ATHENAEUM

PIYUSH PRAJAPATI
GUIDE : AR. RITU GULATI

thank God men cannot fly, and lay waste the sky as well as the earth

jaipur

PIYUSH PRAJAPATI

2

ATHENAEUM

SYNOPSIS

Project name

ath·e·nae·um also ath·e·ne·um
commonly pronounced as

Athenaeum

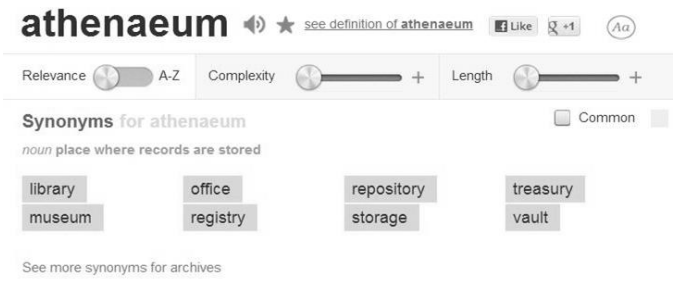
"architecture for architecture"

meaning

1. *An institution, such as a literary club or scientific academy, for the promotion of learning.*

2. *A place, such as a library, where printed materials are available for reading.*

3. *A museum-institutional-residential with part or equal weightage*



objective

The main objective of the program being the focus of the design as to fulfil the base functional aspects of the ATHENAEUM.

"Architecture for architecture"

Another prime factor involving with the field of architecture is to make the ***architecture in itself to grow*** *(literal), e.g. The fact that the building would grow with spaces and functionally with due passage of time.*

Also to provide the residential involvement to the learning, and those residential units would also act as a portion of the museum exhibition.

Mission statement

The mission statement would be to make a center cum hub which would mainly focus on the community of ARCHITECTURE and ARCHITECTS. That is the visual learning institute would focus upon the attainment of the architecture, through architects and by the architects.

Key to success

The key to success lies in the fact of enrichment to what extent it follows the concept and the derivations.

Location

The site is located in JAIPUR, Rajasthan, India

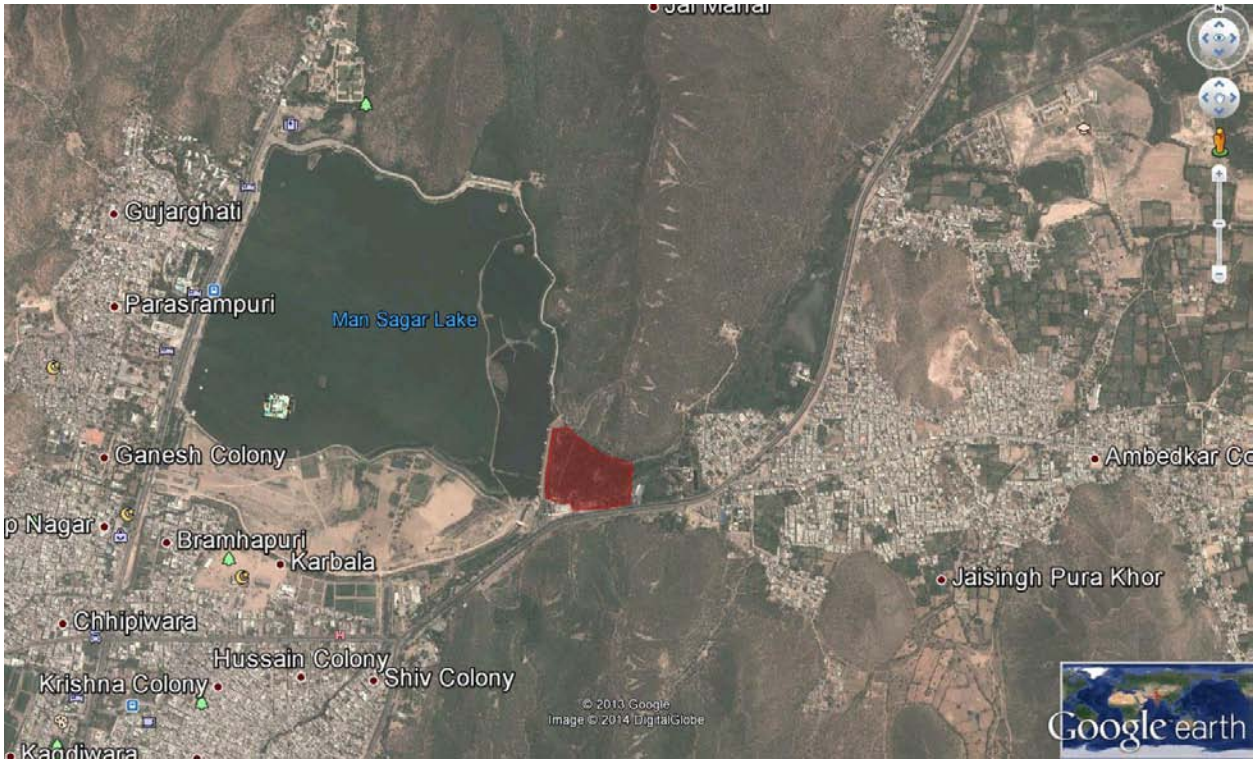
Geographical Coordinates : 26 57’03.52 N , 75 51’26.50 E

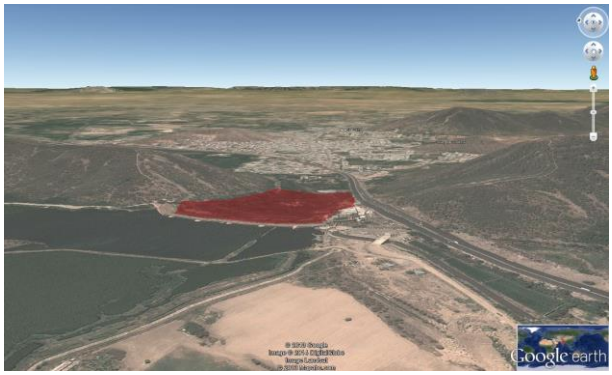
Famous landmarks : Amber fort

Site contours: yes

Water body : yes

The site runs along the Arravali Range in Rajasthan, which is approximately 09 acres of land.





Reasons to choose the site

The following reasons for choosing the above site,

- *The city of Jaipur, also known as the Pink city is one of the oldest architecturally beautified city. That were mainly done by the rulers who ruled there.*

- *The planning principles of city Jaipur holds some importance to every structure and the upcoming structure for the context insertion.*

- *Jaipur is architecturally and culturally rich with scope of new insertion near the fort like AMER FORT is challenging.*

- *Personal interest lied down, for Jaipur- its existence – its words – its fare – its earth – its gratitude – its background score.*

- *Jaipur geographically speaking, could be one of the international concerns or the intersection point through the eyes of Architecture and Architecture establishment.*

- To make the site known and marked as **"the world of Architecture"** being known nationally and internationally

The site context allows the scope of having the process of BIOMIMICRY to bring in the scope of insertion and the design motivation.

Discussed on page no.

The site with proper ecological behavior and supporting Flora and Fauna provides a podium for Biomimicry, and its principles to mark a successful architectural insertion in the form of Athenaeum.

Also the site is the nodal junction for the incoming tourist traffic which is along with the National Highway 11C, connecting Delhi – Jaipur, through roadways.

Another bisecting road which leads to famous tourist spot : Amer Fort.

ATHENAEUM

CONTEXT STUDY - JAIPUR

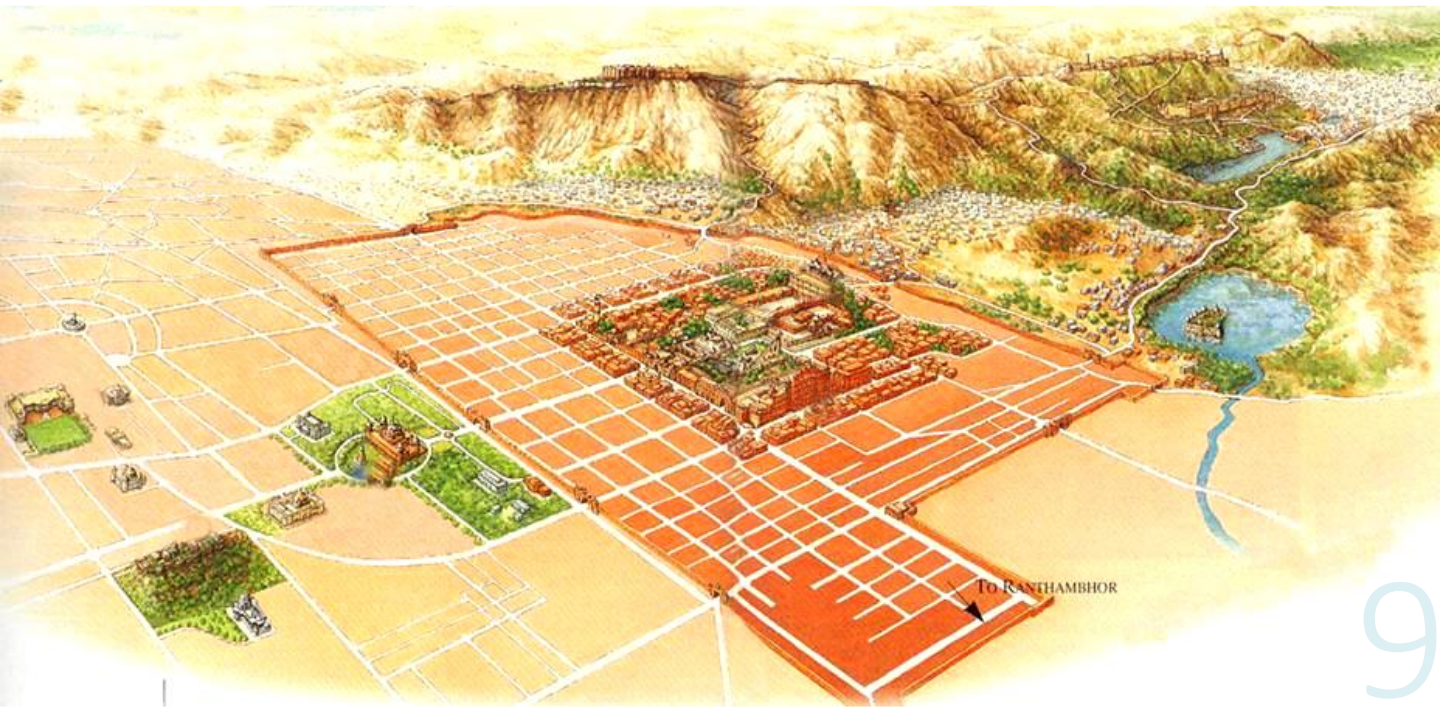
Jaipur, Rajasthan, India

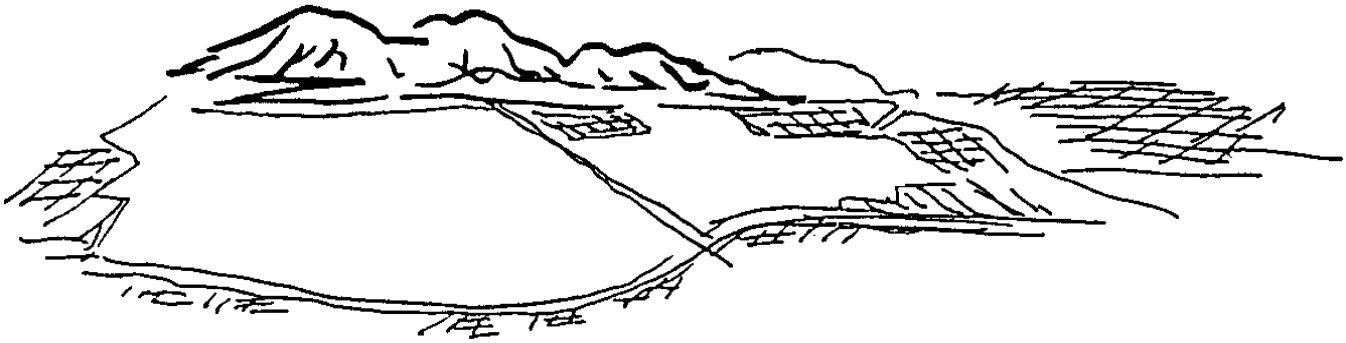
Intent:

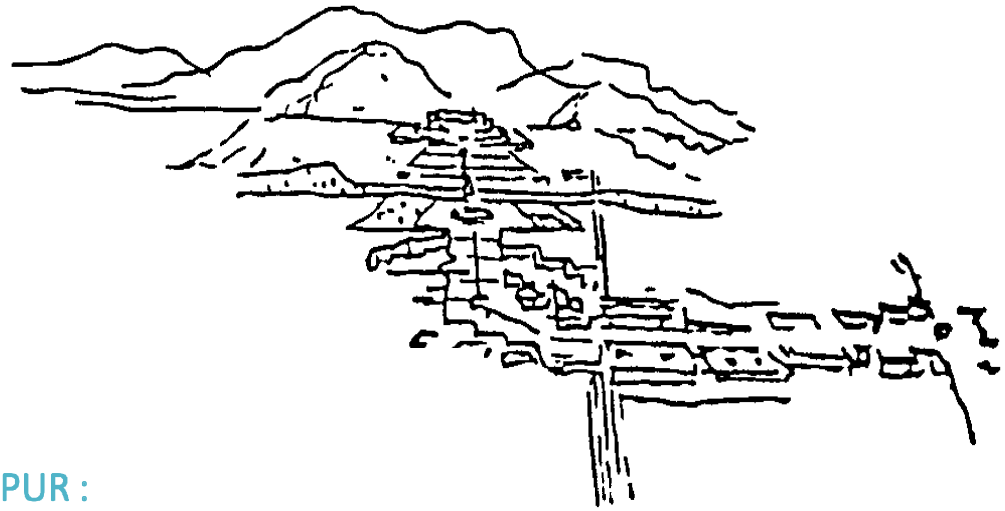
To describe the context of Jaipur and the cultural history of the city merely through pictures and short notes.

This has been brought to analysis with concerns of the site its surrounding and the JAIPURI CONTEXT,

Showing the planning principles, the ideology and the intention behind the context

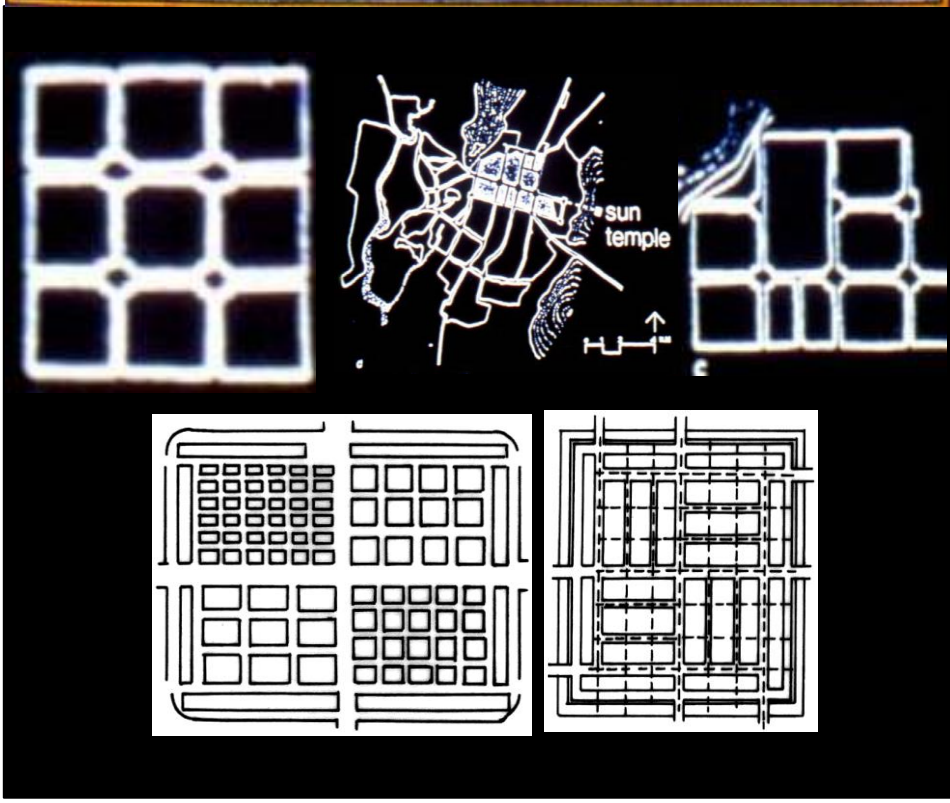


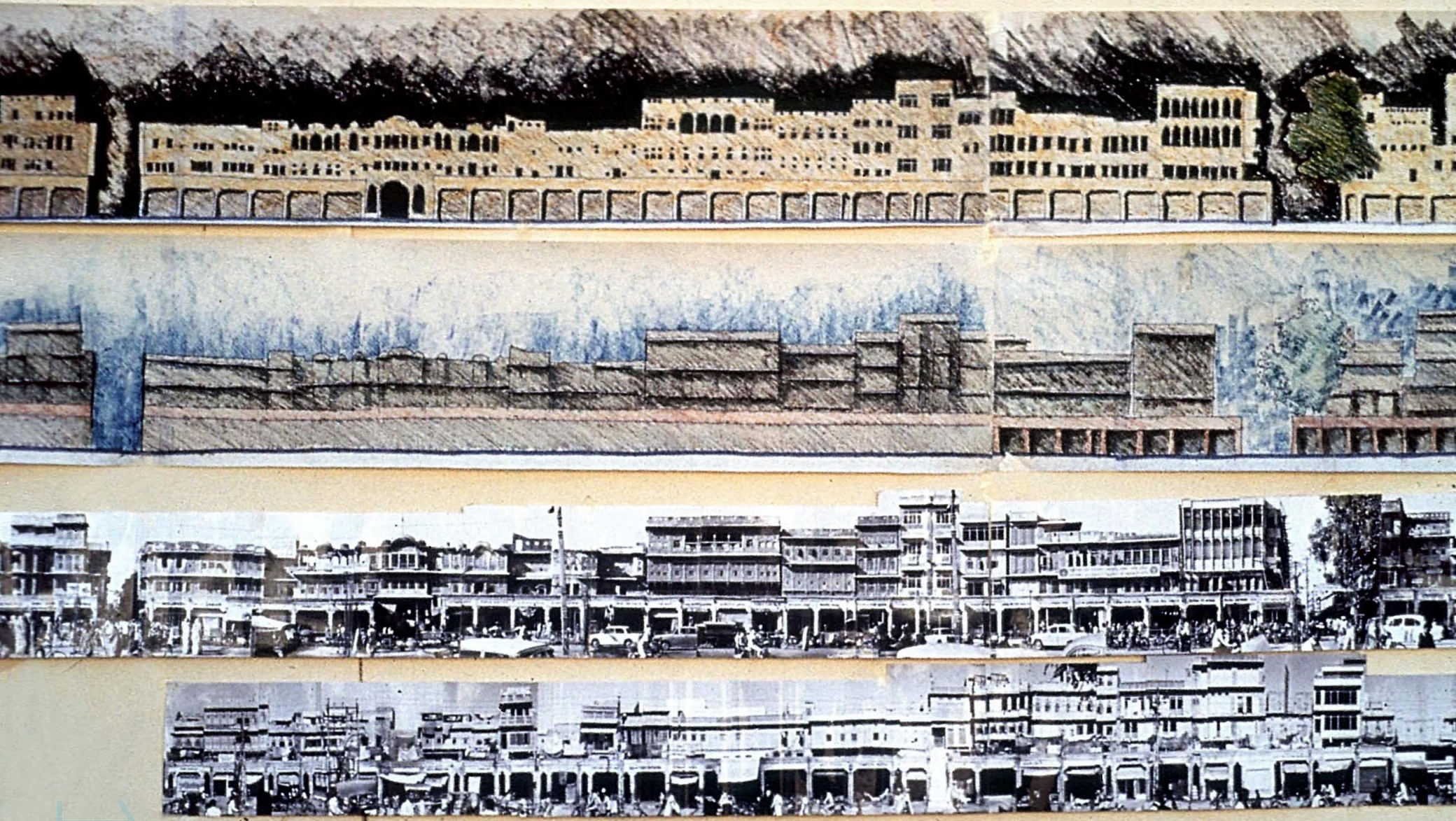




Walled city JAIPUR :

City with great HISTORICAL value
Important case of URBAN DESIGN and ARCHITECTURE
Significant DESTINATION for Tourist
A place of great LIVING CULTURE
A potential place for ECONOMIC development of the region


sun
temple

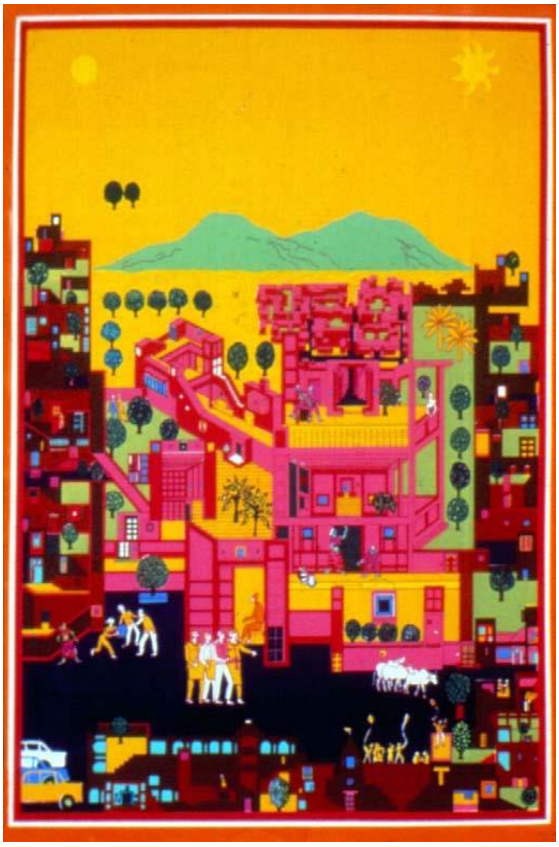


MAJNU PAINTERS

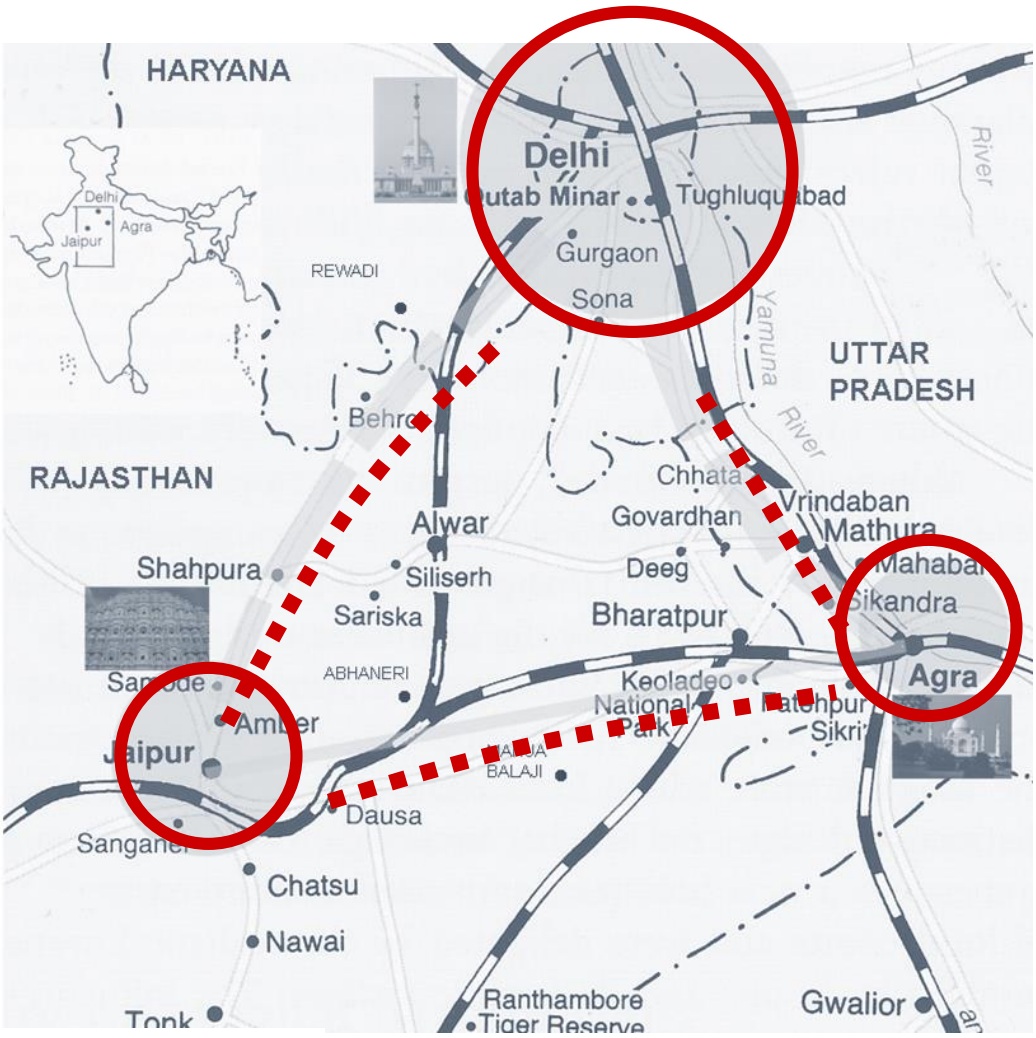
SANJAY ART GALLERY

१.५० पैसे प्रति बोतल बचाइये
गाय छाप
ब्राह्मी आँवला तैल
तंवर रेडियो
RADIO
ॐ फुन्दनमल लेखराज
पुरानी पंजाबी दुकान
तंवर रेडियो

सचदेव बूट हाउस
ईगल फुट वीयर



Vijayanagar
A City
Symbolic of
Permanence and unity
Faith, Safety, Security
and
Social Economic Technical
Opportunities



THE GOLDEN TRIANGLE TOURIST CORRIDOR

DELHI: ENTRANCE TO INDIA CAPITAL OF INDIA AND THE POLITICAL CENTRE.

JAIPUR: WINDOW TO THE RAJASTHANI CULTURE AND A GATEWAY TO THE STATE

AGRA: ONLY THE CITY OF THE TAJMAHAL.

STRENGTHS
-BEST INFRASTRUCTURE IN INDIA AND MOST ADVERTIZED
-MANY VISITABLE SITES
-HAS LOCATIONAL ADVANTAGE
-HAS A LARGE CAPTIVE TOURIST BASE

WEAKNESS
-IT IS NOT A PLANNED CORRIDOR
-RESOURCES ARENT UTILIZED WELL
-IS SPREAD ACROSS THREE STATES
-INDIVIDUAL NODAL CITIES DONT HAVE ONE GUIDING F OCUS
-THERE IS ALMOST NO ATTENTION TO THE SMALLER DESTINATIONS.

PRESENT WORKING:
MOST TOURISTS TODAY TRAVEL FROM DELHI TO AGRA, RETURN TO DELHI THE SAME DAY AFTER SEEING THE TAJ AND VISIT JAIPUR AND OTHER SITES IN RAJASTHAN THEN, DEPENDING ON THE TOUR DURATION.

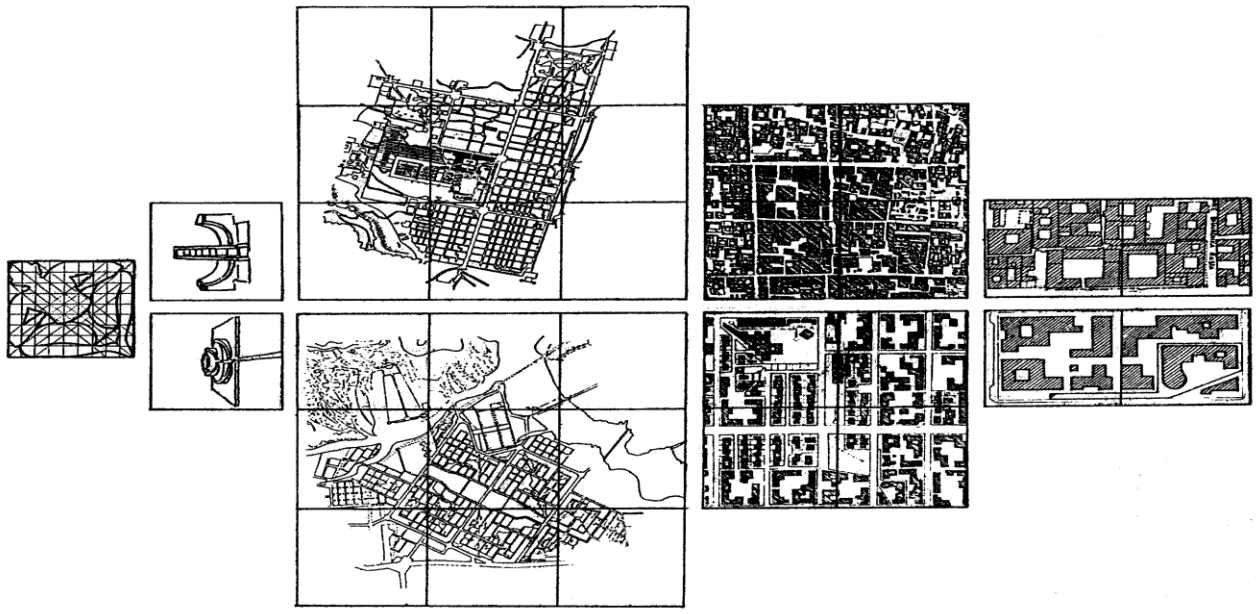
- A small random survey of tour operators
- Approximately 80% of the foreign tourists and 30% of domestic tourists undertake package tours.
- 55-60 % of all foreign tourists and 15-20 % of domestic tourists take the golden triangle tour in some form.
- The corridor hence is of considerable importance.

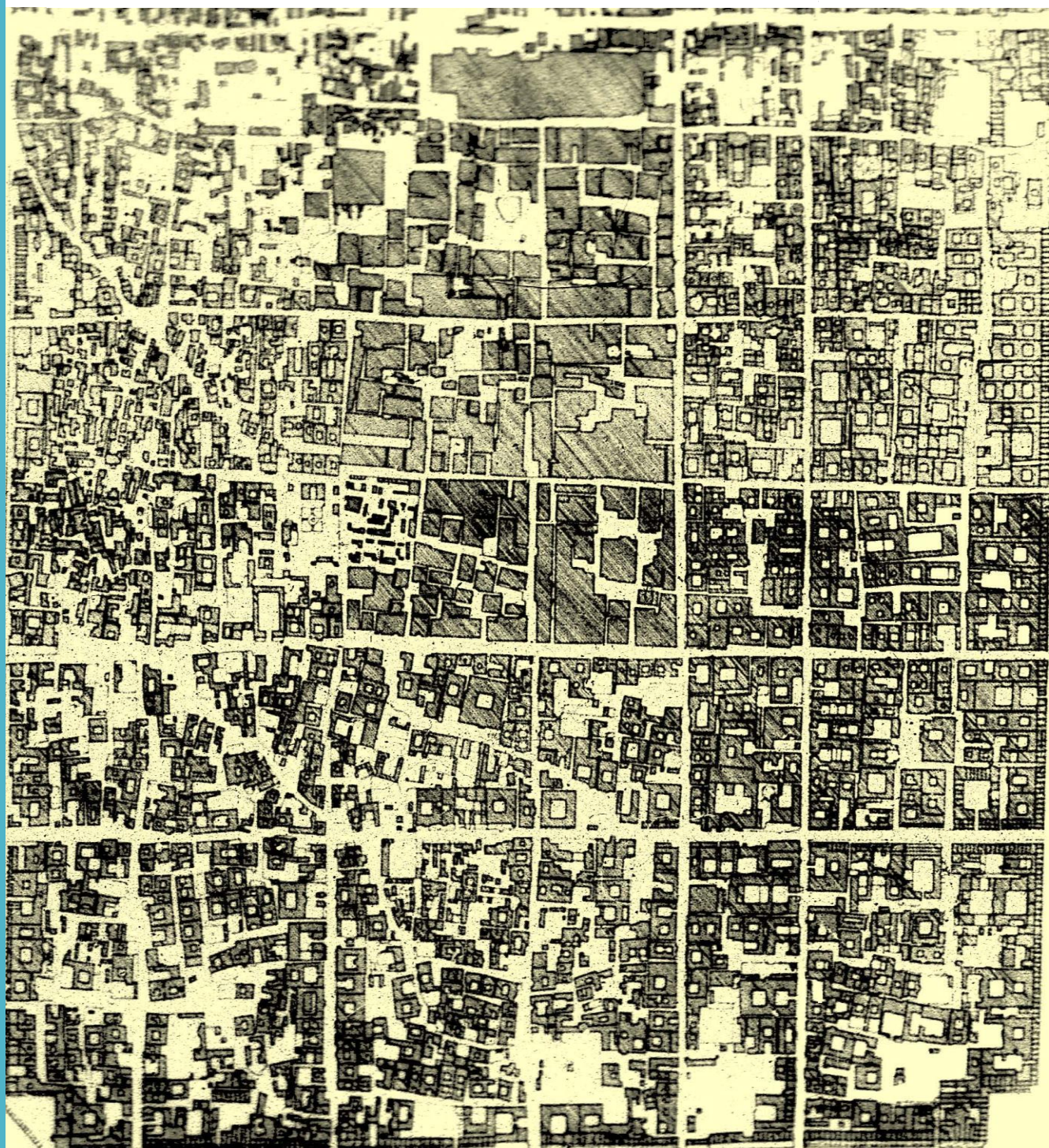
Past at sepia mode

Past at grayscale

If we don’t care…

If we do care...





ATHENAEUM

SITE STUDY

Site study

existing services:

physical characteristics: the green covered site full of local vegetation with sustaining flora and fauna also.

soil type: This type of soil is blackish, graish or dark brown in color, having medium to heavy texture. The soil is less porous but highly fertile with almost balanced macro and micro-nutrients.

water table: depth of water table being 20mts to 40 mts

vegetation: primarily, NEEM, KEKAR TREES, DATE PALMS, covering large chunk of site

slope analysis: as site surrounded by terrain from both sides, there is slope, mentioned in CAD plan

seismic zone: Jaipur comes under zone-ii i.e., low damage risk zone. Which implies that that these quakes are frightening but do not endanger much life and property. Hence the buildings need to be designed up to 6 magnitude of Quake. The last major earthquake that hit nearest to the site was earthquake of 1906.

Aim :

site considerations:

Dimensions, area, shape, orientation – plan and north position

Contours and levels

Soil condition – bearing capacity and its implications

Existing services in and around site

Existing trees, buildings, other features, condition and type of trees

Existing landmarks and views (from site and towards site)

Zoning and Building Bye laws – land use, F.A.R., G.F. coverage, Set back lines, Building byelaws

Climatic data that covers Sun Movement, sunshine, Temperature, Prevailing wind direction and speed, Rainfall, humidity, Shades and shadows of trees and existing features, Local factors affecting climate

Site study

factors affecting micro climate of site:

landform: Represents the topography of a site it may be flat, undulating or sloping major Landforms affecting site arc mountains, valleys and plains.

Temperature also varies with elevation.

water bodies: Evaporative cooling can help to maintain comfort in buildings In hot and dry climate. The maximum temperature In summer is lower near water than on inland sites.

vegetation: Shrubs and trees cool the environment when they absorb Radiation for photosynthesis they are useful in shading a particular part of the structure and ground for reducing the heat gain and reflected radiation by releasing moisture.

street width and orientation: Streets must be narrow so that they cause mutual shading of bun dings.

They need to be oriented in the N-S direction to block solar radiations

Open spaces and built form: Open spaces such as courtyards and atria are beneficial as they promote ventilation. In addition, they can be provided with ponds and fountains for evaporative cooling. Courtyards act as heat sinks during the day and radiate the heat back to the ambient at night. The size of the courtyards

should be such that the mid-morning and the hot afternoon sun are avoided.

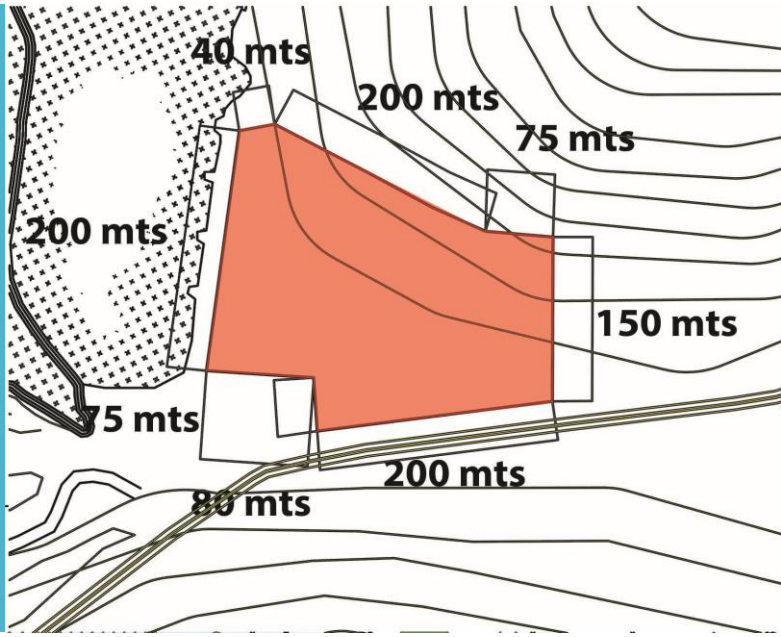
Orientation and plan form: the east-west orientation should be preferred. This is due to the fact that South and north facing walls are easier to shade than east and west

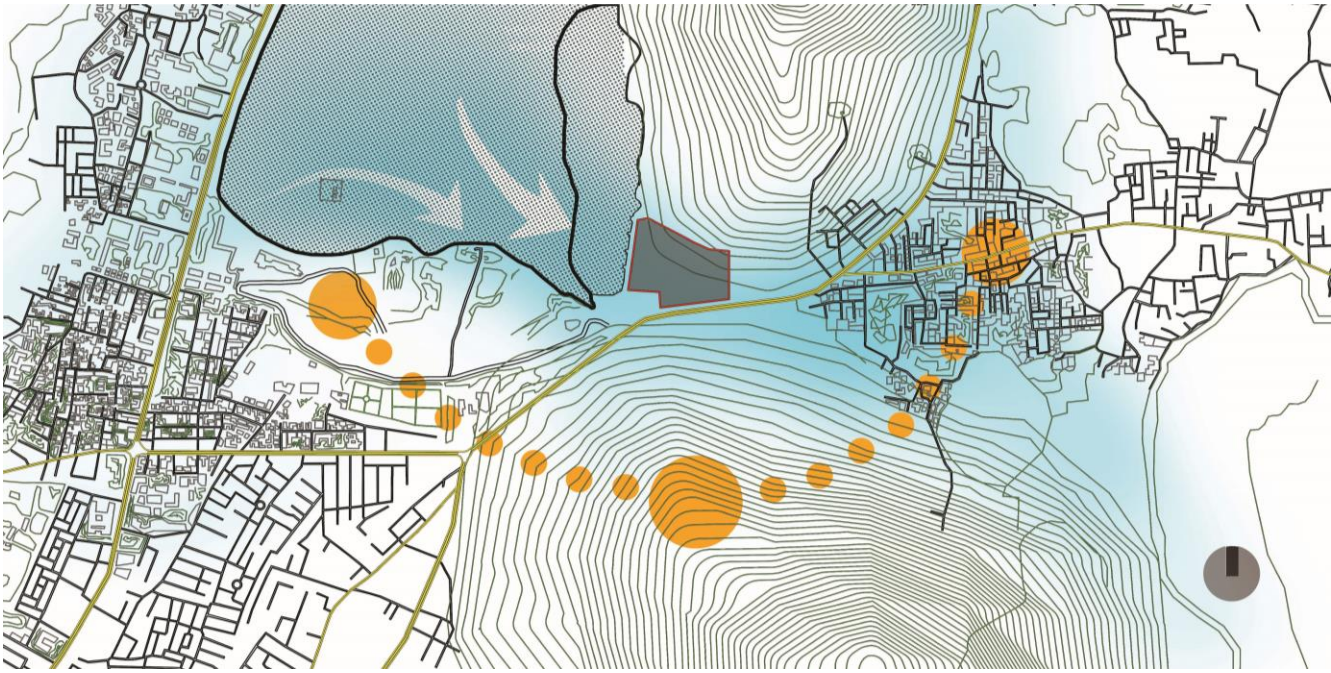
inferences:

- The site is almost green hence it can be used t o the best advantage on my own free will.
- A few date palms, neem, babool and kikar trees present on the site, could to be retained.
- Site has no restrictions as it is a vacant chunk of land , hence no constraints will be applicable except for the building bye-laws.
- Landscaping is helpful in doing so
- Also proper landscaping is needed for outdoor tourist purposes.
- Site is surrounded only from one side, thus service road to be provided on same
- Soil of the area is fertile, so landscaping would be easier.
- Soil bearing capacity is good, hence Spread foundation can be provided. also pile foundations could be used.

