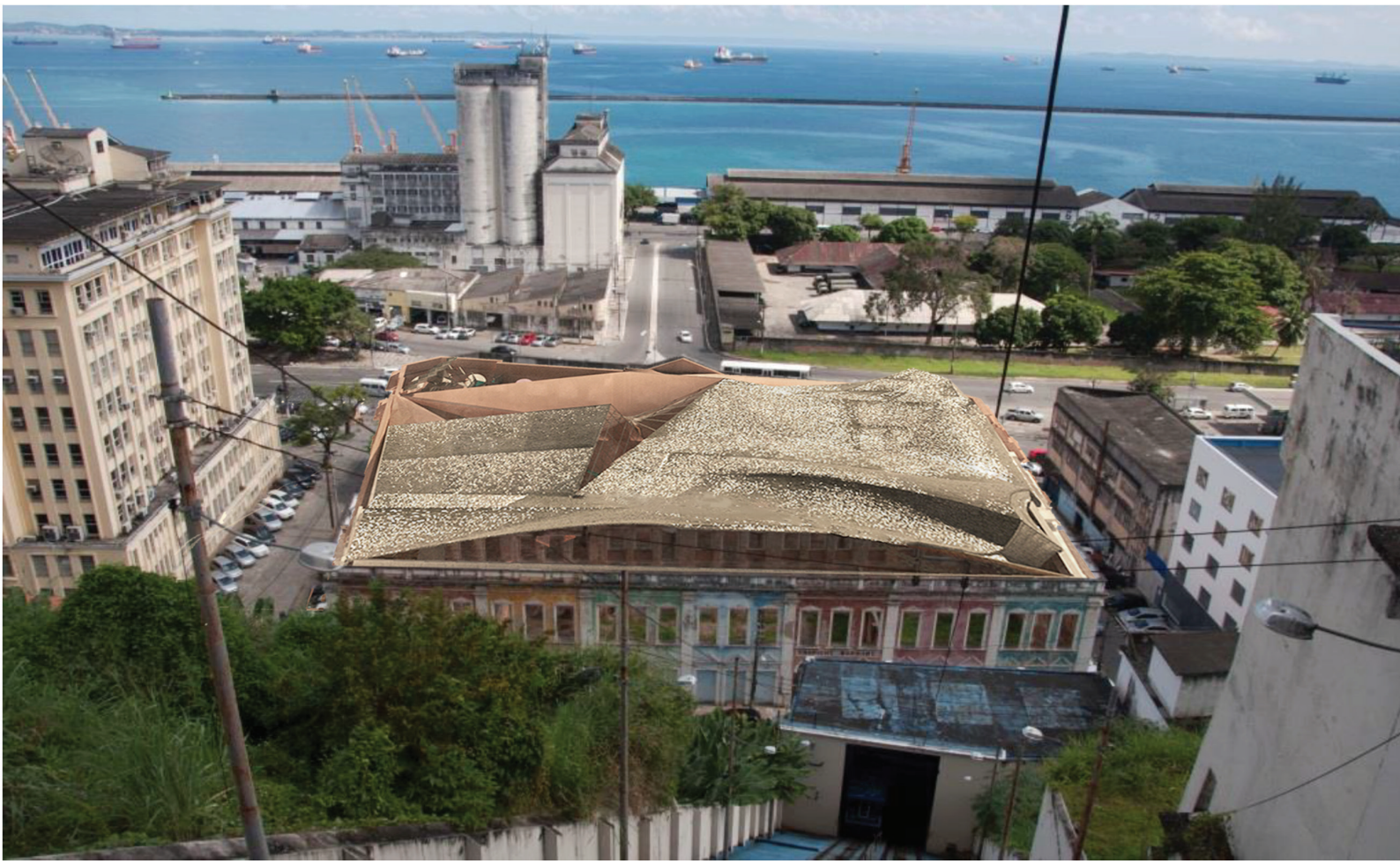
TRAPICHE BARNABE

FLUX / LUX



Modulating Light through Adaptive Reuse
AAHM10: Degree Project in Architecture

Examiner: David Andreen

Supervisor: Gediminas Kirdeikis

LUNDS
UNIVERSITET

ACKNOWLEDGEMENTS

First of all, I would like to thank my supervisor Gediminas for his incredible dedication, patience and thoughtfulness. Everyone who has him as a professor considers themselves lucky. Your questions helped tailor this from research about light and adaptive reuse to discover philosophy, perception, geometry and light.

I am grateful to David Andreen and Elin Daun who have led spatial and to have changed my approach to architecture from new disciplines and materials. Their patience and support created an amazing atmosphere that has made these two years memorable.

Larissa de Souza was the pillar for this research to exist and to recreate the Trapiche Barnabe as if I had been in Salvador. The thorough and detailed analysis of the building made this possible.

Thank you to my mother who has given me every possibility and all of her support.

Thank you to all believed in this, to all my friends that bring the light to Sweden, studio fika which is the source of laughter and inspiration and MARK- I have learned so much from you all.

ABSTRACT

How can we produce structural color through generative design to enhance the effects of natural light and refractive materials in urban recycling? This thesis explores how form be assembled to fabricate an ephemeral construction of volume and color. The objective of this research is to develop a system of glass modules that produce an immersive experience of light that transforms our spatial perception of the Trapiche Barnabé in Salvador, Brazil.

Trapiche Barnabé former sugar mill was built around 1711- 1718 which was in the direct route of communication to the port of Salvador where the most important traders' warehouses were located in the Comercio (commerce) neighborhood. In the 20th century with the expansion of the Port of Salvador and improvement of the streets linked to the port, the main façade is built and still remains. It is one of the few examples of port construction that has survived all the transformations of Comercio. After 1952, Trapiche Barnabé was partially damaged by a fire and the new inheritors of the property abandoned it in 1961 where it fell into rapid degradation. (Andrade, 2016)

"All we can see can be said that is a spatial context of contrasts." (Valberg, 2005) The perception of color is determined by both subjective attributes of a viewers' visual receptors and objective physical attributes of the reflected light and orientation of the colored structure.

Structural color is the result of selective light reflection and absorption of light, the color is determined geometry of the structure and scattering of light occurs at interfaces between materials of different refractive indexes. Norwegian neurophysiologist Arne Valberg states "reflection properties of surfaces relative to their surround are more important for color vision than the actual spectral distribution reaching the eyes" (Valberg, 2005) Spectral color can be defined by wavelength.

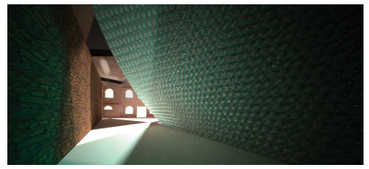
The angle of light incidence, such as time of day can change the observed color while by changing the viewing angle of the observer some structures can change from transparent to multicolored. Framing this phenomenon of interaction of light and colors through space to provide a new presence in the urban context is one of the aims of applying structural color.

TABLE OF CONTENTS

FLUX

TRAPICHE BARNABE

LUX



METHODOLOGY.....6
GEOGRAPHY+ CONTEXT.....8
INTRODUCTION.....13

PART I.

HISTORY OF SALVADOR.....16
SPATIAL RECOVERY.....40
LINA BO BARDI.....42
URBAN ALCHEMY.....50
CIRCULARITY + MATERIALS.....57
(PROPOSAL).....72

PART II.

GEOMETRY+LIGHT.....110
CONCLUSIONS + ILLUSIONS.....140
BIBLIOGRAPHY.....144

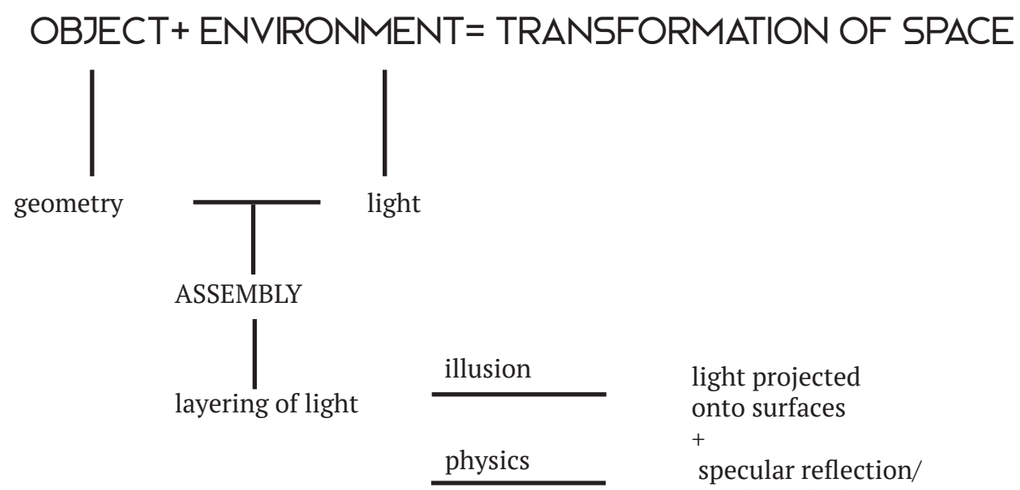
METHODOLOGY

The objective of this project was to produce an intervention that questions what we see as a physical-experential phenomena that could develop into how we see waste as an object, a system and its presence in society.

To use light to transform the identity of a space was the first part of choosing my research topic. How do abandoned industrial buildings become an interactive space that is in flux? The structure is static and is a product of its time and the ambitions of the past. How do we deconstruct the past in a parallel reality that is beyond what we know and can touch? Material becomes a reflection of our society and a way to reflect on our environment.

