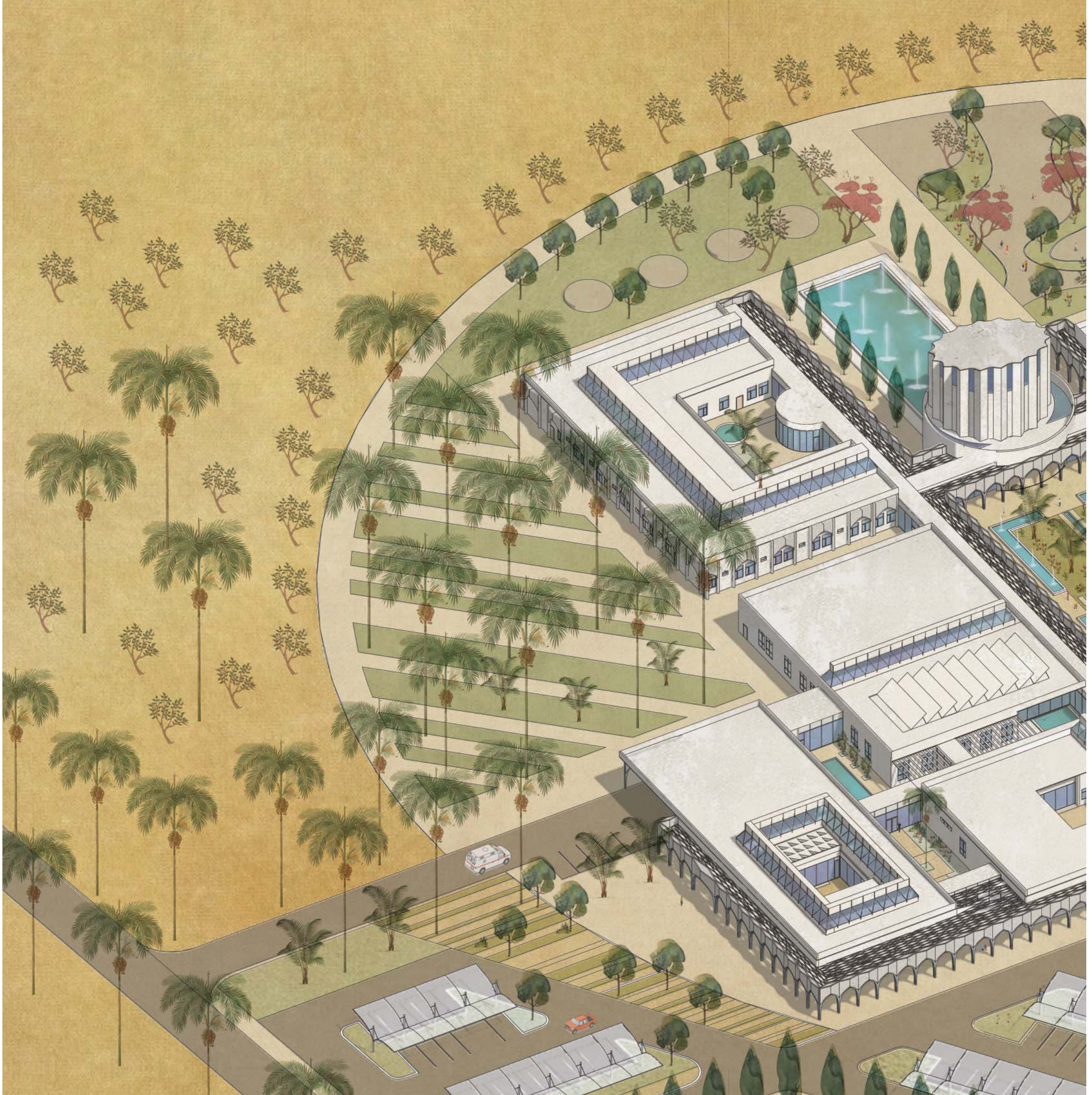
STAFF ENTRANCE

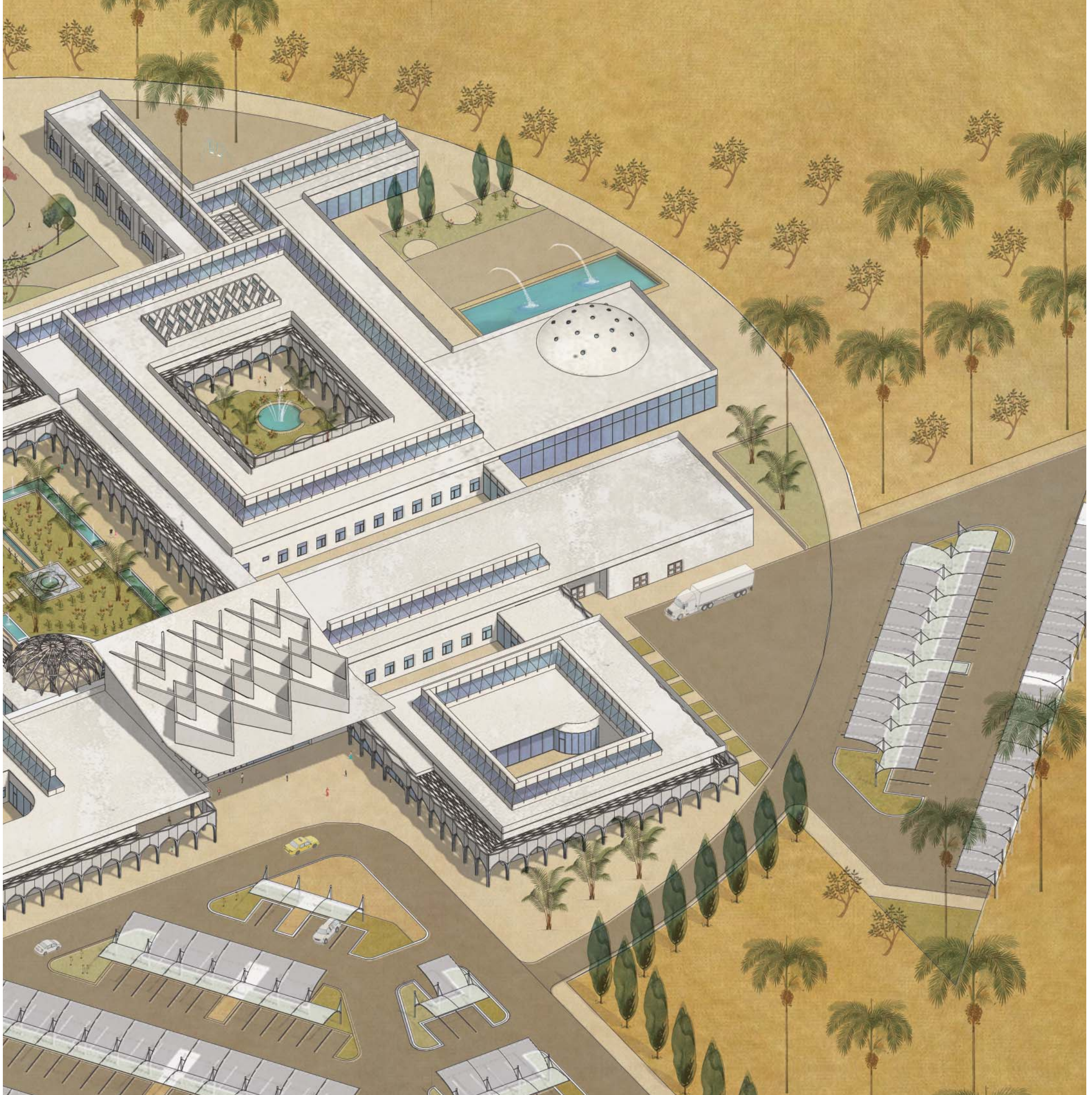


LANDSCAPE



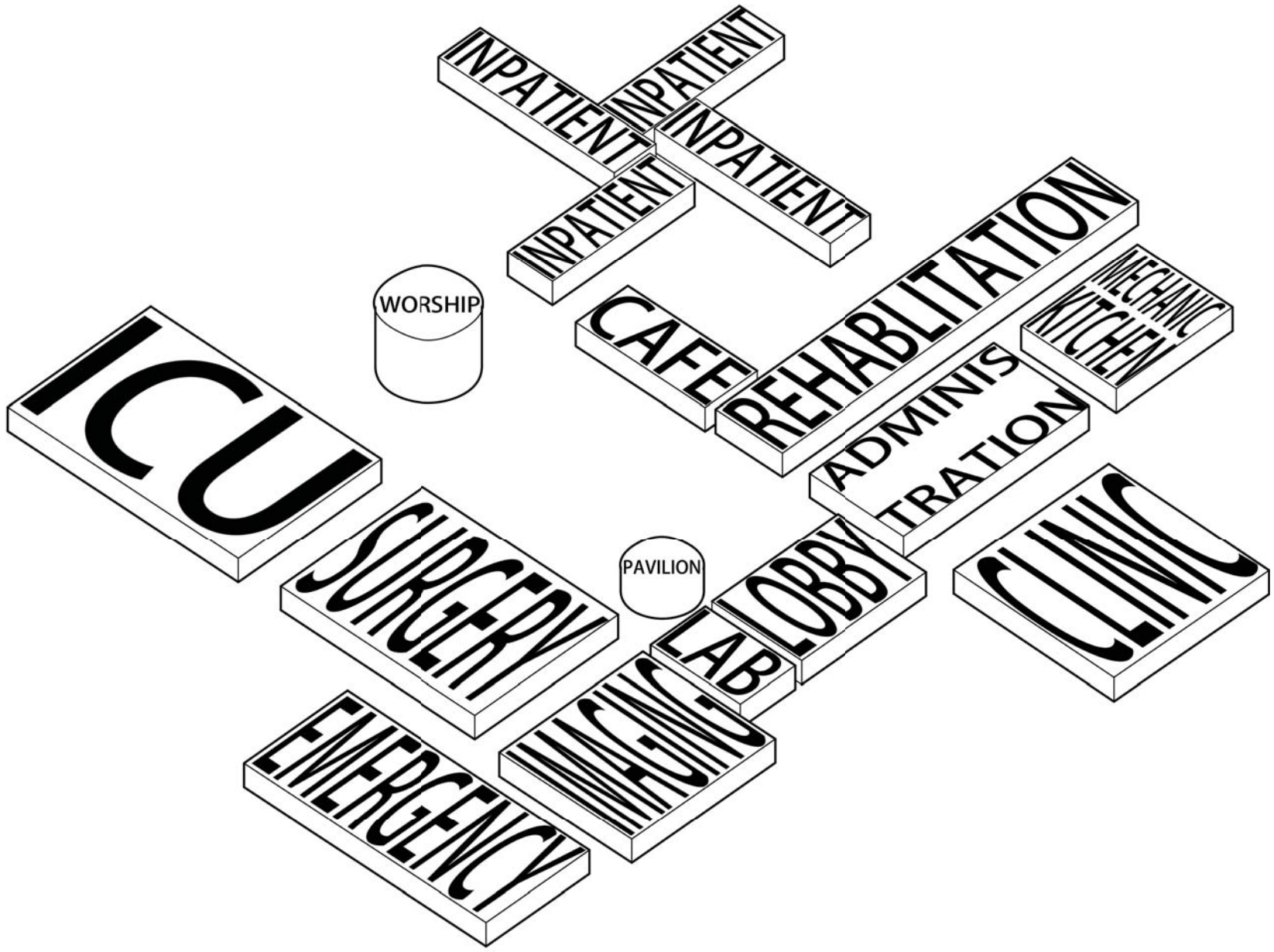
PARKING

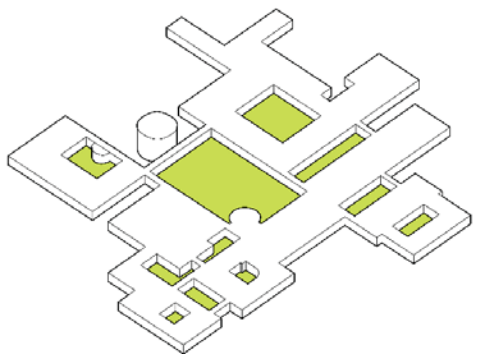


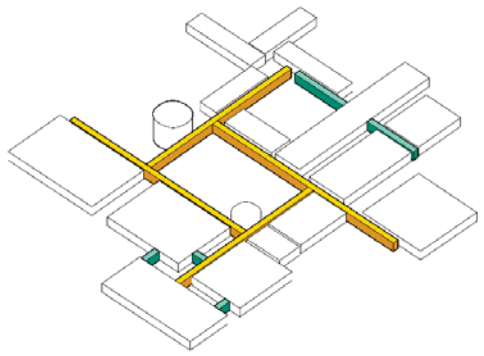


1:1000

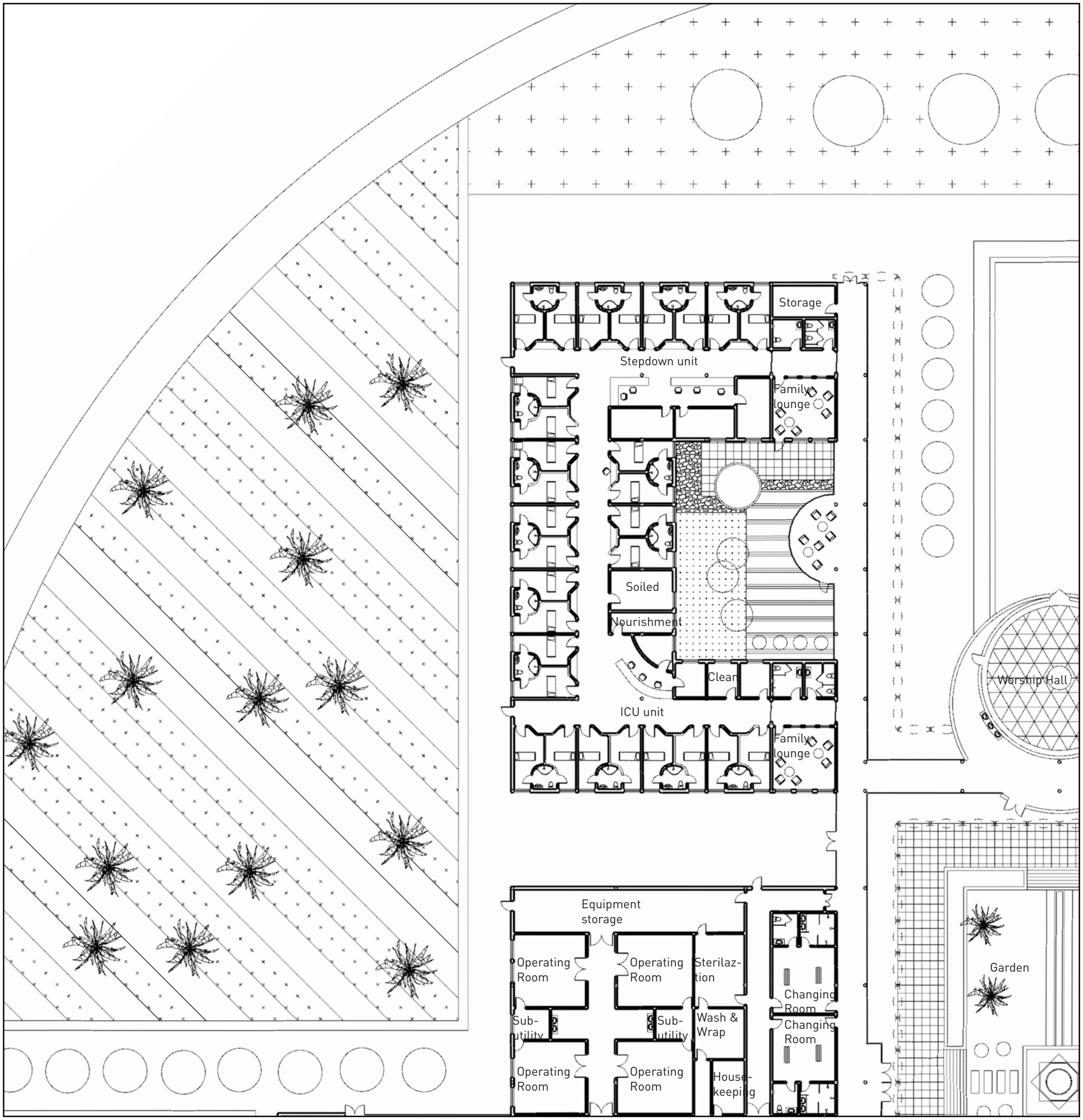
1. Lobby
2. Gift Shop
3. Garden
4. Worship Hall
5. Cafe
6. Children play
7. Pavilion
8. Waiting Room
9. Pool
10. Mechanical Room
11. Traige
12. Nurse Station
13. Work out Area
14. Exam Room
15. Consult Room
16. Trauma
17. Operating Room
18. LAB
19. Philebotomy
20. Therapy Room
21. Clean
22. Soiled
23. Housekeeping
24. Sterilaztion
25. Wash & Wrap
26. Storage
27. Kitchen
28. Nourishment
29. Charting
30. Med. Prep
31. Lecture hall
32. Office
33. Staff Lounge
34. Classroom
35. Library
36. Print room
37. Security
38. Changing Room
39. Conference
40. Reception
41. MRI
42. Ultrasound
43. X-Ray
44. CT/PET
45. Angiogram
46. Nuclear
47. Reading room
48. Control room
49. Equipmemt
50. Holding
51. Family Lounge
52. Patient Room
53. ICU
54. Stepdown
55. Toilet
56. Kitchen loading dock
57. Medical loading dock
58. Shower
59. Pre & Post surgery
60. Sub utility