Site study

The site dimensions
(in meters)
Showing nearby road
and surrounding





Site study

site| water anaylsis

as mentioned, there is **MANSAGAR LAKE** in close access to site. having **JAL MAHAL** , acting as one of a prime source for tourist attraction. compatising mainly

32%

site| green spaces

in site and outside site, vegetation mainly comaparises of various wild shrubs, date palms etc.

the city jaipur
- having lush greenery and ground cover

60%

site| built mass

the build mass is divided in to two main cities

new jaipur

and

old city jaipur

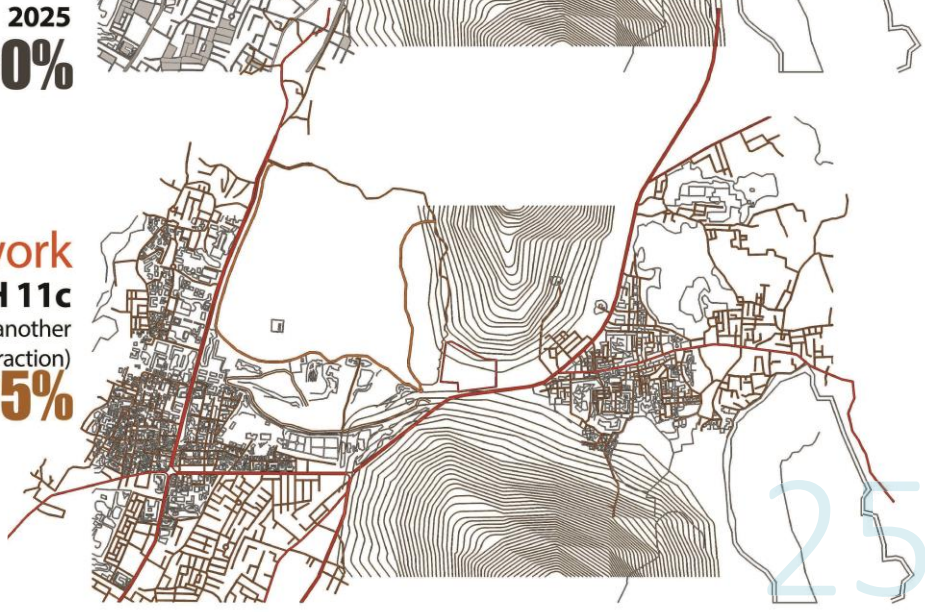
the main concentration is in the old city, and for the development concerns, the city development is now moving towards new city for **JAIPUR VISION 2025**

30%

site| road network

the main route connecting to site is **NH 11c** also another route goes for amer fort (another tourist attraction)

05%



Site observations

About Jaipur

As of 2011, Jaipur had a population of 3,073,350[1] The Population of the Jaipur Metropolitan area is 3,646,590. Jaipur is the 10th largest city of India according to census of 2011. The Hindu population accounts for 74%, Muslim 20%, Jains 4.5%, Christians 0.5%, and Sikhs 1.0%. While 47.49% people lived in rural areas, 52.51% lived in urban areas. The overall literacy rate for the district was 76.44%. 87.27% males and 64.63% females were literate. The sex ratio was 898 females per 1,000 males.

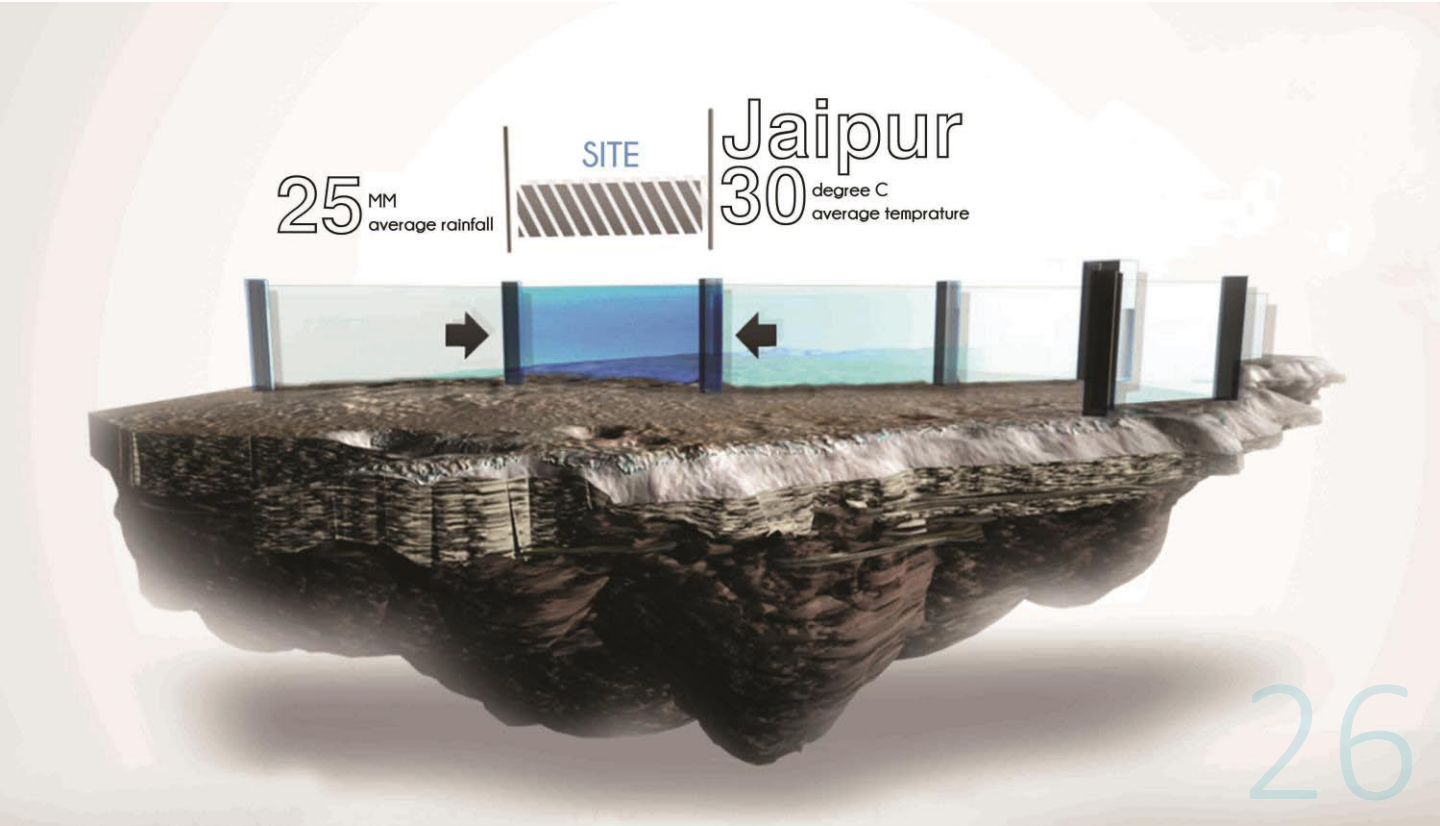
Desert architecture may be characterized as "architecture of the extremes," being basically similar to "regular" architecture but differentiated from it by its obligation to address needs and problems of an extreme character.

Temperatures remain relatively high throughout the year, with the summer months of April to early July having average daily temperatures of around 30 °C (86 °F).

Jaipur has a semiarid climate under the Köppen climate classification, receiving over 650 millimetres (26 in) of rainfall annually but most rains occur in the monsoon months between June and September.

Solar radiation is very strong, and may reach 7.7 Kwh/sq m x day on a horizontal surface

During the monsoon there are frequent, heavy rains and thunderstorms, but flooding is not common. The winter months of November to February are mild and pleasant, with average temperatures ranging from 15–18 °C (59–64 °F) and with little or no humidity.



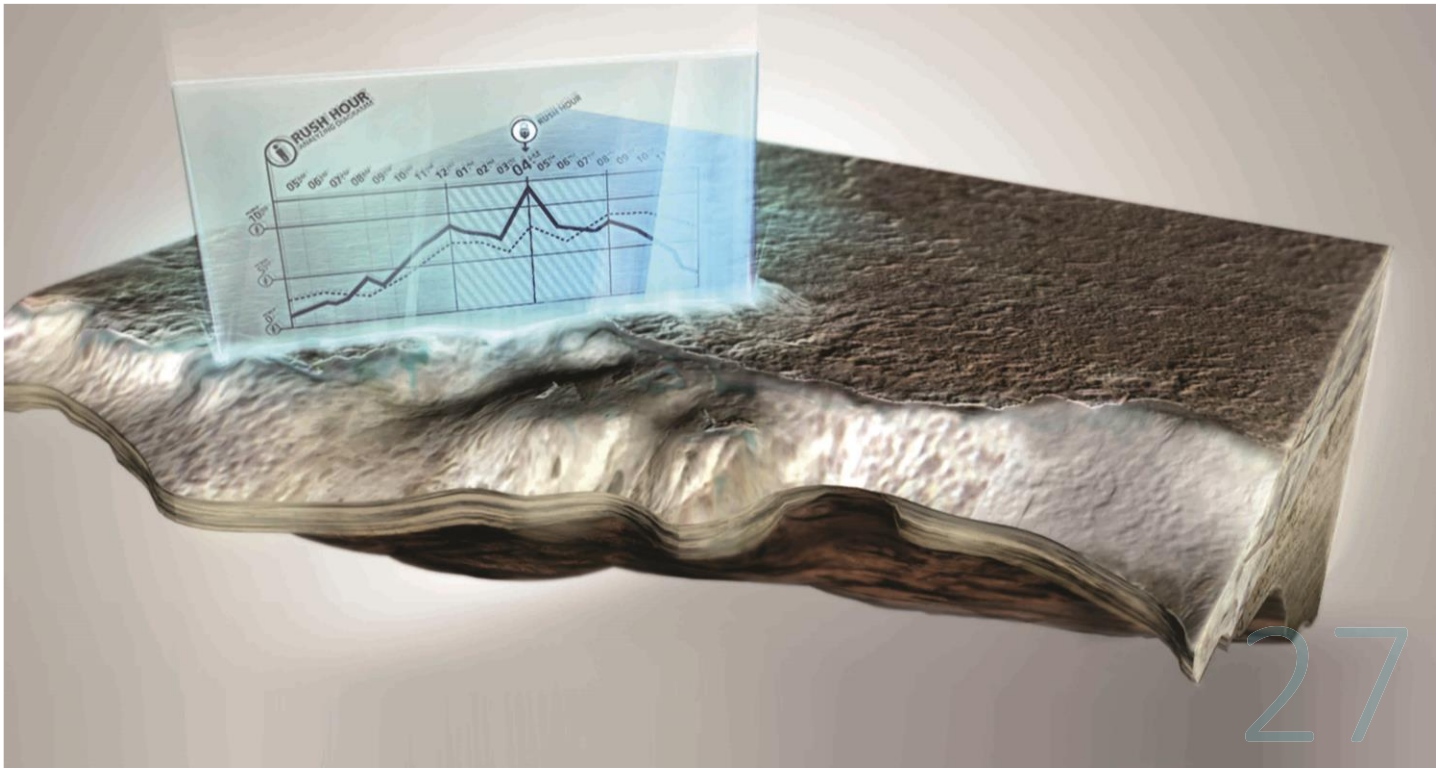
Site observations

Traffic observation: Traffic in Jaipur is commercial and general public oriented. As the national highway is adjoining, the maximum inlet and outlet of traffic is around **4PM** which is gradually increased from 5AM to 4 and then it again reduces to lower limit by 12AM, which is mainly the least. The morning traffic interface is low mainly due to the fact that the site normally doesn't fall under core PINK city area i.e. JAIPUR (old city). Whereas there is an increase in the traffic movement post afternoon. Also the traffic gradually decreases and it is minimum by 12AM, for the very same reason which is the location from the main city.

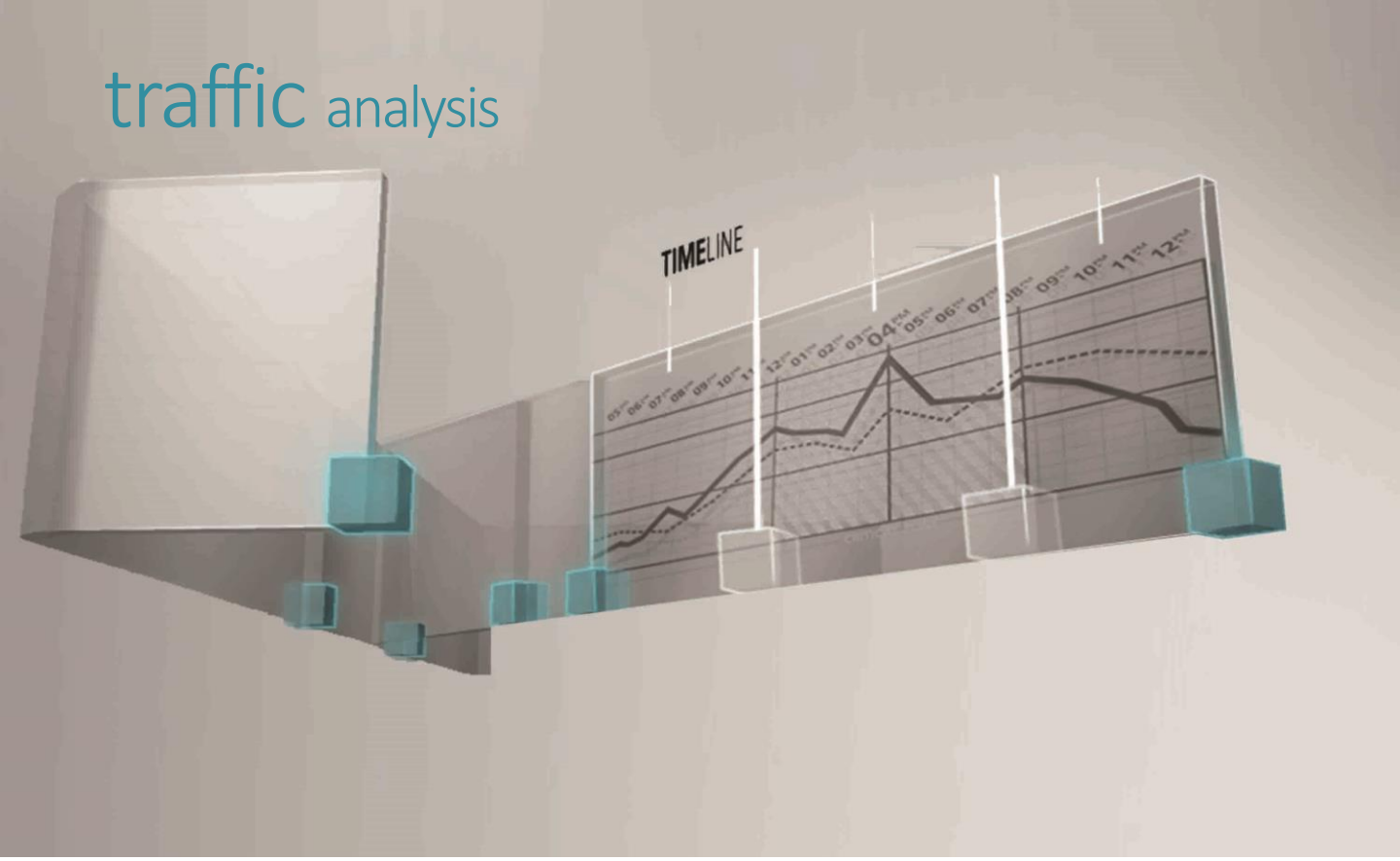
This study now moves from the **macro level** of town planning to the **micro level** of individual buildings, with a focus on those that compose the palace. Aside from the constraints presented by the site itself, the town plan has been explained in the two related contexts of the theoretical paradigm and historical precedents, the latter being somewhat less prominent because of the comparative paucity of historical opportunities for planning and building whole cities on fresh site.

The qualitative analysis marks the time frame to which the Jaipur city traffic respond along that route. The variations has been shown through time line.

Traffic on roads may consist of pedestrians, ridden or herded animals, vehicles, streetcars and other conveyances, either singly or together, while using the public way for purposes of travel. As the site is located on **NATIONAL HIGHWAY 11c**, the inlet and outlet of traffic movement is prominent throughout the periphery but only towards one side of the side.

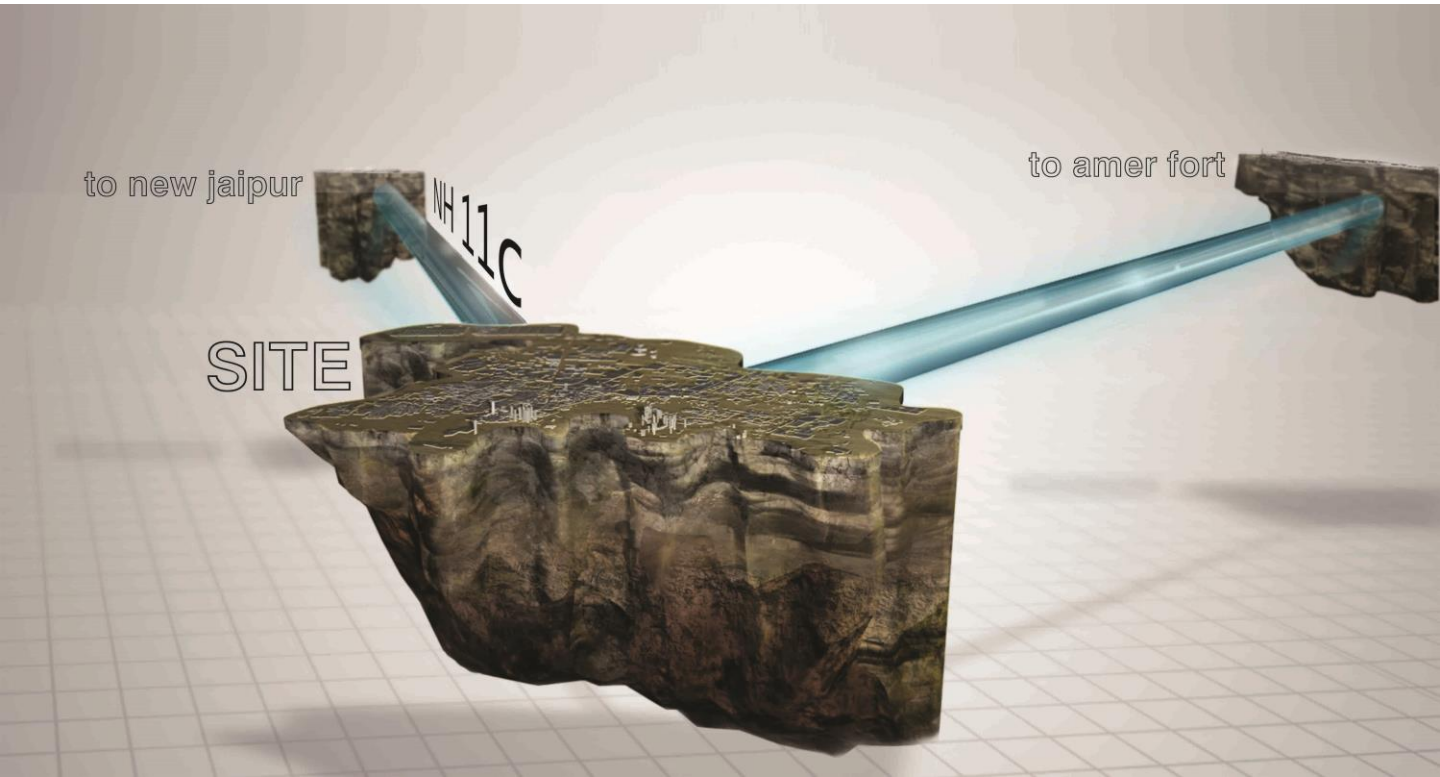


traffic analysis



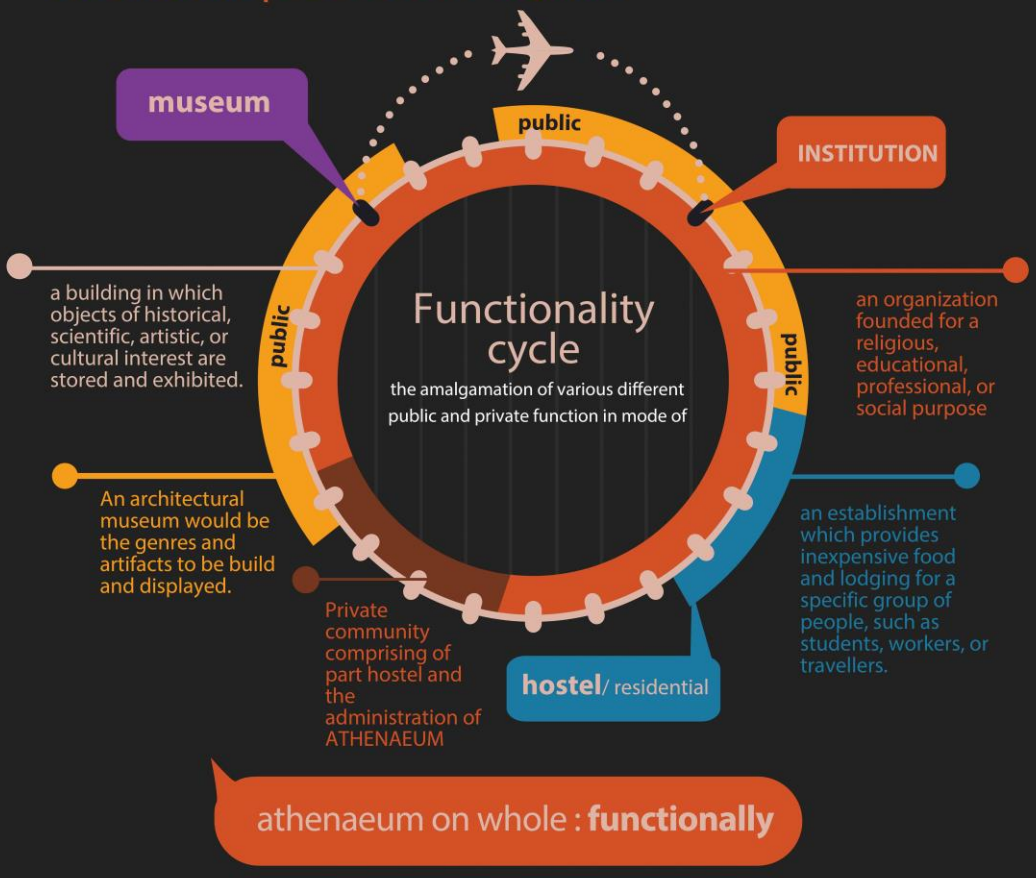
Picture above, Traffic in Jaipur is commercial and general public oriented. As the national highway is adjoining, the maximum inlet, the graph mainly showing the visualization and analysis of traffic with there minimum and peak times. The timeline mainly needed to focus the tourist insertion towards the designed building as in to make out the maximum use of it, in metaphor and literal terms.

NATIONAL HIGHWAY 11c, the inlet and outlet of traffic movement has been shown in the **picture below**, the site connection to AMER FORT (imp tourist dest.) and new Jaipur.

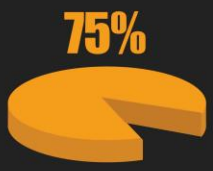


Athenaeum study

athenaeum | function at glance

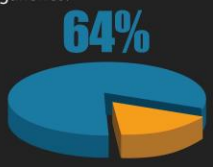


athenaeum on whole : **functionally**



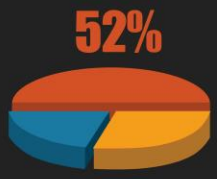
75% public dominancy in the spaces like museum and public galleries.

museum



Public dominancy is considerably reduced in case of institution or to any mode of institute.

institution



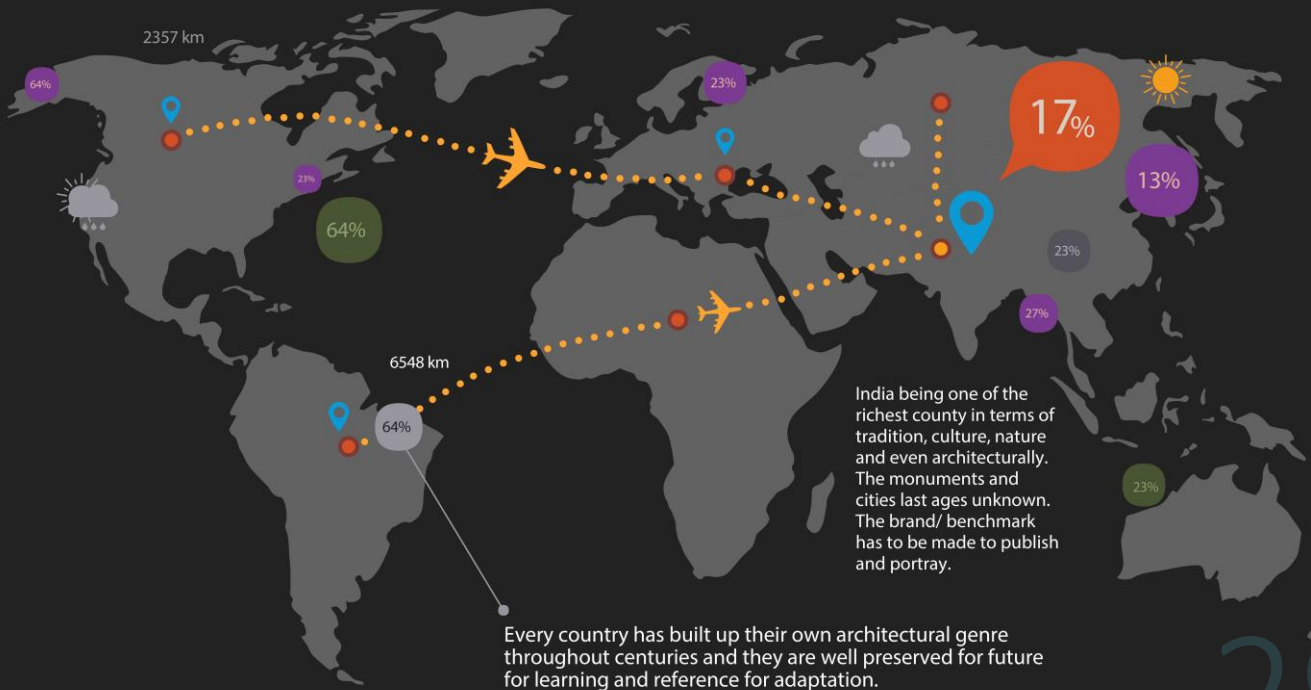
In design like **athenaeum**, the public and the private (institutional) is properly managed and both are given equal weightage: marking the functionality of "visual mode of learning"

athenaeum

athenaeum | world glance

List of athenaeums in world

Chicago
Greece
Egypt ... Jaipur, India



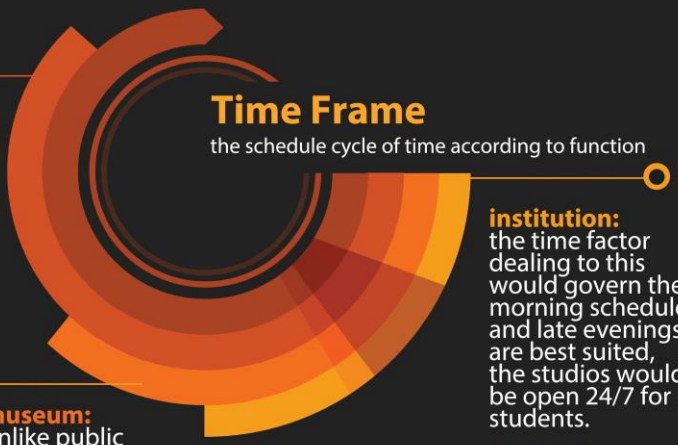
India being one of the richest county in terms of tradition, culture, nature and even architecturally. The monuments and cities last ages unknown. The brand/ benchmark has to be made to publish and portray.

Every country has built up their own architectural genre throughout centuries and they are well preserved for future for learning and reference for adaptation.

Athenaeum study

athenaeum | time frames

the schedule cycle of time according to function



90%

Hostels/ residential: the prolonged cycle which runs throughout the day making it suitable for the occupants.

70%

museum: unlike public museum which shut down by evening time, the athenaeum would function to late evenings or even during nights.

institution: the time factor dealing to this would govern the morning schedule and late evenings are best suited, the studios would be open 24/7 for students.

50%

The athenaeum proposed has been made to function under three functional time frames namely, **institutional (research)+ museum+ hostel accommodation.**

athenaeum | involvement

the aim to involve the maximum

67%

Intention being the user will be the contributor and would contribute to maximim

33%

the important part of any such institution or museum, has to be properly guided and directed. The proper functionality would bring out the mutual interface of the program and the user can contribute to maximum.

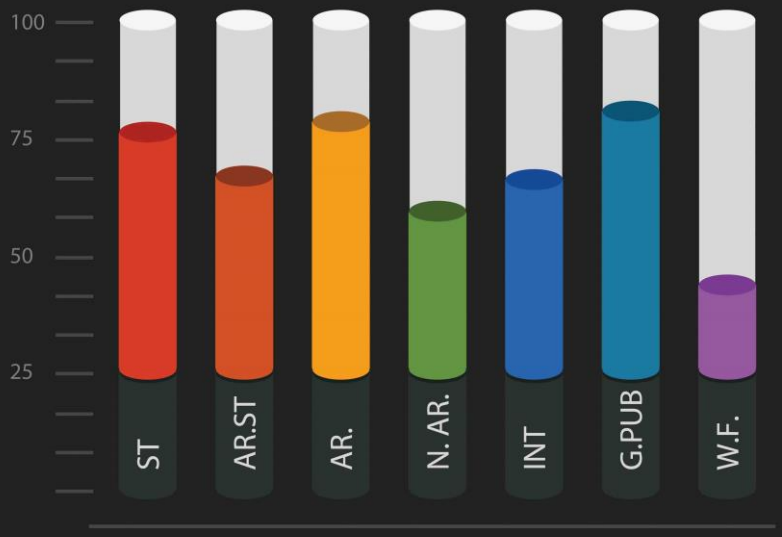
The involvement in athenaeum for every individual has been shown graphically and marked in percentage of involvement. For instance, the project is aiming at obtains **4 out of 6 individual men's and 3 out of 6 individual women** to actually participate in the functionality of the athenaeum

Athenaeum study

CONTRIBUTION LEVELS

the interest makes the contribution. There is liable variation in the contribution to the function or any program, shown below.

percentage marked out of 100



STACK PUBLIC INTERFACE

The total percentage and the comparison of different user type, brought in together.

athenaeum

100%

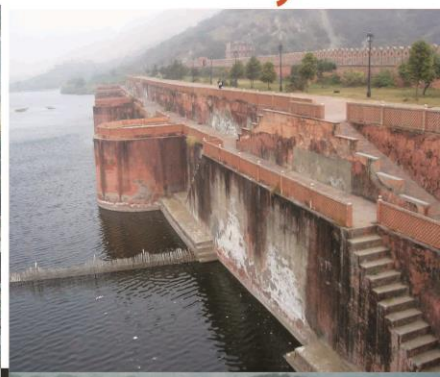
- WORK FORCE
- GENERAL PUBLIC
- INTERNS
- NON. ARCHITECTS (INTERIOR ETC)
- ARCHITECTS
- ARCH. STUDENT
- STUDENT

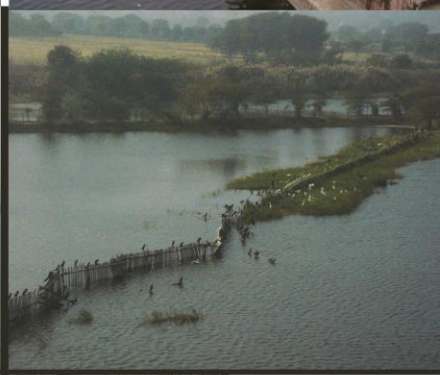
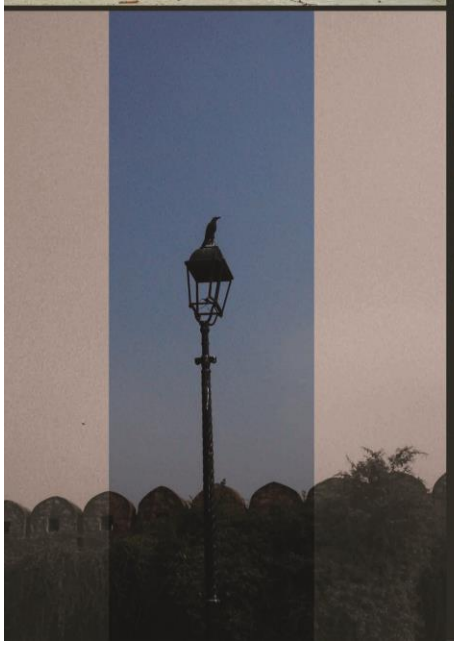
The athenaeum works on various contribution level of different participants. Which mainly shows the interest which will draw there attention and the participation level in the working and functioning of Athenaeum.

The measure of various students, architecture student, architects, non architects (interior designers), interns, general public, work force has been shown.

Site study

site| architecture+ecosystem



ATHENAEUM

CASE STUDY

arts and craft museum, Delhi

[national museum of India]

Architect: Charles Correa

Intent | design, functionally and spatially

experience

The complete journey experienced-
from beginning to end
Moving and proceeding as user

entrance **inference**

the transitional spaces
the light to dark spaces

two way modulation spaces!
No such joint venture as an entire campus

The above statement proven wrong...!!
there were ramp for physically handicapped.
Stone exhibition and cafeteria during entrance venture – followed by reception

noise

Mr. Mahipal
guide lecturer

luxury

Mainly woods finished.
Ample amount of spaces.
View angle has been managed – the visitor only sees, that an architect wants to show.
Marginal space sepration

Outdoor noise is auidable! The train and police vehicle moving.

museum

The lighting → no natural → artificial lighting being preferred
Lighting services are not being concealed.
The use of material like jute to separate spaces, and nothing being in touch with the structural wall
The usage of colors : a black background score + yellow lighting on display materials.

more

samrridhik@gmail.com

observations

Colors !
Using of space and color as background
Followed monochrome colors
Artificial lighting was preferred
One fire alarm and two smoke detectors in each museum module.
Separate small cabin inside for storage
proud of statue and wooden sculptor

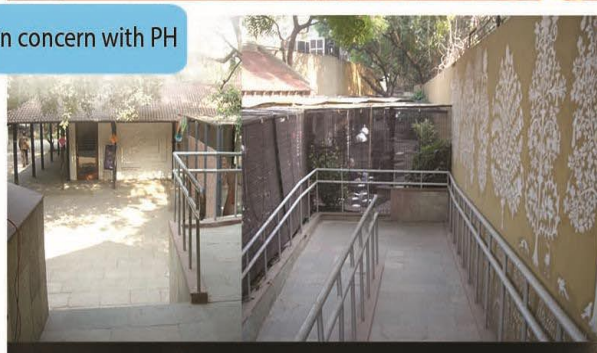
Beautiful interactive spaces – artist painting at the entry making it grandeur
galleries approaches to the user

an art student

demands for bigger museum
feels that the Pragati Maidan is there for every short comings
the theater space is not user friendly and does not work out
during the time of building no scope of future extension was thought of.

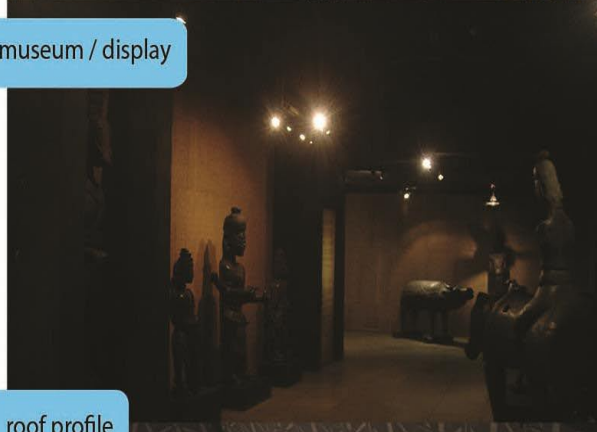
Contextual display

Glimpses of village and village life throughout museum



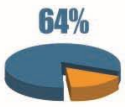
in concern with PH

museum / display

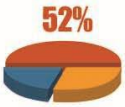


roof profile

75% public dominancy in the spaces like museum and public galleries.



Public dominancy is considerably reduced in case of institution or to any mode of institute.