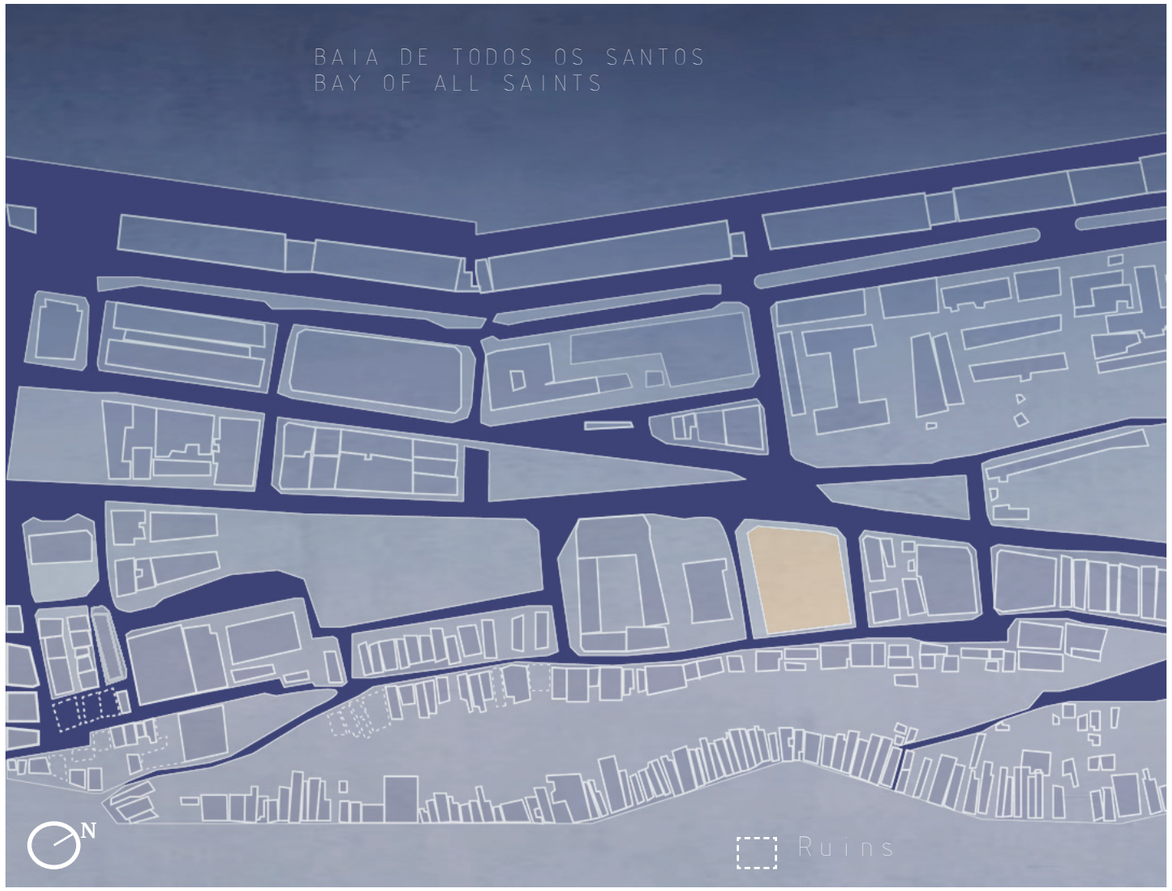
I was intrigued by creating a way to rebuild a space that would be perceived differently each time and lead to new ways of experiencing a building which was abandoned. Temporality as a design strategy to involve people to play and imagine as a part of collective history of the urban fabric.

The first two decisions to pursue this research was to find a building and to extract how structural color is produced and translate that into architecture.

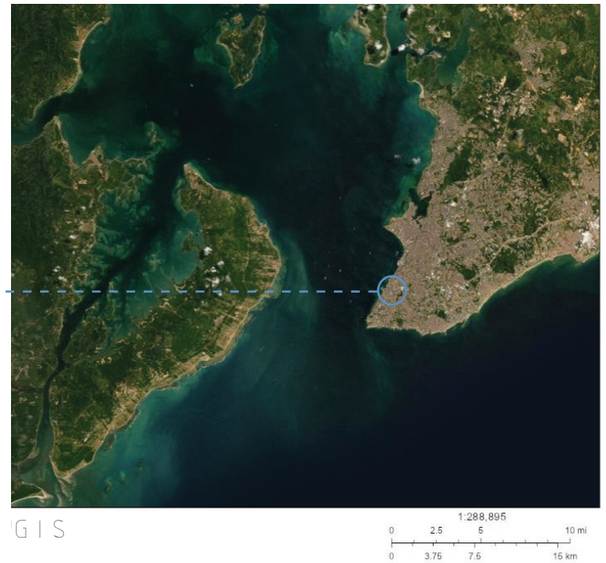


GEOGRAPHIC CONTEXT

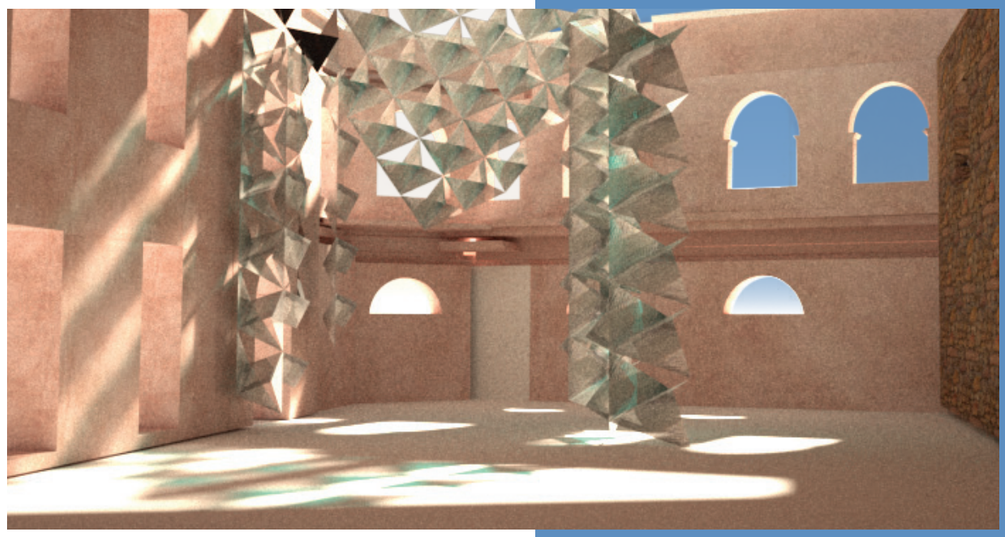
Salvador was a fascinating option due to the industrial and colonial heritage and amount of abandoned buildings. I was aware of the topography and its urban elevators and was inspired by movement and light. Due to the COVID pandemic, and the new strain in Brazil it was not an option to travel there. The Trapiche Barnabe was luckily found in Google Maps and the geographical society of City of Salvador, IPHAN and University of Bahia became key to understanding the role of trapiches in the city's development. The city's location near the Equator provided the conditions to enable this project to exist.



SALVADOR DE BAHIA,
(-12.9670° S, -38.5076° W)



GIS



The research on light optics was done in parallel to compiling the material on the Trapiche Barnabe. The angle of incidence, scattering, diffraction and studying our physiological perception of color from examples in nature defined the forms that could be applied at this scale. Color is measured by the nanometer which made it a challenge to recreate a butterfly wing at an architectural scale. Studying nature and how photonics work made it possible to produce scattering which we can see with the ocean or the sky. However, Snell's Law was the most simple experiment and best way to materialize structural color through different refraction indices.

The material behavior and helix in the lighting experiments through the physics simulating rendering engine VRAY was the longest process to explore the objective of the research. It was half of the entire duration of the project at least-- due to the caustics and speed of rendering the model.

INTRODUCTION

Images constitute a vessel for perception, thought, language and memory.
These four elements are essential to grasping reality- to understand our socio-spatial context and time. How can we remediate and create images through adaptive reuse?

The interaction of light produces a way to seek awareness from materiality and space. To engage how we perceive light, space and time led to applying different ways to research the spirit of the place. FLUX explores how to achieve historical continuity to coexist with the images of two cities- of past and present and the reality of waste. How do we transform the image of waste and make it a dialogue with the city?

“Light from Indi-European leuk- meaning to see (Classen 1993), to shine has been studied as lumen (light as external, quantifiable, objective matter) and lux (subjective, interior as sight and mental sensation)” (Jay 1993).- (Bille, M. and Sørensen, 2007)

This intervention develops how light can allow us to question what we see. Perception and how to challenge it- is the constant of this project. Perception and reality are linked through optical phenomena. Two paradoxes are the following result: the role of ephemeral nature of light clashes with the historical continuity and how waste can be perceived as beauty.

a

PART I.
FLUX

author unknown

“A ruina esconda saudade de una era anterior, mantendo uma relacao proxima com o tempo, com a transitoriedade a ruina faz entender que tudo tem um fim que pertenece e nao pertenece a este tempo, possui una singularidade sobre o tempo o espaco”
(Amarante,2013)

“The ruin hides longing for an earlier era, keeping a close relationship with time, with a transience the ruin makes us understand that everything has an end that belongs and does not belong to this time, that possesses a uniqueness about time and space”

In FLUX, the discussion revolves around i. space (the chosen site)
ii. time (history)
iii. creating continuity in Lina Bo Bardi’s analysis
iv. flux of materials
v. physical transformation of Trapiche (proposal)

1549 Salvador de Bahia is founded

1763 Rio de Janeiro becomes the new capital

1815 Modernization of the port begins

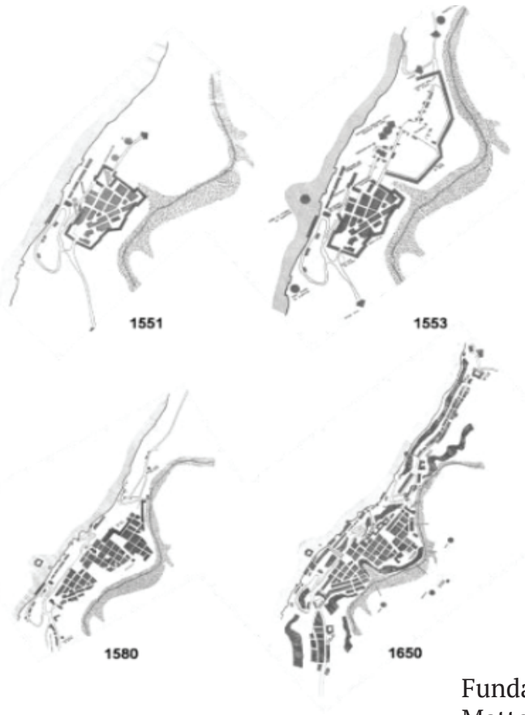
1822 Declares independence from Portugal

1869–1897
Development of transportation system, buses, cables cars and urban elevators

1913 Port is inaugurated

author unknown

Salvador de Bahia was Brazil's first capital for over two centuries. The city of Salvador was founded in 1549 and the port became the main route of access for the strategic expansion of the Portuguese colonial empire. The natural wealth of the colonial world and transatlantic trade was crucial to Lisbon, and the warehouses are built by the sea which became central to the identity of the port.