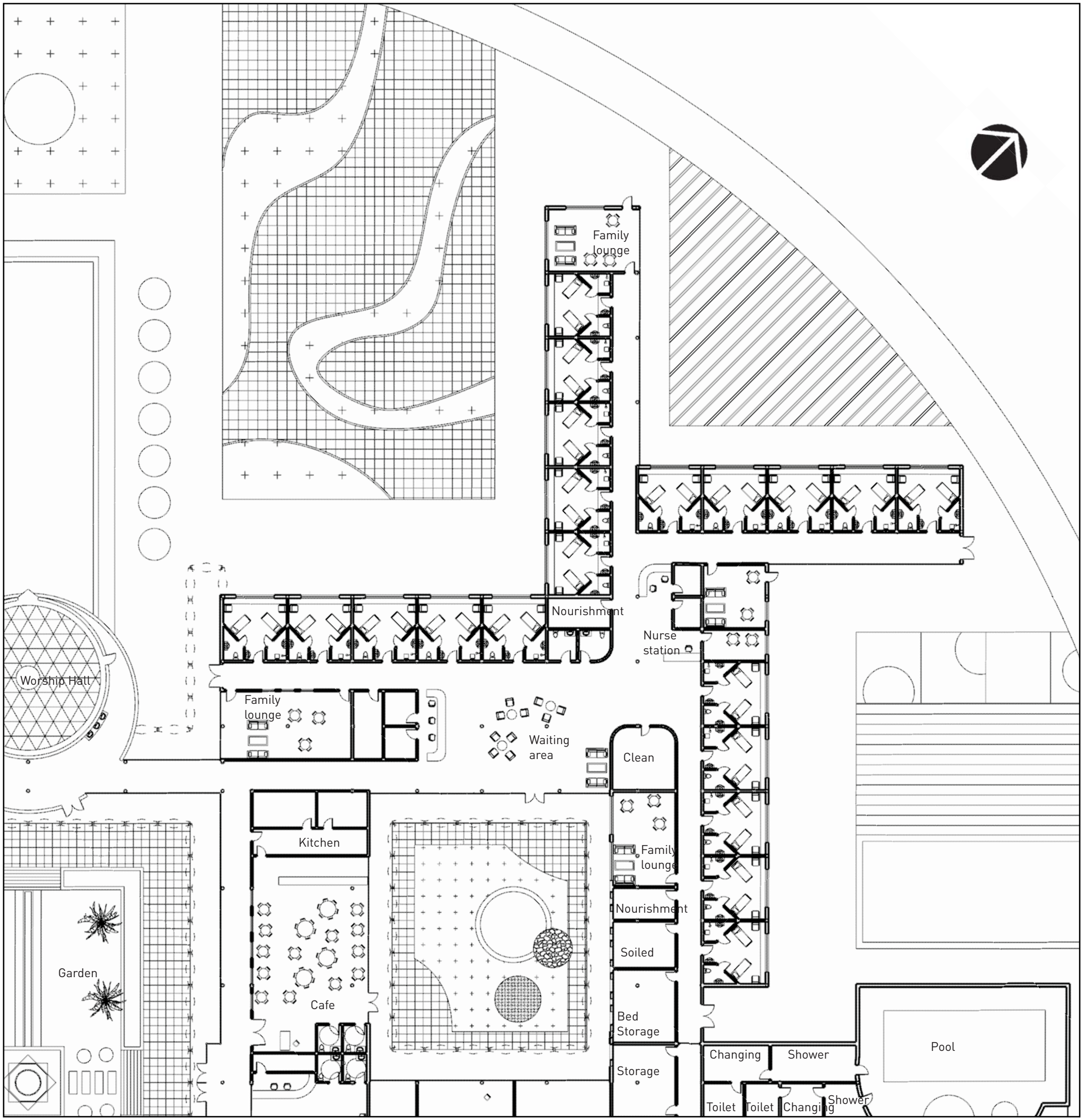


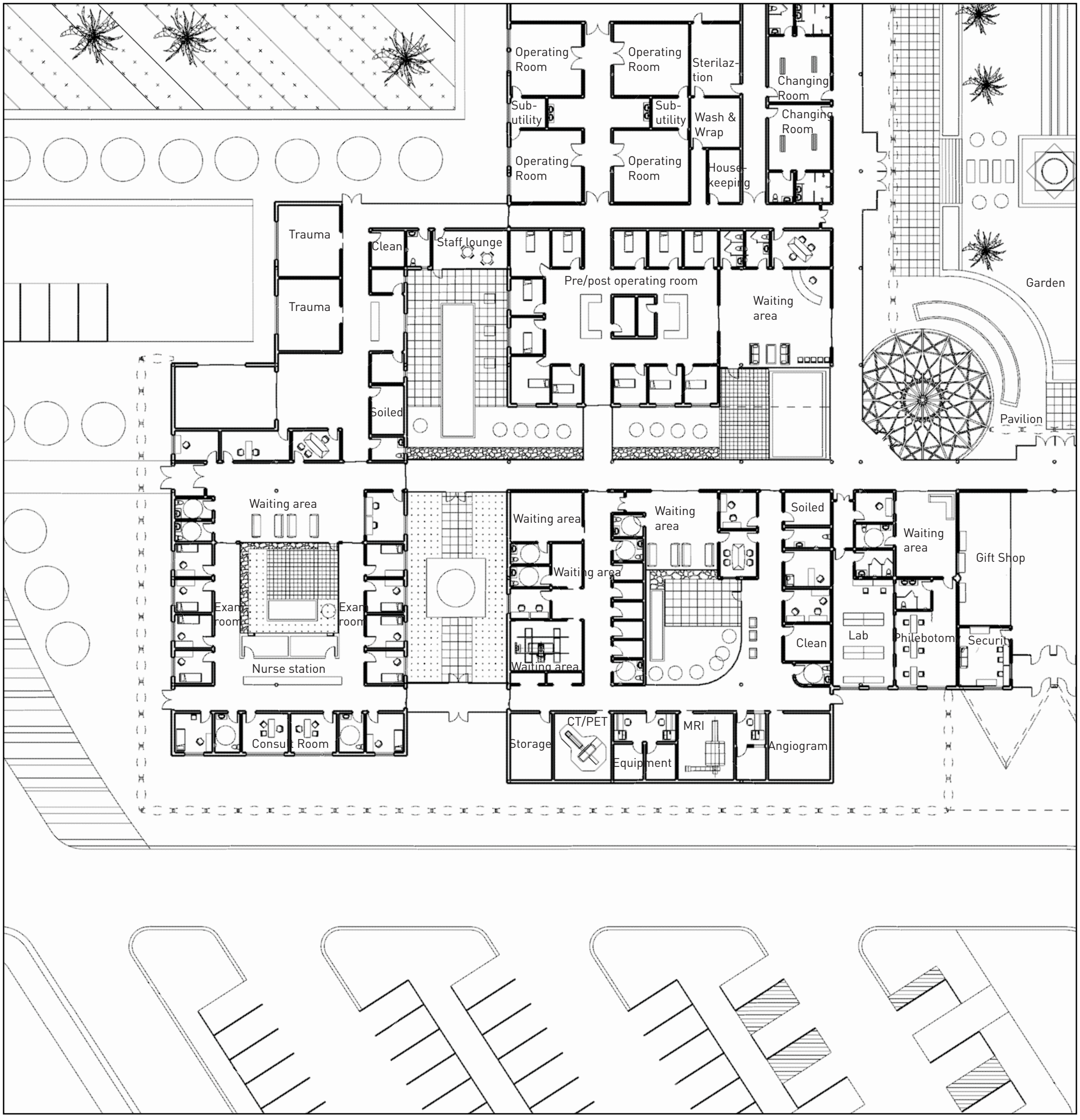


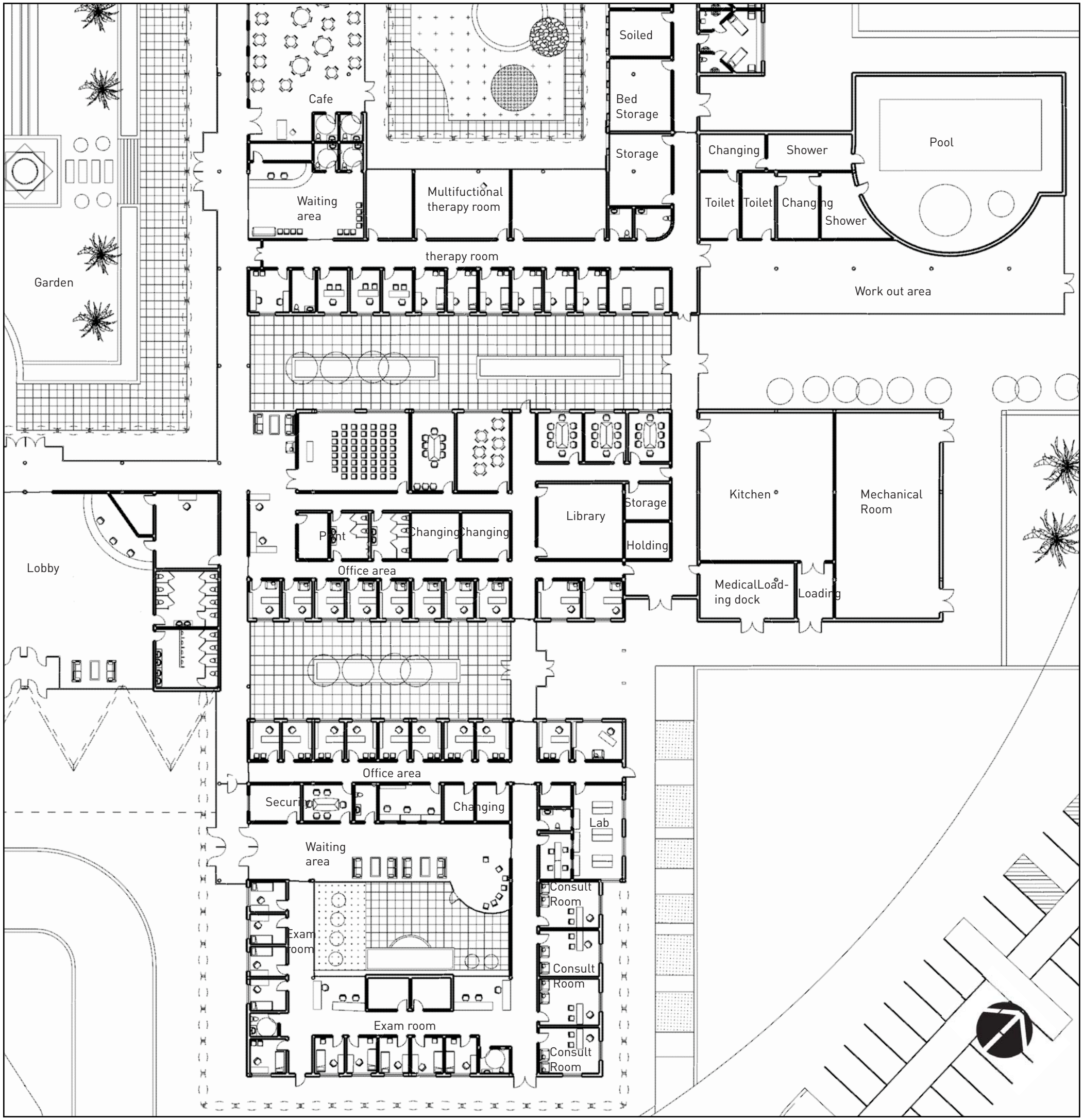


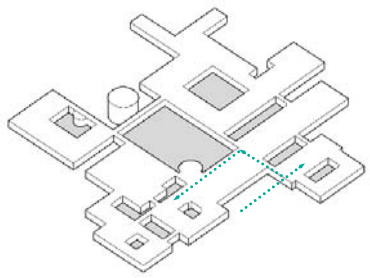
Separate the different departments.
In the central axis to the northwest, it goes lobby, garden with fountains and pavilion and worship hall for all religions.
There are four main axis corridors to connect each department. The windmill plan type will be easier for the hospital expansion in the future.
The central garden with other accessible small courtyards provides a healing environment to the hospital.


Storage
Stepdown unit
Family lounge
Soiled
Nourishment
Clean
ICU unit
Family lounge
Worship Hall
Equipment storage
Operating Room
Operating Room
Sterilaz-tion
Sub-utility
Sub-utility
Wash & Wrap
Changing Room
Changing Room
Operating Room
Operating Room
House-keeping
Garden


Family
lounge
Nourishment
Nurse
station
Worship Hall
Family
lounge
Waiting
area
Clean
Kitchen
Family
lounge
Nourishment
Soiled
Garden
Cafe
Bed
Storage
Storage
Changing
Shower
Pool
Toilet