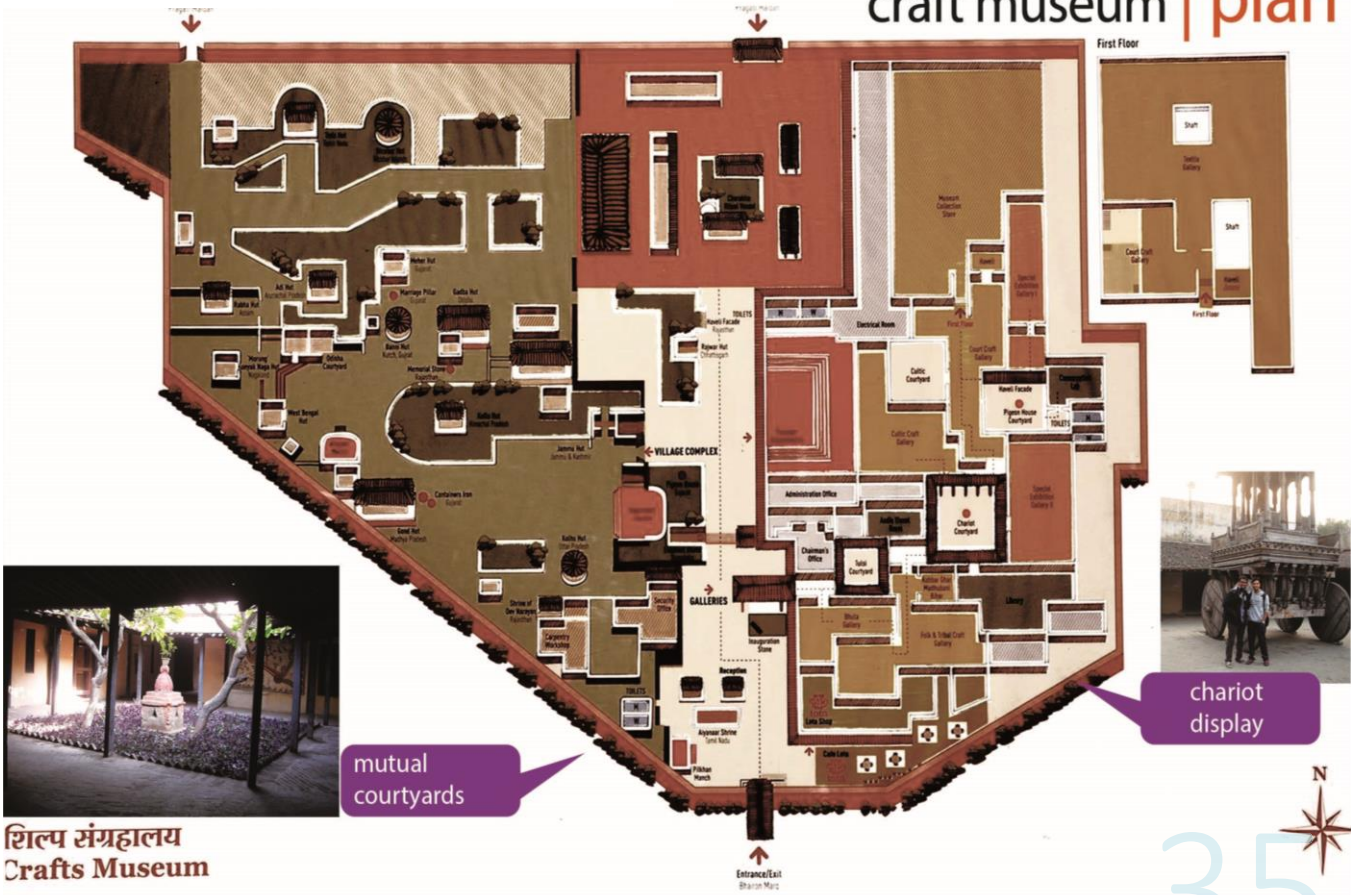


In design like **athenaeum**, the public and the private (institutional) is properly managed and both are given equal weightage: marking the functionality of "visual mode of learning"

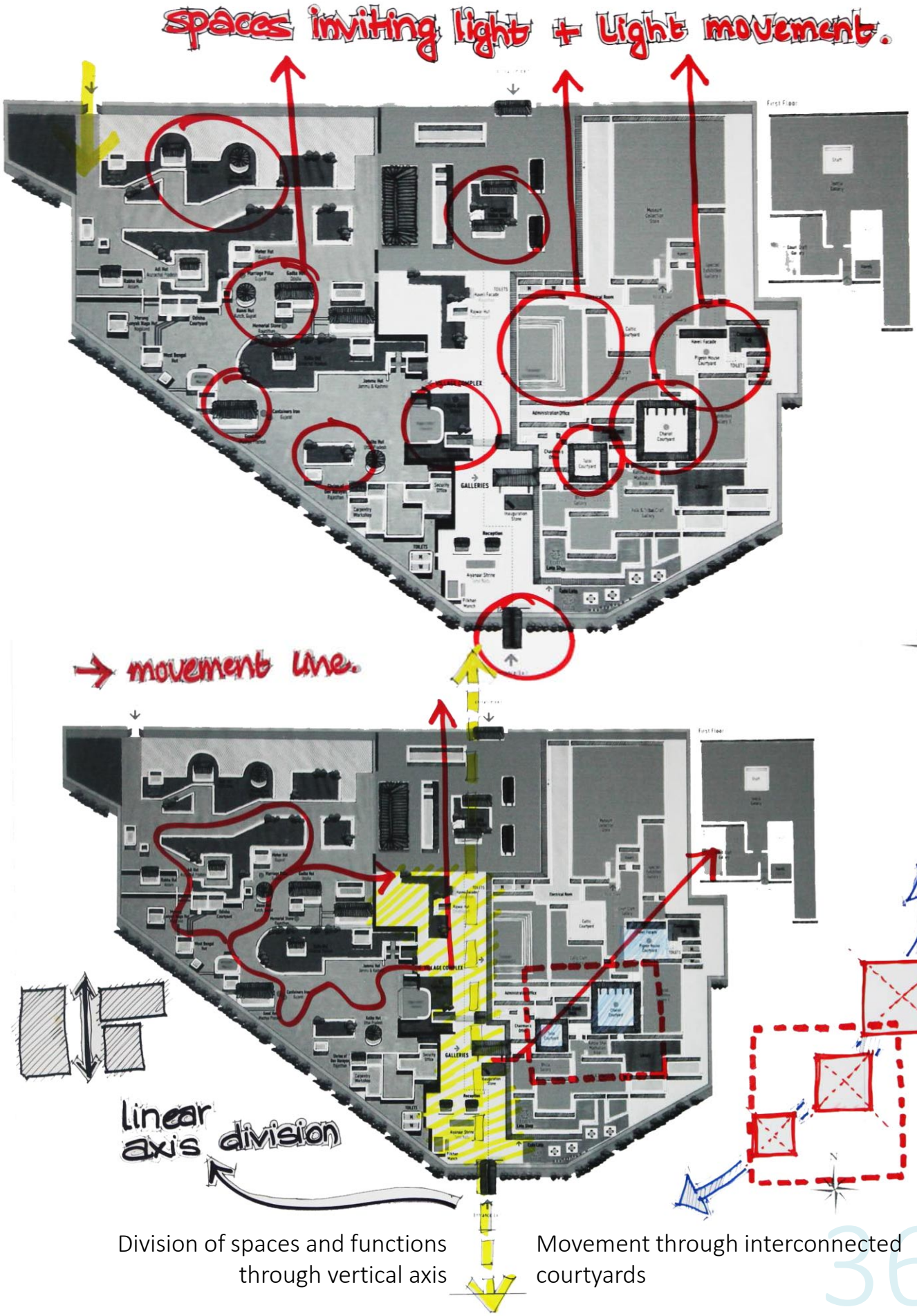
observation

The entrance gallery, the movement through light being directional in nature. Also the materials being used are local in nature and were imported from local places.

craft museum | plan



Movement analysis throughout the campus: **light and axis division**



Division of spaces and functions through vertical axis

Movement through interconnected courtyards

About Arts and Craft Museum: **Ideology and inferences**

inference

Views and observations as a critic

The movement is not defined - one can peruse different directions after reception.

Outdoor **noise** is audible

Services are not concealed

There is no such scope of **future extension**

Congested office space

Emergency vehicle can't entre through main gate and service road is not that accessible.

Drainage problem: leakage and overflow of water during rainy season or during maintenance

Frequent need of renovation.
the spaces are thematic such as dual courtyard and the inter connected spaces.

The movement from village to chariot courtyard and then to haveli courtyard can be noticed spatially and functionally.

The spaces like the painting gallery in entry alley, the material used are the local material of the same place.

To get the exact feeling of the taste and flavour of the exhibit, Correa has used the jist material of that particular place only.

The site being so important, the site is exposed to outdoor noice to some extent. critic analysis.

The campus is mainlyt focused upon, the village courtyard and the exhibition spaces, both working along the central lenier axix.

The movement is very simple and guided. The user can feel all the experiences that the architect wanted to convey through design.

The service roads are connected backwards through Pragati maidan enterance.

It is tough for SUVS or any such motor exhibit to enter with their big vehicle into the campus.

Alliance Françoise ,Delhi

Alliance francaise ,delhi

[french institute of India] Architect: ABRD Architects + Stephane Paumier

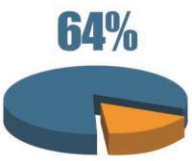
Indo French cultural centre

72 lodhi estate, New Delhi-03

Intent | inference structural and functional

experience

The complete journey experienced- from beginning to end
Moving and proceeding as user



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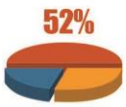


In design like **athenaeum**, the public and the private (institutional) is properly managed and both are given equal weightage: marking the functionality of "visual mode of learning"

ventilation

Mrs . Joe academition

Aesthetic appearance

surrounded by UNISEF building and world bank and the building made contextually.
Material wise such as the textured marble of same tome and shade.

Entrance not that appealing – no security room (even if there, is not functioning)
Proper ventilation
Most of the trees are secured

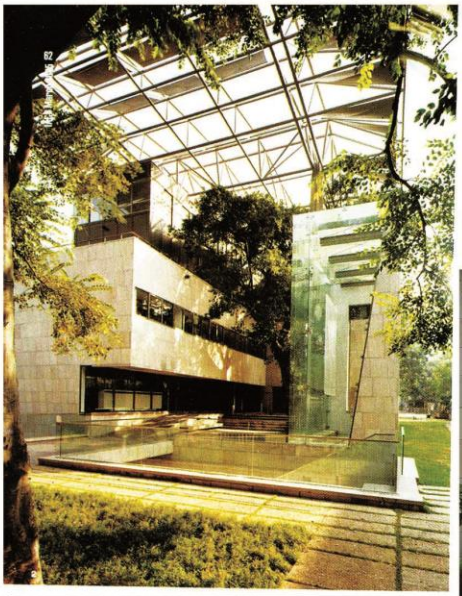
Top surface being treated with solar panels
The design was done in concern with the teachers and their guidance
Rain water harvesting and the water reuse is being practiced.

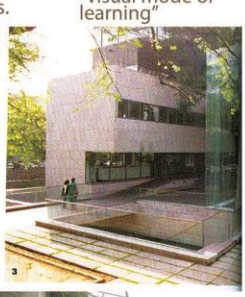
alley/ gallery has the main washrooms whose window mainly open outwards and it mainly stinks.
No special mention and focus was given towards services part.
Semi circular classrooms

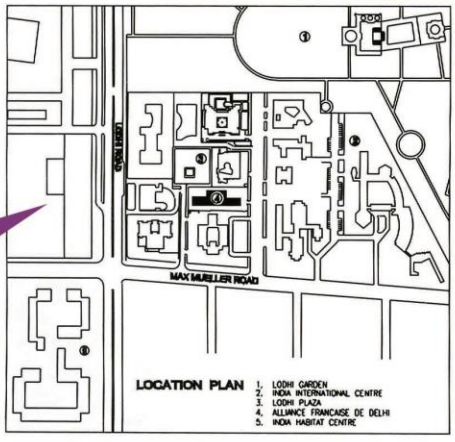
Library:

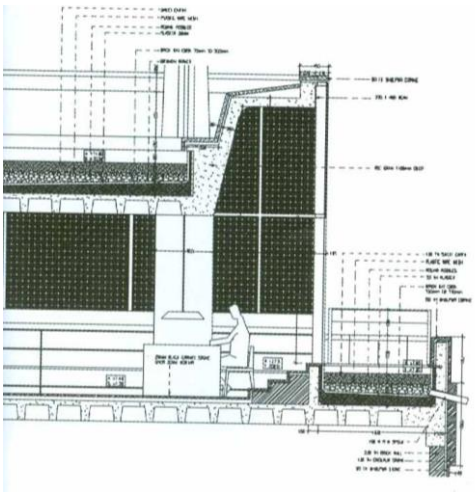
The interface for any student has been brought out beautifully in terms of spatial and functional basis.
Digitally equipped
Proper light and ventilation
Using of metal "jail" in library- having proper inlet and outlet of day light
Exposed concrete work
Ample amount of light through 5m high windowed panels.

toilets are not worked out properly
Exposed usage of materials

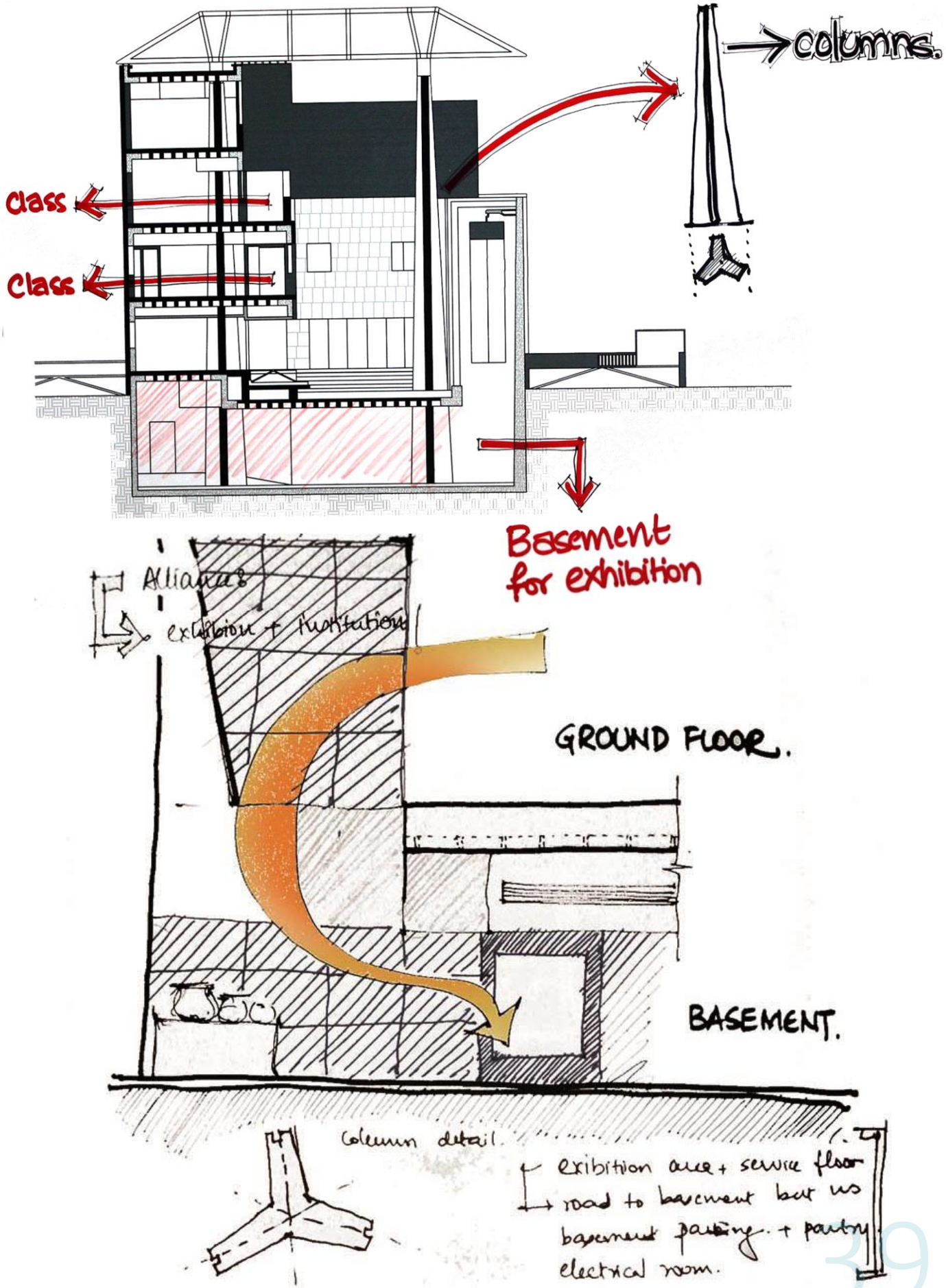








section analysis: structural detail, space segregation, light and ventilation



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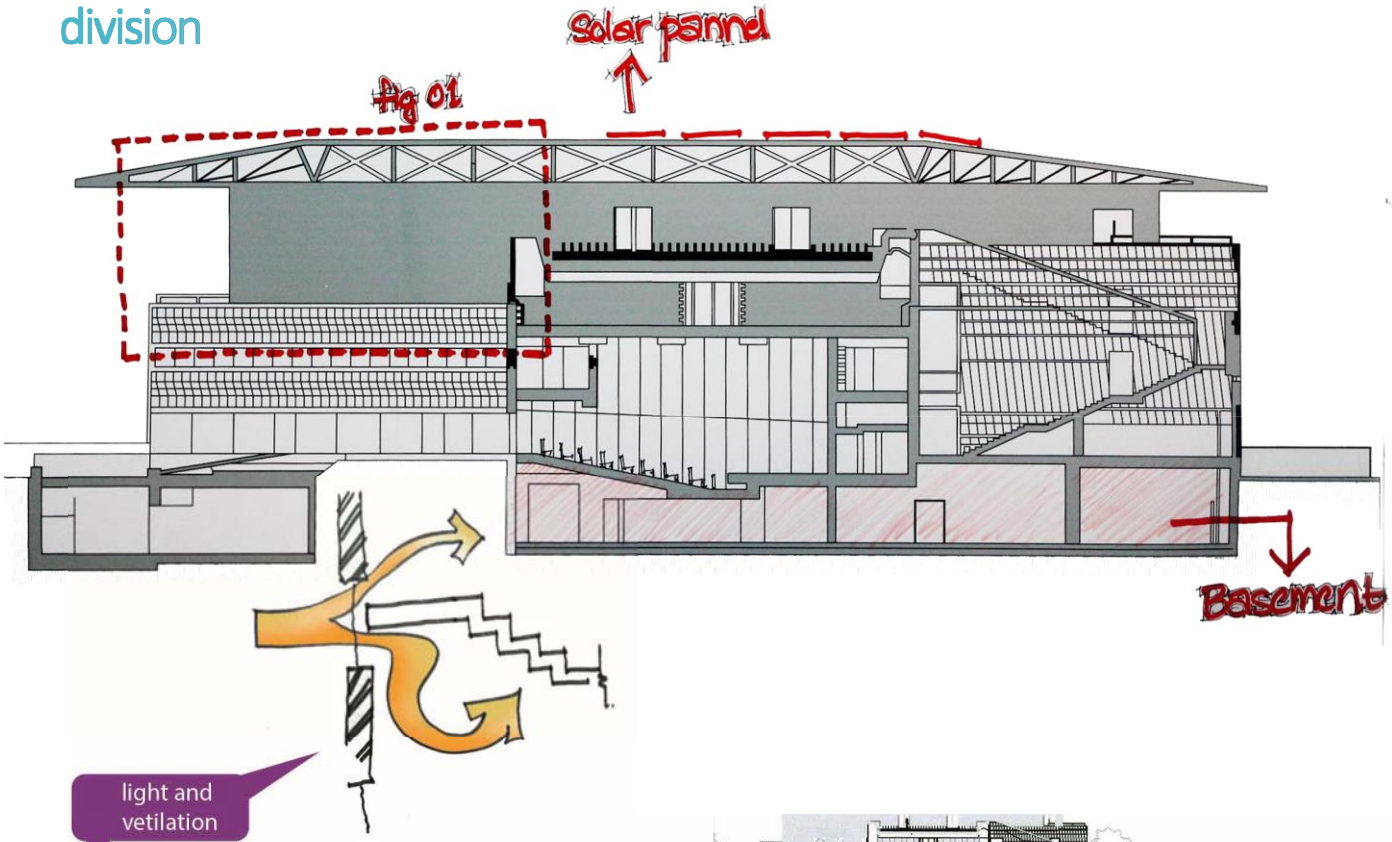
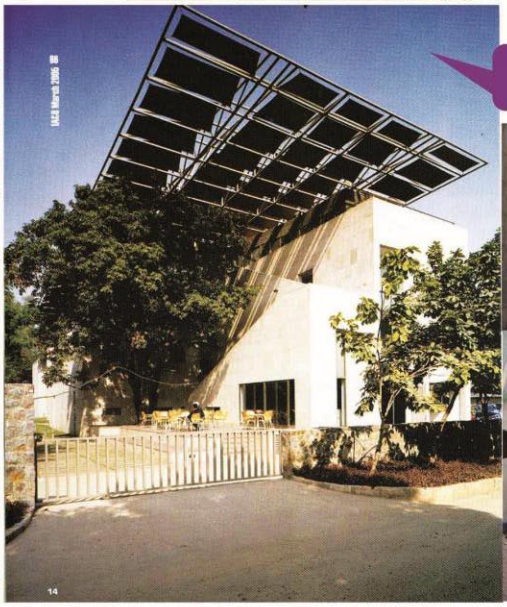
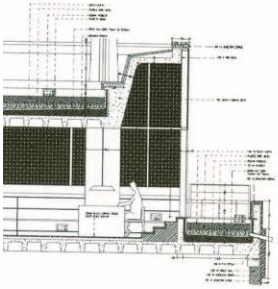


light and vetilation

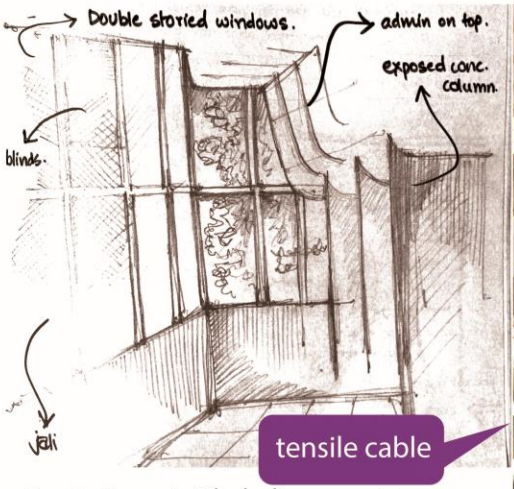
23. Seen here is the terrace attached to the library. The full glass windows with the perforated metal sheet overlook this refreshing strip of green
24. The same view seen here in the evening.
25. Inside the library with sunlight pouring in from its three glazed sides. Also seen on the left, are the steps going to the terrace.
26. The interiors of the library as seen in the evening.



solar pannel



A commission earned via a **competition**, the winning team comprised Anupam Bansal and Rajesh Dongre, both principals of a young firm, ABRD Architects in association with the French architect, Stephane Paumier, Alliance Francaise was founded in 1883 by a small group of prominent individuals to promote the values of French humanism, cultural dialogue and of course, the French language. It has now developed into a global cultural network with its various branches acting as cultural hubs. The Delhi chapter known as Alliance Françoise de Delhi (AFD) was formed in 1956



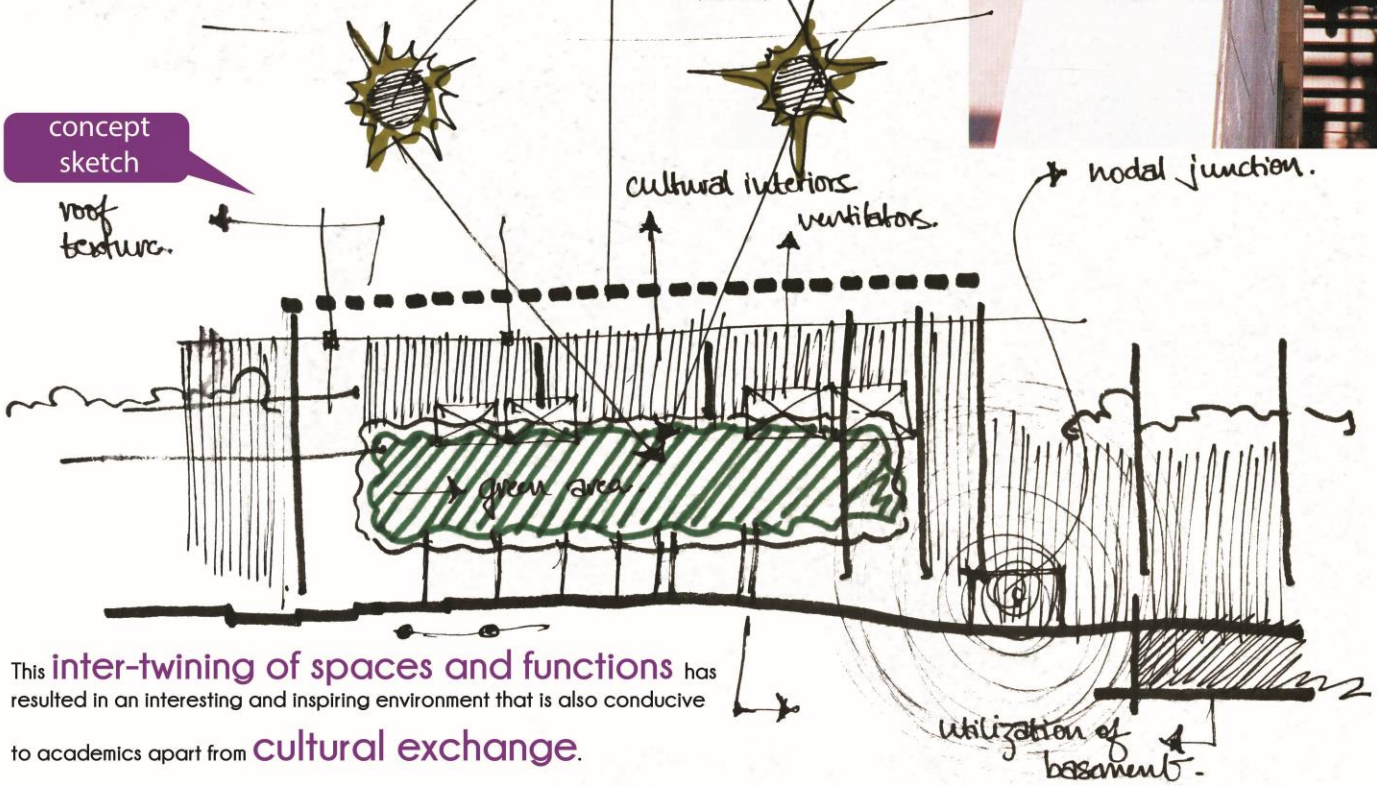
tensile cable

The louvered roof projecting out of the built mass contains transparent solar panels that power the buildings UPS system apart from creating a **microclimate in the courtyards** below and the terraces above, The four terraces, scattered evenly over its functions on the upper floors, couple with the louvered roof to add a charm to AFD's daily functioning. The **concrete parapet** with seeing incorporated within, encourage people to take a break from their daily schedules and sit out.

27. The staircase within the building does not follow the conventional handrail system in the centre. Taut steel strings secured at each step serve this purpose.
28. Seen here are the strings, securely bolted to the coffer slab at the top.
29. The linear staircase seen here from the topmost terrace overlooks the rear courtyard on the right.
30. Looking on to the terrace with the louvered roof casting its shade on it. Also, partially seen is the linear staircase going down to the rear courtyard.
31. A close up view of the roof shows the louvers with solar panels at the top.

climate analysis.

concept sketch

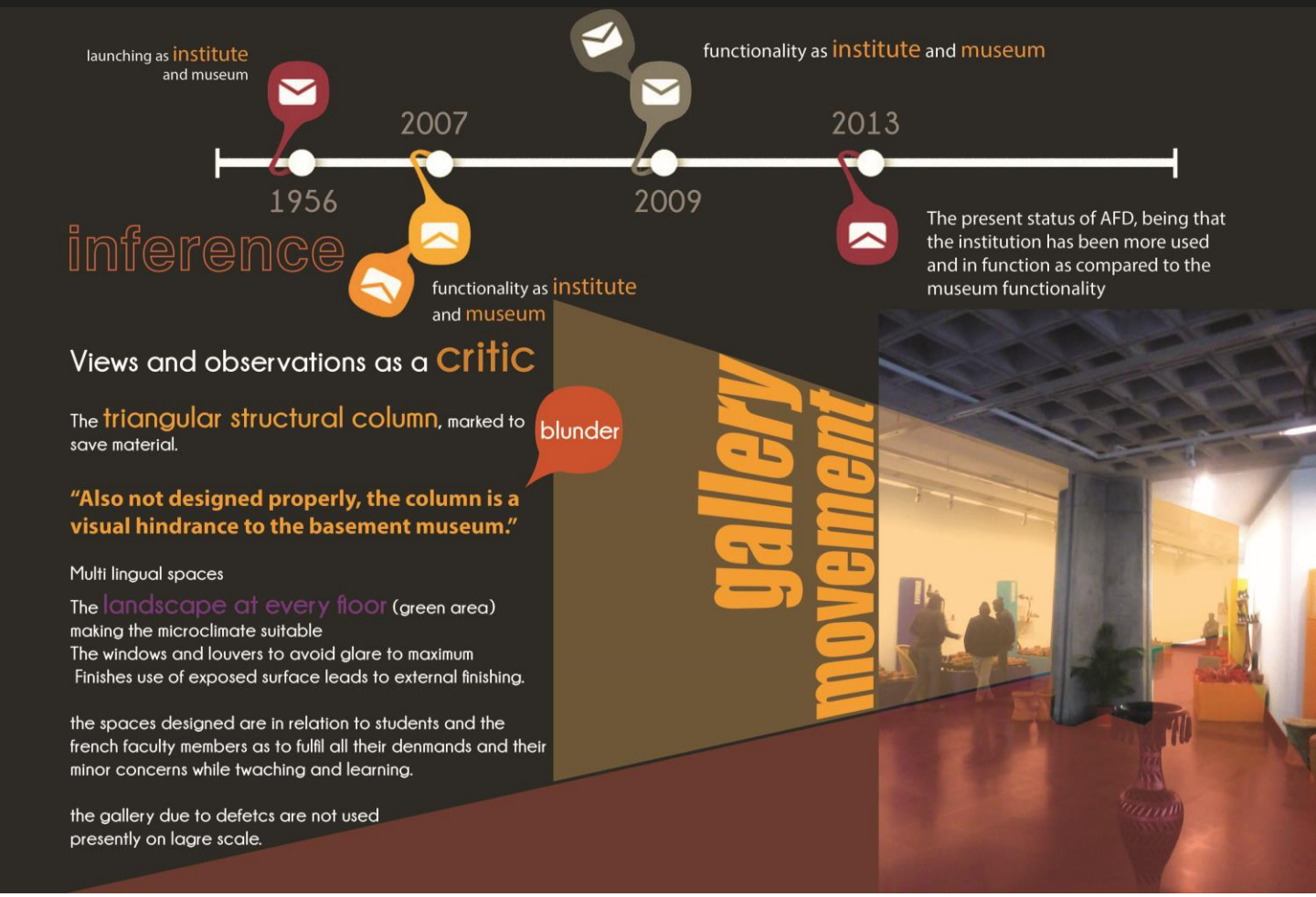


This **inter-twining of spaces and functions** has resulted in an interesting and inspiring environment that is also conducive to academics apart from **cultural exchange**.

The conceptual sketch is the basic ideology behind the section of the institution, the truss (space frame) roof having solar panels which supports the UPS and electricity and the same structural columns and the details which work out completely in a cohesive way for Alliance Francoise.

The use of greenery through landscaping has effected the micro climate of the institution to most extent. The solar panel also helps in shading of the spaces.

inference: structural, space segregation, light and ventilation



As seen through the time line, the institution started working as both art gallery and the French learning institute. And thus with due passage of time the functionality of the program has been dissolved to some extent, and presently only and majorly functioning as French institute and not as the art gallery as such.

The major critic being the structural drawbacks being the COLUMN in between the art gallery causing hindrance.

Also, the micro climate of the institutions has been brought up very well and during summers, the light landscaping at every floor is helpful. Structurally, supportive are the landscape features and the solar panels on trussed roof.

The use of passive solar light is very common feature here and has been used overall for every public places.

This inter-twining of spaces and functions has resulted in an interesting and inspiring environment that is also conducive to academics apart from cultural exchange.

Jawahar Kala Kendra, Jaipur

Introduction

Jawahar Kala Kendra is an arts and crafts center located in the city of Jaipur. The center is important not because of the nomenclature but its close association with the city of Jaipur itself. The center was built in the year 1986 and the construction completed in 1991. The center was launched by the state government to provide space to the cultural and spiritual values of India and display the rich craft heritage. The center is dedicated to the late prime minister of India Jawaharlal Nehru.

This cultural center for the city of Jaipur, is dedicated to the memory of India's great leader Jawaharlal Nehru.

Ideas for the building, sited in an open field near the university in a new part of the city, formed in Correa's mind; but it was not until 1986 that the concept for the building was finalized.

Concept:

The centre is an analogue of the original city plan of Jaipur drawn up by the Maharaja, a scholar, mathematician and astronomer, Jai Singh the Second, in the mid-17th century.

His city plan, guided by the Shipla Shastras, was based on the ancient Vedic madala of nine squares or houses which represent the nine planets (including two imaginary ones Ketu and Rahu).

Due to the presence of a hill one of the squares was transposed to the east and two of the squares were amalgamated to house the palace.

concept:

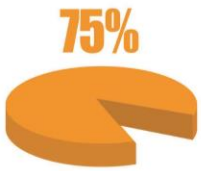
Correa's plan for the Kendra invokes directly the original navagraha or nine house rnandala.

One of the squares is pivoted to recall the original city plan and also to create the entrance.

The plan of Jaipur city based on the nine square Yantra in which one square is displaced and two central squares combined. the squares is defined by 8m high wall, symbolic of the fortification wall along the Jaipur old city

Jawahar Kala Kendra, jaipur

Architect: Charles Correa



75% public dominancy in the spaces like museum and public galleries.

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In design like **athenaeum**, the public and the private (institutional) is properly managed and both are given equal weightage: marking the functionality of "visual mode of learning"

concept

Intent | concept design, function

experience

The complete journey experienced- from beginning to end
Moving and proceeding as user

criticism

inference -1

the main entrance has no provision for handicap, if there why not on the main entrance.

The main journey starts by getting down **5 steps down** (sadly no physically handicapped person could feel that)
Why not to give same feeling of anxiety or behavior to PH

The big gateway attracts the user: the mode of importance.
Whole building being in contours: may be site responsive.

The whole campus doesn't have any CHAJJA leading to long term problems – wooden doors (administration verdict)

Jawahar Kala Kendra is an arts and crafts centre located in the city of Jaipur. The centre is important not because of the nomenclature but its close association with the city of Jaipur itself. The centre was built in the year **1986** and the construction completed in **1991**. The centre was launched by the state government to provide space to the cultural and spiritual values of India and display the rich craft heritage. The centre is dedicated to the late prime minister of India **Jawaharlal Nehru**

Architect's sketch of the entrance facade.

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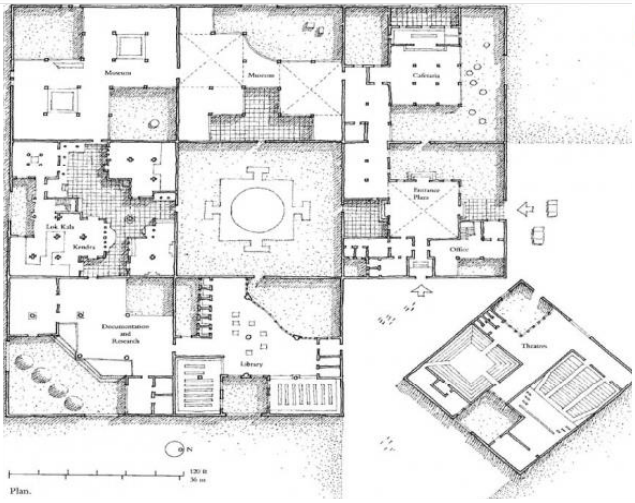
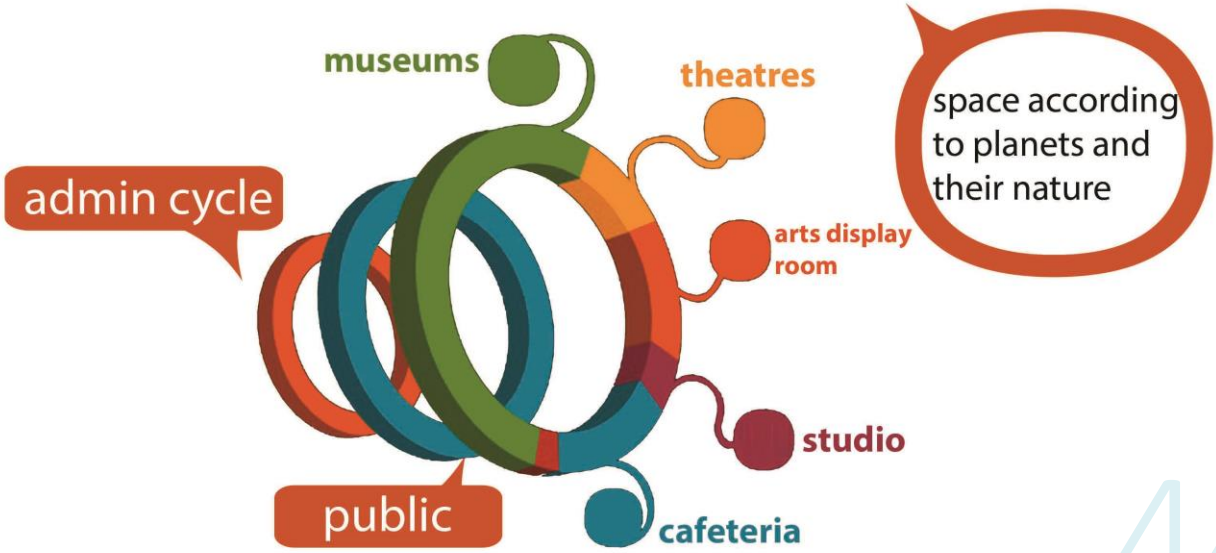
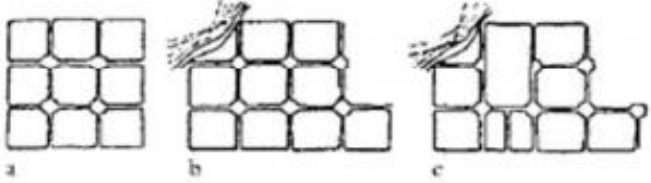
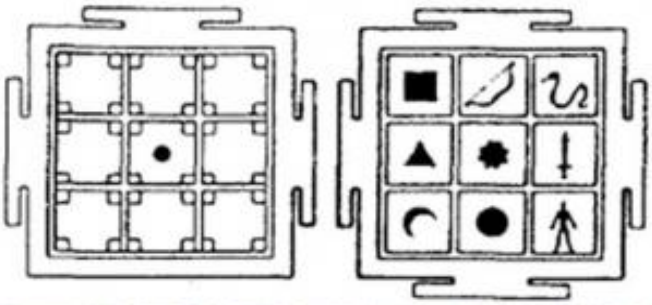






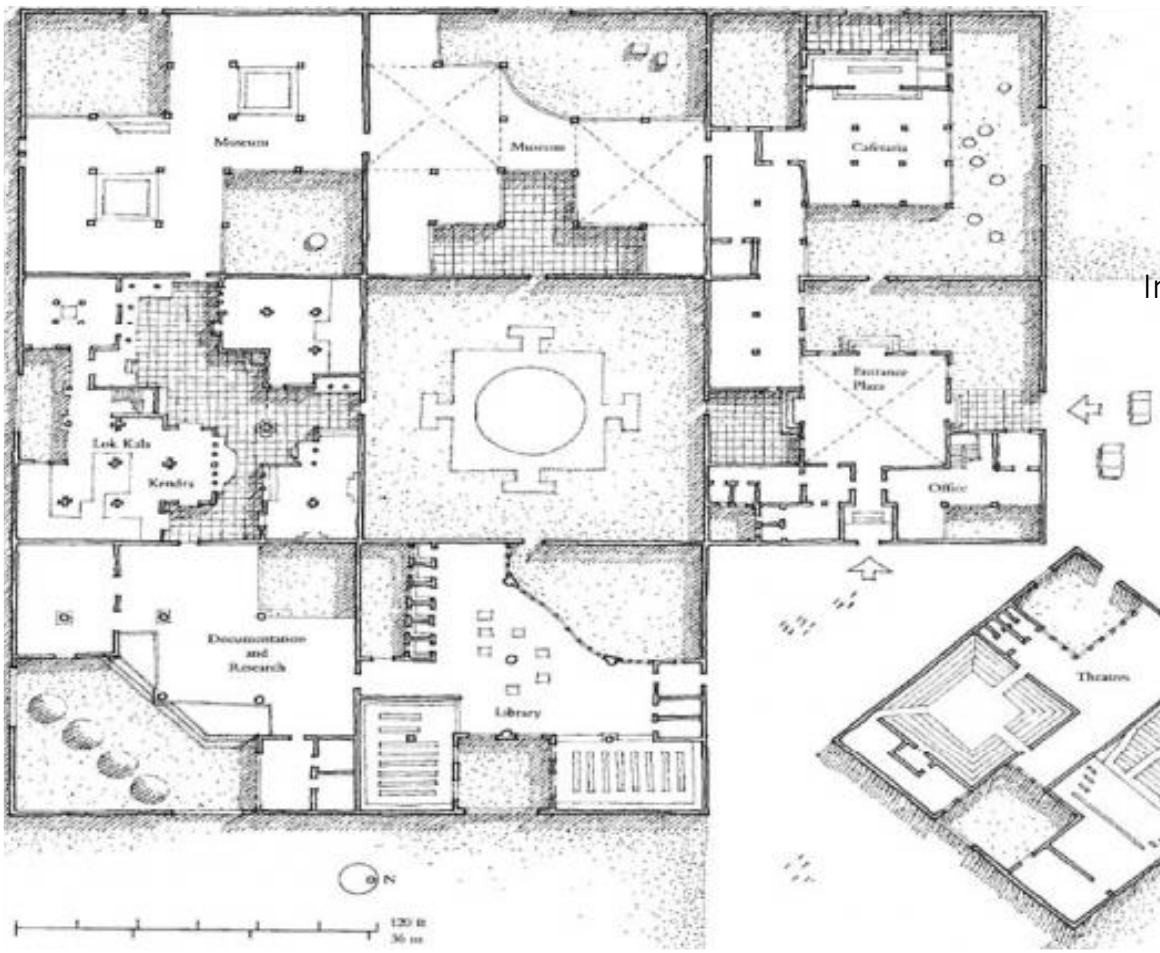
The plan of Jaipur city based on the nine square Yantra in which one square is displaced and two central squares combined.

concept



Ground plan of the Nāt-Mandir in Konarak (left), corresponding to the divisions of the Yantra of the Nine Planets or *Navagraha* (right). The symbols of the yantra are: square = Venus; bow = Mercury; snake = ketu; triangle = Mars; lotus = the sun, at the centre; sword = Rahu; crescent = the moon; circle = Jupiter; man = Saturn. Based on the Mandala Sarvasva.