Fundação Gregório de Mattos 1998

"Map of the Portuguese liberation of the city of Salvador in Brazil in 1631", João Teixeira Albernaz, o Velho, 1631

The colonial administration influences the development of the city as well as the demand to export sugar and gold inthe seventeenth century. The middle of the seventeenth century marks the beginning of the "monumental phase of Bahia architecture" the transition from Renaissance to Baroque— the wealth from sugar becomes manifested in palaces, public buildings, churches and convents.

The city's geography accounted for protection from possible attacks due to steep slope that rises sixty meters from the bay. This fault divides the city in two: Cidade Alta (upper city) and Cidade Baixa (lower city).

The upper city was the administrative, political and religious center of the colony until 1763 when the capital was moved to Rio de Janeiro. The lower city is composed of the port, churches, the fort and warehouses with dock .

The Trapiche Barnabe was originally located 66m from the sea and is one of the oldest examples of this type of warehouses and of Brazilian

Portuguese architecture in the 18th century.

Unknown

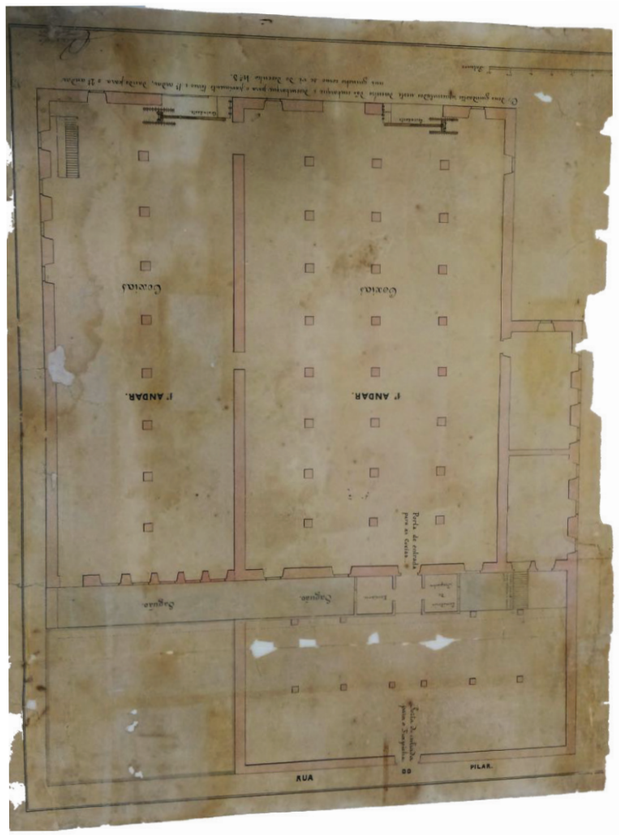
The Comercio neighborhood grew as officials in Lisbon stressed their importance in overseas commercial policy. Around 40 ships left everyday for Lisbon from Salvador. The accumulation of merchant capital led to traders claiming titles and nobility and positions in the colonial administration. The purchase and sale of warehouses created a rise in more private warehouses. In 1758, there is record of six trapiches in the port. (Andrade, 2016) Trapiche refers to an old term for a mill, typically of sugar but takes on a different meaning after the seventeenth century when merchants expand their exports and need to store products to supply vessels. Per year they stored about nine to ten thousand boxes in addition to tobacco, flour, wine, dried cod, oil, leather and wood. By the 19th century there was twenty-six warehouses.

(Dudu Assuncao 2018)

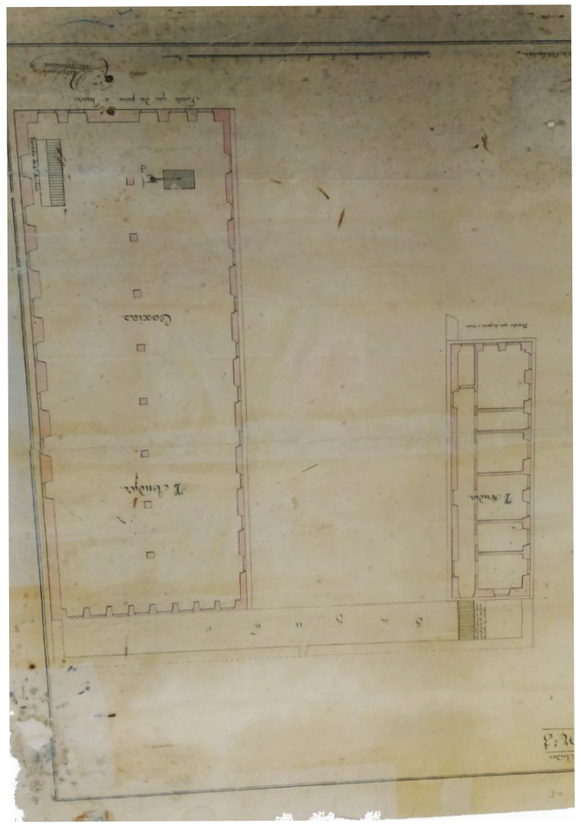
Unknown

The main export of Trapiche Barnabe was sugar where it was extracted, weighed, packaged and stored. It appears in official records in 1711 where different captains are authorized to make shipments of sugar. It is believed it was initially a single story that was connect to the sea of the Baia Todos os Santos.

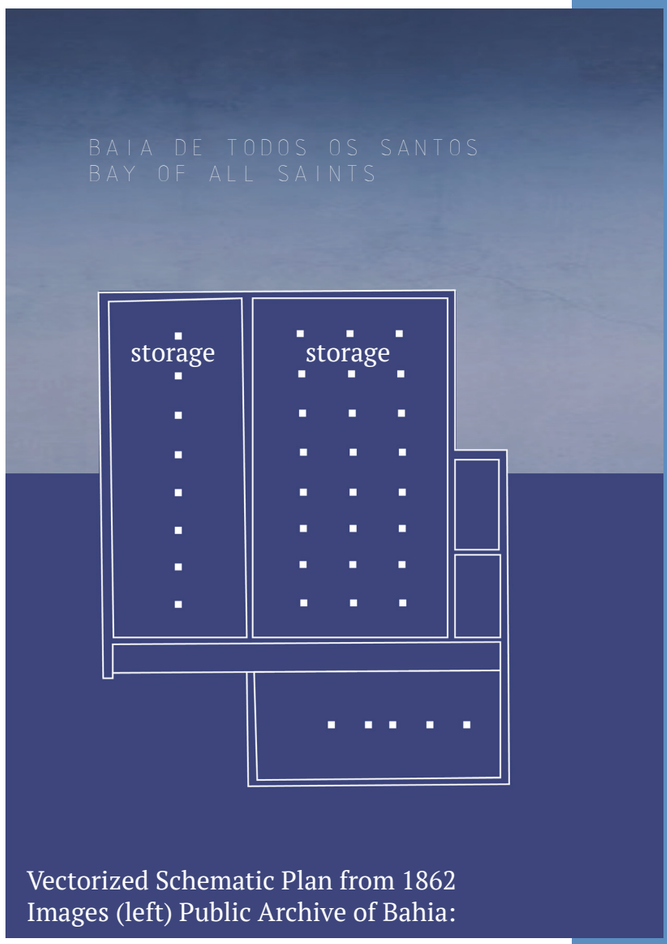
From 1758 there are plans and elevations from Jose Antonio Caldas from Rua do Pilar, the only road before in communication with the port. The Trapiche consisted of only two floors and a basement. The first reference to an expansion of the Trapiche Barnabé appears in 1824. Documents mention the existence of two trapiches described as Barnabé Grande (Great Barnabé) and Barnabé Pequeño (Small Barnabé). It is believed that after the collapse in 1813, the original part was restored and expanded on the southwest side creating two warehouses. (Andrade, 2016)



first floor 1862: Public Archive of Bahia 2016



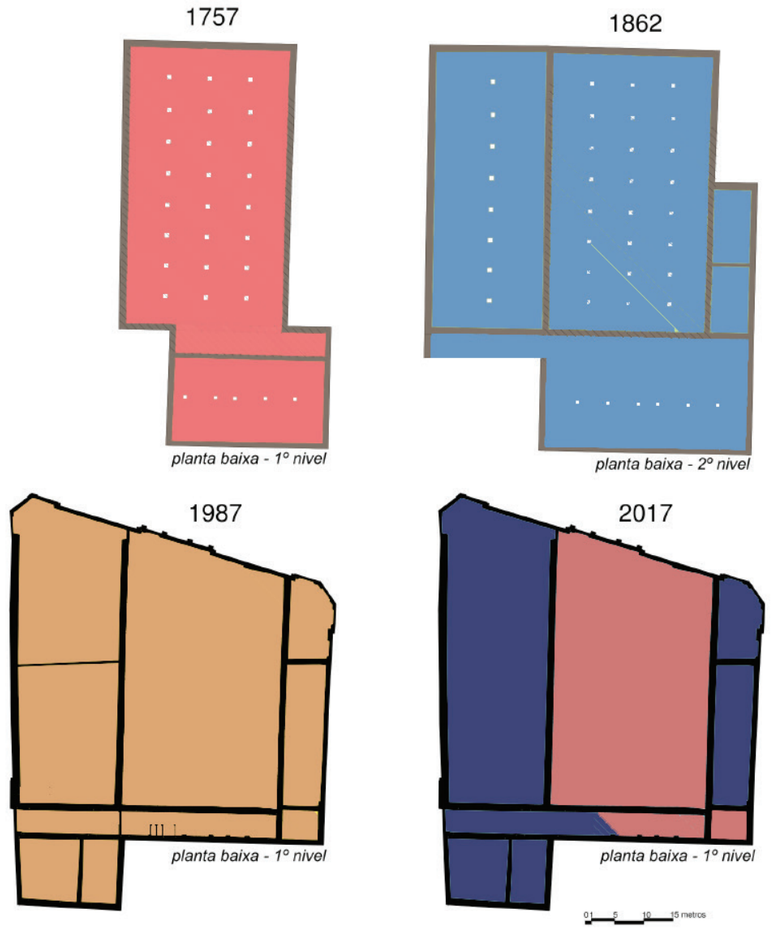
second floor 1862: Public Archive of Bahia 2016



Vectorized Schematic Plan from 1862
Images (left) Public Archive of Bahia:

The Trapiche Barnabe was built directly on the coast of the Bay of All Saints and until the port expansion begins and the sea is filled in shortly after these plans were drafted.