Toilet
Changing
Shower

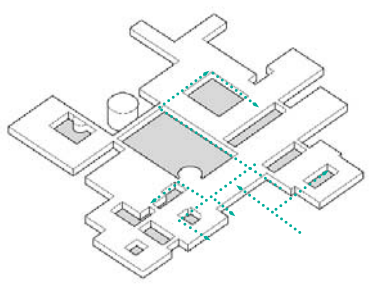

Operating Room
Operating Room
Sterilaz-tion
Changing Room
Sub-utility
Sub-utility
Wash & Wrap
Changing Room
Operating Room
Operating Room
House-keeping
Trauma
Trauma
Clean
Staff lounge
Pre/post operating room
Waiting area
Garden
Soiled
Pavilion
Waiting area
Waiting area
Waiting area
Soiled
Waiting area
Gift Shop
Waiting area
Exam room
Exam room
Nurse station
Lab
Phlebotom
Security
Clean
Consult Room
Storage
CT/PET
MRI
Angiogram
Equipment


Garden
Cafe
Soiled
Bed
Storage
Storage
Changing
Shower
Pool
Toilet
Toilet
Changing
Shower
Waiting
area
Multifuctional
therapy room
therapy room
Work out area
Kitchen
Mechanical
Room
Library
Storage
Holding
Plant
Changing
Changing
Office area
Lobby
MedicalLoad-
ing dock
Loading
Office area
Securing
Changing
Lab
Waiting
area
Consult
Room
Exam
room
Consult
Room
Exam room
Consult
Room



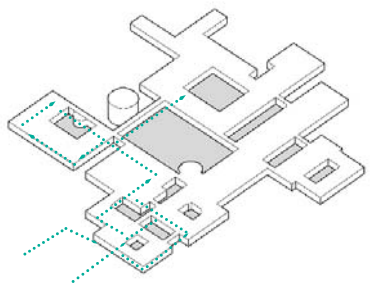
OUTPATIENT FLOW

Clinc is separate from the main hospital, but still connected with the corridor.