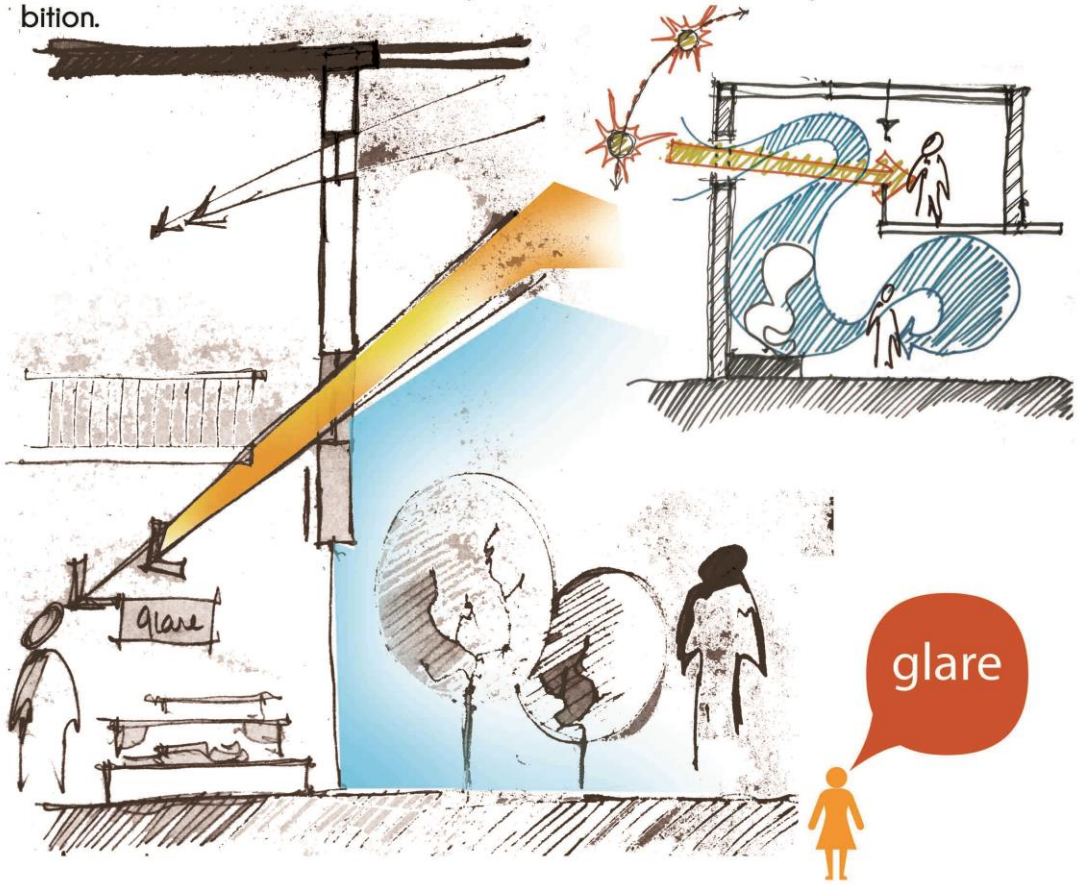
plan



Intentions that lead to Design attributes

Museum not functioning during the late afternoon time. 4:00 pm (glare in the museum.)

Management faults
Glare at museum
Museum could have functioned better.
Current space are not functionally appealing at museum.
There has been no allotment of any live craftsman or workshop with the exhibition.



Scope of future extension is again not possible

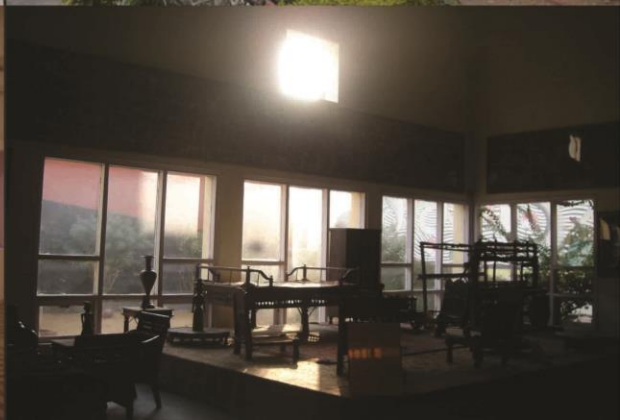
The Indian coffee house the cafeteria mainly used by professionals, work group for meeting, chatting purposes, get together.
And often used a general landmark.
Temporary ramp for ph .

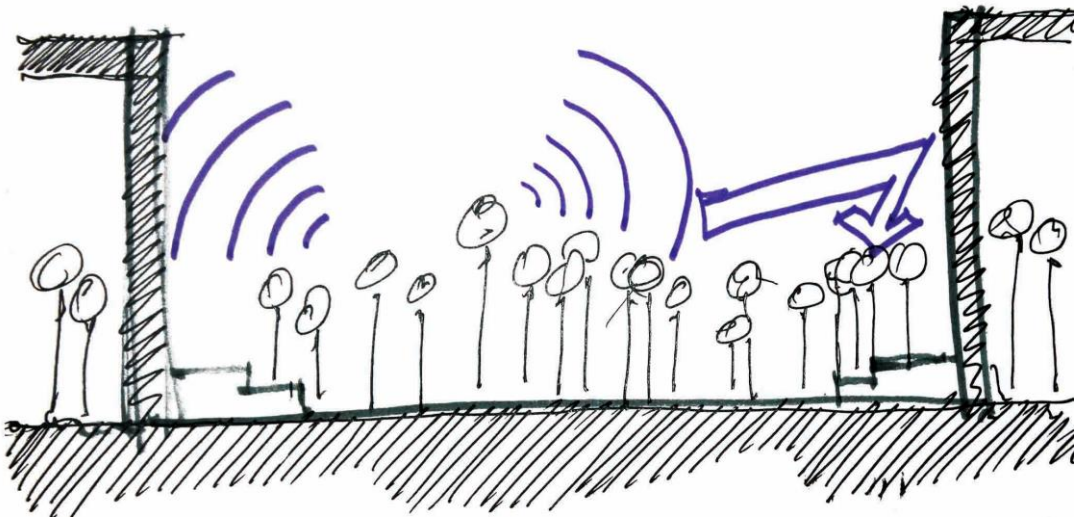
r.p. sharma administrative officer .
Cladding stone 5 x 2 or 6 x2 – maintenance factor if small, less maintenance.
Administrative toilets for staff. (General toilets)
Director or executives director private toilets.

Poor functional space during rainy season.

Karyashala- summa having camp 600 children participated.
(love center) for university point – misuse point .
The purpose has been changed with time .
Design is best as compared .
Museum and the theatre block
1000 inlet & outlet.
Cafeterias has been designed and even the interior has been designed accordingly.

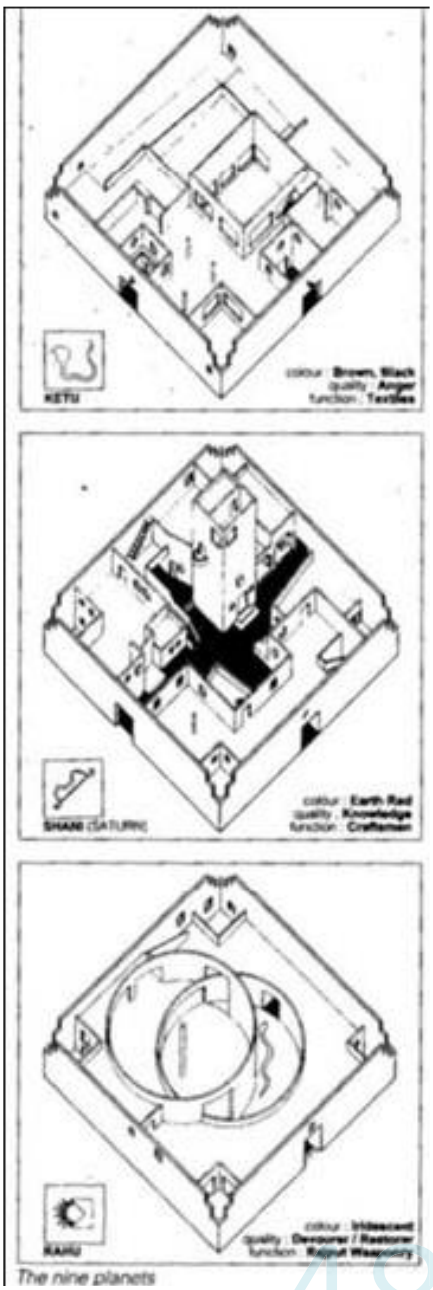
Moon kalayaien – cafeteria table.





inference

- The buildings in a contemporary metaphorical replication of the basic plan of the city of Jaipur, based on the vastu pursh mandala.
- The architect in his attempt to create a brand image for the historical city, has tried to get the essence of the existing form but superficially .
- The critical sustainable aspect of the traditional architecture of Jaipur has not been tackled well.
- The place has an amazing interplay of light , shadow and colors, evoking emotions in the user and invite
- him to move further.
- The spaces flow as an narrative and changes the moods of the user, but the over all circulation lacks of continued covered corridor, which makes the place unusable during summers and rains.
- The open air theatre is only good to look at, it is enclosed by the high walls which create acoustic and ventilation problems at the time of crowd.
- The high walls with no fenestration in the façade makes the building enclosed and it does not open up to the city.
- however within the building the activities are disintegrated but combine to a heterogeneous mixture of various cultural activities happening individually.



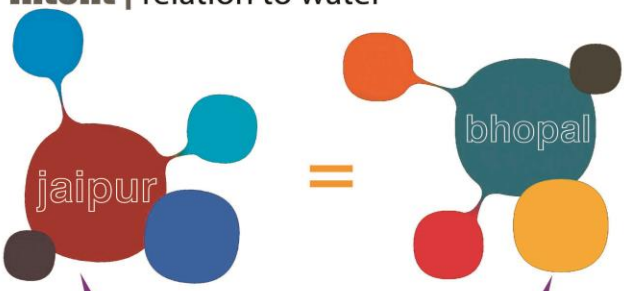
The nine planets

Bharat Bhavan, bhopal

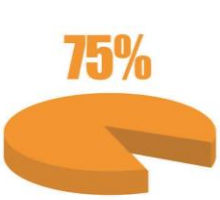
[museum of India]

Architect: Charles Correa

Intent | relation to water



water - bharat bhavan : water - at site



75% public dominancy in the spaces like museum and public galleries.

Public dominancy is considerably reduced in case of institution or to any mode of institute.

In design like **athenäeum**, the public and the private (institutional) is properly managed and both are given equal weightage: marking the functionality of "visual mode of learning"

experience

The complete journey experienced- from beginning to end
Moving and proceeding as user

criticism — inference -1

Mr. D.K. Yadav

Locality factor is very prominent.

The entrance not very grandeur structurally

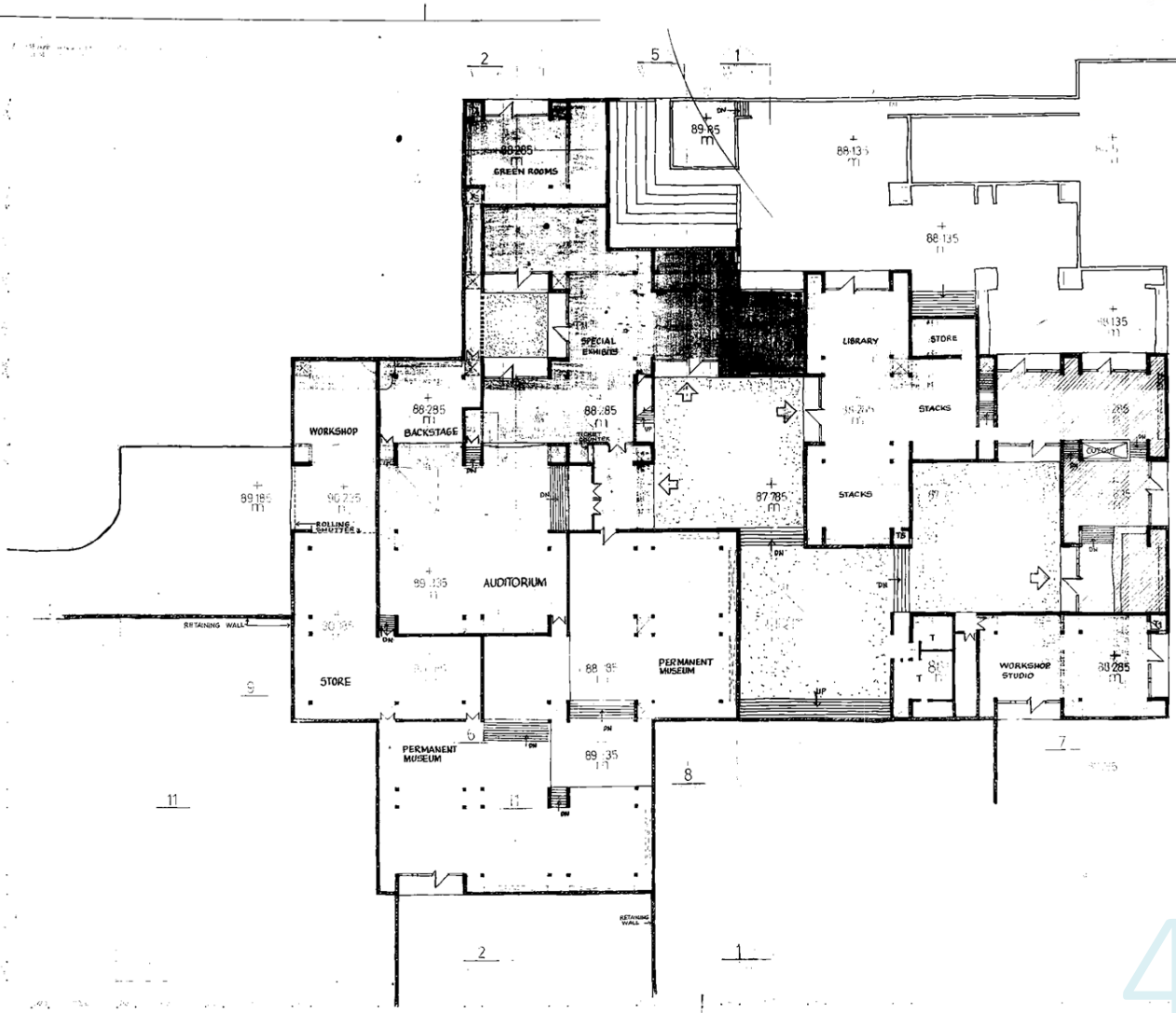
No dedicated parking space for the museum

Parking overflow in case for any special event under progress.

Guard room, purely in context with building architecture – the material ways – exposed stone finished

Harmony between the floor material and wall material

Entrance is very calm and composed, presents contemporary feeling



unlike any other Charles correa building, bharat bhavan is having the **ramp for physically handicapped right from the entrance**

At top most level the user is standing at LVL 0

Landscape has been given main scope of interest and mainly to have aesthetic appeal not pull user.

the tree with time is made and evolved as an sculpture placed right as at center.

The movement is **directed towards lake city**, i.e. the as the movement follows the lake can be seen

Dual space in nature!

The stairs leads upper level in nature which may lead to the view lake from top

View of lake is better from terrace level.

The main intention being to have a relation between the museum built body to a manmade body, being prime importance

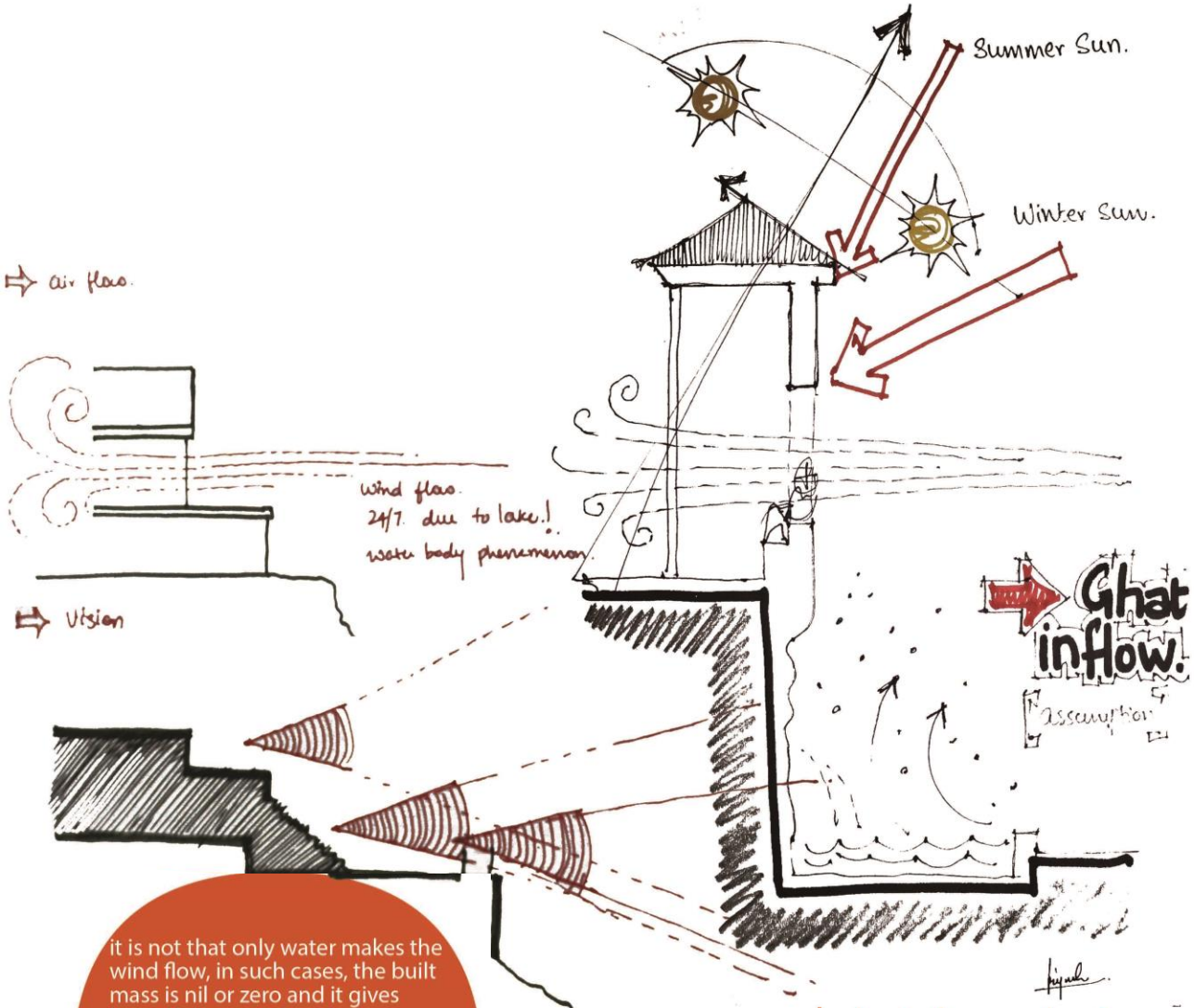
OAT on top with a stage and the stage having the background of lake again

No evergreen trees are used – instead mixed used, which would shed their leaves in winter or spring

A contemporary courtyard which mainly opens and all museum galleries open to that courtyard

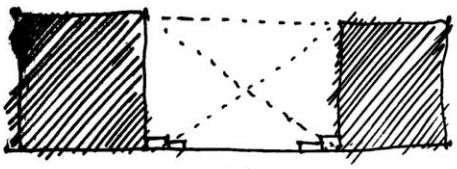
inference -2

relation-picture



it is not that only water makes the wind flow, in such cases, the built mass is nil or zero and it gives beautiful scape of void.
Thus gives the air some space to travel they gather together and flows to every direction possible depending upon then lakes current.
The study of bharat bhavan in relation to the lake : the relation of site (Jaipur) having man sagar lake.

bharat bhavan | sketch analysis

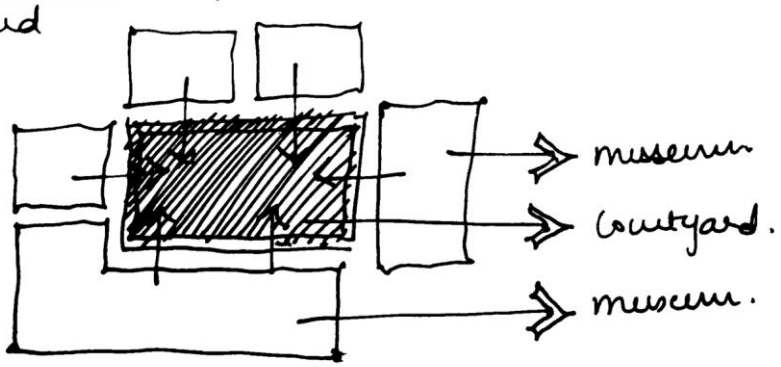


kund courtyard.

relating to water again.

relation to the lake city.

having sculpture in between. which is the same feature as the dargah in the middle of the lake.



Literature study | Athenaeum

The athenaeum – Richard Meier

Introduction

The Atheneum functions as the community, cultural and orientation center for New Harmony, Indiana. It was built between 1974 and 1979. Before analyzing of the formal attributes of the Atheneum, it is critical to briefly discuss the context, or rather the town of New Harmony where this building is situated. New Harmony "was one of the most significant utopian communities in America"(Meier, 191). The town was founded as Harmony in 1814 as a Christian utopia by German immigrant George Rapp, [who felt the second coming of Christ, was imminent. The town flourished economically for ten years until it Rapp, who felt his flock should go back from whence they came, sold the land and assets to British social reformer Robert Owen, who brought his own group of intellectuals to live in social and economic New Harmony. Although the utopian society dissolved around 1829, Meier kept this original historic context as his primary concern in this design. The role of architecture in this society was, in the words of French utopian socialist and philosopher Charles Fourier, was "to find the architectural conditions most appropriate to the needs of individual and social life, and must construct according to these conditions the type of habitation which would constitute the social beehive of the rural commune"

Part 1: form

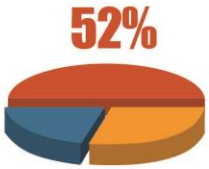
The Atheneum by Richard Meier is an excellent prototype for the discussion of form. Meier strategically uses the building's form to address issues of type and function/program while handling the social and cultural context through tectonics and circulation. This discourse will refer directly to **Paul Rudolph's** Six Determinants of Architectural Form to partially frame this discussion as Meier has explicitly managed each point as he produces his internal logic and organization of form.

New Harmony ,Indiana

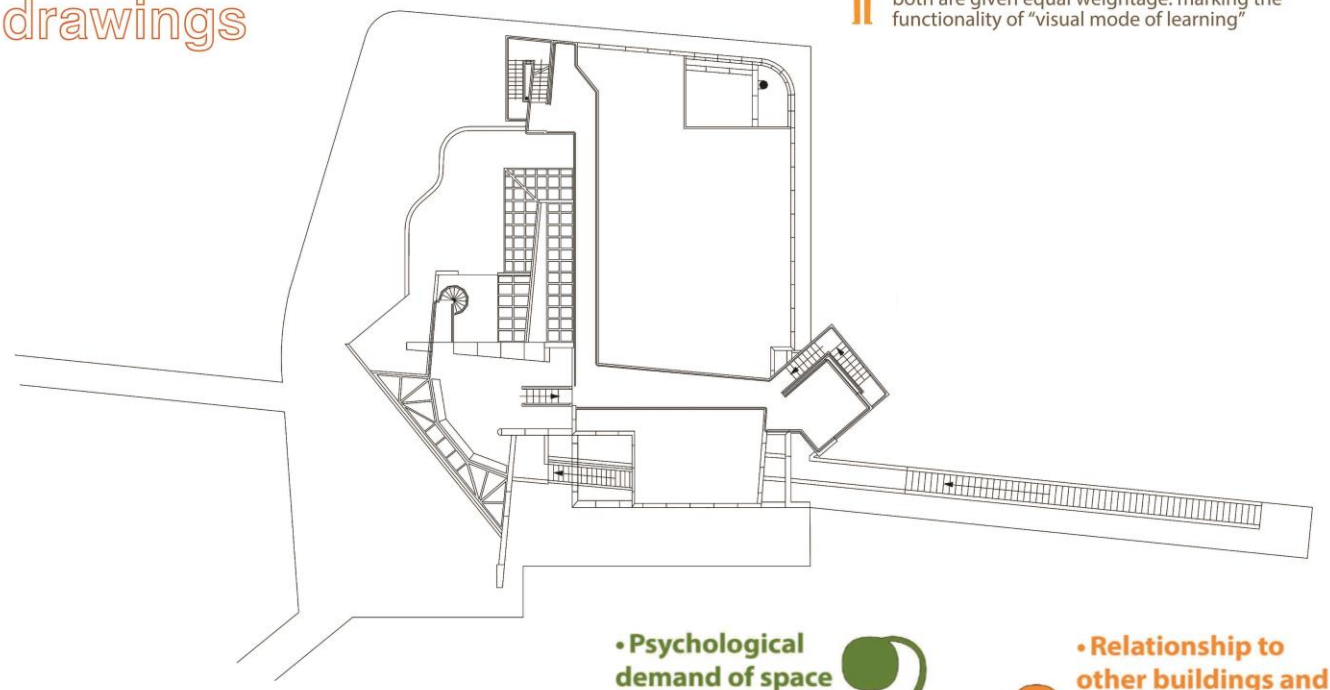
Architect: Richard Meier

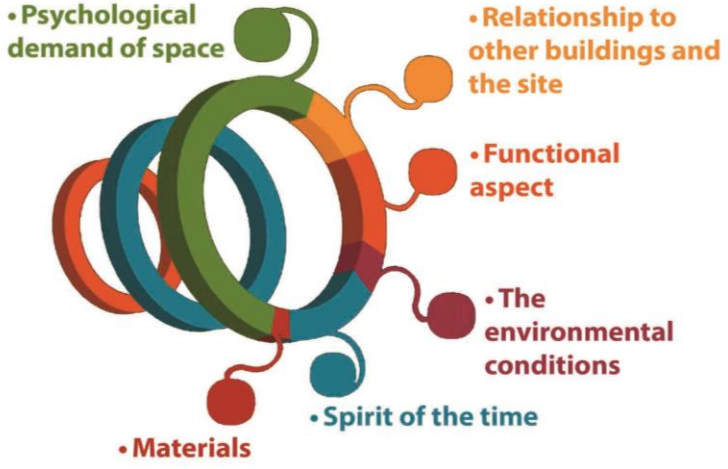
Intent | athenaeum live alalysis

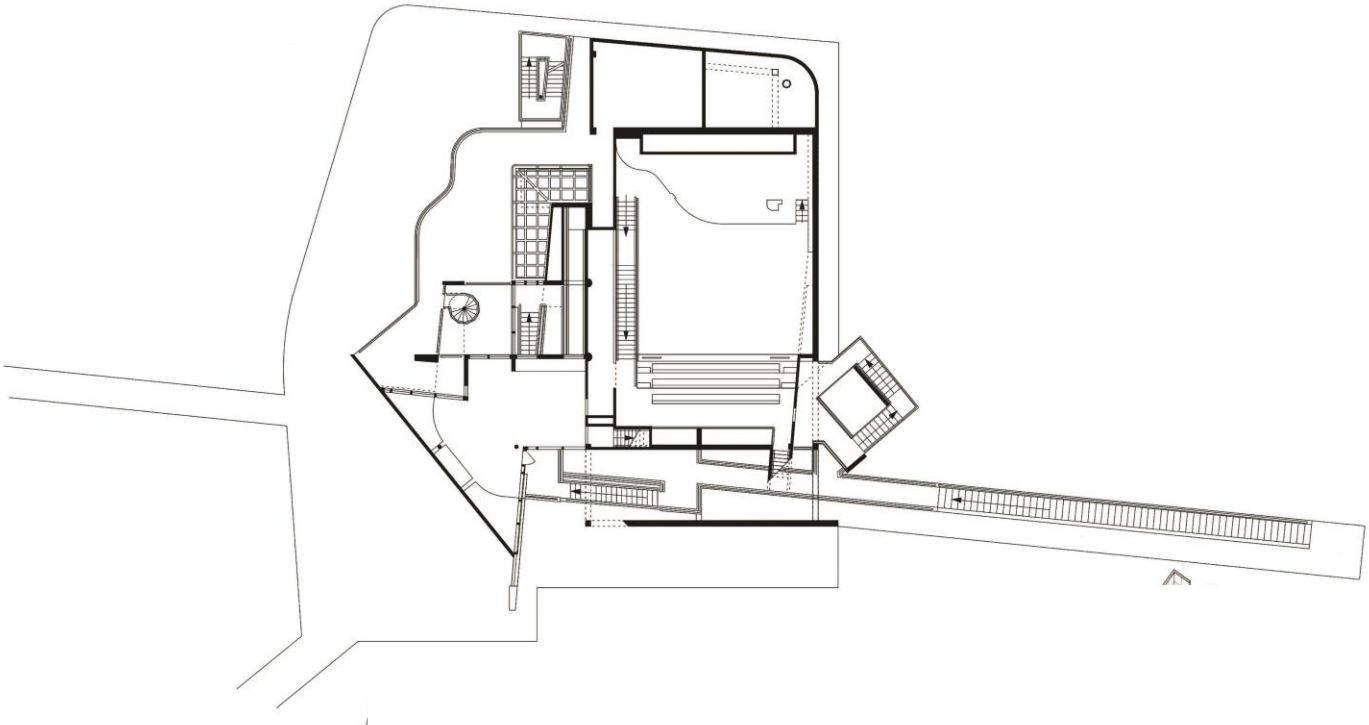
drawings

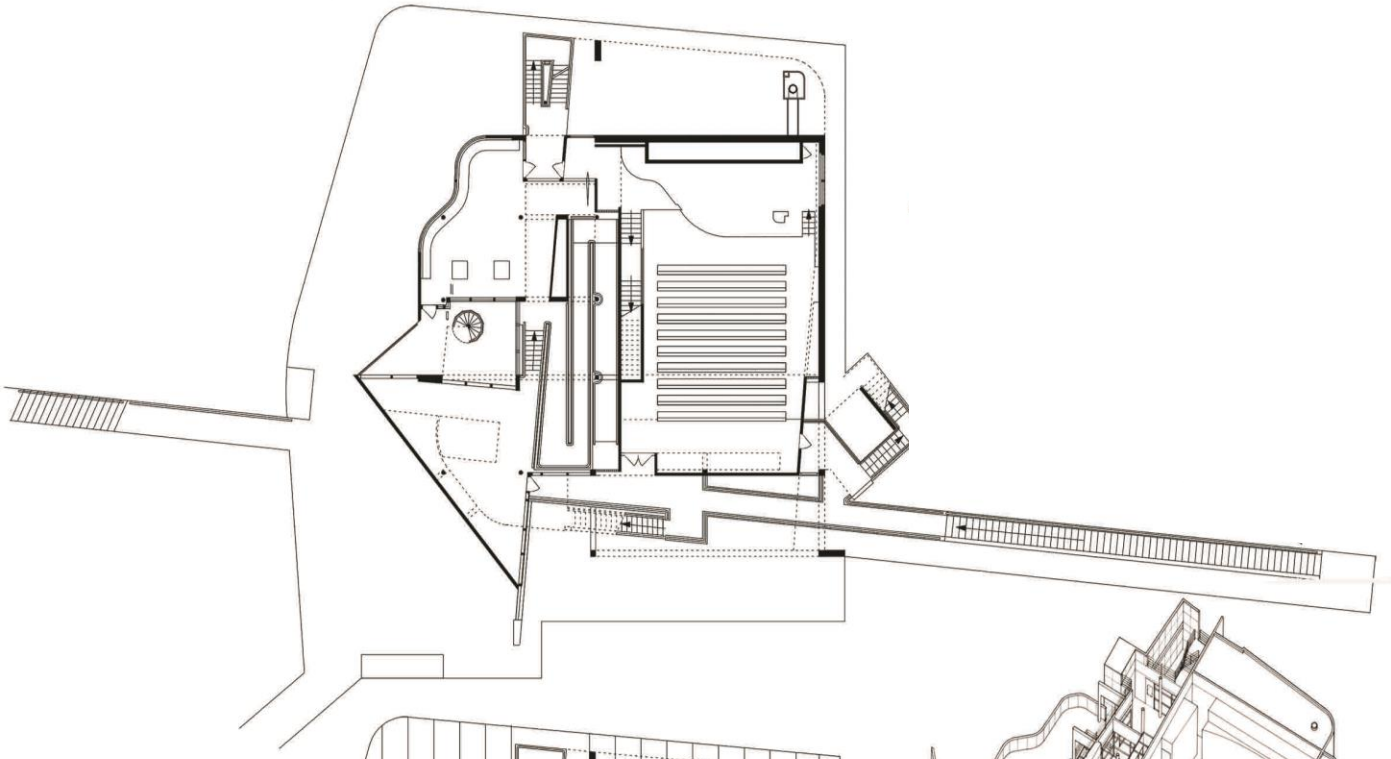


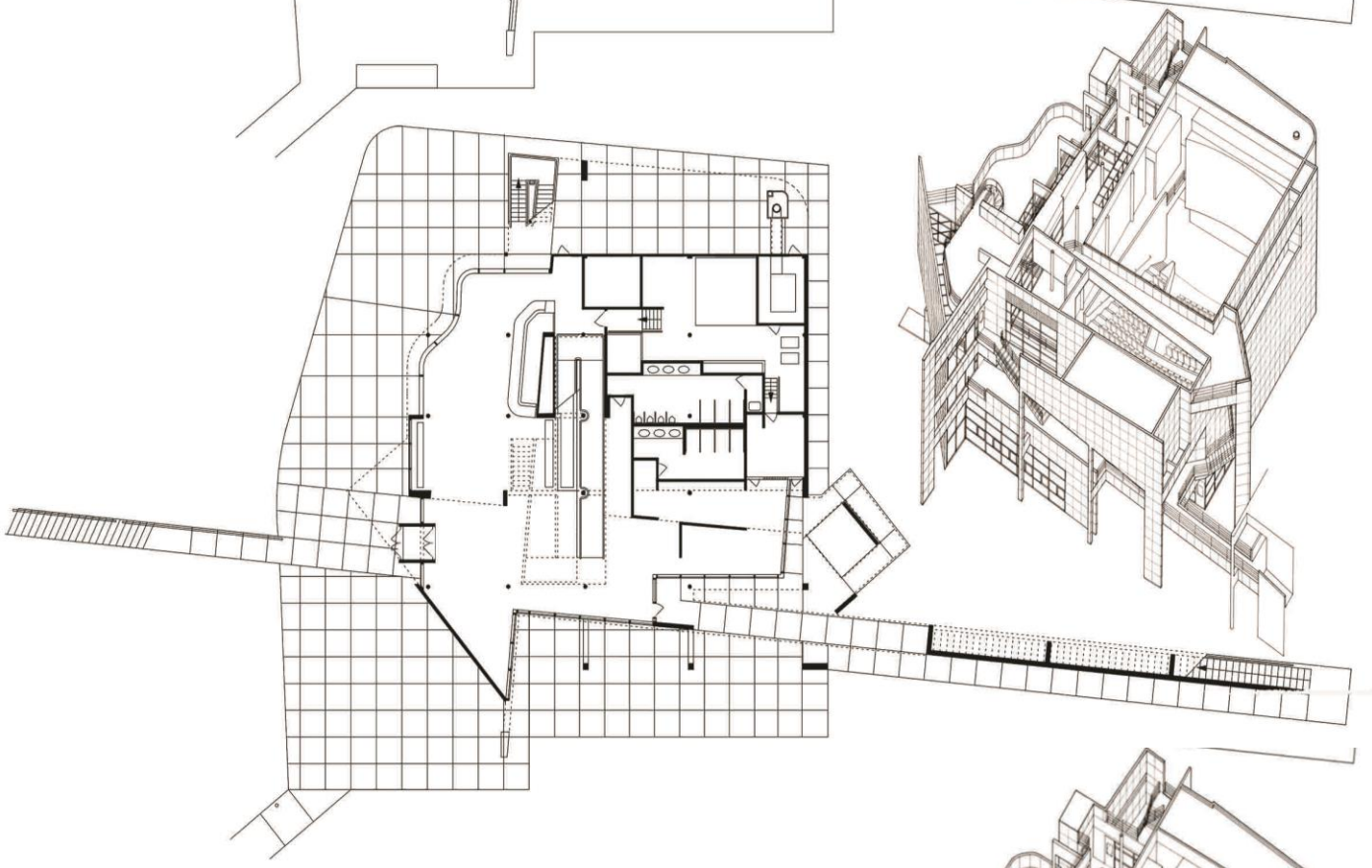
In design like **athenaeum**, the public and the private (institutional) is properly managed and both are given equal weightage: marking the functionality of "visual mode of learning"