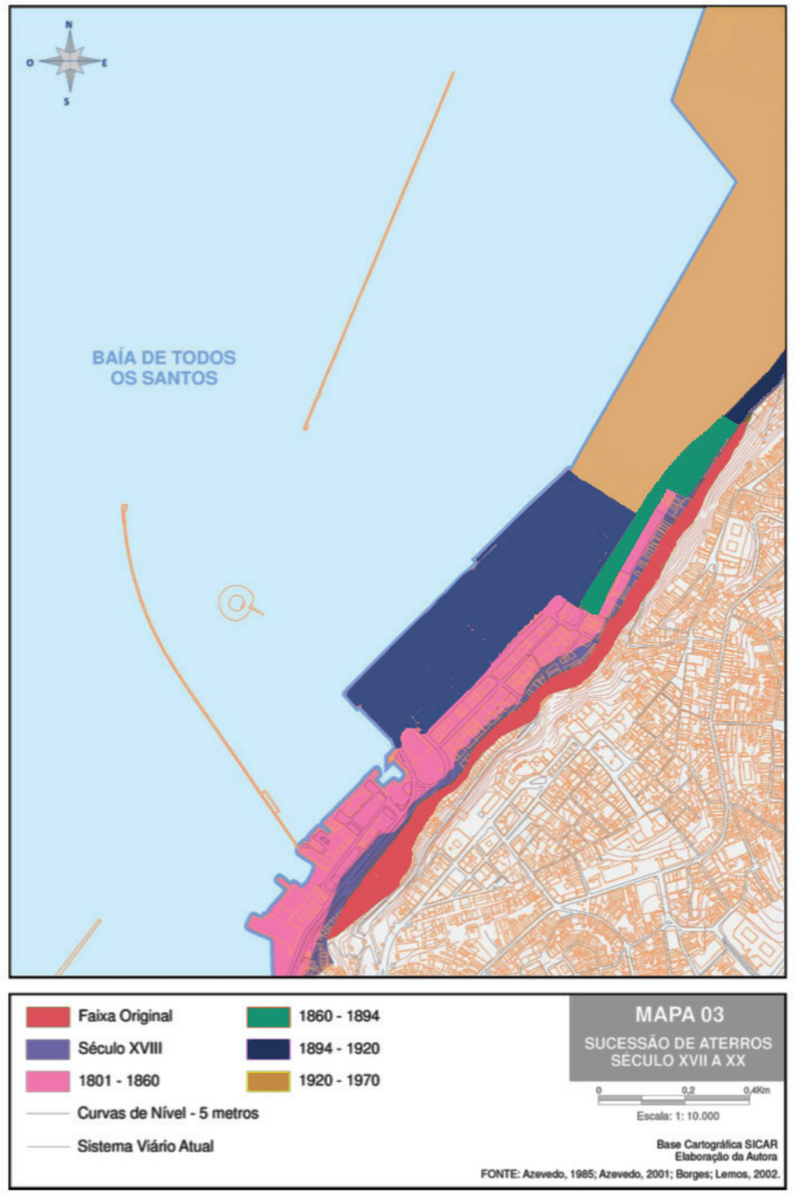
DOCUMENTATION OF TRAPICHE BARNABE + CONSEQUENT EXTENSIONS



original structure

Larissa de Souza 2017

The Trapiche Barnabe with every century has witnessed an extension due to Comercio and the port's expansion. The 20th century however, marks a decline of the economic activity of Comercio and the abandon of these historic trapiches. 2017 refers to the present state of the Trapiche- there was no extension only clearing out overgrown vegetation. This diagram explores the flux of the space.



Santos, 2007


TROPICAL

Source: http://www.salvador-antiga.com/
Keystone New Company

(Robino, 2021 Collage)

In 1808, the Portuguese court arrives in Salvador de Bahia due to the invasion of Napoleon in Lisbon. The transfer of power when the Portuguese capital becomes Rio de Janeiro begins the transition from agriculture to industry as they create trade relations. The discovery of gold also creates a population boom. During the time that the court was located in Brazil, the Portuguese royal family collectively granted more titles of nobility than it had in its past 300 years of existence in ‘Portugal.

Around 1815, the initial phases of modernization in the Port of Salvador begin, improving the storage and commercial logistics with pressure from the imperial government. The legislation demands infrastructure that can attend to the commercial demand of imports and exports especially due to the increase in coffee production. Sugar,diamonds from the interior and more agro-industrial complexes lead to the economic expansion and modernization of urban infrastructure. The architectural language of changes from ornate stucco to glass and bricks. In 1913, the new port is inaugurated, to create more avenues they expanded the port through filling in the sea and the connection to the upper city is improved where the entertainment, nightlife and retail are flourishing in the early 20th century.

(Unknown)

1873

The expansion of the port improves access greatly through these new avenues and connection to the upper city through a hydraulic urban elevator in the cliff.

Geographical Society, City of Salvador de Bahia

(Unknown)

(Unknown)

PLANO INCLINADO DO PILAR 1889

To connect these two “cities” inventions such as cable cars and urban elevators sprung about the city at the beginning of the 20th century. They have a functional and historical role in the Salvador’s urban experience. Directly above Trapiche Barnabé, is the cable car station Inclinado do Pilar where the passengers arrive to the southeast façade which is painted in array of colors in a colonial style. This encounter from above creates a distinct view and experience from the upper city to the industrial part below where Trapiche Barnabé is found.

(IPHAN 1953) Inclinado de Pilar with Trapiche Barnabe below with roof intact

This urban transformation of new roads with the historic center, changes the economic composition of the area. The inflow of poorer sectors of the population: low income households, marginal groups of freed slaves, immigrants, small merchants and craftspeople fosters a strong ethnic identity. "The big colonial houses were split into small apartments, tenements, and workshops for craftsmen and merchants."
(Azevedo, 1990)

From the 1930 onwards there is a gradually decline of dynamic economic activity. Comercio's former glory is marked by decades of decay and abandon. The physical environment is recognized for crime, drug-trafficking and prostitution.

(Flavio Damm, 1966)

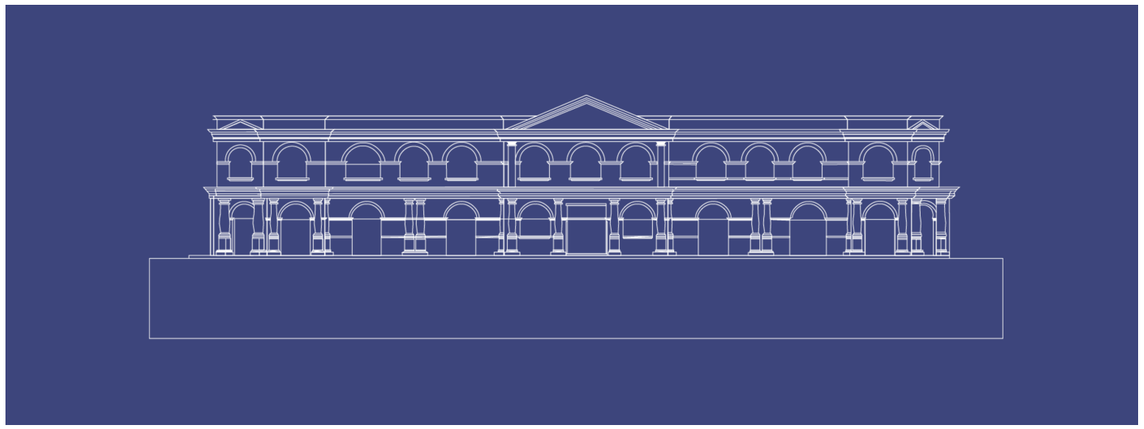
The physical existence of Trapiche Barnabe has resisted centuries and will remain always a link from the upper city to the port. It is visible, open but its clandestine nature lingers. As a result, it exists in a state of paradox. The city has made efforts to improve the property in the 1990s to mimic colonial style of Pelourinho, the historical World Heritage Site. The overgrown vegetation was cleared, as well some of the interior structures. It still has an air of abandon and decay despite the improvements on the facade. A new owner purchased it in 2003 but it exists as a void. It is a stage for events or a parking lot next to the Tax Office.

To keep it as a vestige was one of the questions I came across at the beginning of the project, why rebuild and what does it mean to preserve a historical building? What did it symbolize and what should be remembered? How much will and can disappear?

The Trapiche is a reminder of decadence and how ephemeral growth, wealth and power are. The growth of the port of Salvador and the state of Bahia was created due to sugar and its export. It is also symbolizes the passage of time from the capital of a colony and the first point of exploration of such a vast territory. The influx of cultures of a port and the strategic geographic location emerges an identity between three continents.

Brazil was the world's largest sugar exporter during the 17th century and therefore Brazil imported more enslaved Africans than any other country. Sugar plantations shaped Brazilian society from 1550 to 1835. Brazil was the last country to abolish slavery in the western world in 1888. The rapid expansion of industry, transportation, infrastructure and modernization was due to this cruel practice.

Although at an ethical level our society has progressed, social hierarchies and tensions have decimated, we can reflect on how this cycle of consumption and growth is a universal reality. How do we materialize our present day blindness?