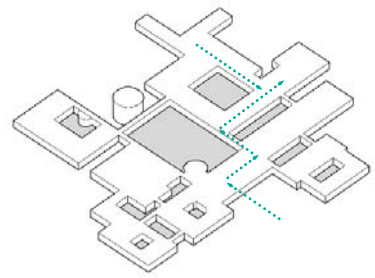
INPATIENT FLOW

Inpatient room is the farest department from the main entrance. All of the room have the sea view.



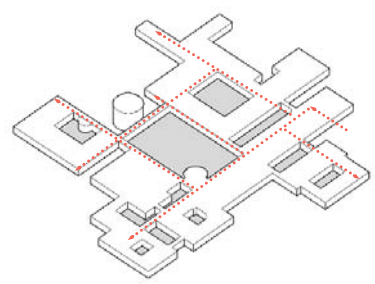
EMERGENCY FLOW

Emergency department seperates the vehicle and walk-in entrance. It closed to Imaging and surgery department.



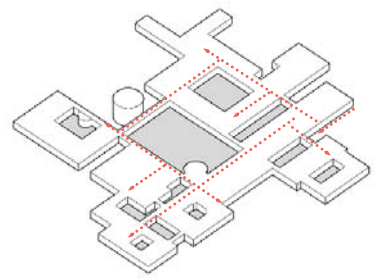
REHABILITATION FLOW

Rehabilitation center located near the inpatient unit. But it still could be used seperately from the hospital.



SUPPORT SERVICE FLOW

The medical and kitchen loading dock are closed to the administration departments.

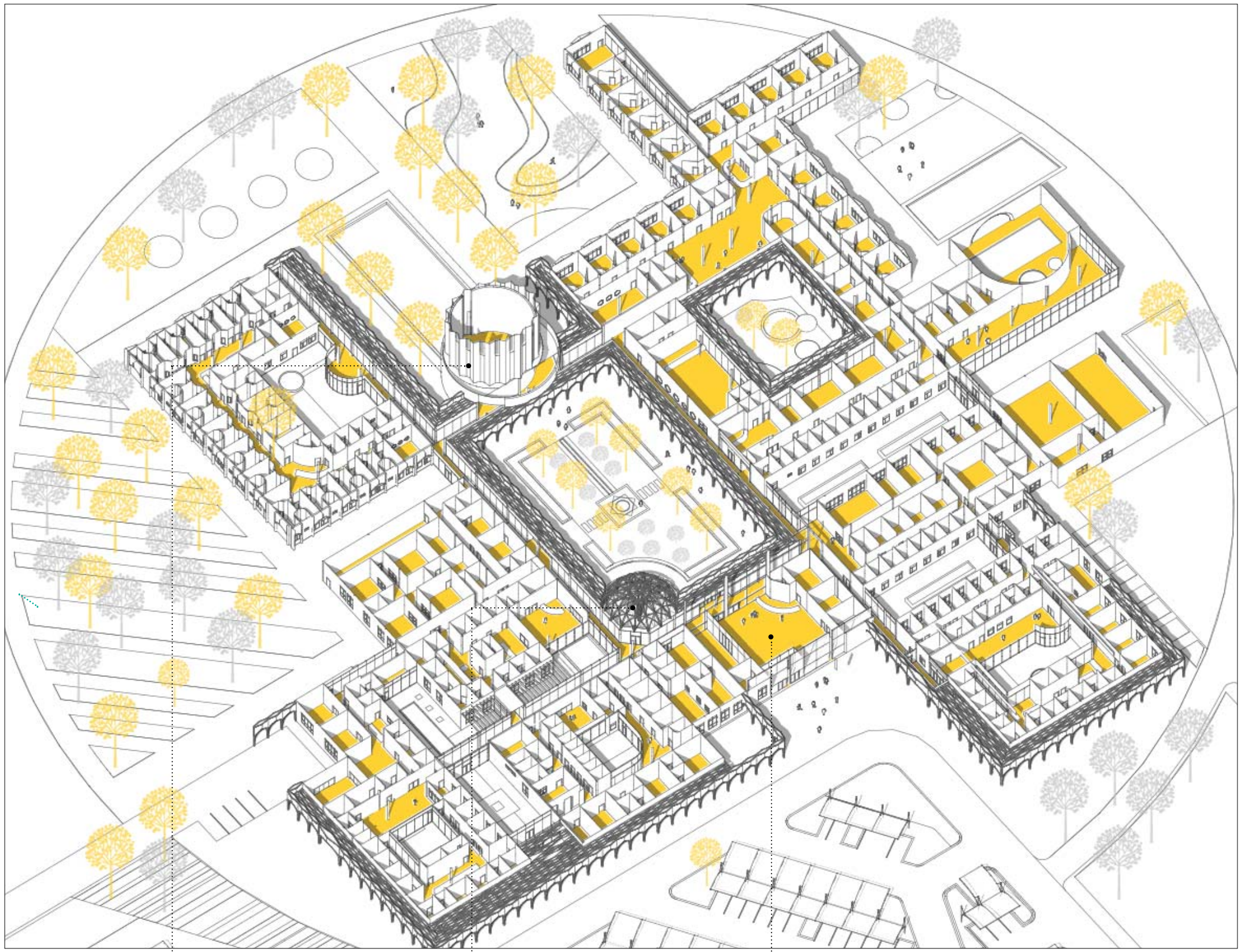


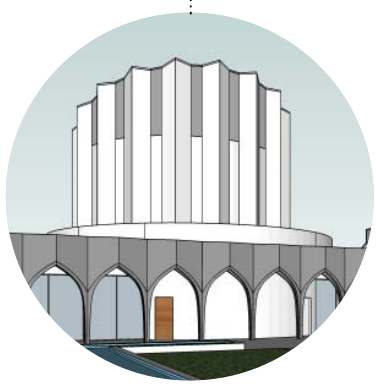
STAFF FLOW

Staff has their own parking lot and the patient won't see their entrance.

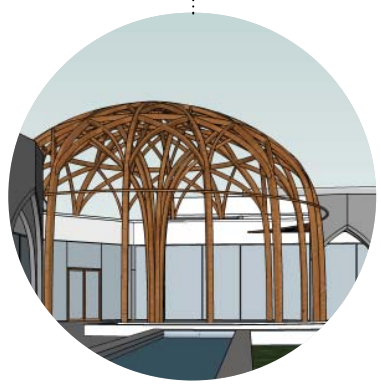
CIRCULATION & ORIENTATION

WAY FINDING





WORSHIP HALL

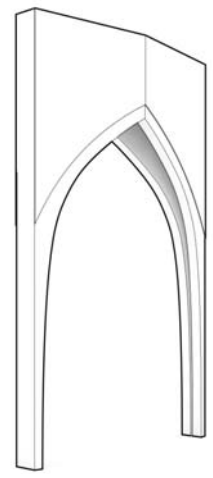


PAVILLION

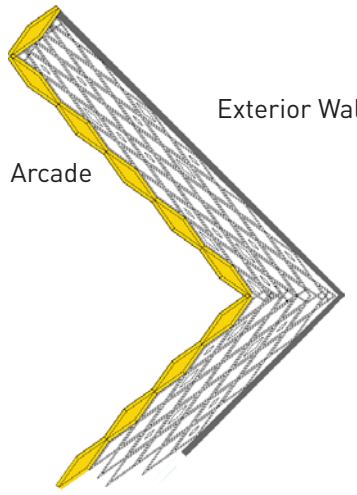
ENTRANCE

Since the hospital is only one level, the horizontal traffic space may be bigger and far. The striking landmark and signage are good for the patient and staff to know where they are. The entrance lobby has a higher vault structure than the other parts, The main garden with the protruding wood pavilion and worship hall are better for the people to locate their way.