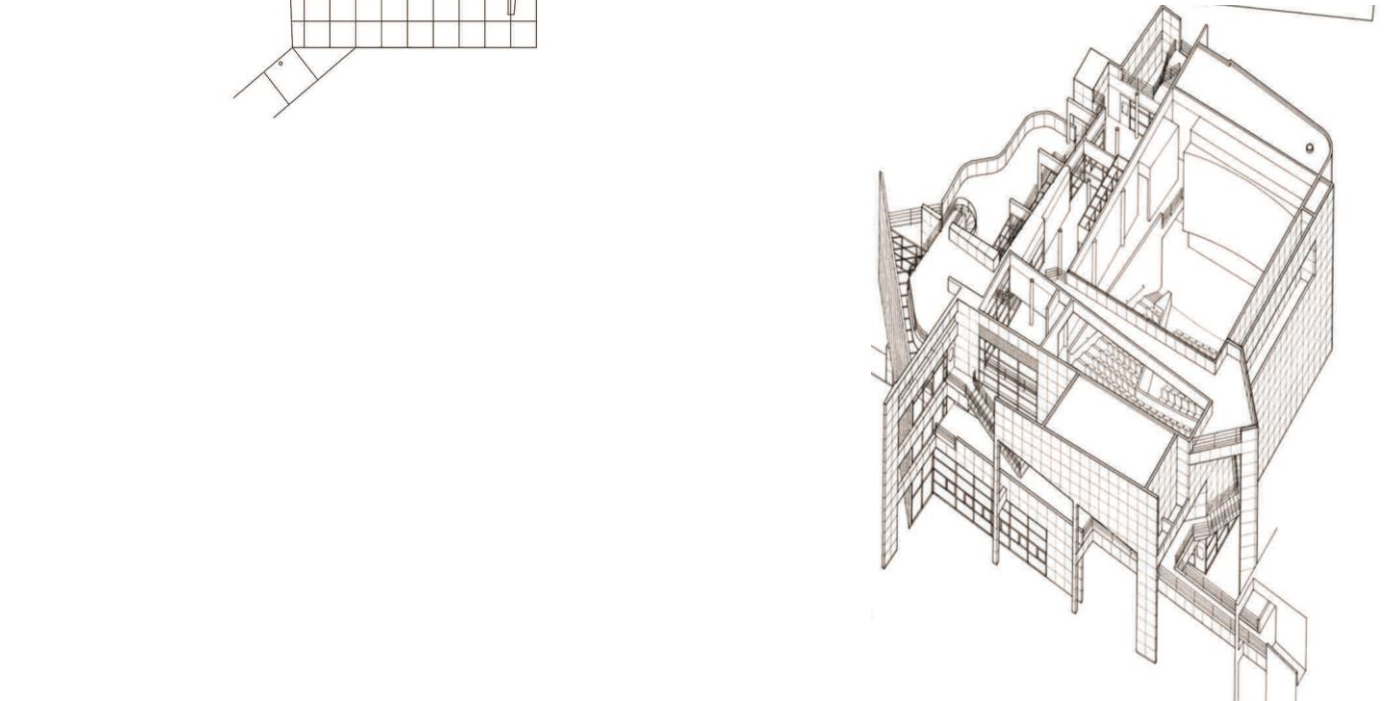


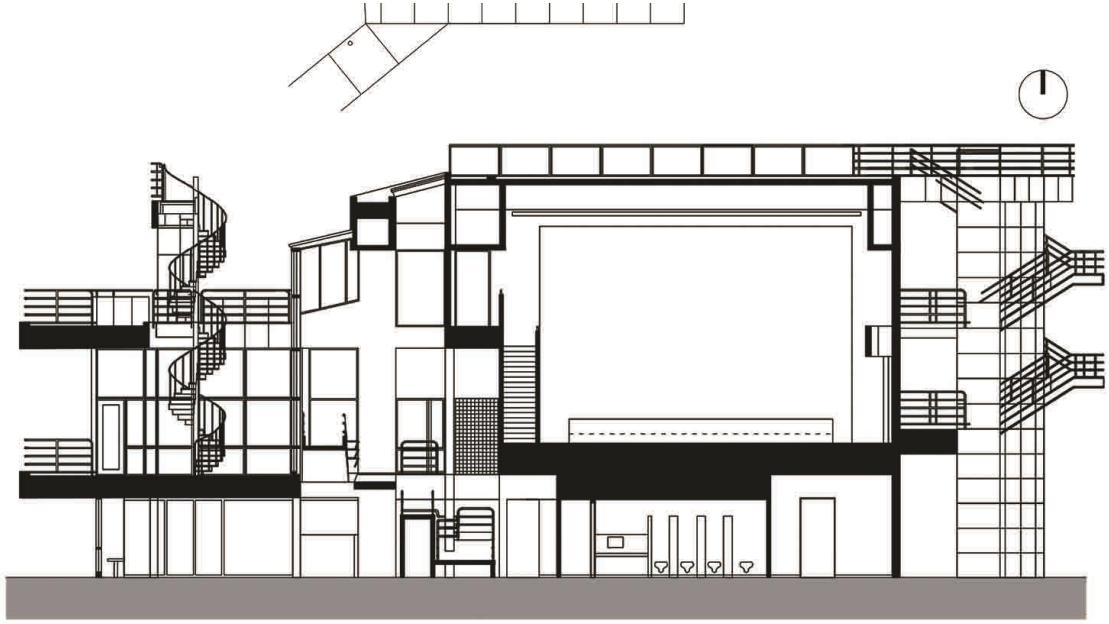




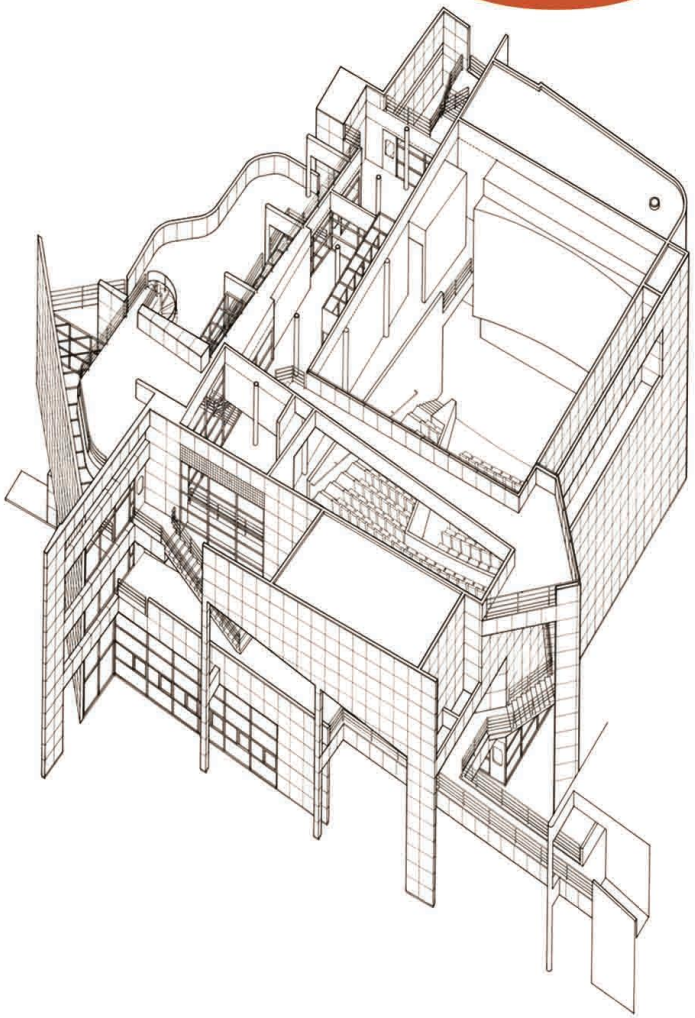








circulation
and
visual
perceptions



Functional aspects

The program of the building is concerned with orientation, community gathering and cultural events. Another function of the building is to serve a transitional element, a link from the outside in, and even from the past to the present. Visitors are introduced to the town with exhibits as they are moved through the programmatic gallery spaces and shown a specially produced film in the center's 200-person theatre. Open spaces and glass walls are elements used to emphasize that this is a public building. Visitors are guided through galleries include communal history exhibits and models. Gallery II is on the second floor and it is this room whose shape mirrors the river and has a long rectangular window that features a view of the river. Gallery IV is a private space for meetings and events, not open to the public. The windows frame specific views and this climaxed as the visitor reaches the open roof deck that exposes wide-open vistas as well as a view to the town.

Region, Climate & Natural lighting conditions

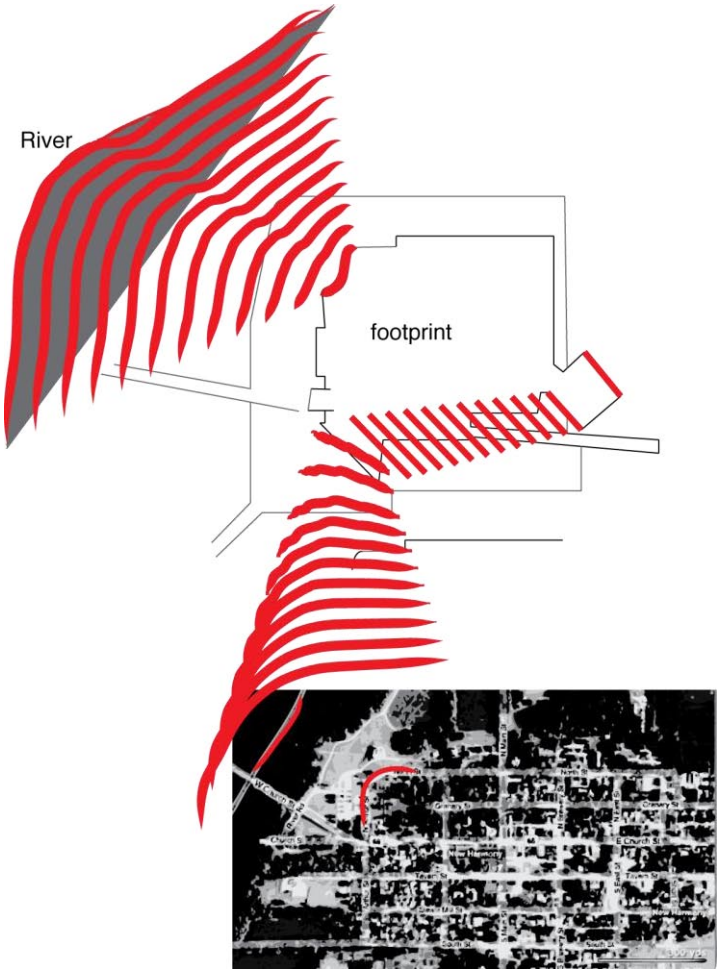
As the building is located near the banks of the Wasbah river, it is consequently on a flood plain. This caused for the planning to include a raising the building up on a podium of earth for protection. As mentioned above, the building is informed by such natural conditions as the passing river and outward views of the landscape.

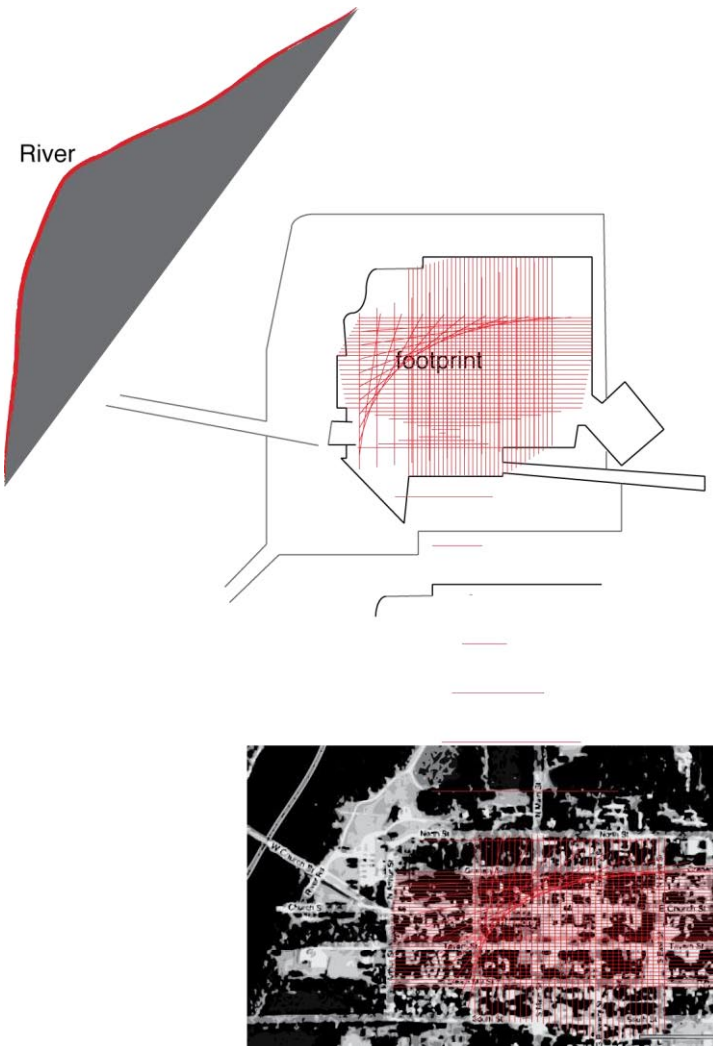
Materials

The 15000 square ft, steel framed building, like many of Meier's other projects, is clad in a pristine white enameled grid. Meier says he continually used white because it is a symbol of "purity, clarity and perfection" (Meier, 8), which becomes particularly appropriate in this context.

Environment

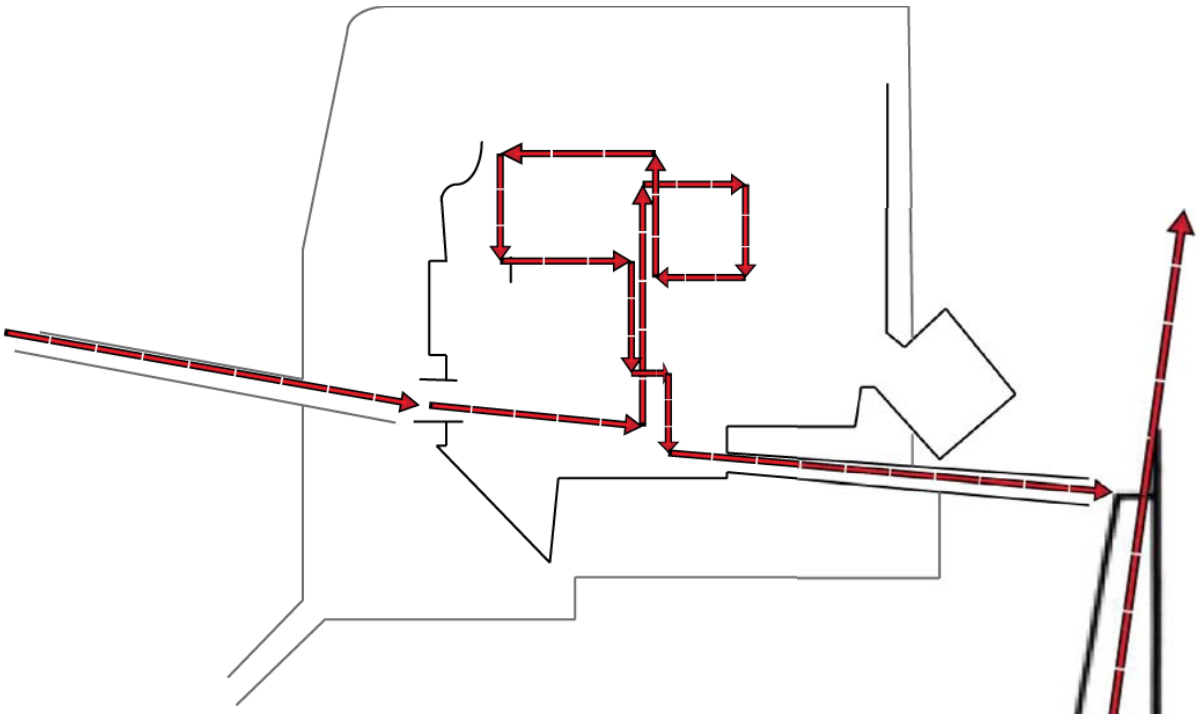
The Atheneum most definitely "define(s) and render(s) eloquent its role in the whole city scheme as it directly accounts for the adjacent town and river in its design. The building has "two dispositions" (ibid, 199). The first, a primary orthogonal grid responds to the street grid of the town. The second uses diagonal planes, which react to the edge of the town. A third form responds to the passing river. The Athenuem is symbolizes the beginning and functions as an orientation centre and "place of arrival" (Meier, 200). As visitors arrive by boat, like the original founders, this monument greets them. A three story diagonal plane marks the entry sequence.





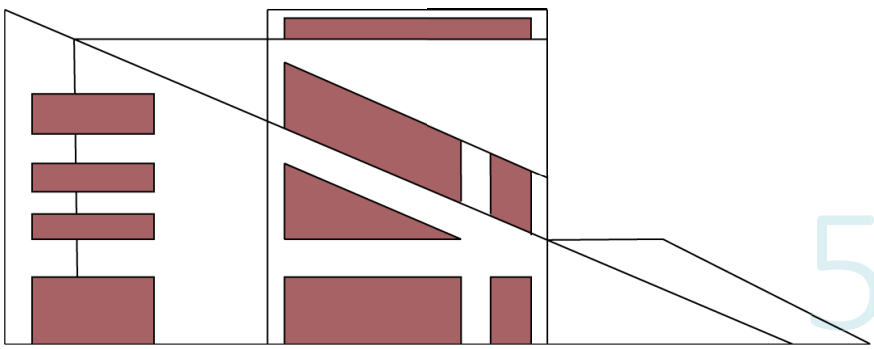
Psychological Demands of space

This determinant is addressed, I believe, by the central circulation pattern of the space. The movement system is a continuous experience. Meier's intentions were to deliberately and naturally guide the viewer to the centre of the building and then through the space with the use of an internal circulation ramp which operates as the "chief mediator and armature" (Meier, 2006) of the space. The ramp is used to set the geometry of the building in motion, in addition to manipulate the visitor's sense of spatial compression and tension. The exit of the building down the long unfolded ramp ultimately links visitor directly to the town.



Spirit of the times

The historical context of the town and the spirit of the times in which this building was actually conceived and built provide an interesting parallel. Around the same time The Atheneum was conceived and built, Architectural discourse was taking different positions on form. Guilo Carlo Aragan discusses the “formative process of typology” and its position as a “precise analytical tool for architectural and urban form, which also provides a rational basis for design” (Argan, 242). He continues by stating that typology “establishes continuity within history” and that type “must be treated as a schema of spatial articulation which has been formed in response to a totality of practical and ideological demands” Meier has employed pure geometric forms in the Modern language, in the tradition of Le Corbusier to express the function and program of the building. As a community centre, The Atheneum acknowledges its context, responds to its surroundings, “invites reciprocal involvement” from the public and differentiates “architecturally between private spaces, between individual activity and communal activity”



ATHENAEUM
BIOMIMETIC ARCHITECTURE
CASE STUDY

Case Study| Athenaeum

Biomimetic Architecture

Intent

To study the Biomimicry principles and adaptations

Introduction

Biomimicry is the study of nature, as a model, measure and mentor, in order to solve human problems. Through studying nature's models it is possible to emulate and appropriate them to solve various design problems, creating buildings that are conducive to nature.

African termites: for its intricate merging of different scientific systems into a huge mound to live in.

Beaver: for creating huge dams across the rivers to ensure food trapping and secure homes.

Bee: for its strong structural and organized

beehives.

Nautilus: for creating a highly effective and mathematical shell (Fibonacci series)

Caddis fly (larvae): for making the home that is a second skin

Prairie dog: for its extensive underground tunnel homes

Spider: for its spinning of the web and the structure that is highly tensile and extreme in its strength.

Bower bird (male), Weaver bird: for its intricate weaving of the nest out of hay and grass.

Great apes (chimps, gorillas and orangutans): for representing the first homes humans started making in its first step of evolution.

Objective

The research is aimed at understanding how a specific animal built structure works and how the system from this nature's marvel can be relevant in architecture to bring balance of aesthetics and logics.

also, comparative analysis of the termite mounds and architecture. The case Opens with an introduction of the relationship of architecture to nature. It Doses biomimetic systems from animal architecture, specifically termite mounds as one of the ways of interpreting nature in architecture. also explained is relevance of going back to the base and restart with new set of principles; principles

Almost all of these 9 laws of nature can be interpreted in terms of architecture and hence as nature reaches perfection

Objective

1. Using a minimum amount of materials

2. Maximizing structural strength

3. Maximizing the contained volume

4. Relating color and texture directly to nature and purpose

5. Selecting materials that most efficiently perform the tasks dictated by the above principles

6. Continuity of interior and exterior, devoid of any area of fragmentation all parts freely flowing from one to another without interruption

7. All features are a unified whole- function and form visibly and invisibly related to and dependent on one another.

Nature runs on sunlight

Nature uses only the energy it needs

Nature fits form to function

Nature recycles everything

Nature rewards cooperation

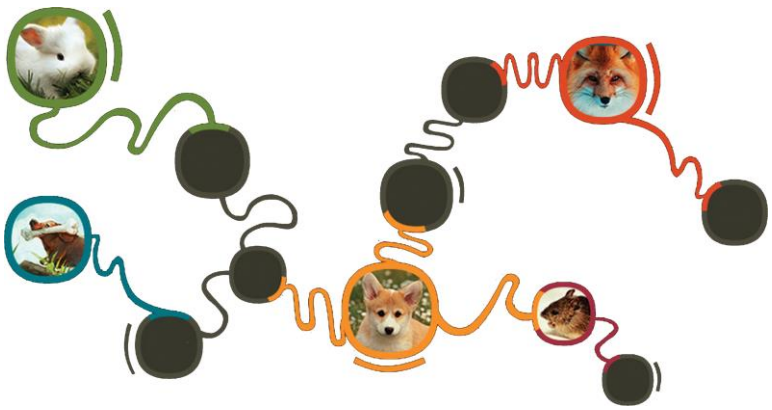
Nature banks on diversity

Nature demands local expertise '

Nature curbs excesses from within

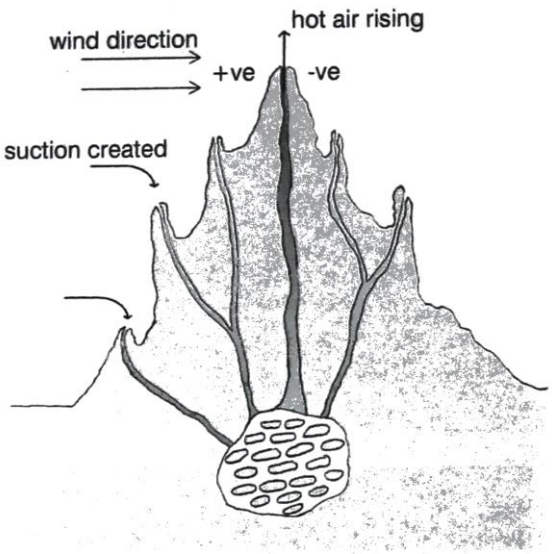
Nature taps the power of limits.

Biomimicry works at numerous scales, from macro eco-systems to micro-organisms. everything is connected to one another because they are all governed by the same laws of nature.
The film covers a "…journey to the outer reaches of our scientific knowledge, with cosmology at one end… and particle physics at the other." Therefore, "…from millimeters to meters we are mostly concerned with structures and mechanisms; and from meters to kilometers and beyond the concern is more with populations and ecosystems" . This is indicative that any scale of system or process being imitated translates through into artificial compositions at various scales.



Cathedral / conical termite mounds

The cathedral mounds (as well as conical, which have the same system, but simpler) have a very elaborate system of ventilation, will be discussed here. According to the topography around the mound, the system will be altered. Most common system found is the **stack effect** and **pressure induced system in combination as well as individually.** The height of the mound and the metabolism of the termites, which is very high, induce the systems to work in harmony.

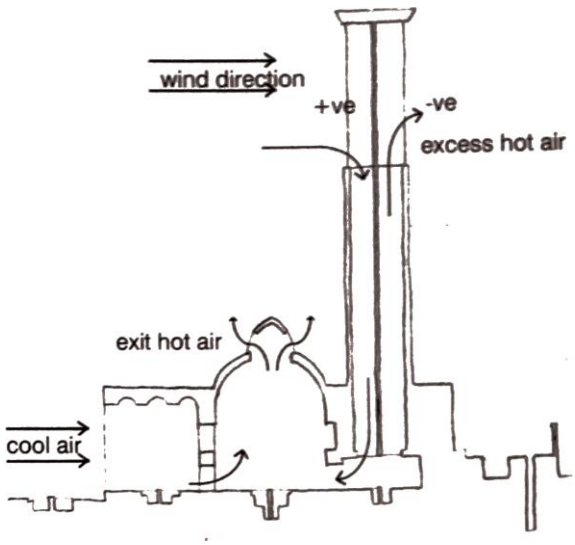


principles of Ventilation

daulatabad Gardens, Yazd

The combination of ventilation Systems is used in the Daulatabad Gardens. They are being hot and dry, and lack of trees makes the system more efficient. **The badger** (wind catcher) is the tallest in the world, which is 33 mts high, so as to generate more pressure difference between the two sides of the surface.

Elements such as wind catchers, jaalis, perforated dome, external, internal and underground water bodies enhance the system.

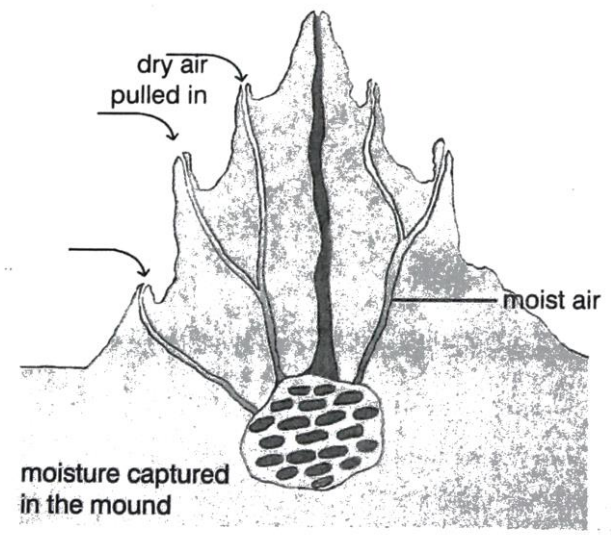


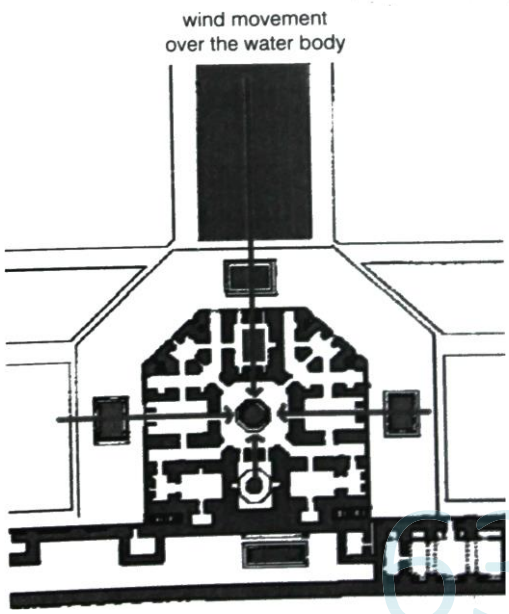
External / surface water bodies

The different types of ventilation systems are described in the previous chapter. The cathedral mounds (as well as conical, which have the same system, but simpler) have a very elaborate system of ventilation, will be discussed here. According to the topography around the mound, the system will be altered. Most common system found is the **mounds are located in extremely dry regions,** there is no natural external water body available to cool the wind entering the mound. But the surface layer of the mound being thick and solid, the moisture of the mound (which is generally from the **saliva of termites** used as building material and absorbed **dew drops** from the atmosphere at night) is .trapped inside the mound. Hence, in this case, the wind is cooled alter it has entered the building through **pressure differences and heat convection.**

stack effect and pressure induced system in combination as well as individually. The height of the mound and the metabolism of the termites, which is very high, induce the systems to work in harmony.

The front of the building is a long water channel (170 mts approx.) running perpendicular to the front facade of the building. Also, the immediate front of the building entrance has another small pond, ensuring that the wind entering the building is cool and humid. All the main openings, which are on the three sides of the building including the front, have a small water body in front of them. All these pools are connected underground system of **qanats.** Thus in the building, the air is cooled before it enters the building. ln addition to these, there are water bodies in the interior of the building as well, which are located In the front court, the central courtyard and under the badgeer which is the living place. Further cools the wind and an overall 12-15 °C temperature difference occurs between the external and internal temperatures.

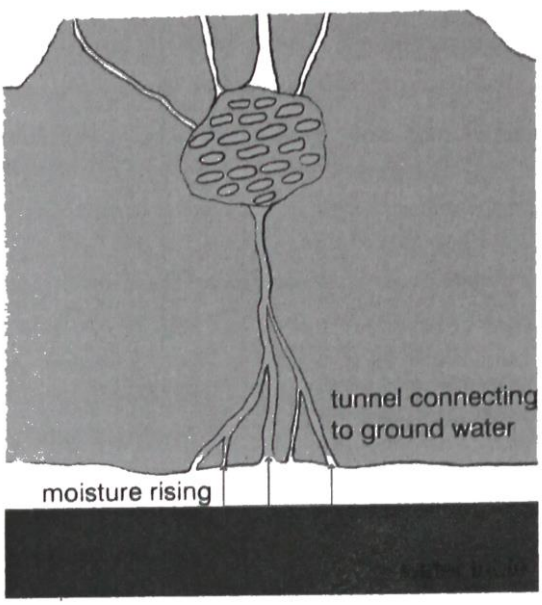


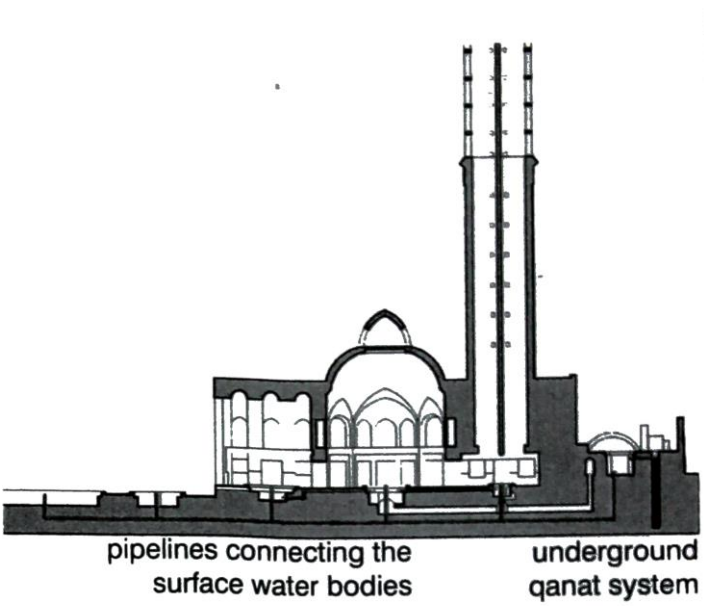


Underground water bodies

Due to lack of external water bodies, termites dig deep down the ground and build tunnels that connect the mound to the **underground water** table of the area. Also, the fungus and mushrooms need water. **The termites use these underground tunnels as a source of moisture for cooling the air as well as the irrigation system.** Water is sucked up in cases of extreme temperature / pressure differences or moisture rises naturally due to the stack effect of the mound. Thus, the underground water channel is an integral part of the complete system.

The Daulatabad quarters is connected to the **underground qanats,** which is a network of underground water system connecting the whole city. The qanat is connected to the building by a well in the backyard, which is in turn connected to the underground storage tank. The water to all the external and internal water bodies for the quarters is supplied from here. In the monsoon season, this works in a reverse manner, by collecting and supplying water to the qanats. Thus these also act as water harvesting system.

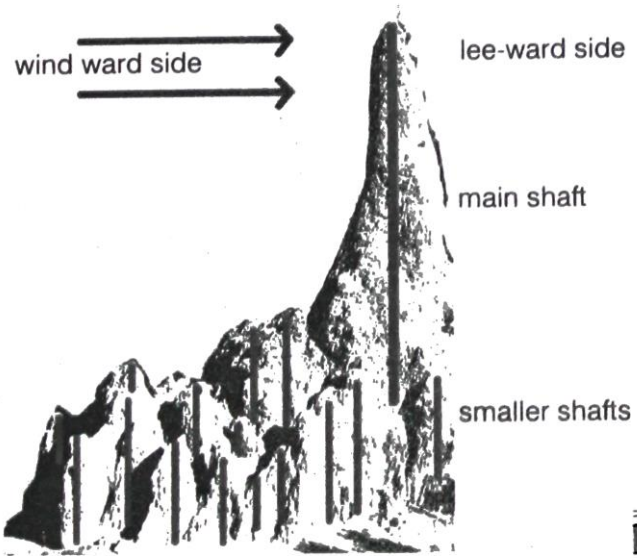


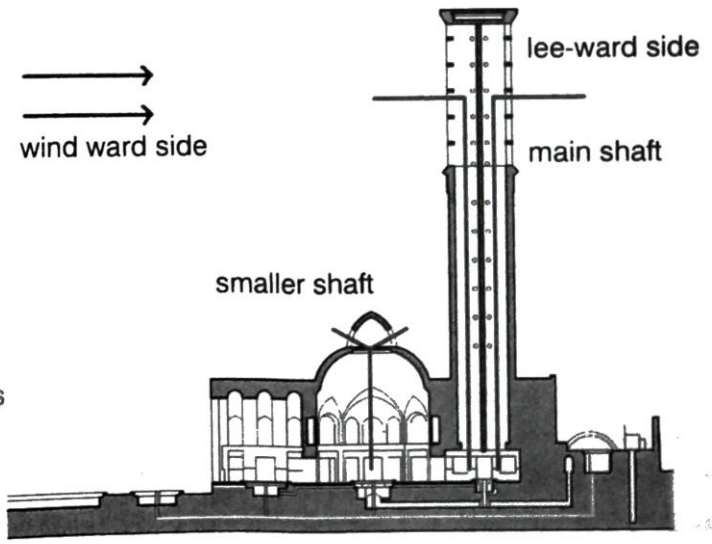


Description of chimneys

The conical termite mound have a **single central shaft for air circulation**, while the cathedral mound has a number of smaller shafts (not to be confused with tunnels on the surface) but also a large shaft on the lee ward side which is internally connected to the smaller chimneys as well. These form a complex system for bringing in and throwing out air according to the need of the situation. The central chimney is the main source of air suction as it is the highest (7-8 mts) and largest." This is generally connected to the nest and the queen's quarters which are the most important chambers of the nest.

The badgeer of the Daulatabad Garden Quarters is located in the southern part of the building. The primary wind direction for the particular area of Yazd being N, it enters the building from the elongated water pool side, making the badgeer a exit point for the internal air. The height of the badger is 33 mts, which captures the night wind effectively when the whole system gets reversed. The chimney opens into the water pool internally to cool the air and also the dust particles get settled in the water due to the moisture present at the base of the chimney, providing clean air for the internal spaces.





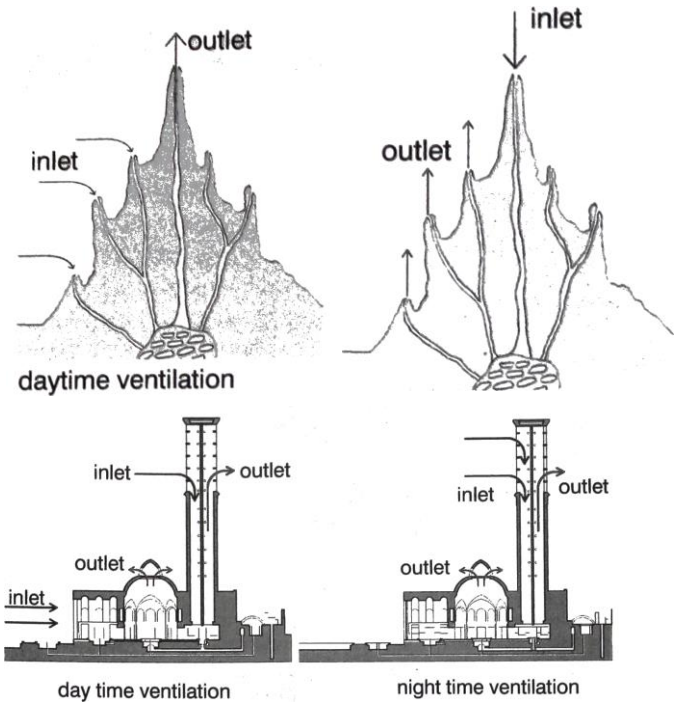
Diurnal differences in system

During the day, the chimney acts as an exhaust for the exhaust for the used wind while the smaller chimneys act as inlets. As the suction created is high, and the heat from the nest and other areas making the air lighter, the central shaft is used for exhale as it is unobstructed and vertical. lt has no curves and bends. Due to this the suction in the nest induces the smaller chimneys to bring in air faster. But during the nights,

The temperature differences between the outside and inside change as the land will be still hotter from the radiation from the sun and the air at the top is cooler because of lower contact to the ground.

Also the speed is higher, which induces a reverse circulation of air, i.e. the cool wind is pushed in from the main chimney and the smaller chimneys become the exhales.

During the day, there are two systems working in harmony. Firstly, the wind coming from the north is cooled by the external water pools and enters the building from the facades which are perforated with jalis. This then flows over the other two water bodies and exits from the dome of the double height courtyard. Secondly, due to the height of the badgeer in the north, the air from the height is sucked in and after flowing above the water pool at the base, it exits through the same double height dome. The excess air is thrown out of the other side of the badgeer, which in turn helps in creating more pressure differences between the windward side and the lee-ward side.

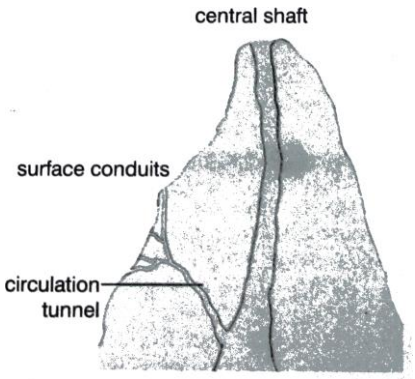


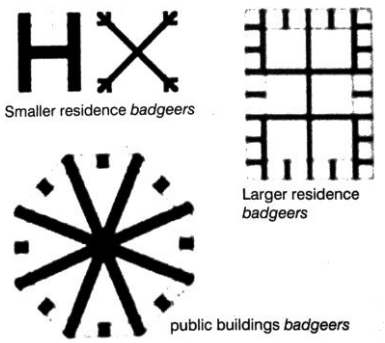
At night, again the system gets reversed and the only entry for the wind will be the chimneys, as the front facade is closed off totally. The air enters from the chimney and exits through the dome, which is nearer to the ground and hence is hotter.