(Robino, 2021)

(4)

The following chapter aligns how spatial recovery coexists with the past without glorification or adapting it to an agenda. Conservation specialist Larissa de Souza allowed me to understand and recreate from the other side of the world— all the details of the Trapiche Barnabé with countless documentation. A fair share of the buildings in the historical centre are abandoned and this lead to questioning the social context of the inhabitants there. How would they use this space and how could it fit the area? The immensity of the Trapiche Barnabé and the use of light in the building did not suit the needs of a library, a museum or an office. Urban recycling at this scale without developing historical continuity would be careless or superficial.

Subconsciously, my primary influences had a poetic inclination to seek this cohesion of time and space. Creating an interaction between symbolism and realism drew a parallel to the cultural and political context of Latin America. An amalgam of paradoxes: political struggle and celebration, tradition and hybridity, rich in natural resources and lacking in infrastructure, the binary opposites of urban and rural life, Western rationalism and local folklore; etc. Popular culture dwells on these imaginary borders of these paradoxes by default. The cities have been shaped by new discoveries (geographic, natural or economic value) and the influx of new perspectives creating an endless patterns of social and historical narratives which somehow share a certain universality.

The effect of these opposing realities is hard to define yet easy to identify in literature, art, language that has influenced me in regard to this project. The term magical realism is first mentioned by German art critic Franz Roh in 1925 who applied it to a group of German painters who rejected Expressionism and advocated a return to the representation of reality from a new perspective- a construction of everyday objects transformed by surreal elements that defy time or natural laws that reveal a human truth. (Moore, 2018) By definition it appeared in Germany in 1925 however, disillusionment and the act of storytelling have existed long before.

The term magic realism becomes widely used by literary critics in Latin America in 1927 when Roh's book is partly translated into Spanish for the magazine Revista de Occidente by the Spanish writer and philosopher Jose Ortega y Gasset. His philosophical work explores time, globalization and politics that still applies to our society today.

In the 1930s, Argentina, Brazil and Uruguay are eager to receive European architects to transform their cities to match their emerging and strong economies. Following the wake of the Second World War, Modernism is extremely prolific in South America due to the newly arrived Europeans escaping the conditions of fascism, their political scrutiny of Modernism and destruction of a continent.

Intellectual freedom, structural innovation and a strong economy provided for exchange of ideas and experimentation.This new generation led Modernism in a new direction— being aware of context. Brazilian Modernism flourished due to the tropical climate creating continuity with landscape between the exterior and interior.

Although Modernism is not the aesthetic expression intended for this project, it does not respond to this space— Salvador also provided for exchange of ideas and experimentation prior to the military coup in 1964. This involved the presence of Lina Bo Bardi who was a lecturer, curator and architect for many institutions in Salvador de Bahia.

LINA BO BARDI

Lina believes that two types of restoration of historic centers, monuments or cities:

The “recovery” of cities, spaces and structures or the “recovery of human acts and events” which surpass the artwork as an object and refers to the authors and society that constructed it and how they lived which connects the present in a historical continuum.” (Condello, Steffen
Lehmann and Springer International Publishing Ag, 2018)

Lina Bo Bardi arrives in 1946 to Brazil from her native Italy, where her work creates a bridge between avant-garde and tradition becoming one of the most influential architects of 20th century in South America. The combination of her experience with reconstruction, as an architectural critic and her immersion leads to an anthropological and philosophical construction of the cultural identity of Brazil.

I was familiar with her projects prior to writing my thesis— mainly her choice of materials and her approach to the site and landscape. Originally, I was drawn to the building of Solar do Unhao, as they had the same typology and was a ideal precedent. I was aware of her adaptive reuse in Sesc Pompeia but it was not until later in the project I realized how her four decades of practice in Brazil had a holistic approach to the social fabric and the research she had done as a director of the Solar do Unhao (MAMB) or for her exhibitions. She considered Salvador her home and had a unique affinity for the transformation of waste and recycling.

Discovering the popular culture and this artistic ingenuity that she observed and wanted to diffuse against commodification was precisely how I wanted to present the perception of waste in our present society. Her strategies aligned with my proposal as a critique of objects and giving space to the present. She believes that recovering an object but inventing its life connected to humans and their constant state of adaptation is what guides her interventions. Her work is tactical and subversive to order: the tactic is about introducing an element of ingenuity and resourcefulness. In contrary to technocratic strategies of “produce, map and enforce” her tactics are about “utility, manipulation and altering the existing object”

She promoted popular culture and subsistence, survival with limited resources and scarcity. She believed “recycling revealed the power to adapt to new demands of importance that is equal, or even superior, to the design” (Condello, Steffen Lehmann and Springer International Publishing Ag, 2018)

She was influenced by the Situationists theory of Derivé and the essence of Japanese culture. In her handwritten notes, she claims “In Japan, there is no shame in using that which, in the West, is waste- just look at things in details instead of looking over them lightly.” What she called the “civilization of survival” was her admiration of turning waste of simple domestic objects into utensils for every day life. (Renato Anelli).

This appreciation of essentiality and reuse without superfluousness of consumer culture with recycling objects, packaging and buildings had a profound impact on her unique influence and trajectory in Brazil.

She carried out extensive ethnographic documentation of her discoveries in Brazil’s Northeastern backlands and their tools for everyday life, work and play. She was inspired by artists and intellectuals in Recife and Ceará to develop research on popular culture and reuse in 1950 primarily for her magazine Habitat. (Lina Bo Bardi et al., 2018)

Consequently, the state of Bahia hires her to curate these crafts, tools and images with theatre director Martim Gonçalves to create the exhibition for the V International Biennale Of Arts in Sao Paulo.

“The criterion for ‘critical restoration’ is based on absolute respect for the entire monument, or as a whole, representing ‘poetically’ the modern interpretation of historical continuity, seeking not to embalm the monument, but integrate it to the maximum extent in modern life.” (Bo Bardi 2013)

The state of Bahia invited Lina Bo Bardi to return to Salvador after the success of this exhibition to direct the Modern Art Museum of Bahia on the site of the Solar do Unhao, a former sugar mill in Salvador. Her intervention preserved some of the original structures and created permeable spaces facing the sea where she demolished some of the existing spaces to make an esplanade open to the public.

She combined both exhibition spaces and educational program as a documentation center for popular art and a technical school to go beyond its role of a museum. She was simultaneously active as a teacher in the Federal University of Bahia from 1960-1964.

In 1985, the historic center of Salvador was recognized by UNESCO as a World Heritage Site. The City of Salvador wanted to reverse the state of physical degradation since the center was practically in ruins with over thirty percent of abandoned properties.

She was comissioned to return to Salvador when she was over seventy years old. She developed a rehabilitation project around the social landscape, culture and vegetation. This consisted of a third of her design production.

She respected the local population, existing fabric and the past but avoided any nostalgia. The idea of restoring a building to its “original state” does not exist: ruins neither disappear nor can be hidden— simply transformed into spaces for living, working and leisure. (Bo Bardi 2013)

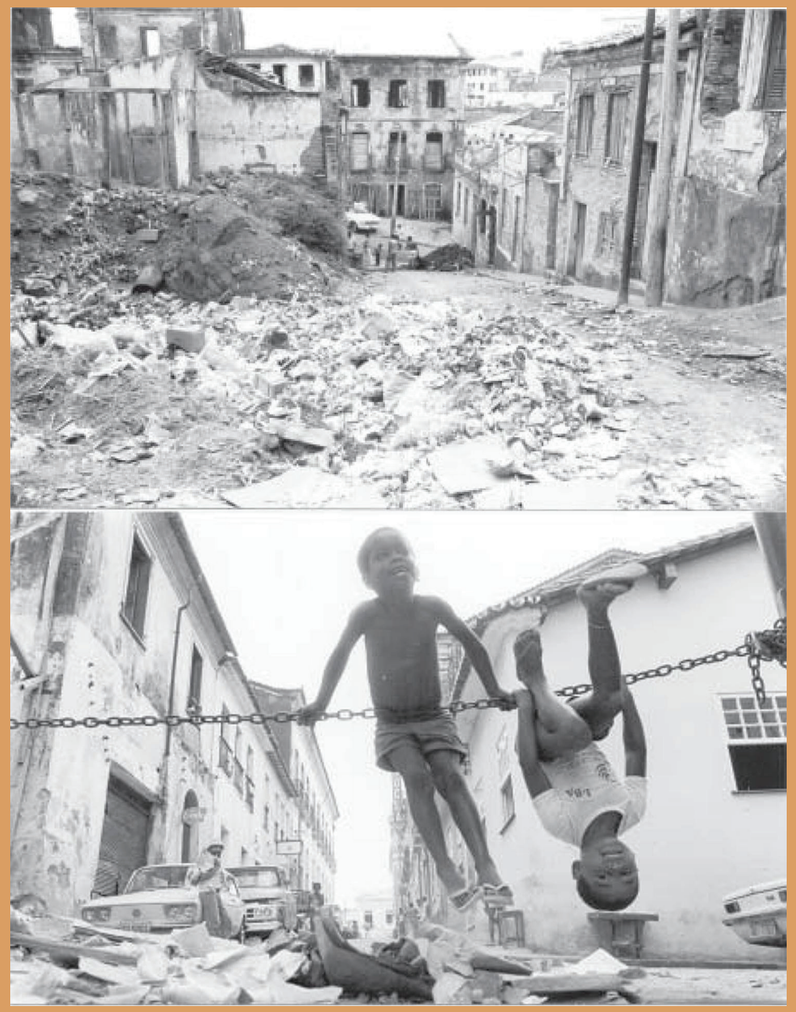
She mainly did spaces of leisure in Salvador such as the Bar of the Three Arches and the Coati restaurant.The character of these places has mythical quality linked with time that is not homogenous or lineal contrary to a utilitarian longevity.