ENRICHMENT
VOLUMES & SHAPES

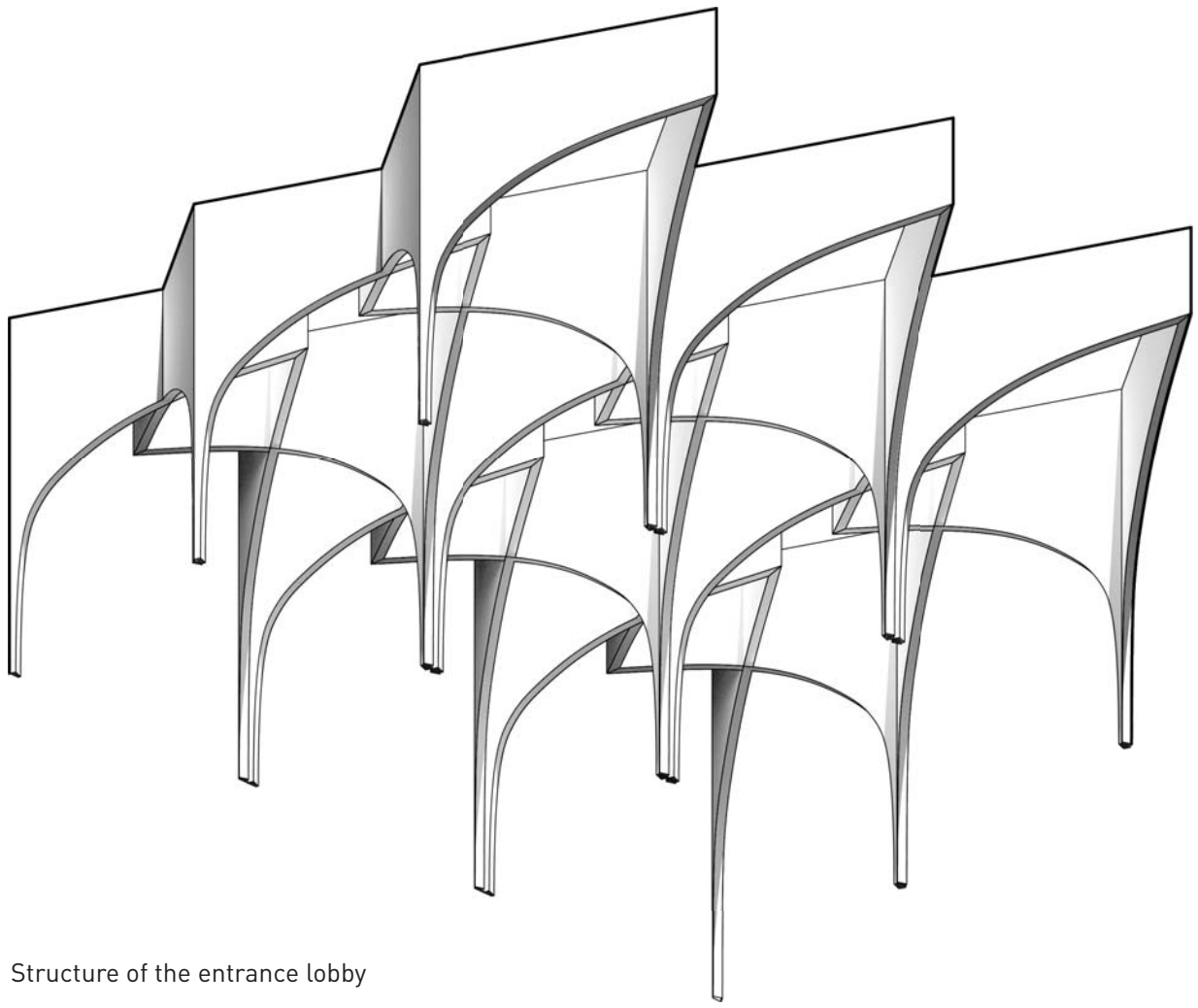


Masonnary Arch



Top view of the wood cover

The masonry arcade and wood cover compose the colonnade, which innovated from the traditional architecture. The triangle element is derived from traditional architecture. The shadow of the wood pavilion is the traditional Islamic geometry pattern. The central column of the pavilion looks like the palm tree.



Structure of the entrance lobby

The masonry arcade and wood cover compose the colonnade, which innovated from the traditional architecture. The triangle element is derived from traditional architecture.

VOLUMES & SHAPES

ENRICHMENT

The shadow of the wood pavilion is the traditional Islamic geometry pattern. The central column of the pavilion looks like the palm tree.

NATURAL IMPACT

ENRICHMENT

The central garden innovated from the traditional Islamic style basis. In the traditional Islamic garden, there are two axes to divide the square plaza, the fountain is located at the junction of the axes.

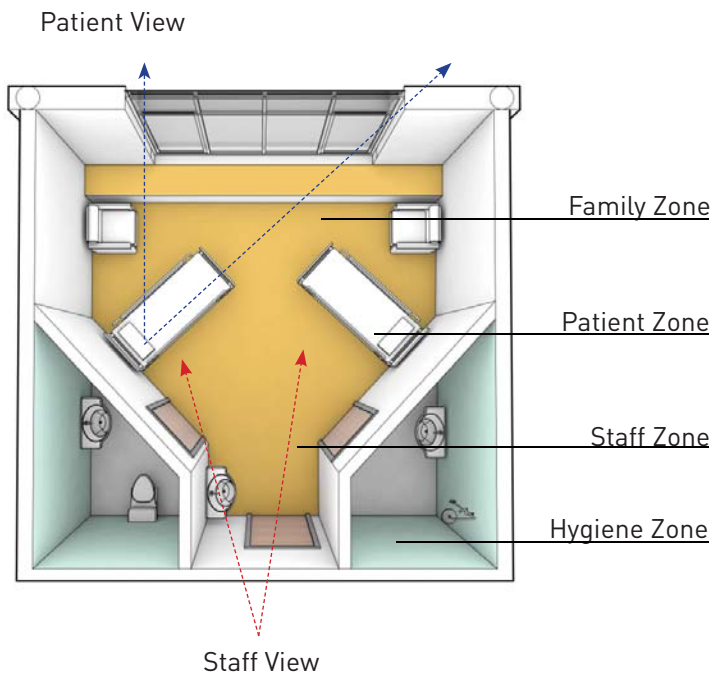
When you enter into the lobby of the hospital, you will see a green garden with some fountains in it. A concrete cylinder worship hall at the end of the garden. There is a wooden pavilion in the corner the garden to provide a shaded place for people to relax and fully enjoy the garden.

CENTRAL GARDEN

Except the Main garden, each department has its own small courtyard. That provides different landscape views to the patient. The courtyard as a healing space to cure the patient in different aspects. The open view of the plant and fountain will distract patients' attention from the painful disease. The positive stimulation through the sight, smell, hear, and touch to lower patients' heart rates, blood pressure and stress levels.

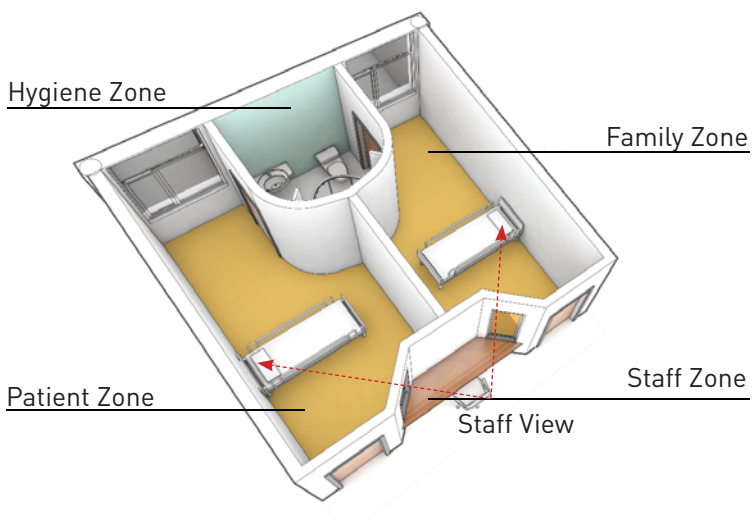
NATURAL IMPACT

ENRICHMENT



INPATIENT UNIT

The inpatient unit has two beds in it. The two pediatric patients could communicate and reduce the loneliness and helpless. Separate the shower and toilet to avoid the bacterial infection.