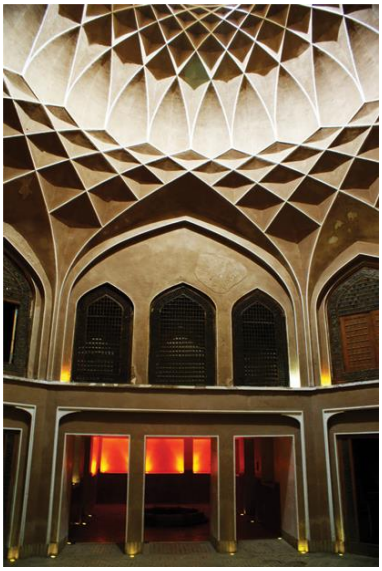
Other types of chimneys

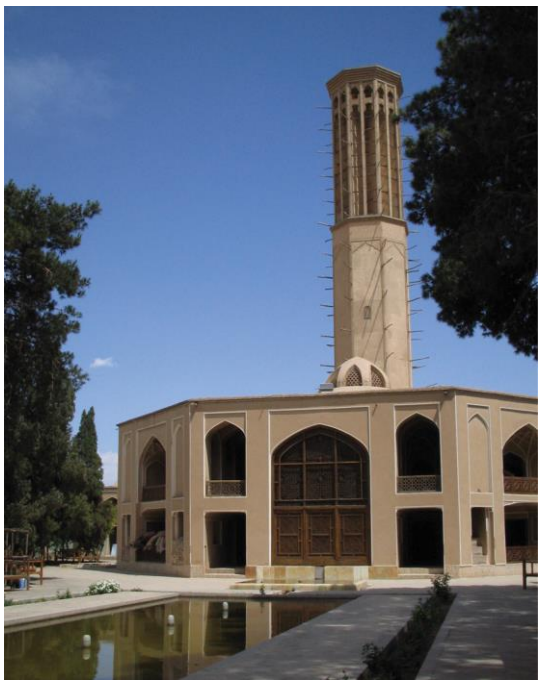
Wind circulation being critical for the termites, it has to be tackled with intensive detailing. When temperatures change, the channels and tunnels have to be modified. With change of locations, change in the form, and functioning of the mound can be seen. All forms of mounds described in the previous chapters have different systems altogether.

Similar to the termite mounds, the badgeer of the buildings of Yazd change with respect to its location in the building and the kind of building. It is sometimes seen as a statement of status as well as the function of the building. For e.g. residences have badgeer which are square or rectangular in plan with two to four partitions generally. Havelis or bigger houses have bigger rectangles in plan with the number of partitions increasing from 4- 8 or 12. Public buildings or gardens have hexagonal, octagonal, or circular badgers with number of partitions equal to the sides Or double.









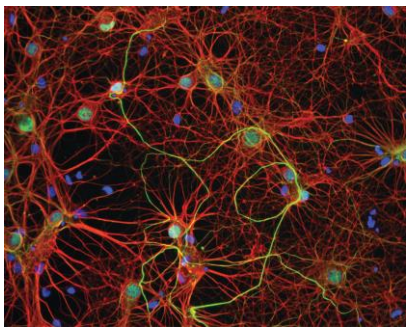
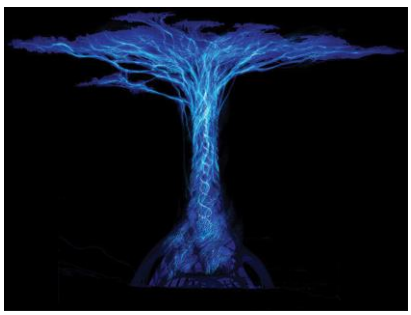
daulatabad garden
Yazd, Iran

Thrust Study| Athenaeum

Biomimetic Architecture

La sagrada familia cathedral | Barcelona

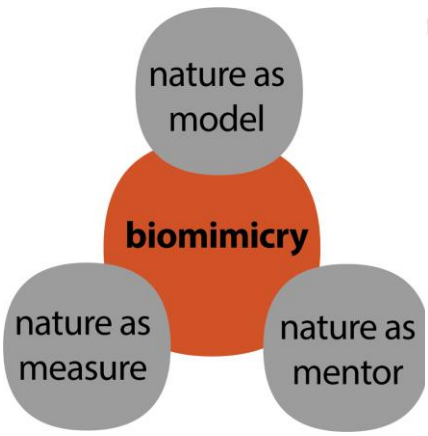
The towers of the La Sagrada Familia church are a well known landmark on the Barcelona skyline, and the church is undisputedly the most popular tourist attraction in Barcelona, in spite of the fact that it has in fact still not been finished.

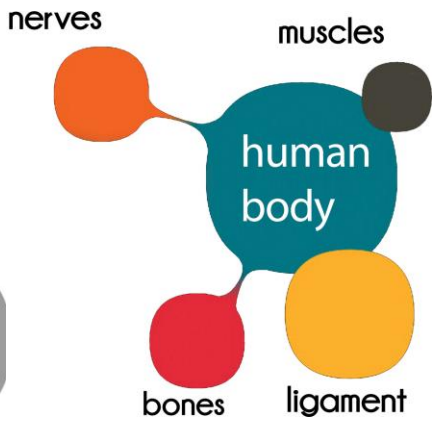



Introduction

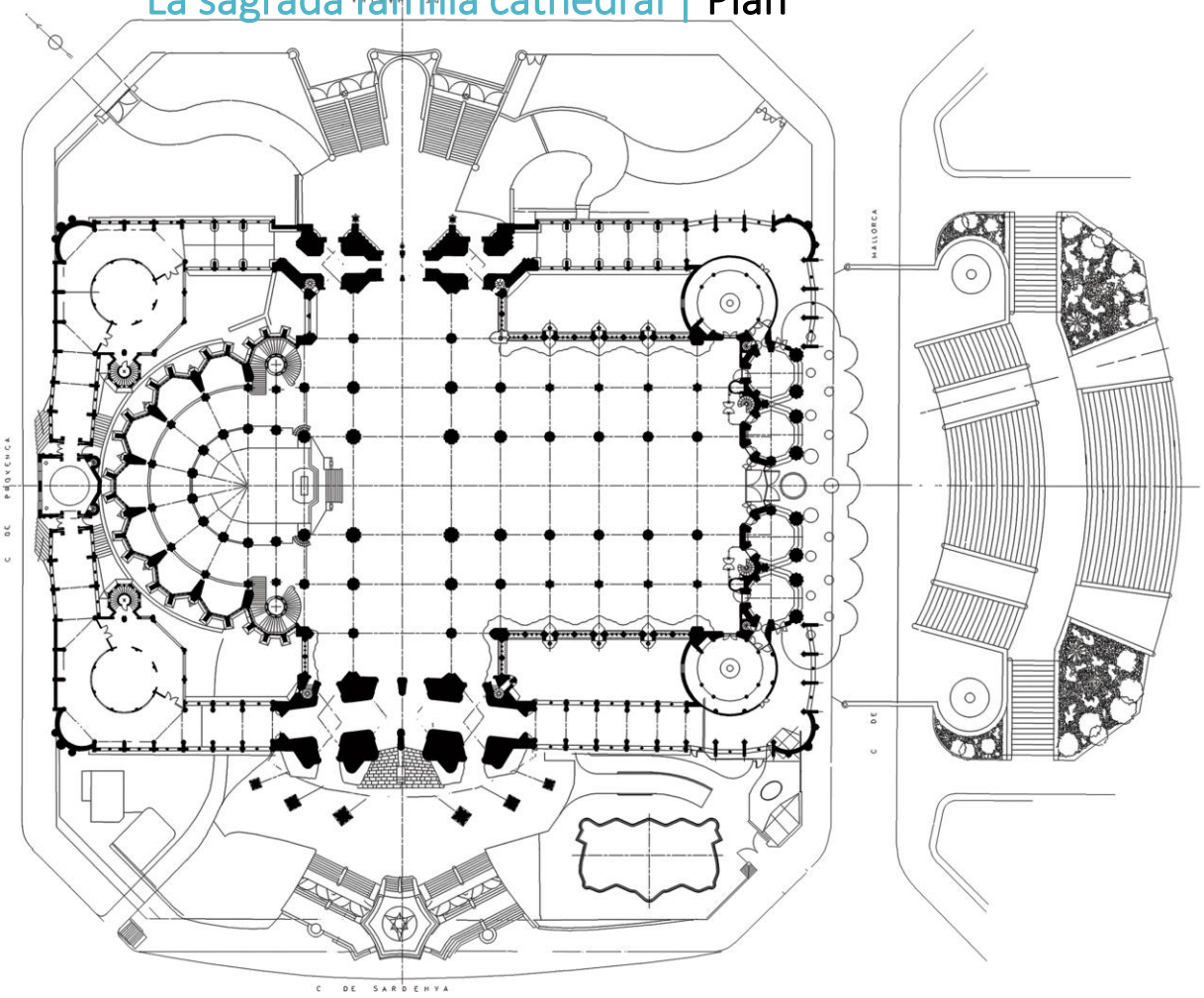
The project started in 1882. Originally Bocabello enlisted the help of architect Francisco de Paula del Villars, who agreed to work for no fee. However, soon arguments arose over the materials the construction should be made from, del Villars wanting to use expensive materials and Bocabello feeling honor bound to spend the donors' money with care.

When the church is finished it will have some 18 towers, each with a symbolic meaning. Four Towers on each of the three facades represent the 12 apostles. The towers reach a height of 90 to 120m (394ft).





La sagrada familia cathedral | Plan



Construction workers and aerial work platforms in the nave

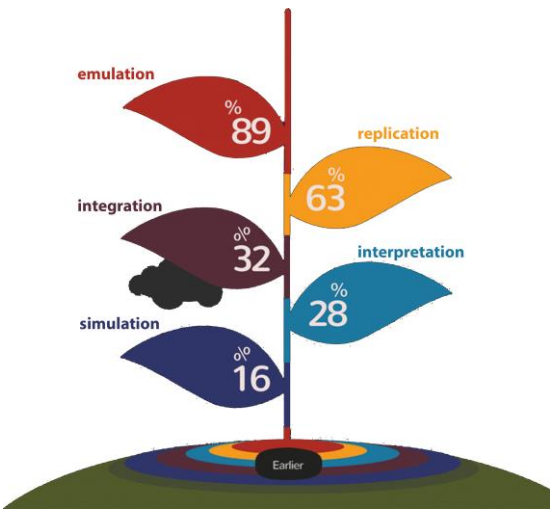
Construction workers in climbing gear on a tower

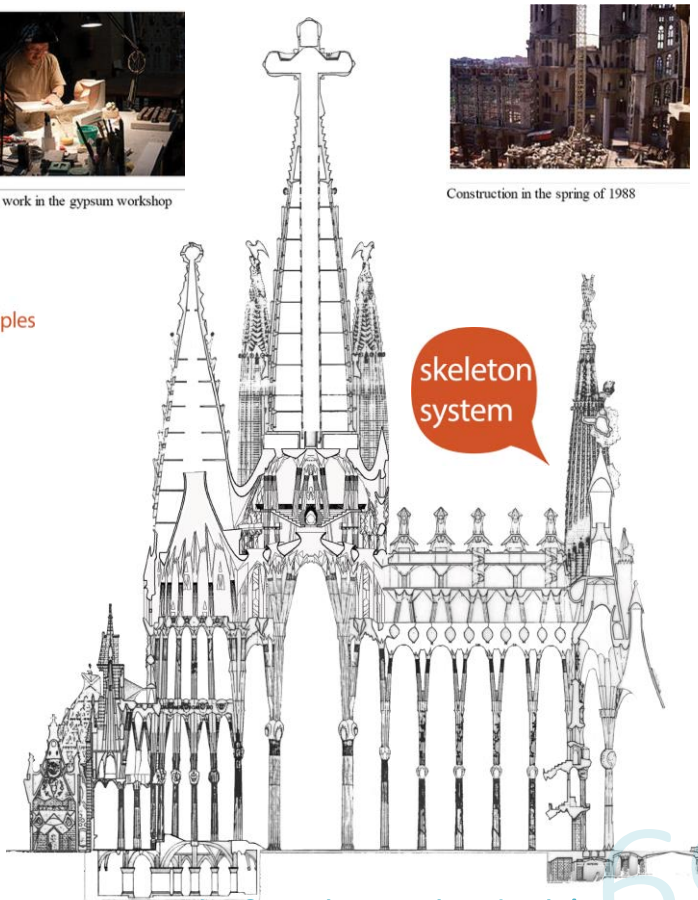
An artist at work in the gypsum workshop

Construction in the spring of 1988

| biomimmicry |

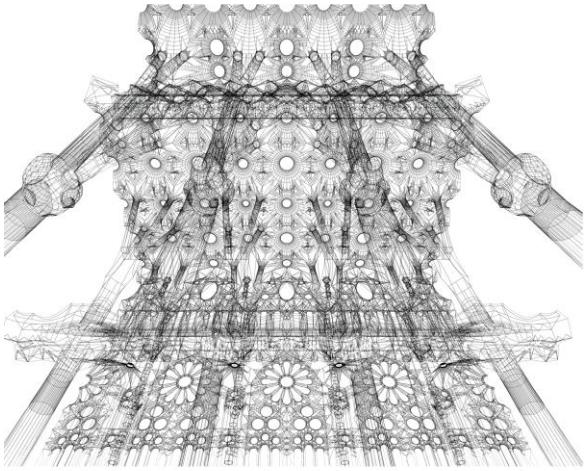
sagrada familia cathedral | biomimecry principles





La sagrada familia cathedral | Section

La sagrada familia cathedral | X-Ray and interior views



La sagrada familia cathedral | View

ATHENAEUM
BYE-LAWS & STANDARDS

area : 9 acres

orientation : E-W

Land use control:

A per the proposed functions and activities described in the design approach strict control on building uses and Land uses must be observed.

No change in permissible Land uses will be allowed unless approved by the Government.

density of development:

The existing building density shall be allowed to change marginally In the complex as per the FAR and ground coverage rules.

The overall density will increase only as per the proposed uses in the open areas.

The resident population in the complex should not increase more than one person per 30 sq.m. of covered area of residential use, however, the floating population can reach up to the carrying capacity of the complex. Every effort should be made to maintain the character of the place by keeping the building and population density minimum.

FAR and ground coverage:

The floor area ratio for all private properties should not be changed

although FAR for Jaipur is 1.5 and ground coverage for such project is 40%

Canopy

No canopy will be permitted beyond the building line on any floor , wherever they are provided within the building line they shall only be along the fixed dimension line.

Porch

No porch will be permitted on front set back .No construction will be permitted over porch

surface treatment

On all exposed elevations (front, side and back) wherever applicable, surface of the buildings shall be finished in smooth plaster i.e. am\n exposed brick, stone concrete or any other type of exposed treatment shall be permitted except in case of framing of windows ,doors and jharokhas or jalis

Color Treatment

No other color than the one specified shall be permitted on any surface of the building . The following are the colors specified :

Level: 3600(color line) – White

1st floor and above – Jaipur Pink

Boundary Walls – Jaipur Pink .

Plinth

Plinth level will be- max – 1.50m,min- 0.45

The column grid towards proposed arcade side and opposite side will be 3m x 3m or in multiples thereof.

Architectural museum + architectural institution + hostel + commercial cell

Architectural museum

Reception: 10 sq mts

Staff numbers – 10 – 15 sq mts each

Director room: 25 sq mts

Caretaker rooms: 25 sq mts

Architectural theatre

Galleries

Movie space (knowledge theatre)

Record room: 20 sq mts

security room: 15 sq mts

maintenance room: 20 sq mts

pantry: 10 sq mts

public Workshops

Library - public

Temporary exhibition

Permanent exhibition

Architectural institute

Auditorium (750 capacity)

Lecture rooms (4-5 numbers) : 60 sq mts each

Discussion rooms (40-50 capacity) : 60 sq mts each

Discussion rooms (15 capacity) : 30 sq mts

Faculty rooms (10 numbers) : 15 sq mts each

Studios

Workshops

Library - public

Library - private

Commercial cell

Architects office: 5 numbers

Client cell : 15 sq mts

Presentation room: 30 sq mts

Workstation (6 people) : 30 sq mts

Hostel accommodation

Staff (faculty) housing + staff (office) housing + intern student

50 – 60 rooms : 20 sq mts each

Dinning mess : 50 sq mts

kitchen: 15 sq mts

Toilets as per requirements and norms

Store rooms

Security rooms

Caretaker rooms

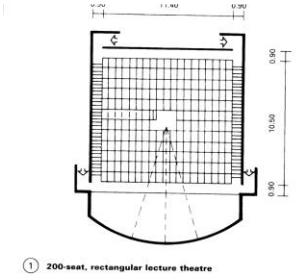
Intent | Standards

auditorium

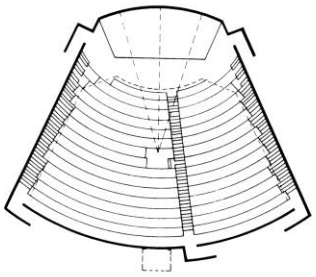
museum

lecture rooms

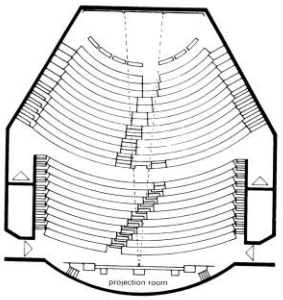
architect' institution



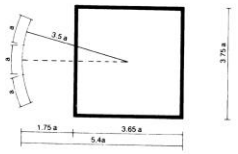
① 200-seat, rectangular lecture theatre



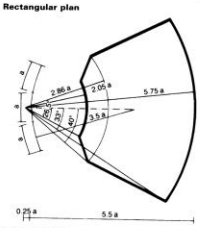
② 400-seat, trapezoidal lecture theatre



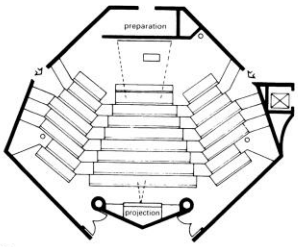
③ 800-seat lecture theatre



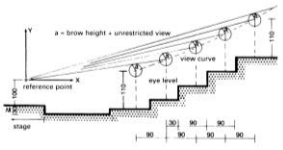
④ Rectangular plan



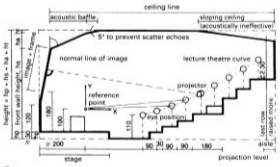
⑤ Trapezoidal plan



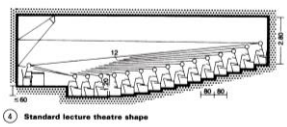
⑥ 200-seat theology lecture theatre at the University of Tübingen



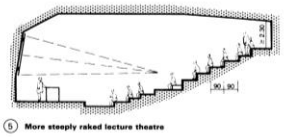
② Drawing for calculating view curve



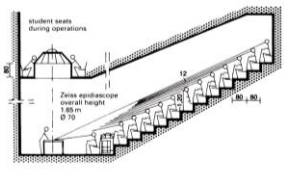
③ Long section of a lecture theatre



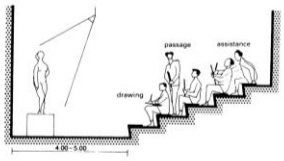
④ Standard lecture theatre shape



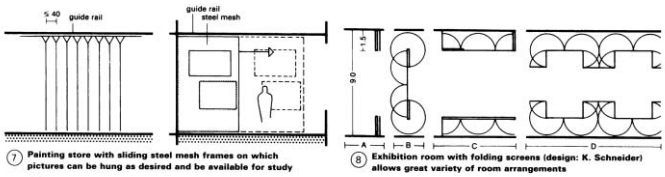
⑤ More steeply raked lecture theatre



⑥ Lecture theatre with demonstration table (medical)

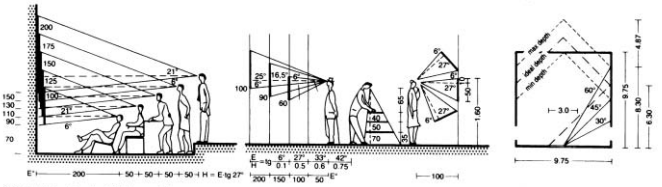


⑦ Tiers in life drawing studio: 0.65 m² seating space per student



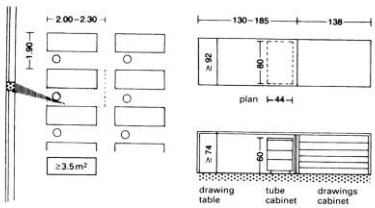
⑦ Painting store with sliding steel mesh frames on which pictures can be hung as desired and be available for study

⑧ Exhibition room with folding screens (design: K. Schneider) allows great variety of room arrangements



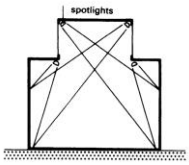
⑨ Field of vision: height/size and distance

⑩ Exhibition room with side lighting

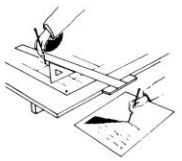


① Workplace in drawing room

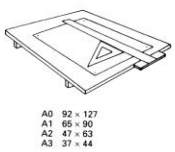
② Work surface



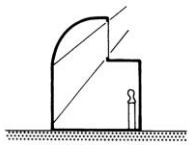
② Install lighting so that angles of incidence correspond with natural light



③ Light for writing coming from behind left, and for drawing from the front left

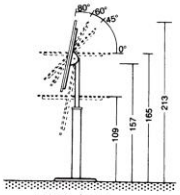


④ Drawing board sizes

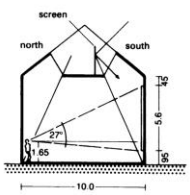


④ Gallery passage, lit from one side only, lower part with indirect, attenuated lighting

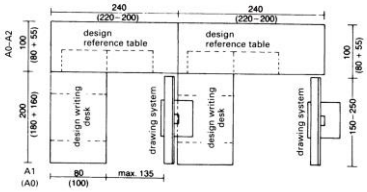
⑤ Adjustable drawing table



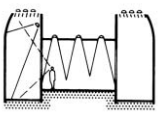
⑥ Section → ⑤



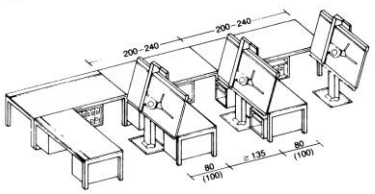
⑥ Ideal uniform lighting from both sides (following S. Hurst Seager)

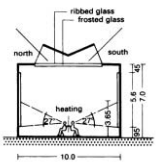


⑦ Work space plan → ⑧



③ Typical cross-section for museum of natural history

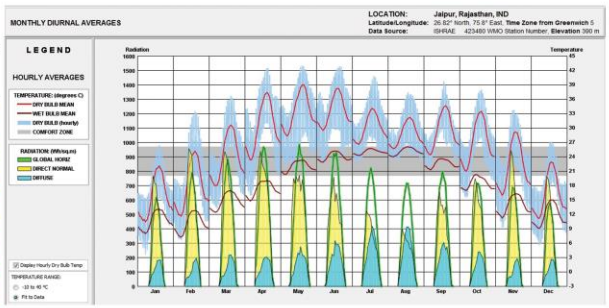




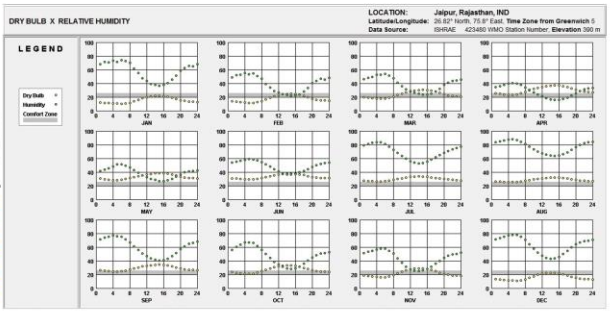
⑤ Well-lit exhibition hall based on Boston experiments

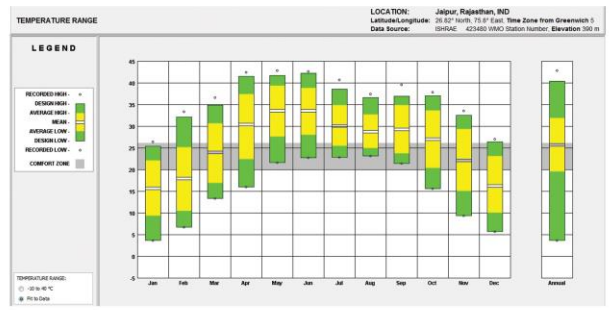
Intent | Climate Analysis

MONTHLY DURINAL | range

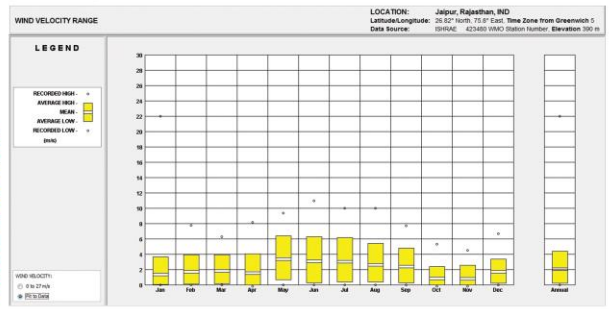


DBT X R.H. | relation

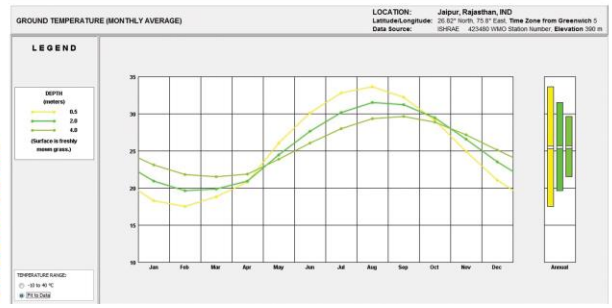




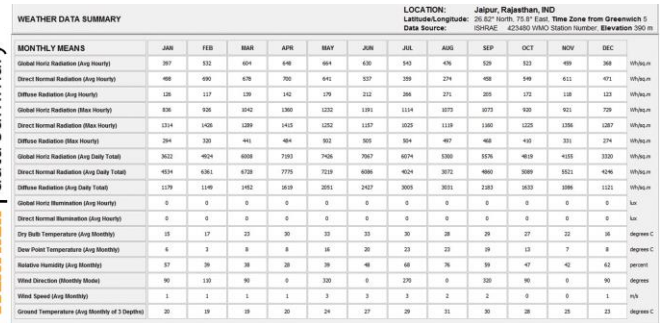
WIND VELOCITY



GROUND TEMP.



WEATHER | data summary

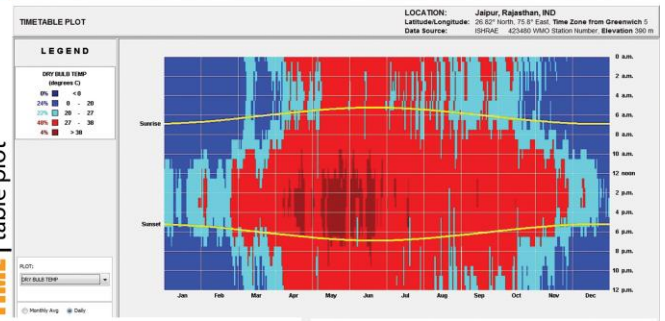


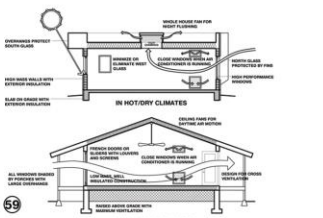
WEATHER DATA SUMMARY

LOCATION: Jaipur, Rajasthan, IND
Latitude/Longitude: 26.82° North, 75.8° East, Time Zone from Greenwich 5
Data Source: ISHRAE 423480 WMO Station Number, Elevation 390 m

MONTHLY MEANS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Global Horiz Radiation (Avg Hourly)	397	532	604	648	664	630	543	476	529	523	459	368	Wh/sq.m
Direct Normal Radiation (Avg Hourly)	488	690	678	700	641	537	359	274	458	549	611	471	Wh/sq.m
Diffuse Radiation (Avg Hourly)	126	117	139	142	179	212	266	271	205	172	118	123	Wh/sq.m
Global Horiz Radiation (Max Hourly)	836	926	1042	1360	1232	1191	1114	1073	1073	920	921	729	Wh/sq.m
Direct Normal Radiation (Max Hourly)	1314	1426	1289	1415	1252	1157	1025	1119	1160	1225	1356	1287	Wh/sq.m
Diffuse Radiation (Max Hourly)	284	320	441	484	502	505	504	487	468	410	331	274	Wh/sq.m
Global Horiz Radiation (Avg Daily Total)	3632	4924	6008	7193	7426	7067	6074	5300	5576	4819	4155	3320	Wh/sq.m
Direct Normal Radiation (Avg Daily Total)	4534	6361	6728	7775	7219	6086	4024	3072	4860	5089	5521	4246	Wh/sq.m
Diffuse Radiation (Avg Daily Total)	1179	1149	1452	1619	2051	2427	3005	3531	2183	1633	1096	1121	Wh/sq.m
Global Horiz Illumination (Avg Hourly)	0	0	0	0	0	0	0	0	0	0	0	0	lux
Direct Normal Illumination (Avg Hourly)	0	0	0	0	0	0	0	0	0	0	0	0	lux
Dry Bulb Temperature (Avg Monthly)	15	17	23	30	33	33	30	28	29	27	22	16	degrees C
Dew Point Temperature (Avg Monthly)	6	3	8	8	16	20	23	23	19	13	7	8	degrees C
Relative Humidity (Avg Monthly)	57	39	38	28	39	48	68	76	59	47	42	62	percent
Wind Direction (Monthly Mode)	90	110	90	0	320	0	270	0	320	90	0	90	degrees
Wind Speed (Avg Monthly)	1	1	1	1	3	3	3	2	2	0	0	1	m/s
Ground Temperature (Avg Monthly of 3 Depths)	20	19	19	20	24	27	29	31	30	28	25	23	degrees C

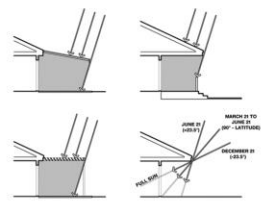
TIME | table plot





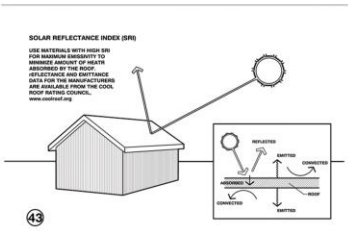
59

In this climate air conditioning will always be required, but can be greatly reduced if building design minimizes overheating.



37

Window overhangs (designed for this latitude) or operable sunshades (extend in summer, retract in winter) can reduce or eliminate air conditioning.

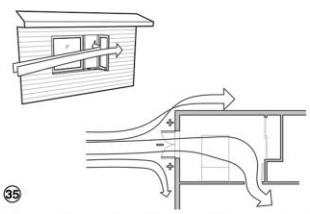


43

Use light colored building materials and cool roofs (with high emissivity) to minimize conducted heat gain.

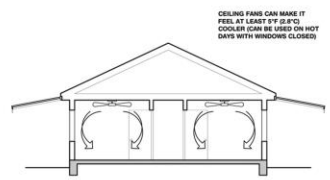
32

Minimize or eliminate west facing glazing to reduce summer and fall afternoon heat gain.



35

Good natural ventilation can reduce or eliminate air conditioning in warm weather, if windows are well shaded and oriented to prevailing breezes.

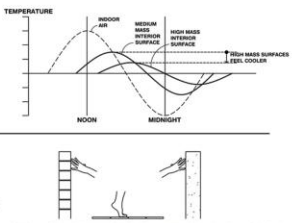


42

On hot days ceiling fans or indoor air motion can make it seem cooler by at least 5 degrees F (2.8C) thus less air conditioning is needed.

57

Orient most of the glass to the north, shaded by vertical fins, in very hot climates, if there are essentially no passive solar needs.



40

High mass interior surfaces like stone, brick, tile, or slate, feel naturally cool on hot days and can reduce day-to-night temperature swings.

ATHENAEUM

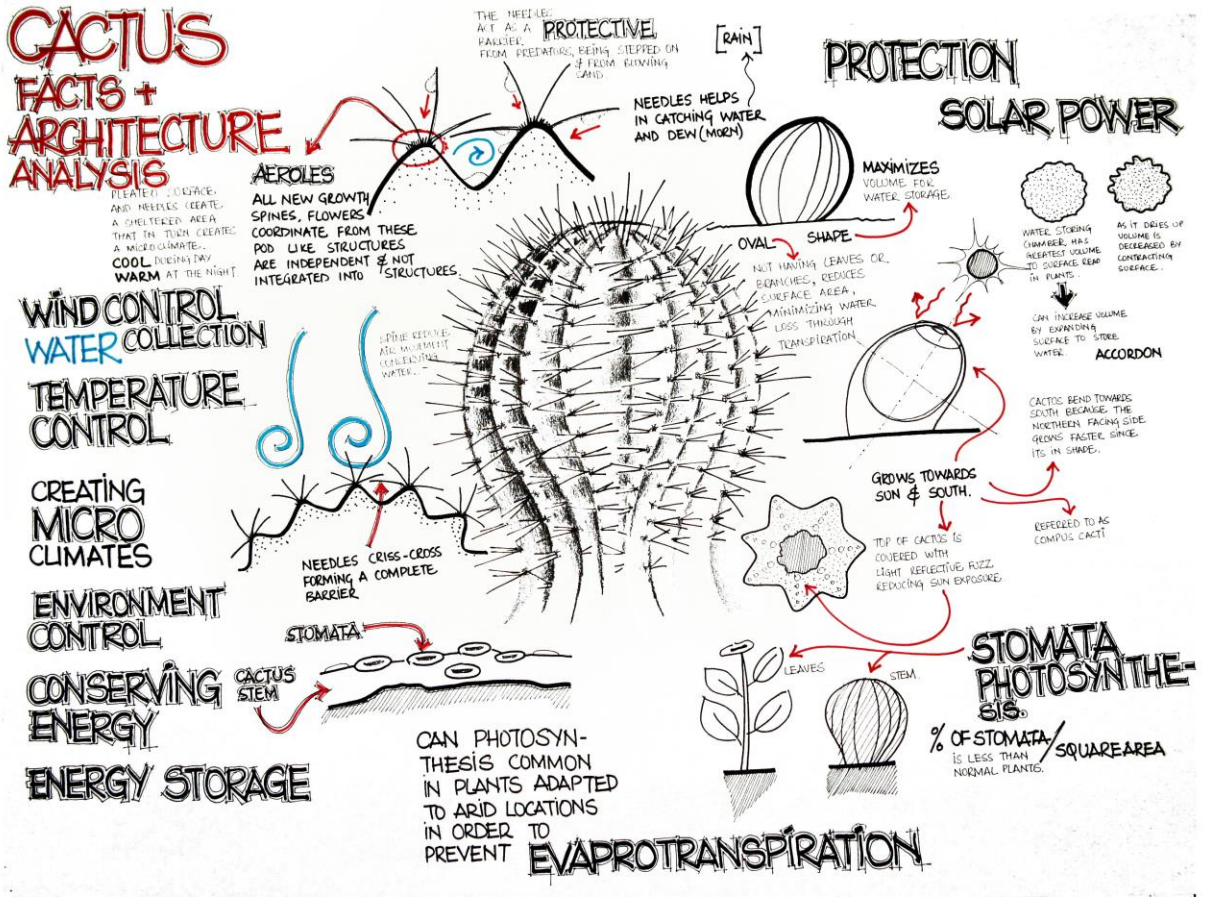
CONCEPT AND EVOLUTION

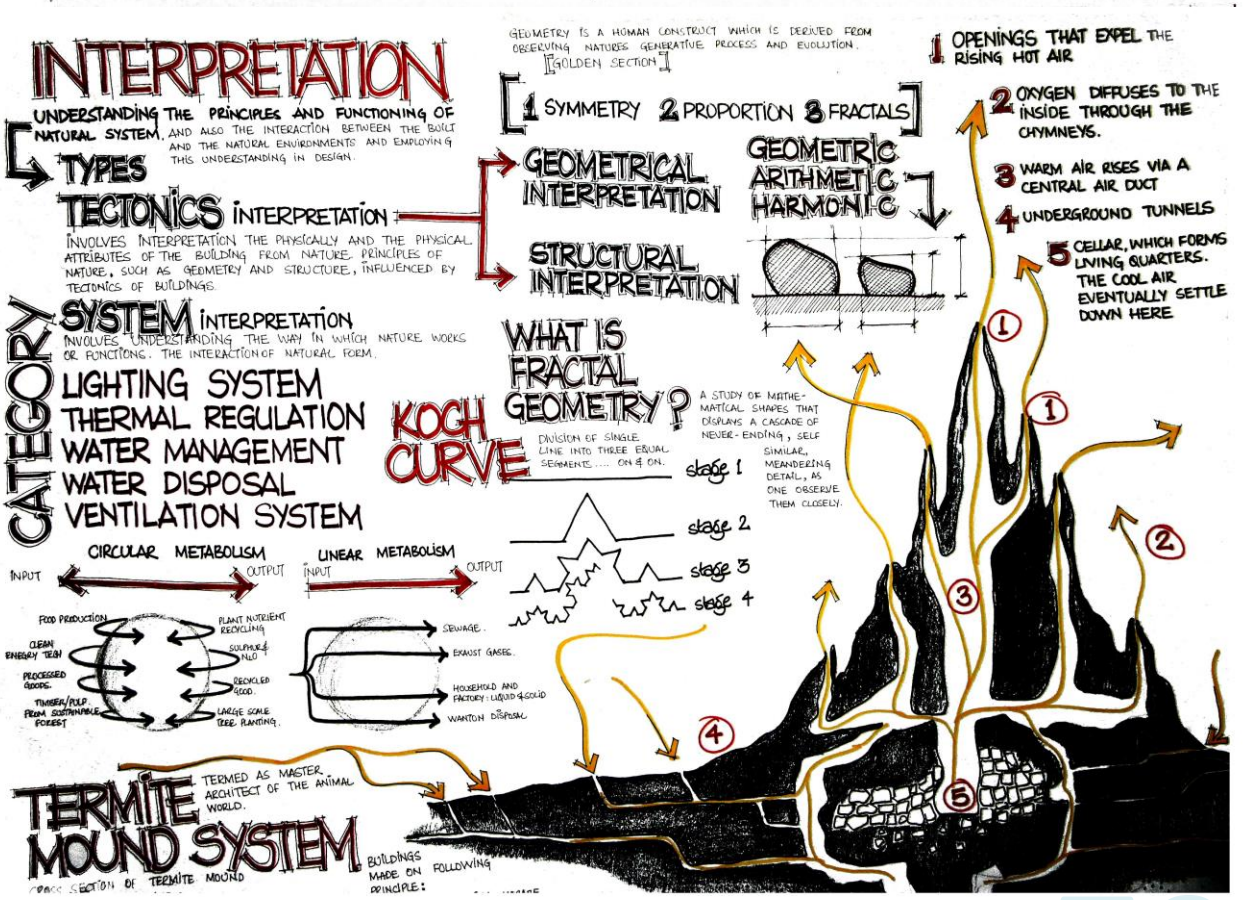
BIOMIMICRY : THE ELEMENTS OF CONCERN

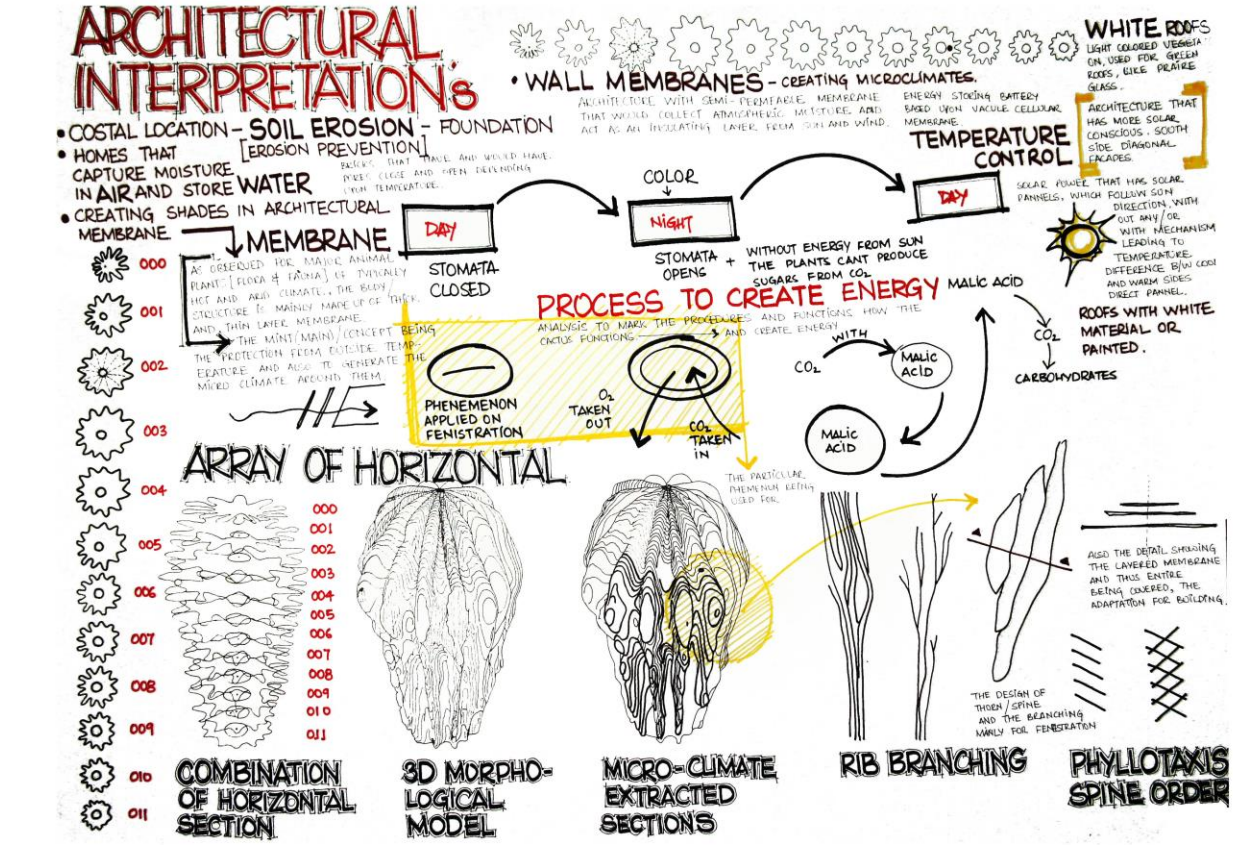
1. CACTUS - FOR FAÇADE MEMBRANE DEVELOPMENT
2. TERMITE MOUNDS - FOR TEMPRATURE MODULATION
3. GOLDEN RATIO - PLANNING PRINCIPLES