Creating a ludic space that gives space to the present. Lina Bo Bardi’s approach to spatial recovery brought back life to the places. Her proposal was based on what she calls the “spirit of a building” which unites work, art and nature. The recovery of a building is a dialogue between the materials and the territory shaped by the form of human creativity and civilization. (Lina Bo Bardi and Universidade De São Paulo, 2002)

“It is in the constancy of the laws of nature that the scientist can seek truths to understand its functioning, but it is the architect, as an artist, who, by mimicking nature, creates a new world, a new “nature” (Lina Bo Bardi and Universidade De São Paulo, 2002)

Lina Bo Bardi's vision for Pelourinho was not fulfilled. Her proposal respected the popular culture and ethnic identity of the residents and her intention was to make encourage the historic continuity to coexist and engage with the life of its residents and the local traditions. She resigned the comission in 1989, according to her colleagues the project wanted to take a tabula rasa approach to clear the residents of Pelourinho.

The State of Bahia changed direction to develop tourism and economic potential. Antônio Carlos Magalhães, began an intervention project called "Program for the Recovery of the Historic Center of Salvador" which consisted of 7 stages. (Cao, n.d.)



The intervention during the government of Antonio Carlos Magalhães excluded the past and consumed the social and cultural landscape. According to Barros and Pugliese (2005), around 95% of the people who lived there were tragically expelled from their homes. The appropriation of urban space and expulsion of 1,800 families led to the disintegration of community coexistence.

Now imagine that this is still the present of thousands of people, victimized by an exclusionary revitalization project to make this World Heritage Site perfect for tourists, unthinkable for its residents.

"Most of them now live in the surroundings of the Historic Center, in the long Baixa dos Sapateiros, as homeless people, still linked to the territory of Pelôurinho, where they constantly bump into police forces that prevent them from transiting there." (Cao, n.d.)

UTILITY, MANIPULATING + ALTERING THE OBJECT
MATERIAL FLUX

Images: Studio Swine, Can City 2013

URBAN ALCHEMY

“To violate an era by embalming it in plaster means ignoring the fatigued and painful process of humanity”
- Lina Bo Bardi

A circular approach to spatial recovery was one of most important factors to this project. Creating a modular strategy that could recycle material is where this project began looking at the WOBO bottle by Heineken and RE3 by TU Delft which will be discussed in the following chapter.

I was interested in a way that ordinary objects an waste could be used as a building material that modulated light. Before understanding the light optics and the laws of physics, it was critical to acknowledge the presence of waste and how to transform it. Looking at construction waste was difficult without field research on site and agricultural/ food waste would require help from other faculties/ backgrounds and time to test its strength/ tension/ compression/ durability.

I was eager to experiment with all the possibilities which some of which lead to the present narrative of the building. The recycling sector in Brazil relies on the catadores or informal waste collectors.

Ninety percent of recycled material in Brazil is collected by the catadores. The 2020 Recycling Yearbook shows us that, in 2019, c ollectors’ cooperatives ensured that more than 1 million tons of waste were destined for recycling, moving an amount of more than half a billion reais with the sale of these materials.

The National Movement of Recycled Material Collectors estimates there are 800,000 catadores according to David Amorin, the communication coordinator of the MNCR. They are organized in over 1,800 cooperatives and are responsible into transforming waste into merchandise again. Among seventy percent are women and they represent the majority in the organization and the regional, state and national comissions. Many are homeless, single mothers, children or people that have lost their relatives. The census in 2010 counted 387, 910 waste pickers nationwide did not count the scavengers that live and work in the open-air dumps, many of them are marginalized by society faced with constant prejudice. They suffer from a very cruel social stigma and their difficult work conditions are compounded by poor living conditions. Travelling long distances, lifting and pushing the material for more than twelve hours a day. The recycling rate per waste picker is estimated between 606 to 1608 kg/ person/ month depending on skills and the type of equipment available. (Ramos et al., 2013)

Society denies their importance being least privileged in society and their work goes unrecognized because they bear the image of “living with waste”.

Teaching the social value of waste-picking and protection of the environment is a struggle for the catadores. They feel responsible and dignified for cleaning their city, not relying on crime, drug-trafficking gangs or naive tourists.

Thomas, (2018)

Unknown

The trade of collecting aluminium cans, plastic and glass bottles outperform the recycling rates of the records in Europe and the United States. The materials most commonly collected by the waste pickers are plastic , aluminum, cardboard, iron,white and mixed paper. Only 70.8% collect glass claiming there is no market to sell this material that is in the vicinity of this organization there are no companies that buy glass. (Ramos et al., 2013)

To give you an idea, the kg of cardboard in São Paulo, was R$ 0.50 and the kg of PET crystal, R$ 2.50. In Poá (SP), according to Marcos Antonio Lima, of the Cooperative for Recycling for the Environment (Cruma), cardboard was oscillating between R$ 0.80 and R$ 0.90, kg of glass between R$ 0.14 and R$ 0.15, the kg of PET crystal between R$ 3.30 and R$ 3.50 and aluminum was R$ 5.60 per kg. To obtain a minimum wage of R$1,045.00, it would be necessary, at today's price and without the costs of the activity, to collect 418 kg of PET in Poá, and 298 kg of PET in São Paulo. The 2 liter PET bottle of soda is, on average, just 47 grams....
(www.uol.com.br, 2020)

The documentary Ecosystem of Waste interviews the president of the Bahia state chapter for the National Movement of Catadores (MNCR) which shares that during Carnival it is an opportunity for catadores to make more than in one week than an entire month but shares that there is more catadores now than the last 15 years.

In seven days they can earn 1200 Reais, the current minimum wage in Brazil is 1039 Reais. They also receive a daily salary of 60 reais per day during the 7 days of the party according to the Cata Bahia Network and the MNCR. After the party ends at 5am, all the material gets collected and the police gives support to the waste pickers central area. (Thomas, 2010)

In Salvador, during in Carnaval catadores travel from all parts of Brazil for the week-long celebration. “After the party ends, people remove their costumes, outsiders leave and don’t remain to view the city naked and mistreated. Beyond celebration, sound, and euphoria of carnival there is an ecosystem of waste, defined by the connection of consumerism, street vending and waste picking” (Thomas, 2010)

This quote began the point of departure for creating a dialogue in Salvador. The carnival became sort of a metaphor of what is beyond the facade: the ecosystem of waste and the denial and marginalization of the catadores. The faded glory of the Trapiche Barnabe and the euphoria of Carnaval share the ephemeral nature that I wanted to create to transform the void through an immersive fantasy of objects as a way to question the reality of consumerism and waste.

CIRCULARITY +MATERIALS

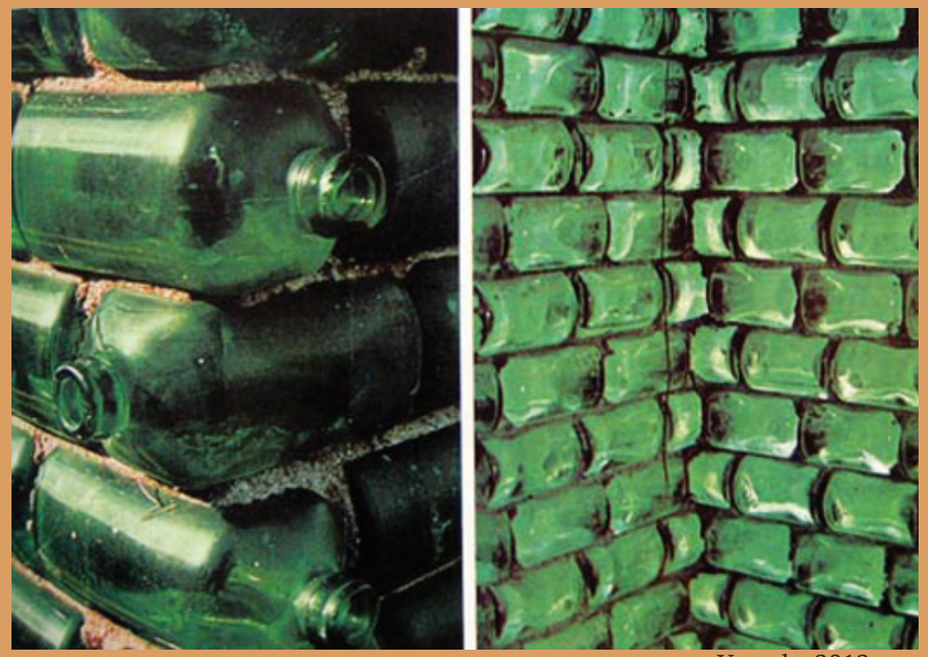
This project aims to support their role in society through exploring the flux of materials and transforming their life cycle using light as a tool to challenge our perception and the way we see objects. Glass recycling into building materials provides an alternative approach to reinvent the market. It becomes a building material, a tool for dialogue, and a space for innovation.

Without the help of light, color is invisible. This experience comes hand in hand with our perception of waste and how we can see it transforming a ruin. The circularity of waste in Salvador becomes part of the urban alchemy and constant flux. To develop new ways of using glass, aluminium, vegetable oil, the catadores have an opportunity to improve and have access to knowledge.

The Trapiche Barnabe becomes a laboratory, foundry, glass atelier and learning space. The alchemy, is to bring the light holistically and humanistically on their role. Their main concerns are inclusion, their children and their food security.

Studio Swine-
Can City: recycled aluminum and vegetable oil transformed into objects that are a portrait to street life in Sao Paulo

WOBO BOTTLE BY HEINEKEN



Yoneda, 2012

After Alfred Heineken visited Curaçao during a world tour of his factories in 1960, he was struck by the litter of beer bottles on the beaches and the poor quality housing due to the lack of affordable building materials. (www.heinekencollection.com, n.d.) He saw the potential to design a bottle that could be recycled as a building material to solve housing shortages.

He enlisted Dutch Architect N. John Habraken to design a functioning beer bottle, which when emptied and laid on its side, became a self-aligning, interlocking, glass brick. Habraken's design could fit the neck of one bottle into the base of the next, while the sides were lined with rows of small bumps that made it easier for both people and mortar to grip them. To overcome the problem of creating corners and openings without having to modify the bottles, they were designed in two sizes: a 500mm version and a 350mm 'half-brick'. In 1963, Heineken produced 100,000 of these bottles but the idea was met with resistance.