ICU ROOM

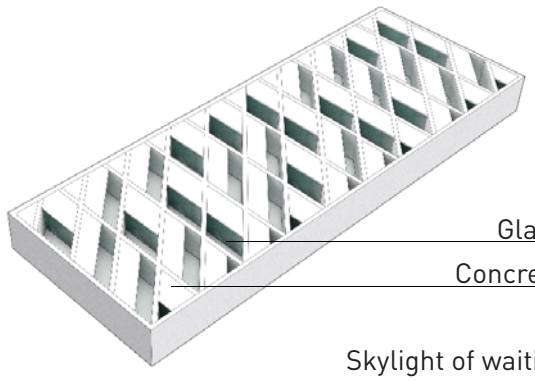
Shared toilet between two ICU rooms.

Decentralized nurse station, one nurse serve 2 pediatric patients. The ICU unit has only 1 bed in each unit to provide the privacy.

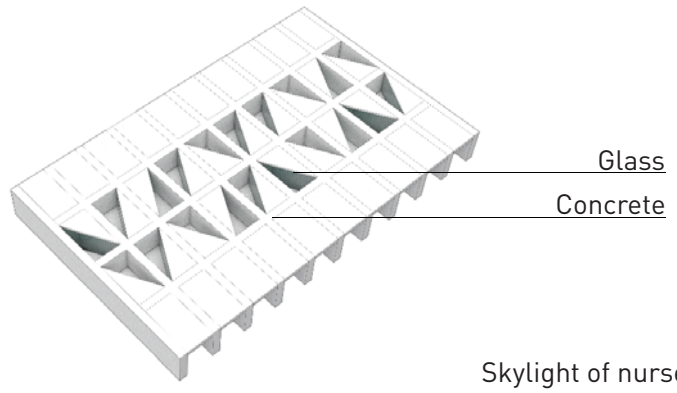
PRIVACY &SOCIAL INTERACTION

ENRICHMENT

The pediatric patients will heal quickly when they learn from others. The inpatient room provides a comfortable and healing environment for the children to communicate and play together.



Skylight of waiting room



Skylight of nurse station

The good climate conditions and the building orientation maximize natural light and the visual relationship with the landscape, leading patients to perceive its changes, the time and seasons passing by, and reducing one's sense of isolation. Quality of light and lighting play a fundamental role on the environmental and psychological well-being.