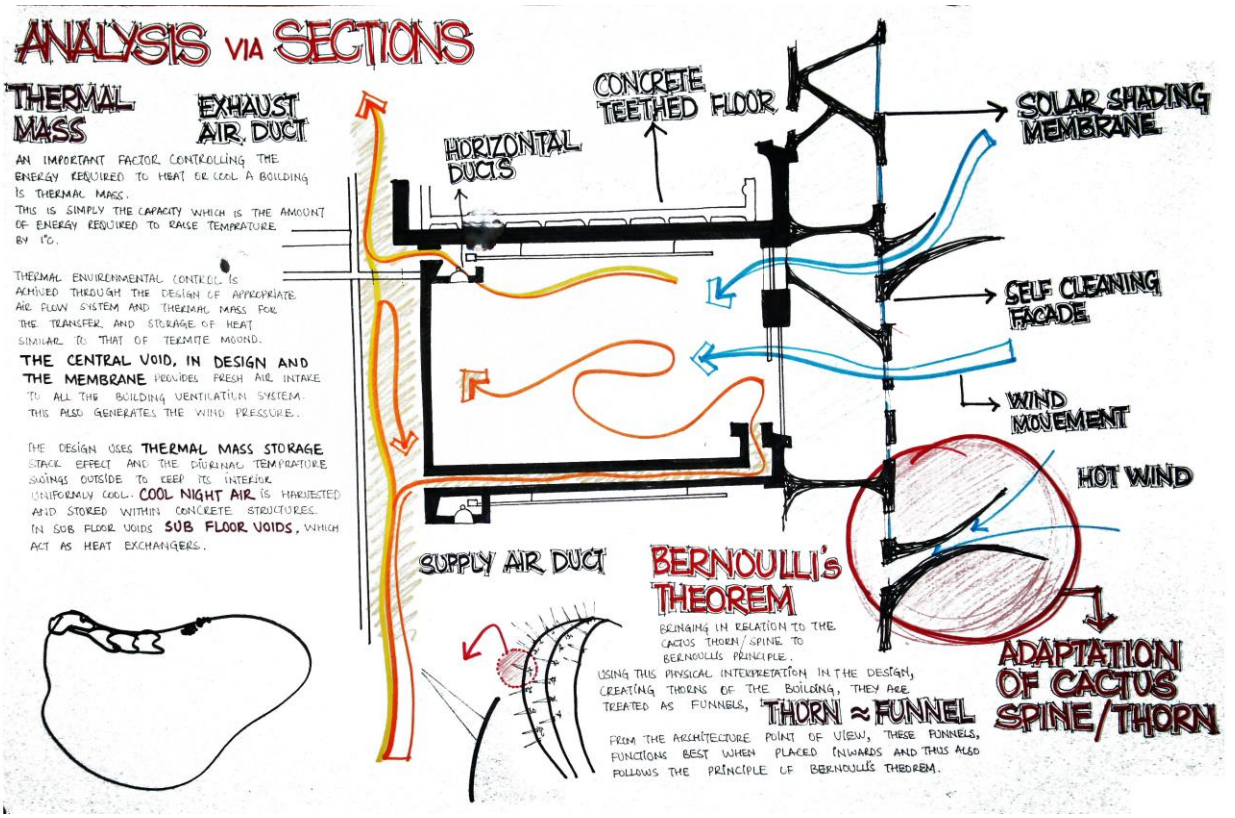
ELECTIVE : DIGITIZATION

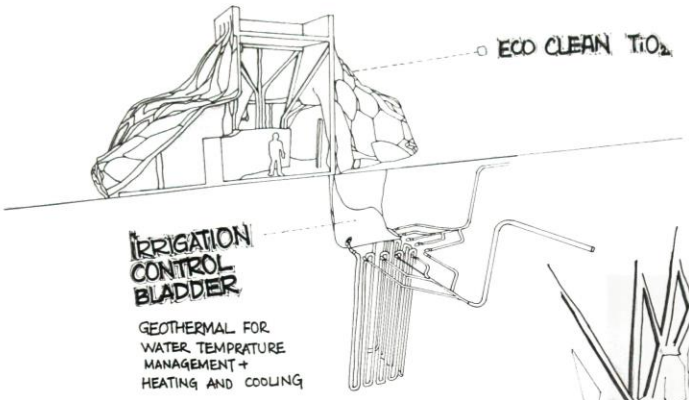
ARCHITECTURAL INTERPRETATION
FORM FRACTALS DESIGNS
GOGGENHEIM MUSEUM
FORM SHADOWS
STRUCTURAL
EXTURE
LAR TOWER
SOLAR SHA
MEMBRANE
COSTAL LOCATION
HOMES THAT
CAPTURE MOISTURE
IN AIR AND STORE WATER
CREATING SHADES IN
MEMBRANE
ANALYSIS
WATER
KOCH CURVE
CONCERN
VOIDS
TO INTERPRET THE CONCEPT
OF FRACTAL IN VOIDS
DESIGN
MEMBRANE
DESIGN
SKETCH
ANALYSIS
OVERVIEW
CLEANING
COMBINATION
OF HORIZONTAL
SECTION
ENERGY
ROTATION
ROTATION
THEOREM
NEGATIVE
ADAPTATIV
OF
SPINE


CACTUS
FACTS + ARCHITECTURE ANALYSIS
PLEATED SURFACE AND NEEDLES CREATE A SHELTERED AREA THAT IN TURN CREATES A MICROCLIMATE.
COOL DURING DAY
WARM AT THE NIGHT
AEROLES
ALL NEW GROWTH SPINES, FLOWERS COORDINATE FROM THESE POD LIKE STRUCTURES ARE INDEPENDENT & NOT INTEGRATED INTO STRUCTURES.
THE NEEDLES ACT AS A BARRIER FROM PREDATORS, BEING STEPPED ON & FROM BLOWING SAND.
PROTECTIVE
[RAIN]
NEEDLES HELPS IN CATCHING WATER AND DEW (MORN)
PROTECTION
SOLAR POWER
MAXIMIZES VOLUME FOR WATER STORAGE
OVAL
SHAPE
NOT HAVING LEAVES OR BRANCHES, REDUCES SURFACE AREA, MINIMIZING WATER LOSS THROUGH TRANSPIRATION
WATER STORING CHAMBER, HAS GREATEST VOLUME TO SURFACE READ IN PLANTS.
AS IT DRIES UP VOLUME IS DECREASED BY CONTRACTING SURFACE.
CAN INCREASE VOLUME BY EXPANDING SURFACE TO STORE WATER.
ACCORDON
WIND CONTROL
WATER COLLECTION
TEMPERATURE CONTROL
CREATING MICRO CLIMATES
ENVIRONMENT CONTROL
CONSERVING ENERGY
ENERGY STORAGE
SPINE REDUCE AIR MOVEMENT CONSERVING WATER.
NEEDLES CRISS-CROSS FORMING A COMPLETE BARRIER
CACTUS BEND TOWARDS SOUTH BECAUSE THE NORTHERN FACING SIDE GROWS FASTER SINCE ITS IN SHADE.
GROWS TOWARDS SUN & SOUTH.
REFERRED TO AS COMPUS CACTI
TOP OF CACTUS IS COVERED WITH LIGHT REFLECTIVE FUZZ REDUCING SUN EXPOSURE.
STOMATA
CACTUS STEM
LEAVES
STEM
STOMATA PHOTOSYNTHESIS.
% OF STOMATA/SQUARE AREA IS LESS THAN NORMAL PLANTS.
CAN PHOTOSYNTHESIS COMMON IN PLANTS ADAPTED TO ARID LOCATIONS IN ORDER TO PREVENT EVAPROTRANSPIRATION


INTERPRETATION
UNDERSTANDING THE PRINCIPLES AND FUNCTIONING OF NATURAL SYSTEM, AND ALSO THE INTERACTION BETWEEN THE BUILT AND THE NATURAL ENVIRONMENTS AND EMPLOYING THIS UNDERSTANDING IN DESIGN.
TYPES
TECTONICS INTERPRETATION
INVOLVES INTERPRETATION THE PHYSICALLY AND THE PHYSICAL ATTRIBUTES OF THE BUILDING FROM NATURE PRINCIPLES OF NATURE, SUCH AS GEOMETRY AND STRUCTURE, INFLUENCED BY TECTONICS OF BUILDINGS.
SYSTEM INTERPRETATION
INVOLVES UNDERSTANDING THE WAY IN WHICH NATURE WORKS OR FUNCTIONS. THE INTERACTION OF NATURAL FORM.
CATEGORY
LIGHTING SYSTEM
THERMAL REGULATION
WATER MANAGEMENT
WATER DISPOSAL
VENTILATION SYSTEM
CIRCULAR METABOLISM
INPUT
OUTPUT
FOOD PRODUCTION
CLEAN ENERGY TECH
PROCESSED GOODS.
TIMBER/PULP FROM SUSTAINABLE FOREST
PLANT NUTRIENT RECYCLING
SULPHUR & N2O
RECYCLED GOOD.
LARGE SCALE TREE PLANTING.
LINEAR METABOLISM
INPUT
OUTPUT
SEWAGE.
EXAUST GASES.
HOUSEHOLD AND FACTORY: LIQUID & SOLID
WANTON DISPOSAL
GEOMETRY IS A HUMAN CONSTRUCT WHICH IS DERIVED FROM OBSERVING NATURES GENERATIVE PROCESS AND EVOLUTION.
[GOLDEN SECTION]
[1 SYMMETRY 2 PROPORTION 3 FRACTALS]
GEOMETRICAL INTERPRETATION
STRUCTURAL INTERPRETATION
GEOMETRIC
ARITHMETIC
HARMONIC
WHAT IS FRACTAL GEOMETRY?
A STUDY OF MATHEMATICAL SHAPES THAT DISPLAYS A CASCADE OF NEVER-ENDING, SELF SIMILAR, MEANDERING DETAIL, AS ONE OBSERVE THEM CLOSELY.
KOCH CURVE
DIVISION OF SINGLE LINE INTO THREE EQUAL SEGMENTS.... ON & ON.
stage 1
stage 2
stage 3
stage 4
1 OPENINGS THAT EXPEL THE RISING HOT AIR
2 OXYGEN DIFFUSES TO THE INSIDE THROUGH THE CHYMNEYS.
3 WARM AIR RISES VIA A CENTRAL AIR DUCT
4 UNDERGROUND TUNNELS
5 CELLAR, WHICH FORMS LIVING QUARTERS. THE COOL AIR EVENTUALLY SETTLE DOWN HERE
TERMITE MOUND SYSTEM
TERMED AS MASTER ARCHITECT OF THE ANIMAL WORLD.
CROSS SECTION OF TERMITE MOUND
BUILDINGS MADE ON FOLLOWING PRINCIPLE:


ARCHITECTURAL INTERPRETATION's
• COSTAL LOCATION - SOIL EROSION - FOUNDATION
[EROSION PREVENTION]
• HOMES THAT CAPTURE MOISTURE IN AIR AND STORE WATER
• CREATING SHADES IN ARCHITECTURAL MEMBRANE
• WALL MEMBRANES - CREATING MICROCLIMATES.
ARCHITECTURE WITH SEMI-PERMEABLE MEMBRANE THAT WOULD COLLECT ATMOSPHERIC MOISTURE AND ACT AS AN INSULATING LAYER FROM SUN AND WIND.
ENERGY STORING BATTERY BASED UPON VACULE CELLULAR MEMBRANE.
WHITE ROOFS
LIGHT COLORED VEGETATION, USED FOR GREEN ROOFS, LIKE PRAIRIE GLASS.
ARCHITECTURE THAT HAS MORE SOLAR CONSCIOUS. SOUTH SIDE DIAGONAL FACADES.
TEMPERATURE CONTROL
BRICKS THAT HAVE AND WOULD HAVE PORES CLOSE AND OPEN DEPENDING UPON TEMPERATURE.
COLOR
DAY
NIGHT
DAY
STOMATA CLOSED
STOMATA OPENS
+ WITHOUT ENERGY FROM SUN THE PLANTS CAN PRODUCE SUGARS FROM CO2
SOLAR POWER THAT HAS SOLAR PANNELS, WHICH FOLLOW SUN DIRECTION, WITH OUT ANY/OR WITH MECHANISM LEADING TO TEMPERATURE DIFFERENCE B/W COOL AND WARM SIDES DIRECT PANNEL.
MEMBRANE
AS OBSERVED FOR MAJOR ANIMAL PLANTS [FLORA & FAUNA] OF TYPICALLY HOT AND ARID CLIMATE, THE BODY STRUCTURE IS MAINLY MADE UP OF THICK AND THIN LAYER MEMBRANE.
THE MINT (MAIN) CONCEPT BEING THE PROTECTION FROM OUTSIDE TEMPERATURE AND ALSO TO GENERATE THE MICRO CLIMATE AROUND THEM.
PROCESS TO CREATE ENERGY
ANALYSIS TO MARK THE PROCEDURES AND FUNCTIONS HOW THE CACTUS FUNCTIONS AND CREATE ENERGY
MALIC ACID
ROOFS WITH WHITE MATERIAL OR PAINTED.
CO2
CARBOHYDRATES
WITH
CO2
MALIC ACID
MALIC ACID
PHENEMENON APPLIED ON FENISTRATION
O2 TAKEN OUT
CO2 TAKEN IN
THE PARTICULAR PHEMENON BEING USED FOR.
ARRAY OF HORIZONTAL
000
001
002
003
004
005
006
007
008
009
010
011
ALSO THE DETAIL SHOWING THE LAYERED MEMBRANE AND THUS ENTIRE BEING COVERED, THE ADAPTATION FOR BUILDING.
THE DESIGN OF THORN/SPINE AND THE BRANCHING MAINLY FOR FENISTRATION
COMBINATION OF HORIZONTAL SECTION
3D MORPHOLOGICAL MODEL
MICRO-CLIMATE EXTRACTED SECTIONS
RIB BRANCHING
PHYLLOTAXIS SPINE ORDER


ANALYSIS VIA SECTIONS
THERMAL MASS
EXHAUST AIR DUCT
AN IMPORTANT FACTOR CONTROLLING THE ENERGY REQUIRED TO HEAT OR COOL A BUILDING IS THERMAL MASS.
THIS IS SIMPLY THE CAPACITY WHICH IS THE AMOUNT OF ENERGY REQUIRED TO RAISE TEMPRATURE BY 1°C.
THERMAL ENVIRONMENTAL CONTROL IS ACHIVED THROUGH THE DESIGN OF APPROPRIATE AIR FLOW SYSTEM AND THERMAL MASS FOR THE TRANSFER AND STORAGE OF HEAT SIMILAR TO THAT OF TERMITE MOUND.
THE CENTRAL VOID, IN DESIGN AND THE MEMBRANE PROVIDES FRESH AIR INTAKE TO ALL THE BUILDING VENTILATION SYSTEM. THIS ALSO GENERATES THE WIND PRESSURE.
THE DESIGN USES THERMAL MASS STORAGE STACK EFFECT AND THE DIURNAL TEMPRATURE SWINGS OUTSIDE TO KEEP ITS INTERIOR UNIFORMLY COOL. COOL NIGHT AIR IS HARVESTED AND STORED WITHIN CONCRETE STRUCTURES. IN SUB FLOOR VOIDS SUB FLOOR VOIDS, WHICH ACT AS HEAT EXCHANGERS.
CONCRETE TEETHED FLOOR
HORIZONTAL DUCTS
SOLAR SHADING MEMBRANE
SELF CLEANING FACADE
WIND MOVEMENT
HOT WIND
SUPPLY AIR DUCT
BERNOULLI's THEOREM
BRINGING IN RELATION TO THE CACTUS THORN/SPINE TO BERNOULLI'S PRINCIPLE.
USING THIS PHYSICAL INTERPRETATION IN THE DESIGN, CREATING THORNS OF THE BUILDING, THEY ARE TREATED AS FUNNELS, THORN ≈ FUNNEL
FROM THE ARCHITECTURE POINT OF VIEW, THESE FUNNELS, FUNCTIONS BEST WHEN PLACED INWARDS AND THUS ALSO FOLLOWS THE PRINCIPLE OF BERNOULLI'S THEOREM.
ADAPTATION OF CACTUS SPINE/THORN

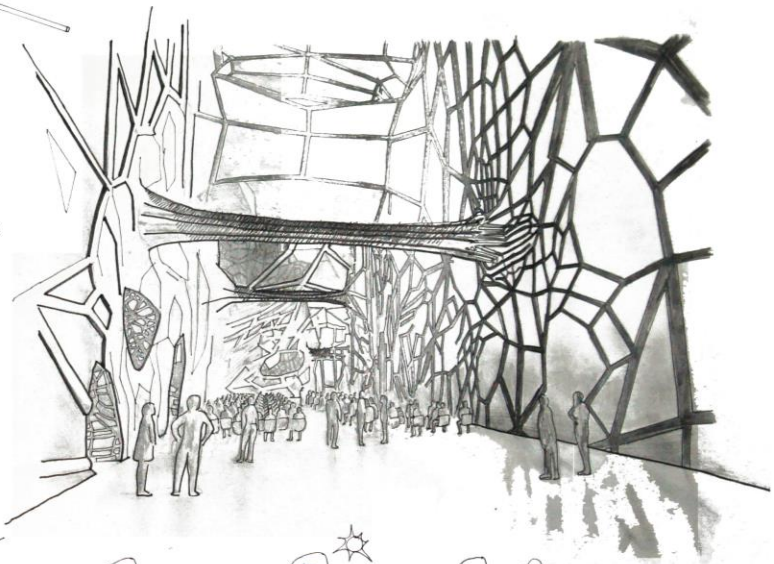


IRRIGATION CONTROL BLADDER

GEOTHERMAL FOR WATER TEMPRATURE MANAGEMENT + HEATING AND COOLING

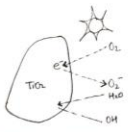
LEAD TO IRRIGATION FOR ER XERISCAPE
[VERTICLE RISE ONLY NEEDED FOR DRIP IRRIGATION OR SURFACE WATERING. OTHERWISE CAN CONNECT TO WELL PIPES]

SKETCH ANALYSIS & OVERVIEW

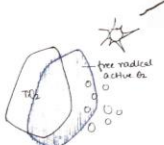


SELF CLEANING MECHANISM

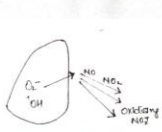
ELECTRON IN TiO_2 BECOME ENERGIZED BY UV LIGHT



ELECTRON TRANSFER ENERGY TO O_2 AND WATER IN AIR



FREE RADICALS ARE FORMED BY TRANSFERED ENERGY (O_2^-, $^{\cdot}OH$)



THE FREE RADICALS ATTACK & DESTROY ORGANIC MATTER VIA OXIDATION

*OH FREE RADICALS CALLED HYDROXY'S GROUP ON SURFACE OF ECO CLEAN

THE HYDROXYLS MAKE THE BUILDING SURFACE SUPER SLICK. INSTEAD OF BEADING UP ON SURFACE, THE WATER COLLAPSES ON SURFACE AND RUNS OFF, UNDERCUTTING DIRT AND GRIME.

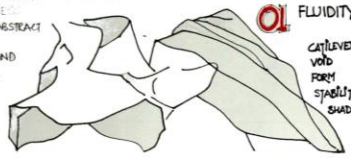
FORM ANALYSIS

ANALYSIS BASED UPON PAPER FOLDING TECHNIQUE

ANALYSING, FORM, SHADOWS, STRUCTURAL STABLITY, TEXTURE, VOIDS

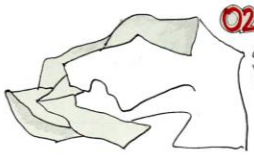
PROCESS:

A PAPER BLANK, USUALLY TAKEN AND IS CRUSHED WITHOUT ANY CONSCIOUSNESS AND THE ABSTRACT FORM IS CREATED AND ANALYSED.



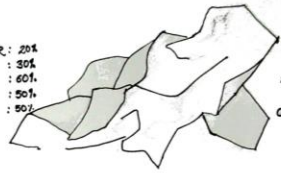
01 FLUIDITY

CANTILEVER : 40%
VOID : 40%
FORM : 50%
STABILITY : 80%
SHADOW : 50%



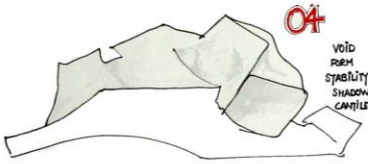
02

CANTILEVER : 20%
VOID : 30%
FORM : 60%
STABILITY : 50%
SHADOW : 50%



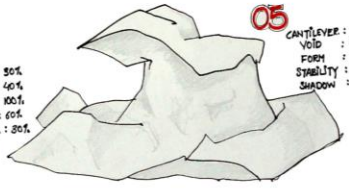
03

VOID : 50%
FORM : 90%
STABILITY : 80%
SHADOW : 60%
CANTILEVER : 40%



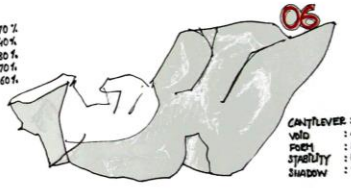
04

VOID : 50%
FORM : 40%
STABILITY : 100%
SHADOW : 60%
CANTILEVER : 80%



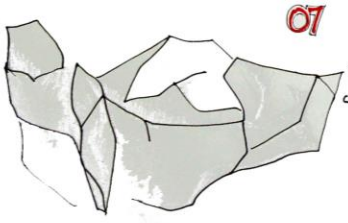
05

CANTILEVER : 70%
VOID : 40%
FORM : 80%
STABILITY : 70%
SHADOW : 60%



06

CANTILEVER : 40%
VOID : 40%
FORM : 80%
STABILITY : 80%
SHADOW : 70%

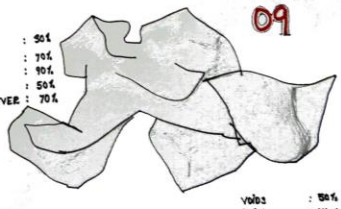


07

VOID : 70%
FORM : 80%
STABILITY : 100%
SHADOW : 60%
CANTILEVER : 80%

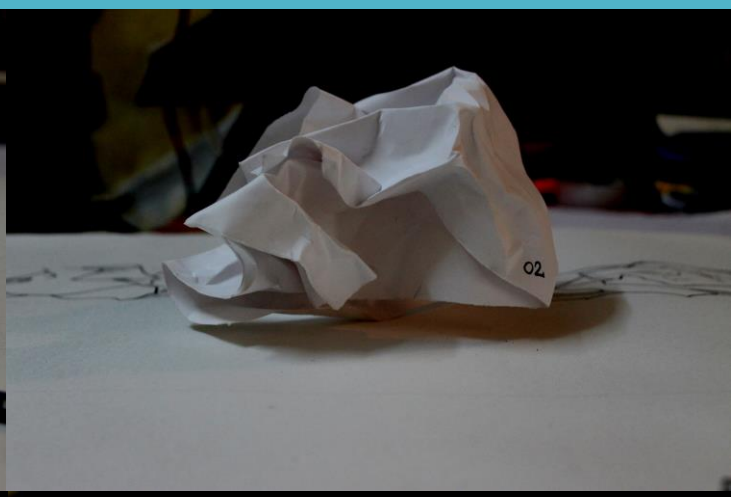
08

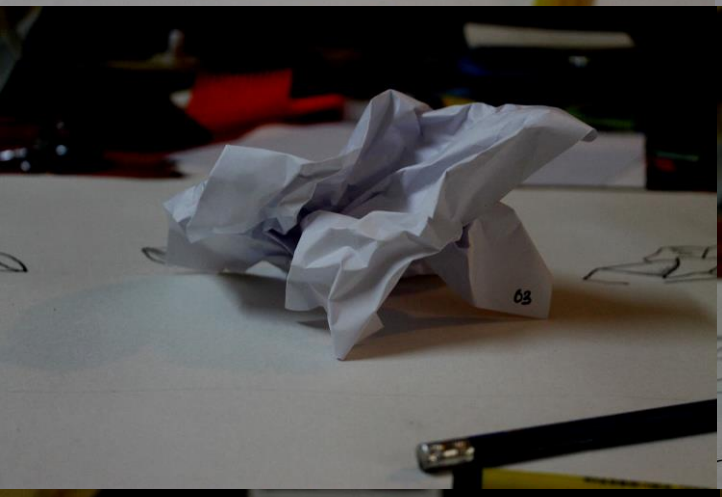
VOIDS : 50%
FORM : 70%
STABILITY : 90%
SHADOW : 50%
CANTILEVER : 70%



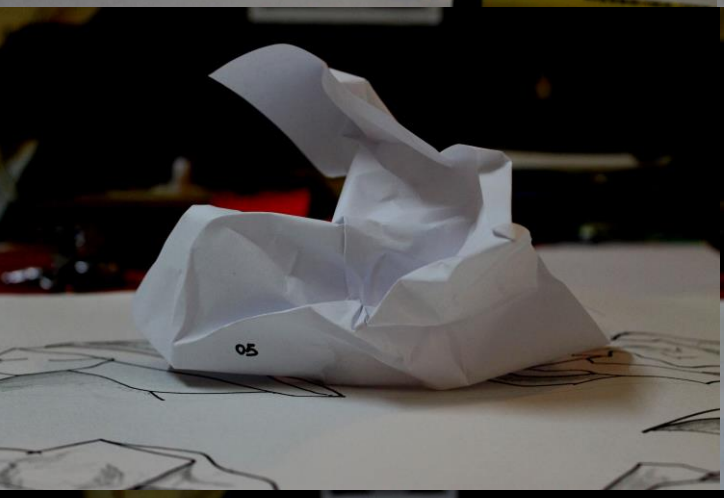
09

VOIDS : 80%
FORM : 70%
STABILITY : 60%
SHADOW : 60%
CANTILEVER : 40%


02

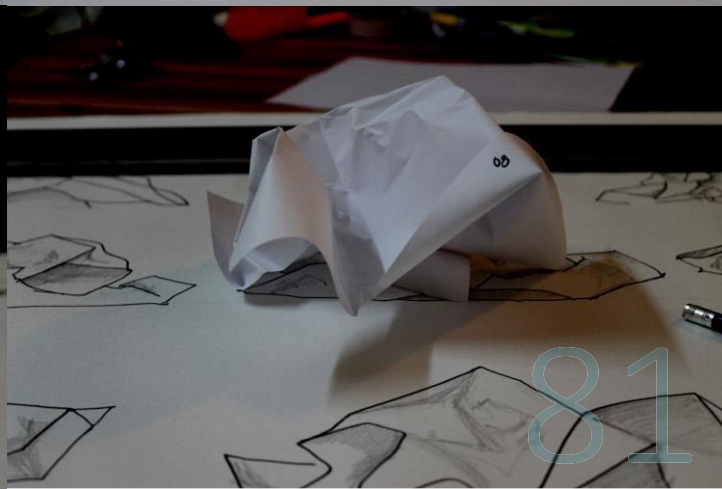

03

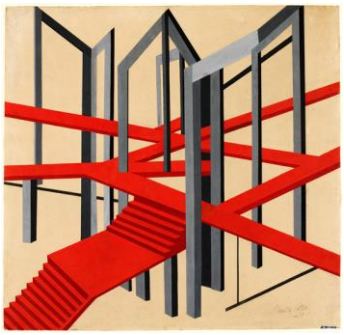
04


05

06

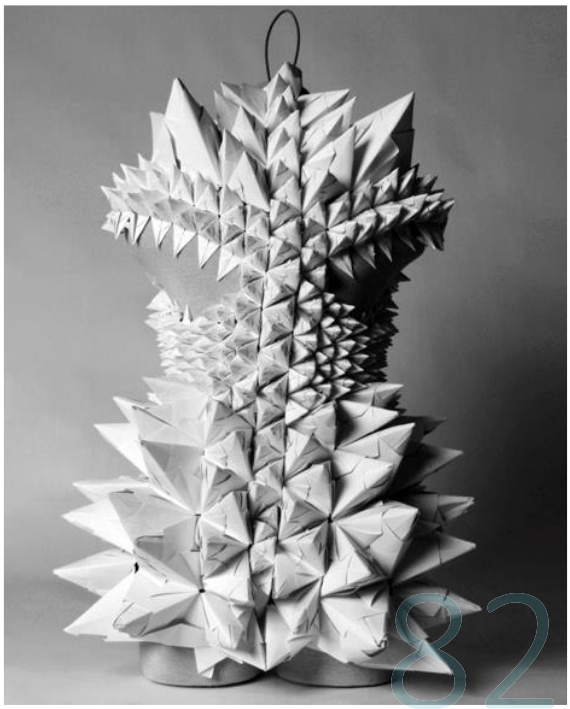
07

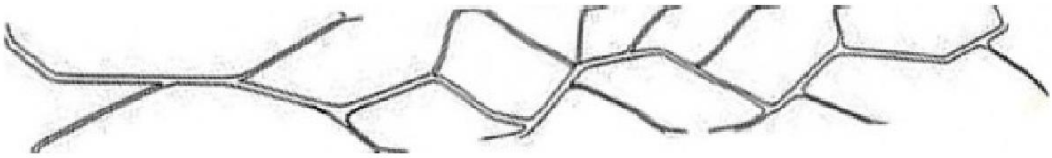

08



Digitization through Biomimicry :

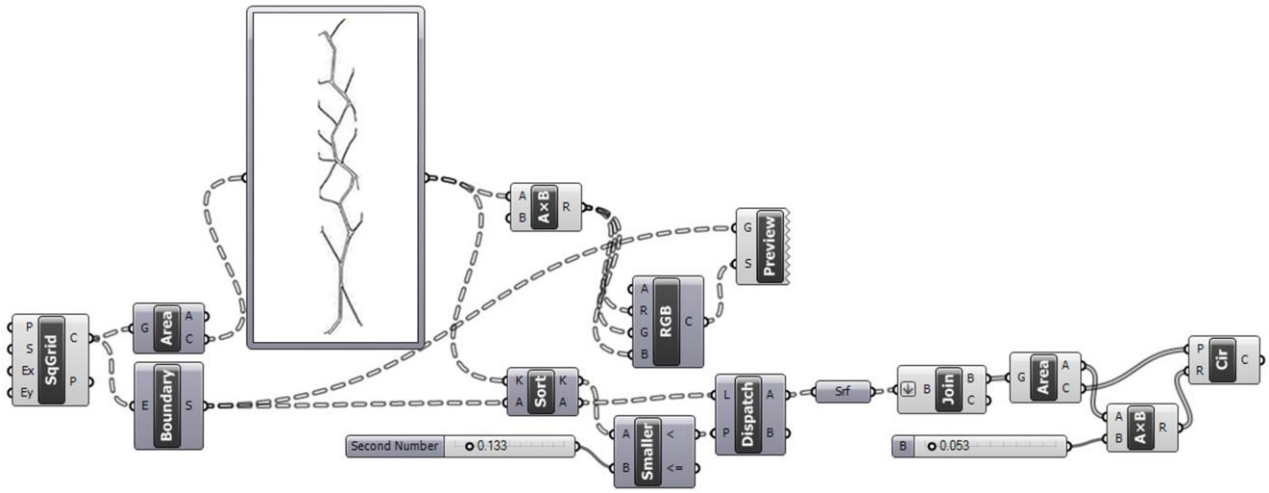
It is a digital diary of research on the relationship between architecture and computational geometry. It includes experiments with geometry, parametric modeling, digital fabrication and related issues. Also it is a laboratory of pedagogical approaches specialized for early years of design education. Currently it is organized by the elements of a knowledge basis (gnosis), synthetic components that resembles a body of knowledge themselves (synthesis), and utilizations with a design output (praxis).



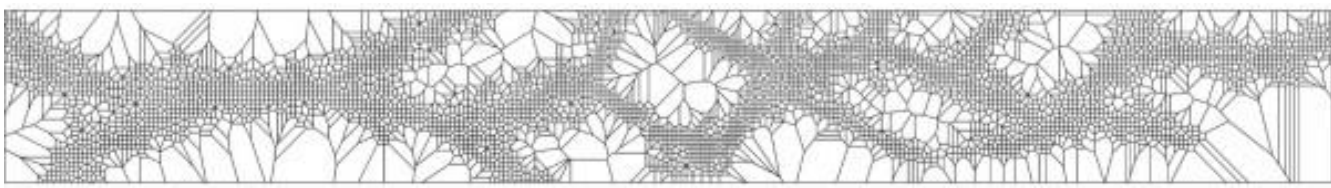


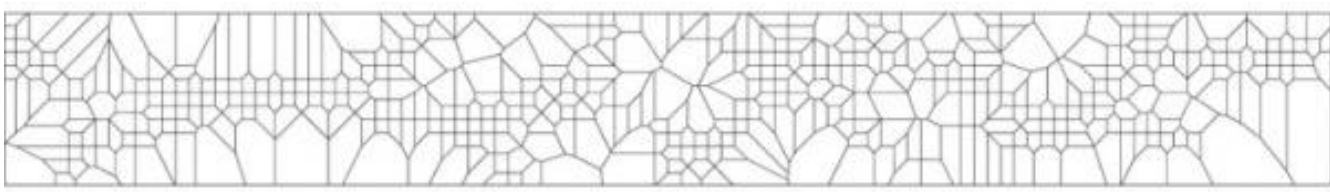
Microscopic image of cactus skin

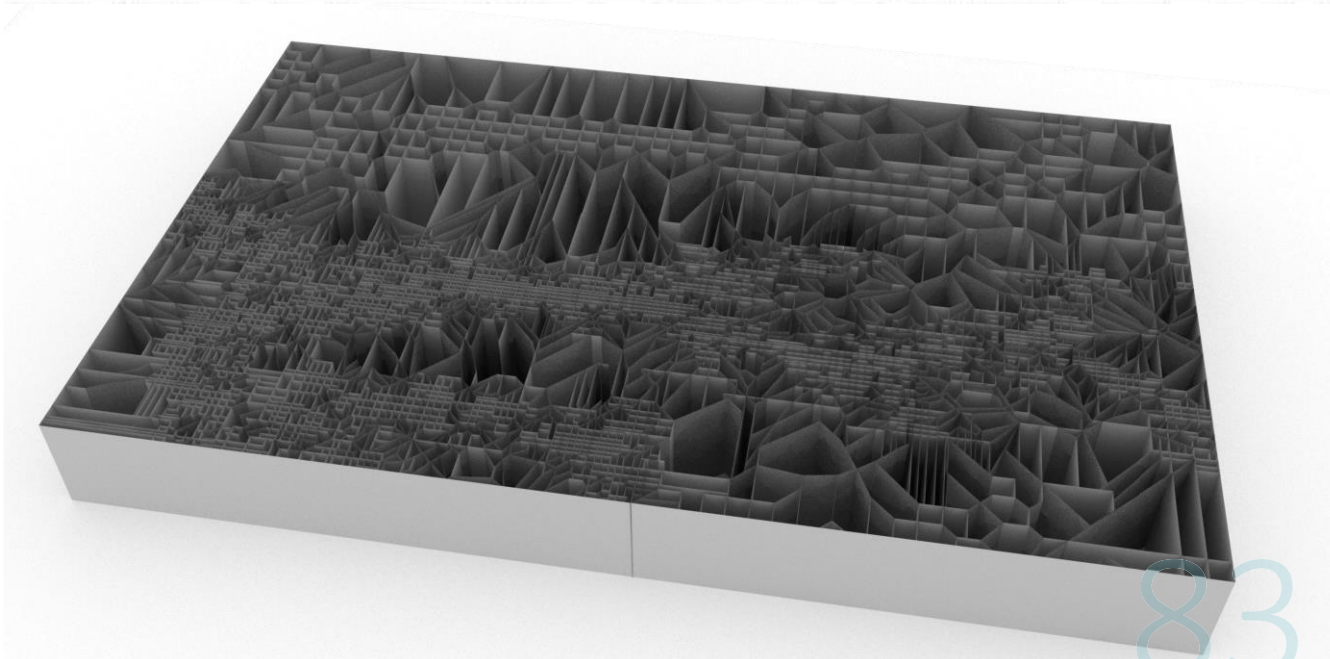
The process of coding/ image processing through grasshopper



Product obtained after bitmap coding, coding is shown in upcoming pages







Membrane fractal algorithm

Decoder. Ghx

The document tree is shown below.