Yoneda, 2012

“Re3 Glass” was developed by TU Delft Glass + Transparency group. Using discarded glass to create load bearing building materials, Re3 stands for reduce, reuse and recycle. They wanted to reinvent the limitations of all glass structures which are confined by planar surfaces and use interlocking geometry that would allow it to be reversible.

Their investigation implements the use of everyday glass waste from beer bottles to television screens to explore the recycling opportunities. Casting existing glass is less costly electricity wise than creating raw glass. Using larger shards creates wave-like color in the final product. Crushed glass or cullet tends to be easier to melt and creates a more dense glass. The transparency of glass creates an interesting solution to repair historic buildings and reveal the state of the monument.

Photo by Faidra Oikonomopoulou

Creating a standardized glass brick reduces number of moulds. By pouring molten glass into moulds, solid 3-D glass components can be attained of considerably larger cross-sections and of virtually any shape. A steel mold allows for standardization and to reduce waste rather than plaster or terracotta. The cooling process called annealing must be controlled for hours to avoid cracks and uneven shrinkage. Cooling down avoids thermal shock and internal residual stresses Currently an estimated amount of 367.000 tonne/ year of borosilicate glass waste is being discarded, instead of recycled (Rodriguez Vieitez et al., 2011; Scalet et al., 2013).

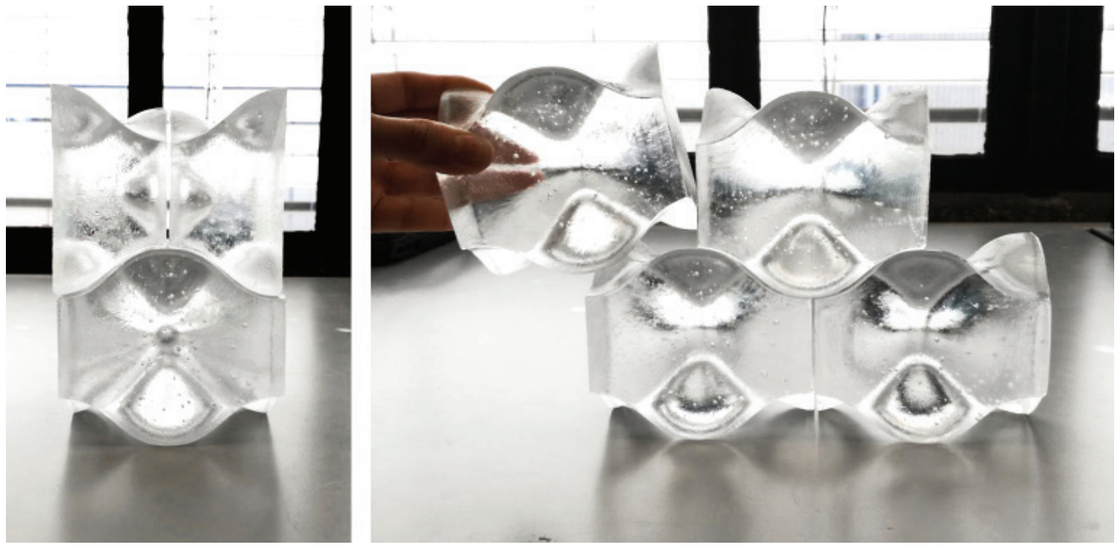
Borosilicate glass is considered as a standard for many industry due to high optical qualities and a low thermal expansion coefficient. Typical applications for borosilicate are oven ware, lightbulbs and laboratory and pharmaceutical waste.It is also strong in compression and fire resistant. Glass equipment construction for optics and microelectronics have tested that recycled borosilicate glass maintains its mechanical properties. Therefore, casting recycled borosilicate glass could be applied to the built environment.

The Glass Group at TU Delft prototyping and research was crucial to being able to understand recycling, fabrication and structural feasibility. Designing with glass bricks is usually custom-made which was not part of the urban re-cycling agenda of this project. Eliza Scholtens’ work explored seven prototypes with different recycled borosilicate products and cullet size.

They analyzed the Crystal Houses by MVRDV for Chanel, the Atocha Memorial and the Optical House by Hiroshi Na-kamura. Crystal House uses soda-lime glass and UV light applied to adhesive. The Optical House has a wall of 6000 borosilicate blocks. The facade requires a substructure, metal dowels puncture the assembly of glass bricks from a steel beam above. It is dry assembly which is recyclable.The Atocha memorial is 11 meters high and is made of 15,6000 borosilicate glass blocks and self-sup-porting structure using a rigid adhesive. (Scholtens, 2019)

Table 2: Comparative assessment of the different interlocking block types based on the established design criteria

Block type	A	B	C	D	E
					
Interlocking mechanism	smooth curves	smooth curves	male and female blocks	sliding blocks – intense curves	semi-sphere keys for vertical stacking – ability to rotate
Shear capacity	high	high	moderate	moderate	moderate to high
Self-alignment	high	high	high	low	high
Multi functionality	high	high	moderate	moderate	high
Equal mass distribution / homogeneous annealing	effective	effective	risk of internal residual stresses	risk of internal residual stresses	effective
Lim. number of dif. units / ease of assembly	high	high	moderate	moderate	high



Curvy geometries allow for homogenous shrinkage leading to an internal stress free object. Photo by Faidra Oikonomopoulou

I was particularly interested in Eliza Scholtens last prototype that when it came to light and materials. It was a combination using 25% tubes, 25% laboratory ware, 50% of Pyrex oven materials. CUBE seen below had a mix of cullet of between 2.3 and 5mm and powder. The mix of densities created a wave pattern and almost gradient effect on the volume. (Scholtens, 2019) It had an extreme amount of air bubbles which would also provide more interesting lighting effects since the refraction indices would vary.

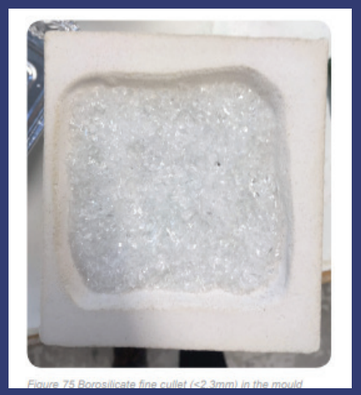


Figure 75 Borosilicate fine cullet (<2.3mm) in the mould

(Scholtens, 2019)

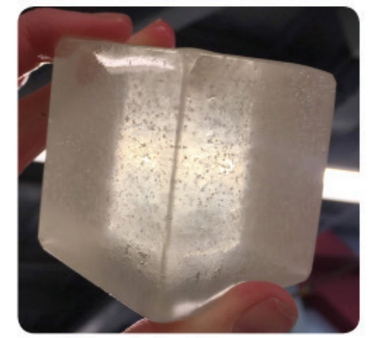


Figure 76 Cube made of fine cullet

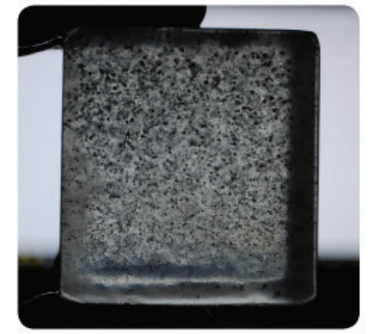


Figure 77 Extreme amount of internal air bubbles

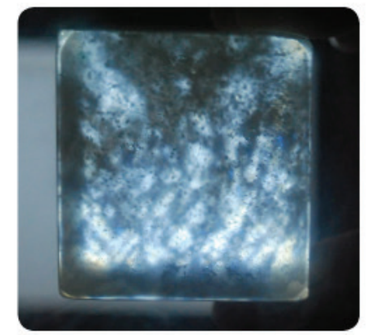
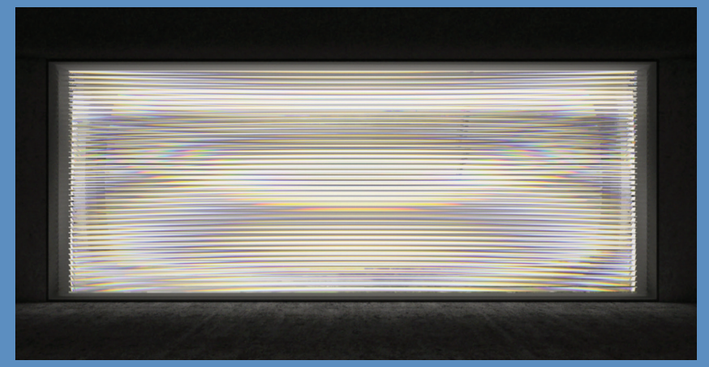
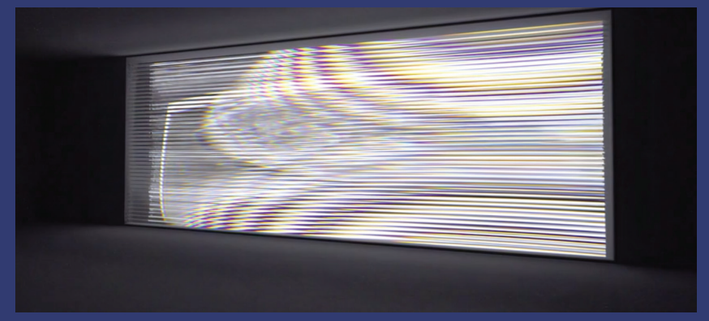
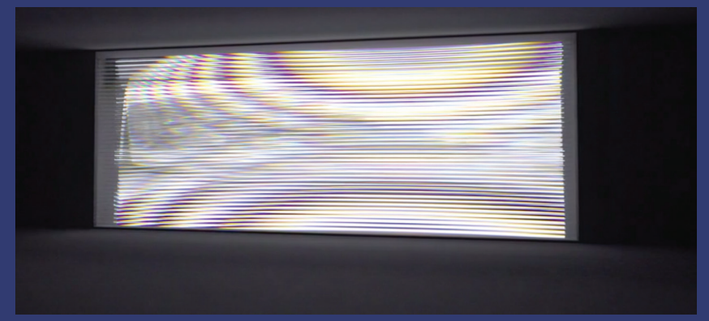