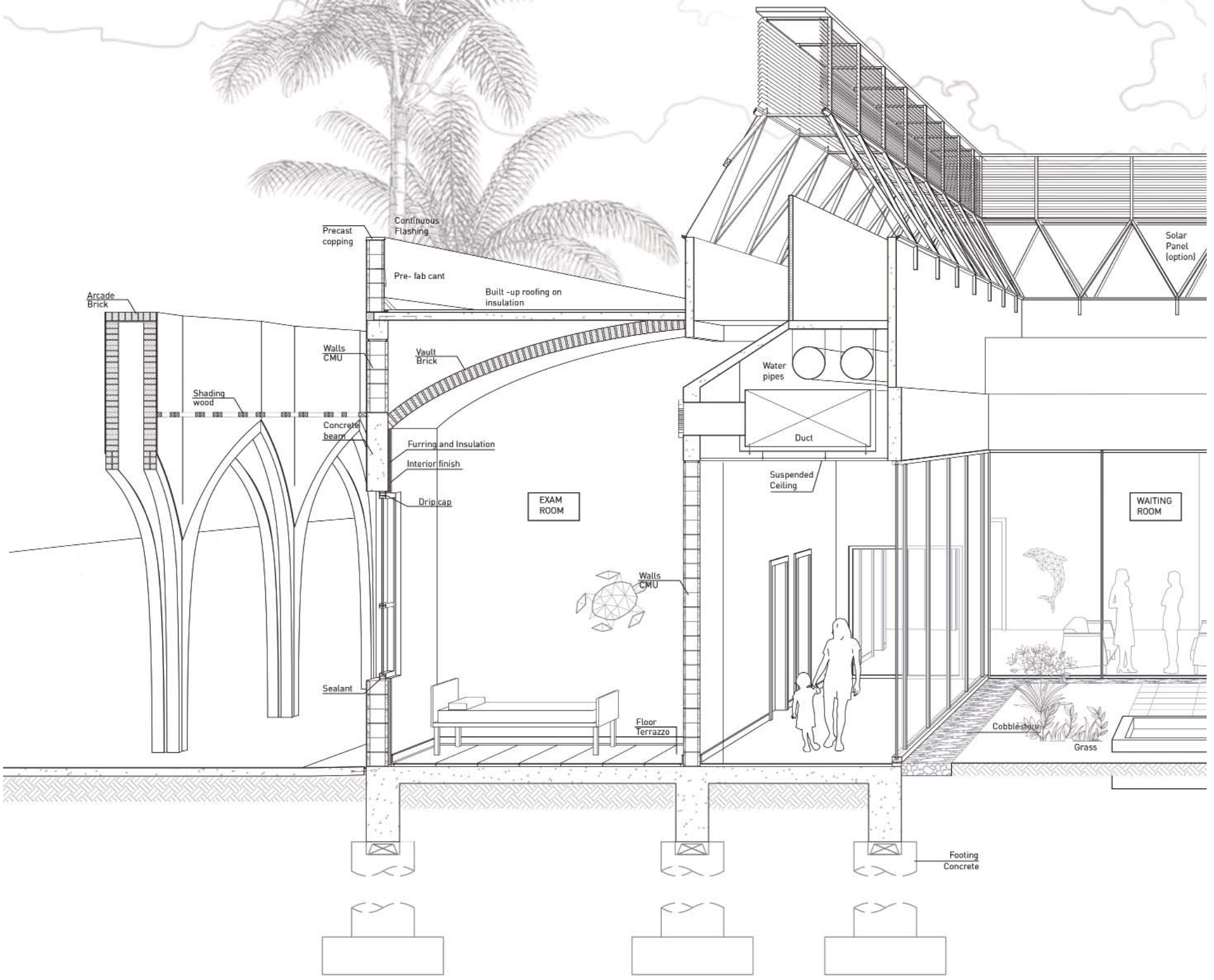
Skylight of nurse station

LIGHT

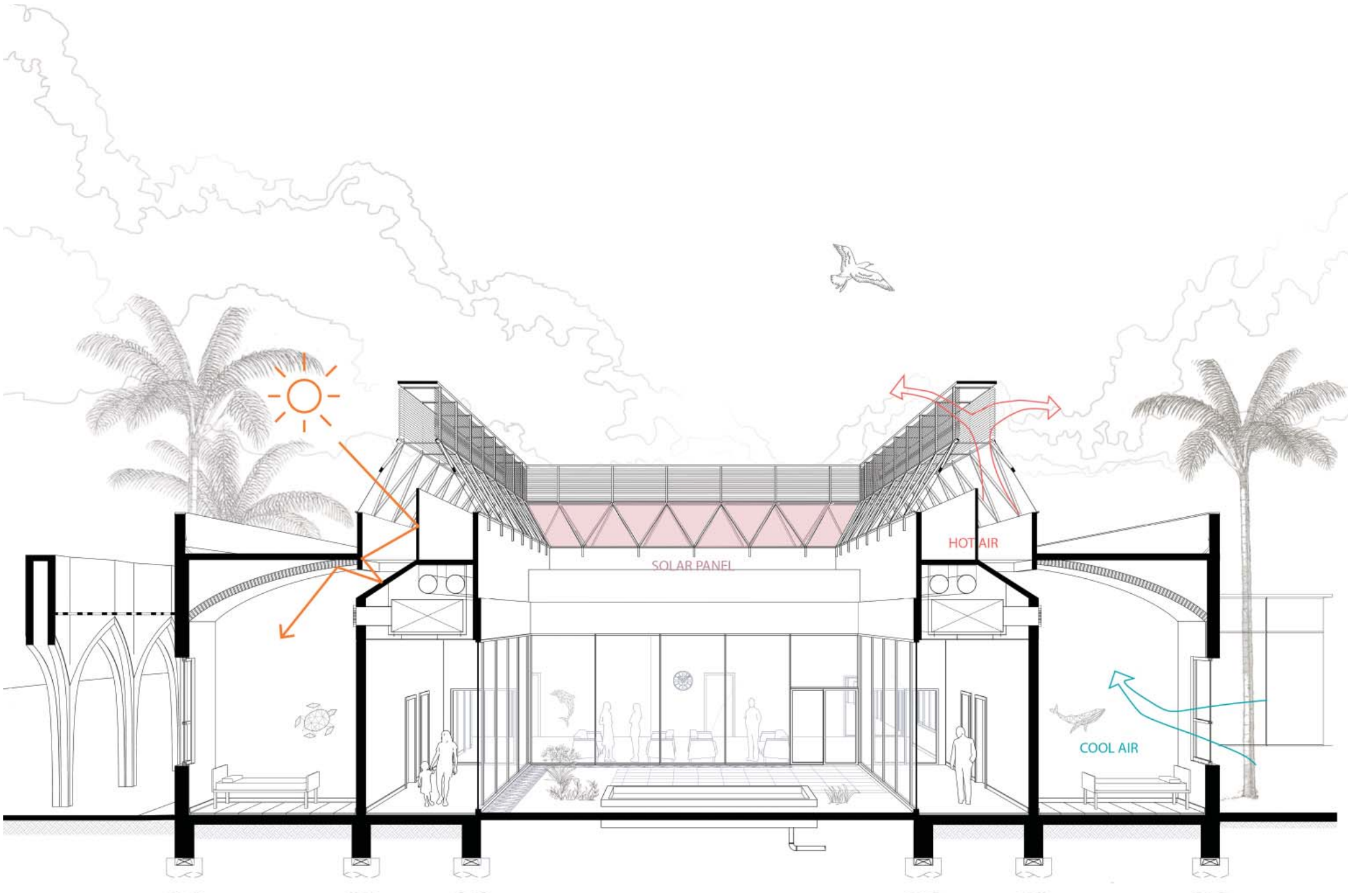
VARIABLES

The swimming pool has a concrete dome roof with some skylights on it. As time goes on during the day, the light spot will changed the place, which will attract patients' attention and surprise them. Therefore the daylight therapy with the water therapy, both cure the patient effectively.

Skylight of pool


Arcade
Brick
Precast
copping
Continuous
Flashing
Pre- fab cant
Built -up roofing on
insulation
Solar
Panel
(option)
Walls
CMU
Vault
Brick
Water
pipes
Shading
wood
Concrete
beam
Furring and Insulation
Interior finish
Duct
Suspended
Ceiling
Drip cap
EXAM
ROOM
WAITING
ROOM
Walls
CMU
Sealant
Floor
Terrazzo
Cobblestone
Grass
Footing
Concrete


Water proof
Treatment
Base and counter-
flashing
Water
pipes
Duct
EXAM
ROOM
Walls
CMU
Floor
Terrazzo
Terrazzo topping
Underbed
Divider strip
Drainage



Air flow: The hot air will come out from the louvers on the top.
Daylighting: Reflactive sunlight to reduce the use of the electricity.
Solar panel: Install them on the south of the truss structure.

It is the good way to use the low tech method to reduce the outcomes of the economy, but also to create a more comfortable place for the patient and staff.

The building is arranged around a series of small and intimate courtyards with the possibility of empowering the patients and staff to switch off the courtyards and induce a breeze through the rooms through a thermal chimney.

LIGHT & AIR

VARIABLES

Each courtyard has moving water within it and the concept is that there should not be a variety of landscape experiences, but also that there should be a different sound of water in each court.

SOUND

VARIABLES

CHAPTER 3
CONCLUSION

- *Picture from Dr Greg Dunn*

CONCLUSION

To design a functional building and tell a good story is the essential things. Although there may some trouble to start it. Such as the sensitive site due to the conflict to the America, it is not easy to find the accurate information of the site. Also, there is no neuroscience hospital for children in the Libya, which means there is no reference of the pediatric neuroscience hospital.

With a full functional hospital. The gaming is good way to start design the plan. Also it is a good and clear way to explain to professors and client.

However, finding a good strategy way makes the design more excited. To combine the two disciplines, neuroscience and architecture is a new exploration these years.

The building is located in an islamic region, so the building must follow the local culture of the religion.

However, it is still a modern building to receive international patients. Additionally, the region is not rich to use modern materials and technology building method. Therefore, the local material wood and masonry are widely used in the building. Low-tech method such as to bring natural light and natural air into the room need to be considered.

The worship hall should be located in the middle axis and have a hallway to wash hands and take off shoes.

The parking area better to have cover due to the hot climate. The big pool located in the northwest, so the wind will bring moisture cool air into the building.

Due to the 1 level of a big footprint building, the roof becomes a big issue. The local residential building is flat. Also, if think of the future expansion on the upper floor, the building could be the flat roof. However, the glass chimney and daylights make the building's 5th facade rich.


LAB

BIBLIOGRAPHY

1. Louise Chawla. (2012). Professor of Planning and Urban Design. The importance of access to nature for young children. University of Colorado, Boulder CO, USA
2. Praskach, Ana. (2009). "Nature, daylight and sound: A sensible environment for the families, staff and patients of neonatal intensive care units" .Graduate Theses and Dissertations. http://scholarcommons.usf.edu/etd/2154
3. Anjali Joseph. (2006). Ph.D. Impact of Light on Outcomes in Healthcare Settings. Published by The Center for Health Design,
4. John P. Eberhard. (2009). Founding President and Board Member Emeritus the Academy of Neuroscience for Architecture, Applying Neuroscience to Architecture. San Diego, CA 92101, USA
5. Cagil Kayan. (2011). Enriching healthcare environments for children. Chalmers Architecture, MPARC
6. GOOOOD, http://www.gooood.hk/the-crown-sky-garden-by-m-k.htm
7. http://neuroticarkitekten.blogspot.com/
8. Barbro B. Johansson. (2000). MD, PhD. Brain Plasticity and Stroke Rehabilitation: The Wills Lecture. American Heart association.
9. Gazzaniga. (2008) M. Gazzaniga, Neuron 60 (2008), pp. 412–415. Article | PDF (88 K) | View Record in Scopus | Cited By in Scopus (4)
10. Yvonne Osei. (2014). Exploring Sensory Design in Therapeutic Architecture. Carleton University, Ottawa Ontario
11. Thomas Fisher. (2016). How Neuroscience Can Influence Architecture. http://www.architectmagazine.com/practice/how-neuroscience-can-influence-architecture_o
12. Eve Edelstein. (2014) New approaches to the creation of healthy environments. http://www.worldhealthdesign.com/Neuro-architecture.aspx
13. Nahla Adel Elwefati. (2007) Bio-Climaic architecture in Libya: Case studies from three climatic regions. Thesis submitted to the graduate school of natural and applied sciences of middle east technical university.

RESUME

YINGZHE DUAN

duan.yz-9117@tamu.edu
+1-(979)-402-5857

EDUCATION

Texas A & M University (TAMU)
College of Architecture
09/2016- 05/2018

Shenyang Urban Construction University
Department of Architecture & Art
09/2010-07/2015

WORK EXPERIECNE

HKS, Inc, Dallas, USA
Healthcare Interior department
07/2017-09/2017

Zaha Hadid Architects, Beijing, China
02/2016-08/2016

Crossboundaries Architects, Beijing, China
10/2015-11/2015

ACADEMIC EXPERIENCE

Emergency Department (ED) design workshop, Austin, Texas, USA
09/18/2017

Architecture & Healthcare Study abroad program with Clemason University, Europe
05/2017 - 06/2017

SKILLS

Autodesk Revit Architecture
Autodesk CAD, Adobe PS AI ID
Ecotect Analysis
Rhino, Sketch up, 3Ds Max
Grasshopper, Kangaroo, Weaverbird
V-ray, keyshot, Lumion

PUBLICATIONS

Texas A&M Students Create Building Envelope Design from GM Manufacturing Scrap
Http://www.generalmotors.green/product/public/us/en/Gmgreen/home.html
07/2017

Student Design Competition at Texas A&M Explores a Museum of waste
TEXAS ARCHITECT magazine
06/2017

HONORS & AWARDS

First place of the architecture competition design
Houston museum of waste
Texas A&M University | 12/2016

Outstanding graduate
SUCU | 16/2015