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<Archive name="Root">
<!-- Grasshopper archive -->
<!--
Grasshopper and GH_IO.dll are copyrighted by Prajapati vaio
-->
<!--
Archive generated by GH_IO.dll file utility library (0.2.0002)
-->
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D:\THESIS\THE LAST LEAR\10 SEM\2014 FALL PARAMETRIC MODELING\path.jpg
</item>
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D:\THESIS\THE LAST LEAR\10 SEM\FALL PARAMETRIC MODELING\path.jpg|path.jpg
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Solve area properties for breps, meshes and planar closed curves.
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Brep, mesh or planar closed curve for area computation
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<item name="Name" type_name="gh_string" type_code="10">Centroid</item>
<item name="NickName" type_name="gh_string" type_code="10">C</item>
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<item name="Mapping" type_name="gh_int32" type_code="3">1</item>
<item name="Name" type_name="gh_string" type_code="10">Points</item>
<item name="NickName" type_name="gh_string" type_code="10">P</item>
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<X>910.5</X>
<Y>61</Y>
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<item name="Name" type_name="gh_string" type_code="10">Radius</item>
<item name="NickName" type_name="gh_string" type_code="10">R</item>
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<W>32</W>
<H>20</H>
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<X>910.5</X>
<Y>81</Y>
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<item name="Name" type_name="gh_string" type_code="10">Boundary</item>
<item name="NickName" type_name="gh_string" type_code="10">B</item>
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</item>
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<Y>101</Y>
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<Oy>0.964720514571397</Oy>
<Oz>0</Oz>
<Xx>1</Xx>
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<item name="Size" type_name="gh_interval2d" type_code="61">
<Au>0</Au>
<Bu>897.020856692652</Bu>
<Av>0</Av>
<Bv>115.347251235135</Bv>
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Optional base plane. If no plane is provided, then the best-fit plane will be used.
</item>
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<Y>121</Y>
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<item name="InstanceGuid" type_name="gh_guid" type_code="9">1eb10835-b0ce-4226-a0ad-9a505b3ccebd</item>
<item name="Name" type_name="gh_string" type_code="10">Cells</item>
<item name="NickName" type_name="gh_string" type_code="10">C</item>
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<item name="Name" type_name="gh_string" type_code="10">Smaller Than</item>
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<item name="Name" type_name="gh_string" type_code="10">Smaller Than</item>
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<item name="Bounds" type_name="gh_drawing_rectanglef" type_code="35">
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<W>73</W>
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<X>725</X>
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<item name="Name" type_name="gh_string" type_code="10">First Number</item>
<item name="NickName" type_name="gh_string" type_code="10">A</item>
<item name="Optional" type_name="gh_bool" type_code="1">false</item>
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</items>
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<Y>106</Y>
<W>14</W>
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<item name="NickName" type_name="gh_string" type_code="10">B</item>
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<item name="InstanceGuid" type_name="gh_guid" type_code="9">cfb8df8b-37d4-420e-985f-70e083614707</item>
<item name="Name" type_name="gh_string" type_code="10">Smaller than</item>
<item name="NickName" type_name="gh_string" type_code="10"><</item>
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<W>25</W>
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<item name="Pivot" type_name="gh_drawing_pointf" type_code="31">
<X>752.5</X>
<Y>120.5</Y>
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<item name="Name" type_name="gh_string" type_code="10">… or Equal to</item>
<item name="NickName" type_name="gh_string" type_code="10"><=</item>
<item name="Optional" type_name="gh_bool" type_code="1">false</item>
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<W>25</W>
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<item name="Pivot" type_name="gh_drawing_pointf" type_code="31">
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<item name="Name" type_name="gh_string" type_code="10">Dispatch</item>
</items>
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Dispatch the items in a list into two target lists.
</item>
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<X>825</X>
<Y>79</Y>
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<item name="Name" type_name="gh_string" type_code="10">List</item>
<item name="NickName" type_name="gh_string" type_code="10">L</item>
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<X>797</X>
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<Y>62.5</Y>
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<item name="Name" type_name="gh_string" type_code="10">Dispatch pattern</item>
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<item name="Optional" type_name="gh_bool" type_code="1">false</item>
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</items>
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- Piyush Prajapati
  (Grasshopper + rhinoceros)

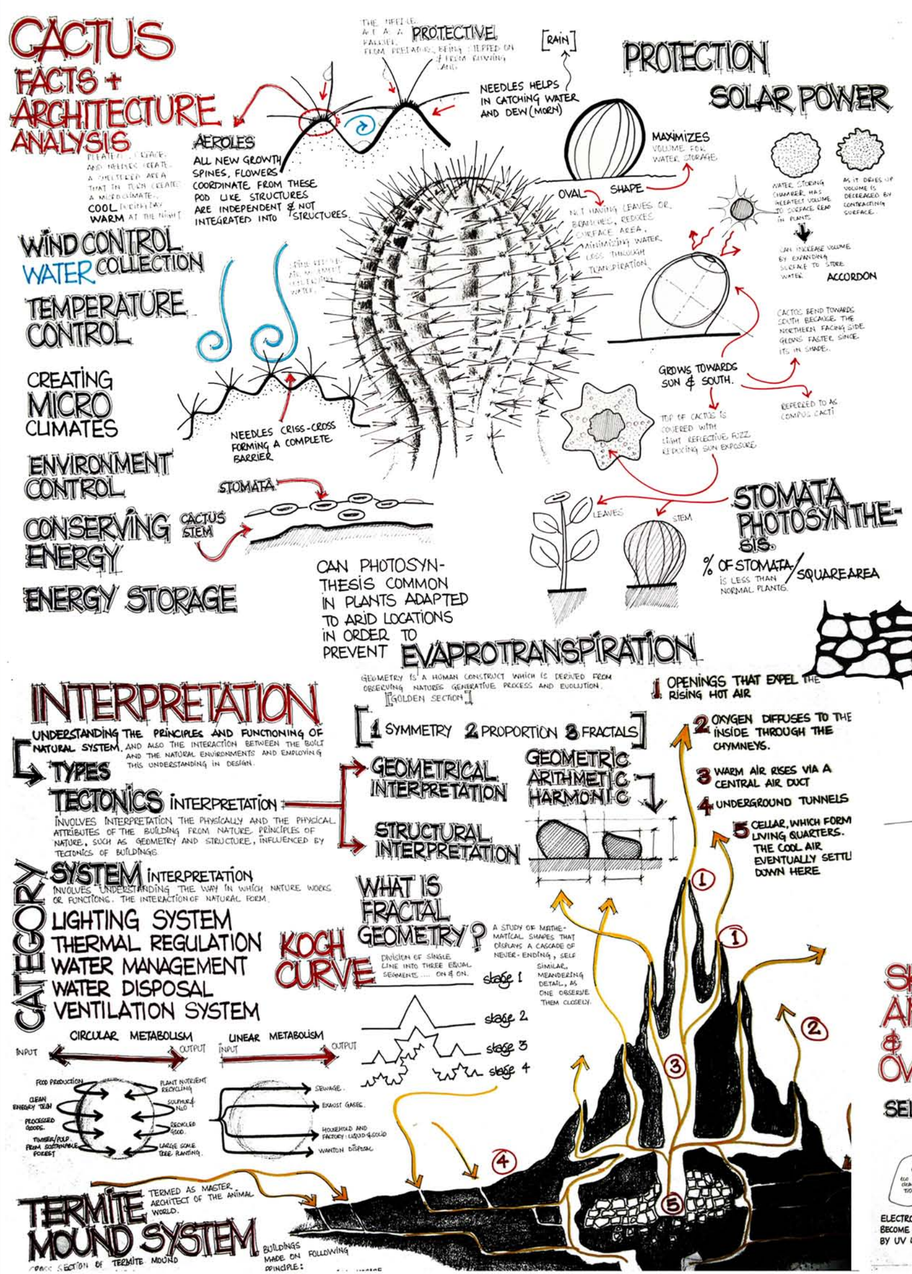
Winner of the best architectural thesis amongst the nation, hosted by governing body of architecture in India, C.O.A.

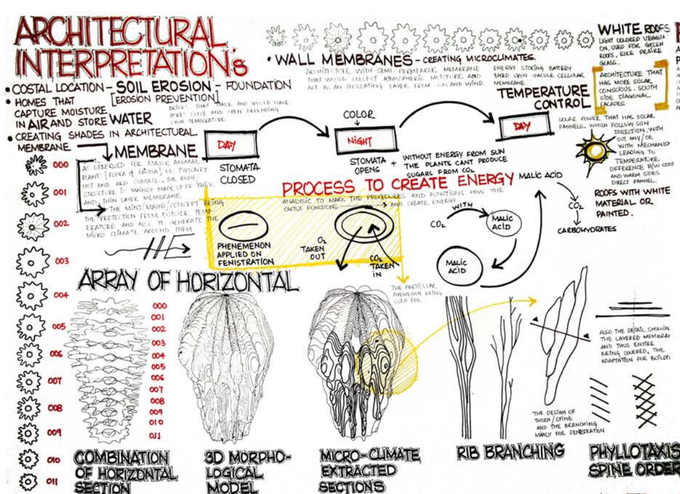
topic : athenaeum

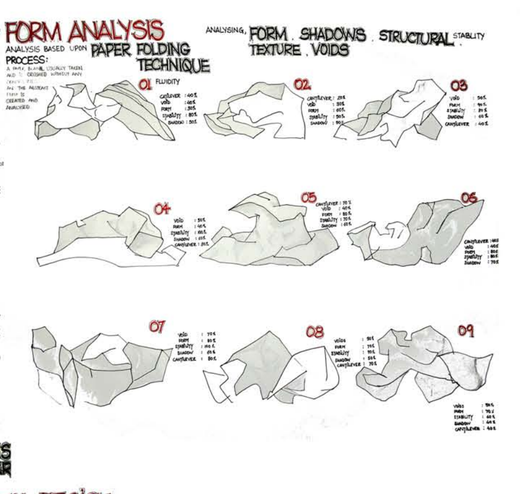
a visual learning institute, in concern with architecture

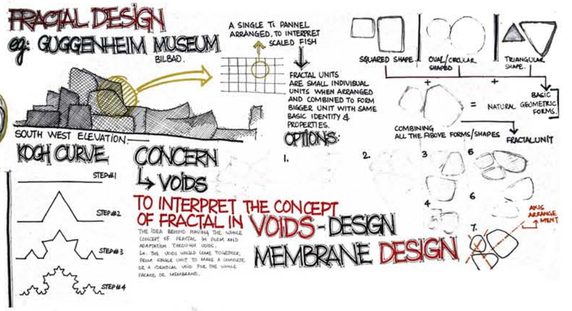
concept and derivations

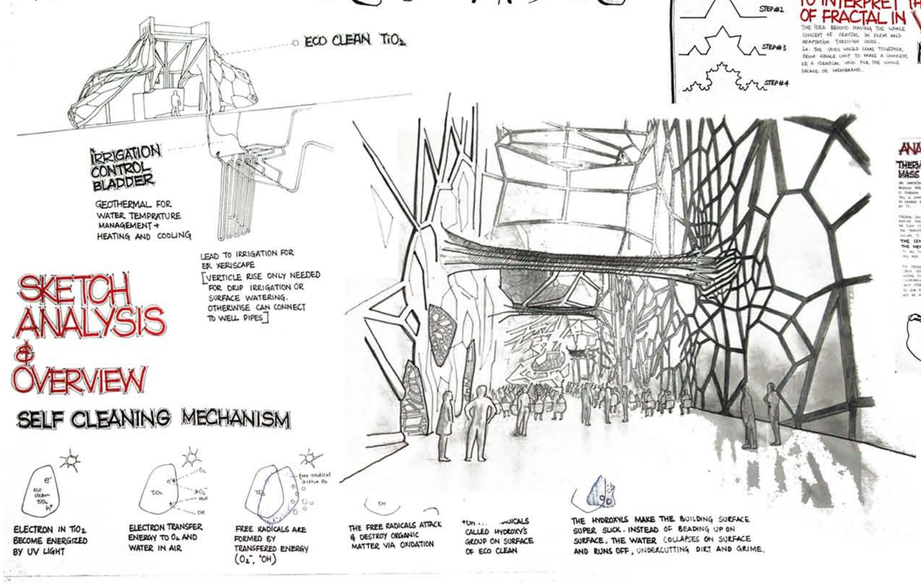
thesis project 08

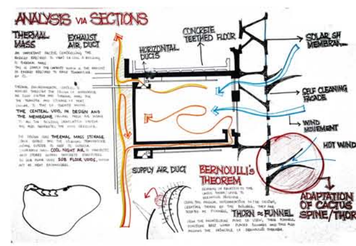












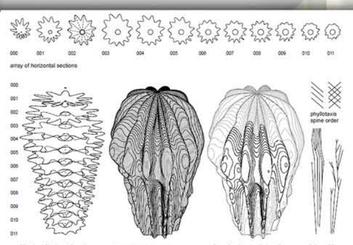
the conceptual evolution of the biomimic elements and then proceeding to the parametric designing through grassopher by doing image processing

thesis project 01

athenaeum

a visual learning institute, in concern with architecture

Creating a podium for architecture comprising architectural **museum**, architectural **research** and the **commercial cell**



objectives of architectural exhibition:

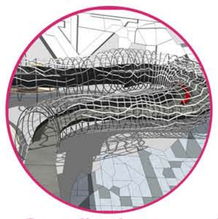
1. Indian excavations
2. aquatecture
3. architectural innovations
4. architectural model display
5. Jaipur context display
6. evolution of Architecture
7. contribution an individual can give to architecture
8. landscape architecture

biomimicry : the replication of microscopic image of CACTUS SKIN/ surface and integration to architectural principles

Research: the academic part of the institute for the research purpose comprising of workshops, studios, library, auditorium, leisure areas, administrative units, architectural theatre and walk in theatre.

Indian excavations: Jaipur, being rich in architecture and also in architecture remains, a guided space for the architectural excavations to be displayed, where the remains or newly excavated items/sculptors are showcased.

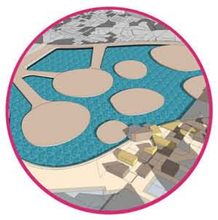
Contextual gallery: the rising ramp or the contextual displayed gallery, which leads to the axial arrangement to the JAL MAHAL, from where the user can have the access to have a direct view of Jaipur's Jal mahal



Contribution to architecture: a rising gallery, the main nature being to emphasize on how can an individual contribute to architecture. The gallery being rising, mirrored, reflective, glossed and wired making the feel and simulating the human.

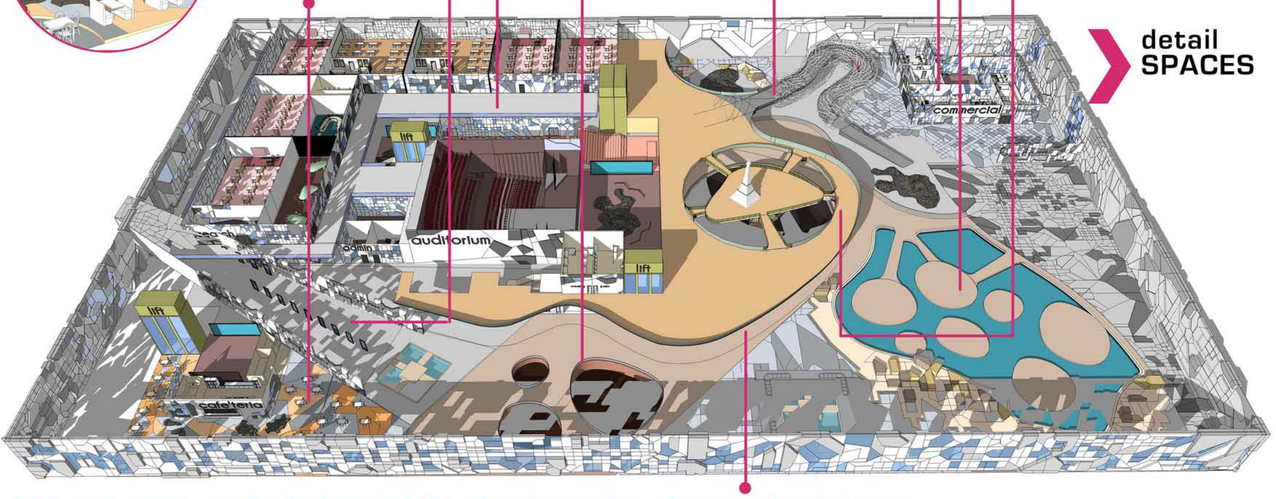
Cafeteria: the leisure area with semi informal spaces all together, in connection with the museum and the research area.

Commercial : the commercial cell comprising up of 4 different local architects, where local projects are carried upon. Also the interns coming here are entertained, and they act as the member of the athenaeum.



Aquatecture: the modern and the innovative architecture of present century, showcasing the modern technologies in relation to the building in water and building for water. (also the concern of having reduced land in present time as a social cause is also shown)

Architectural innovation: the advancement in architecture has been shown and displayed all together with modern technologies and inventions.



detail SPACES

Athenaeum comprising of both research department for architecture and the architectural museum

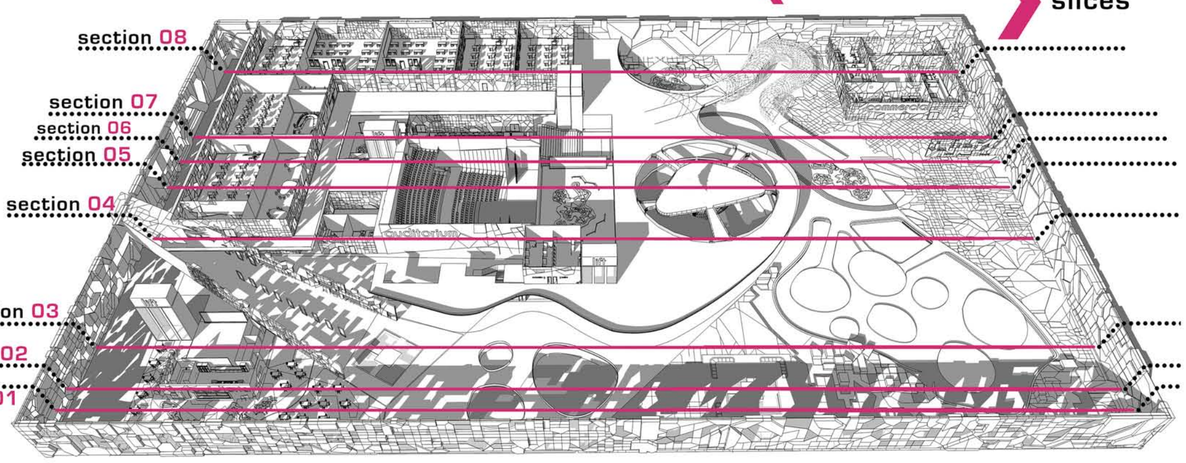
Architectural model display: general display of architectural building models and the units.

Structural walls : the fabricated designed panel of the cactus membrane

Evolution of architecture: the architecture has grown from primitive times to the present days. Displaying everything from art nova, contemporary , to deconstruction and Biomimicry.

exploded view of sections

SECTION slices



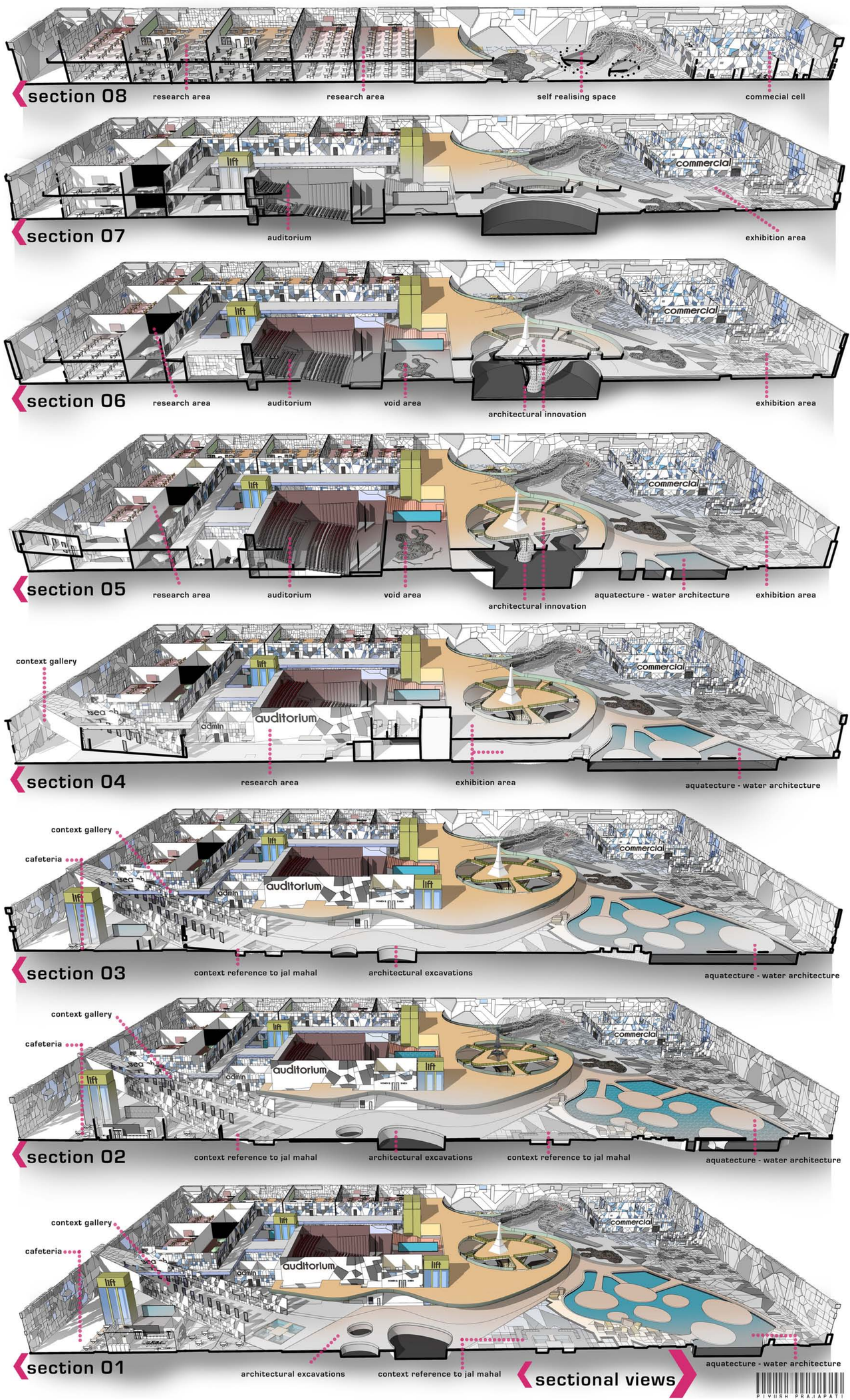
PIYUSH PRAJAPATI

thesis project 02

athenaeum

Exploded views of section mainly to enhance the internal **spaces**, internal **zoning**, and the **layout**.

Section at various points for individual design demarcation showing the **connectivity** and the **movement** throughout the building



sectional views

PIYUSH PRAJAPATI

thesis project 03

Ground floor plan and the **upper floor plans** are shown and labelled for their spaces

Also the evolved **elevation**, designed envelope through image processing and also using the same in the planning areas.

The algorithm (coding) being shown showing the process of evolution - pattern obtained in two forms - denser and the lighter version according to the local climatic conditions

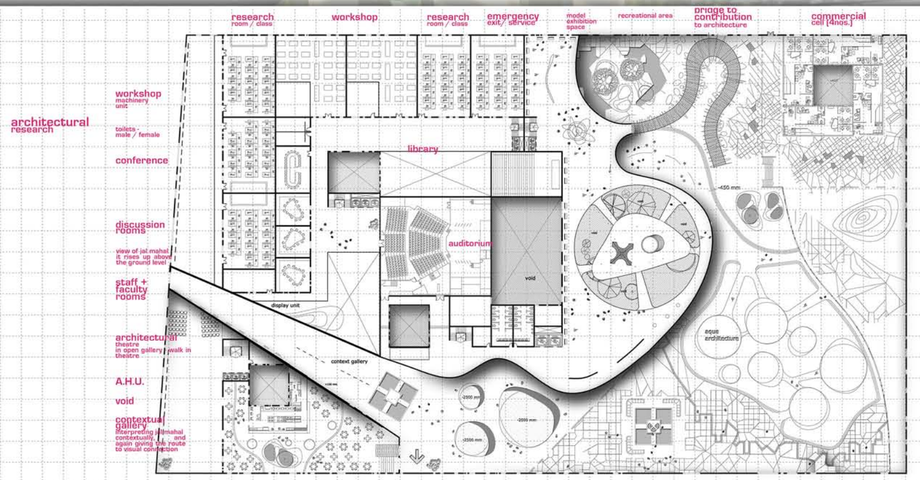
thesis project 04

The thrust revolves around **Biomimicry**, interpretation, simulation and the emulation are the process adapted for coding through parametric.

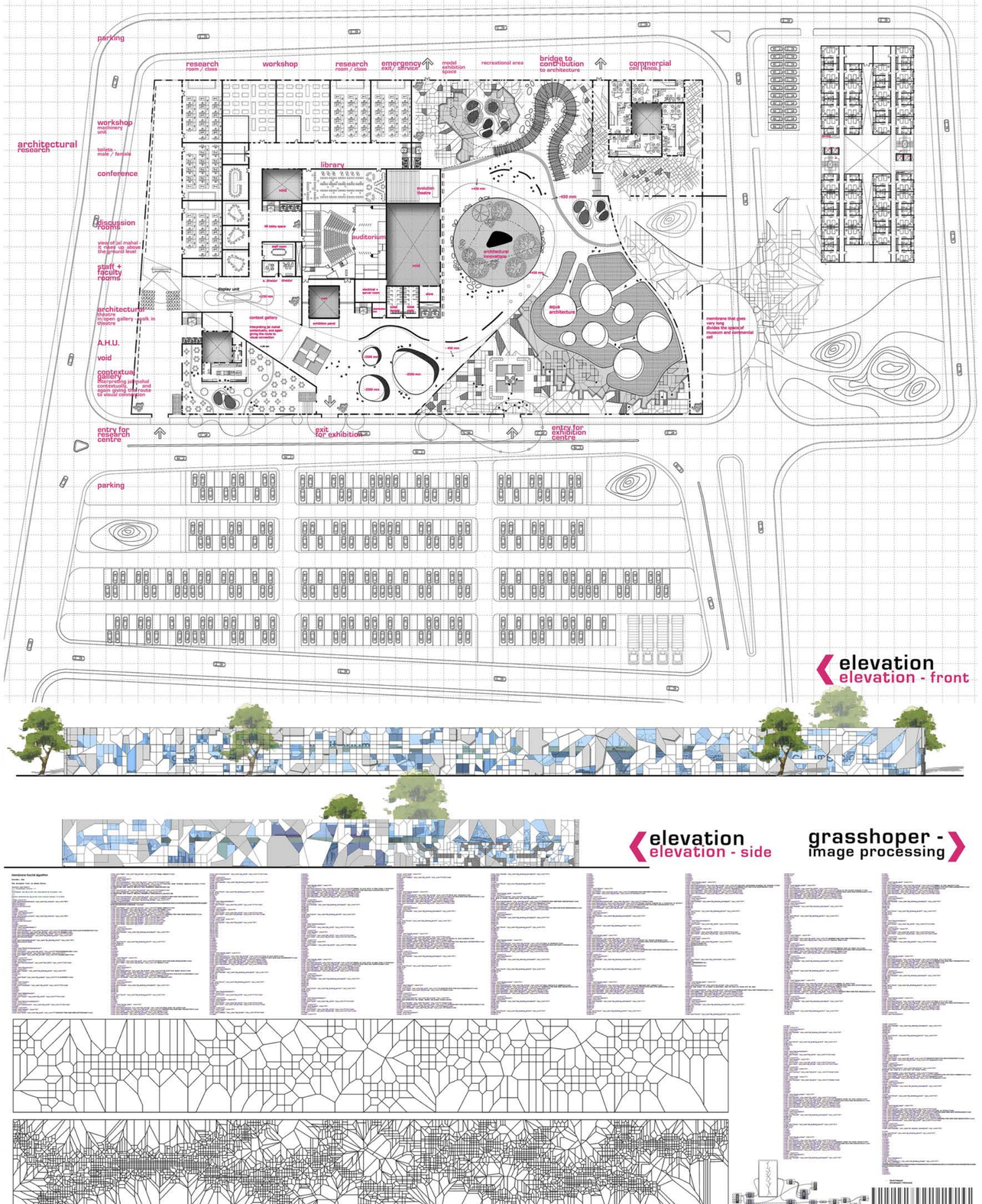
Incorporating the advanced method of architecture adaptively in buildings and to the structures. Making the new scenario of logical reasoning in buildings.

The concern is the cactus parametric analysis of form through **image processing method of digitization** and the form shell evolution using grasshopper. Also the termite mounds for the climatic concerns and the golden ratio for the planning principles are used

upper floor plan



ground floor plan

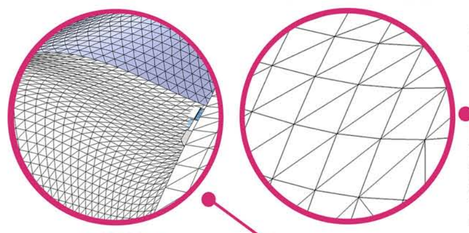


elevation
elevation - front

elevation
elevation - side

grasshoper -
image processing

elevtive digitization



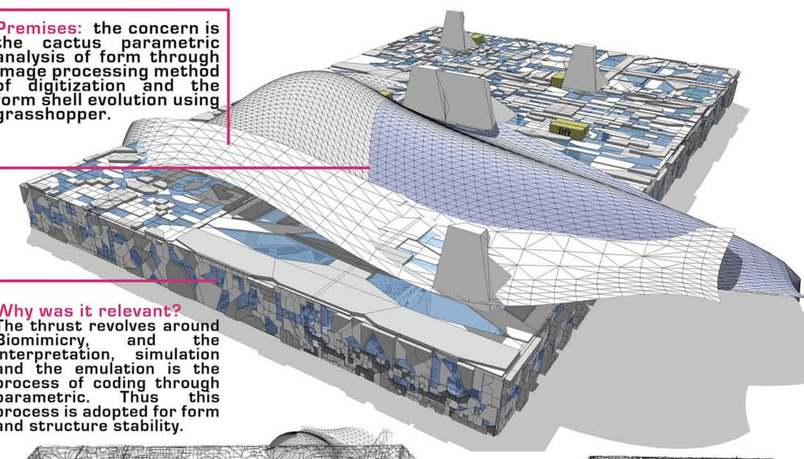
Aim and objective:
to incorporate the advanced method of architecture adaptively in buildings and to the structures. Making the new scenario of logical reasoning in buildings.

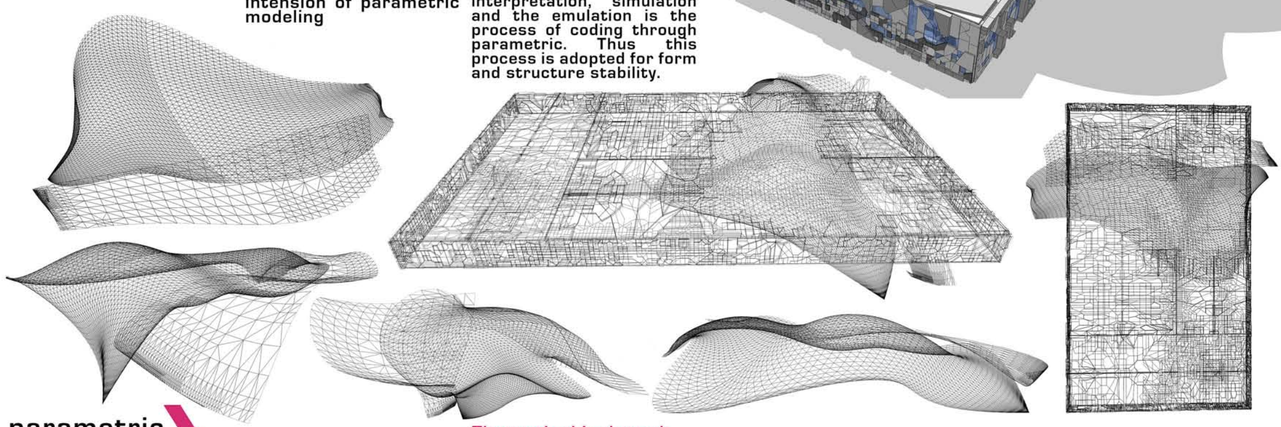
Premises: the concern is the cactus parametric analysis of form through image processing method of digitization and the form shell evolution using grasshopper.

The lighter and the denser version of the processed image, in the form of mesh supported with the tensile system as roofing.

The two analogy of the mesh being adopted with the known intension of parametric modeling

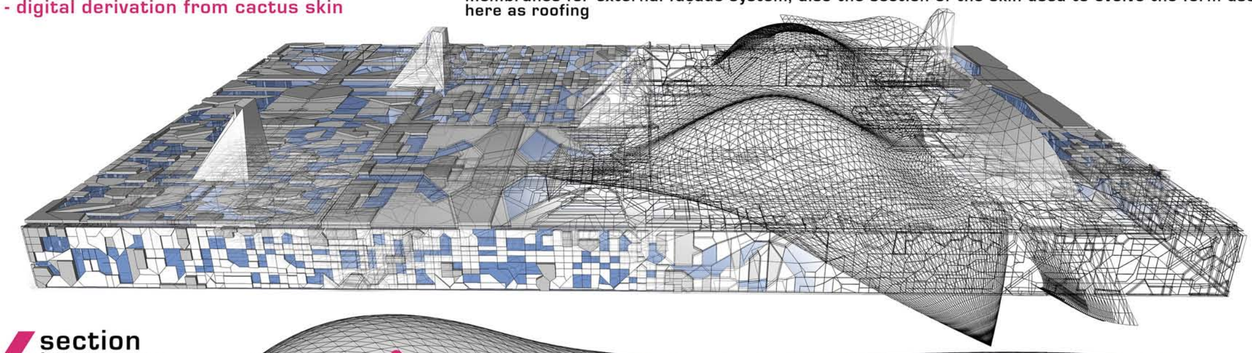
Why was it relevant?
The thrust revolves around Biomimicry, and the interpretation, simulation and the emulation is the process of coding through parametric. Thus this process is adopted for form and structure stability.



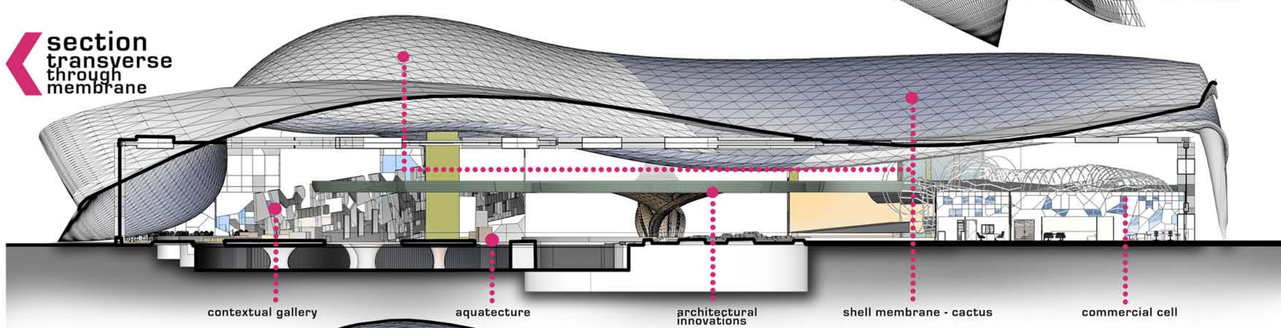


parametric analysis of membrane
- digital derivation from cactus skin

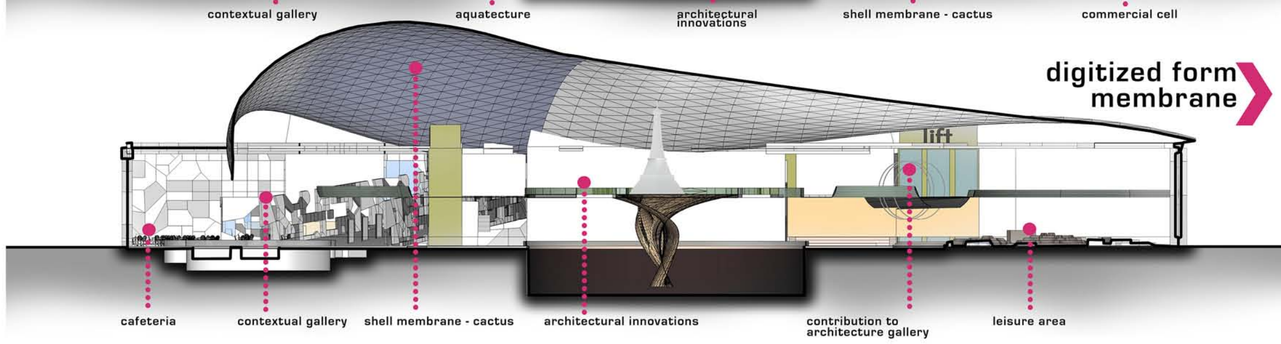
The method I adopted:
the biomimic analysis carried on with the local flora of Jaipur i.e cactus, and extracting the microscopic image from it and then digitally processed to produce the patterns which is again used as membranes for external façade system, also the section of the skin used to evolve the form used here as roofing

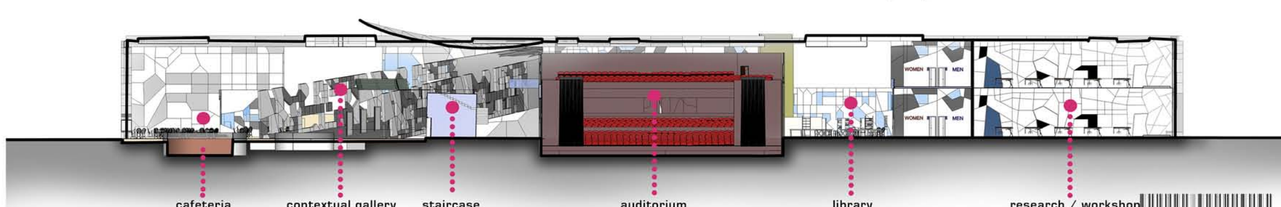


section transverse through membrane



digitized form membrane





PIYUSH PRAJAPATI