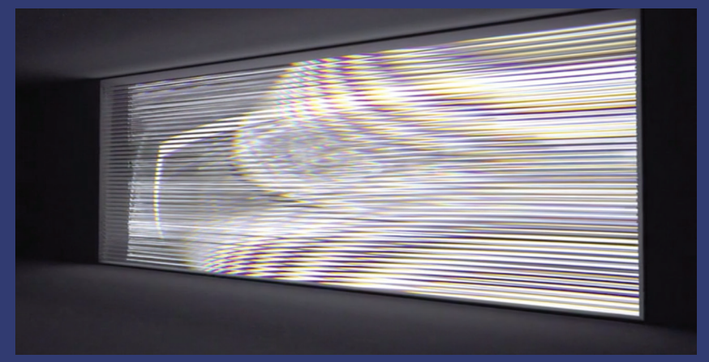
Figure 78 Cube internal stress analysis (side view)

BOMPAS | 2019







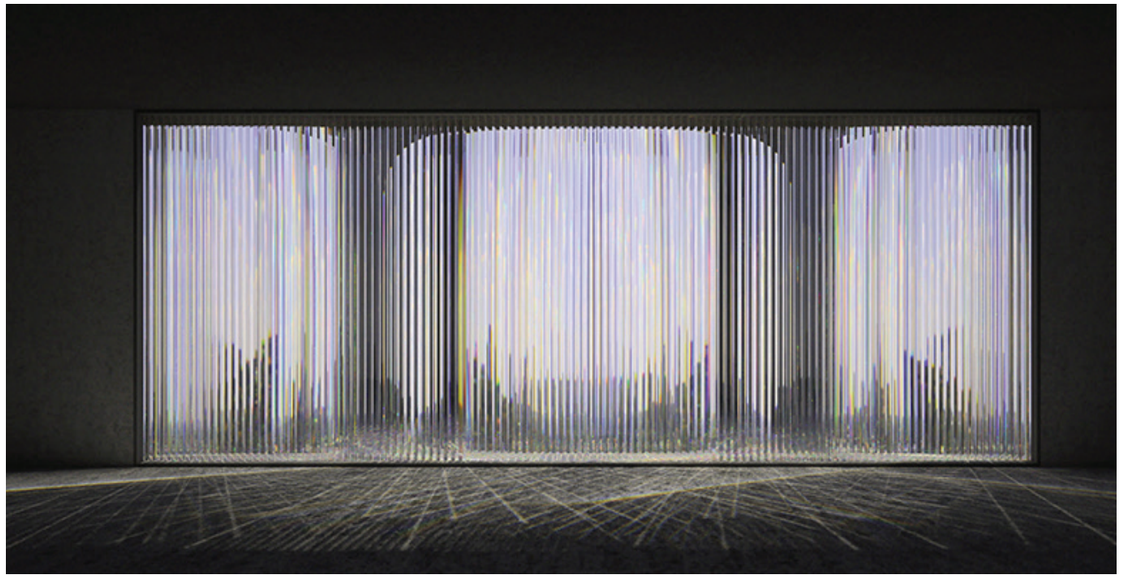


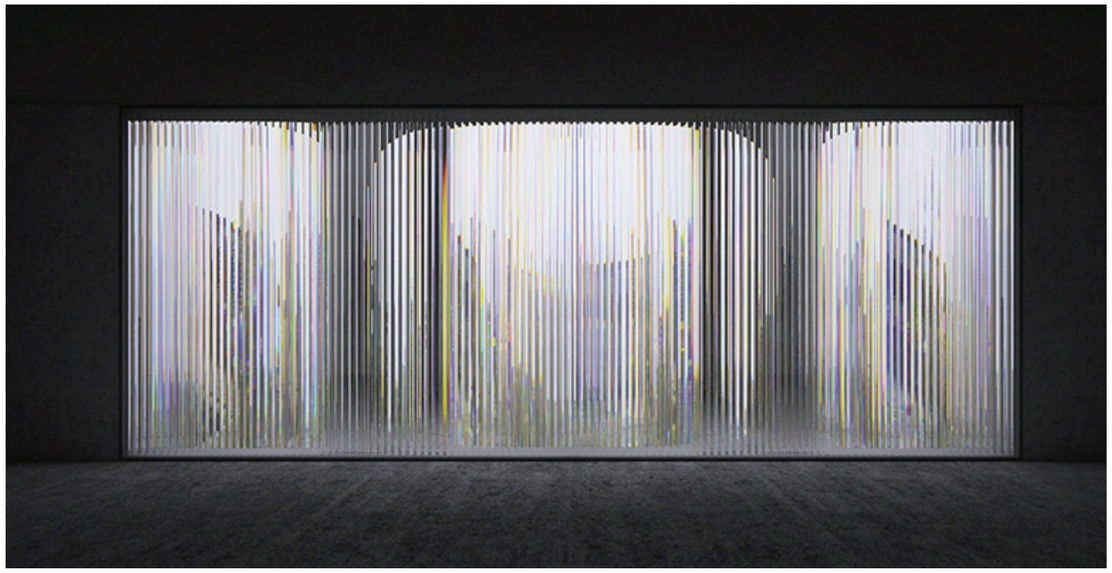
The work of Philippe Bompas, architect and researcher at EPFL explores caustics and controlled light through geometry and parametric analysis .

The optical properties of borosilicate when calibrated with photometric light simulations creates reflection of color spectrums.

On the image above we can see an installation of borosilicate rods but depending on the observed angle, light bends and forms iridescence.

The rods in a controlled light environment produce holographic scattering due to the curved glass.





Useless Window Experiment with Natural Light
1. Sunny
2. Overcast

Philippe Bompas

Using recycled borosilicate glass crushed to cullet and silicon dioxide which is used for molded glass objects we can achieve near zero thermal expansion. Cullet reduces costs for production since it needs a lower temperature to melt thus releasing less carbon dioxide.

This intervention relies on mixing 40% recycled glass and 60% fused silica (mechanical and optical properties). Depending on the size of the silica particles it can appear red, green or blue and produce structural color depending on viewing angle.

As humans we are drawn to reflection of light due to our instinct for water, the reflection of the different elements this building create spaces for learning and interaction and to use transparency to question our society.

For casting bricks using solely borosilicate or a combination of silica/ borosilicate should be used to reduce shrinkage. For 2D elements, soda-lime/ float glass elements which use are more abundant can be used.

Fondazione Prada

Fondazione Prada

ROOF MATERIALS

(Material District, 2010)

The roof material is made up of aluminium foam panels which are durable, strong but very light weight made from 100% recycled content.

They are heat and corrosion resistant which suited the tropical climate near the sea. They also have very strong wind resistance. They can be made into complex geometric forms easily. They are also recyclable.

Air is injected into molten aluminium which creates gas bubbles throughout the metal and the foam is removed for cooling. In some cases the fine ceramic particles are also dispersed when air is injected to stabilise the air bubbles and create panels with different details and textures. This material also provides great sound absorption.'

Currently, it is produced in three different thicknesses:
 12.7mm, 25.4 mm and 43.2 mm

Standard panels sizes: 1220 mm x 2440 mm, 1220 mm x 3048 mm, (Cymat, n.d.)
1220 mm x 3660 mm

CAN CITY BY STUDIO SWINE

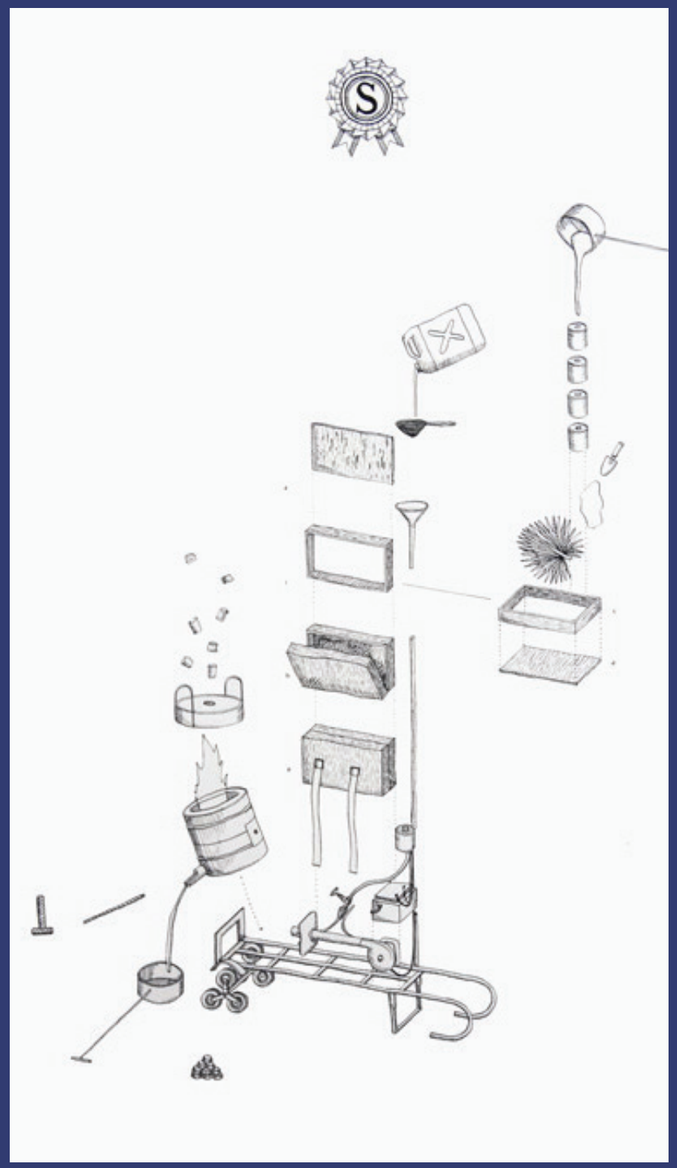
Studio Swine's practice transforms waste on site to have a local impact and combine art and resourcefulness.

Can City explores the catadores in the streets of Sao Paolo.

Aluminium cans and recycled vegetable oil from street vendors and local cafes is used to create furniture and motifs using salvaged materials. They aim to create art or unique products to increase the value and perception of waste.

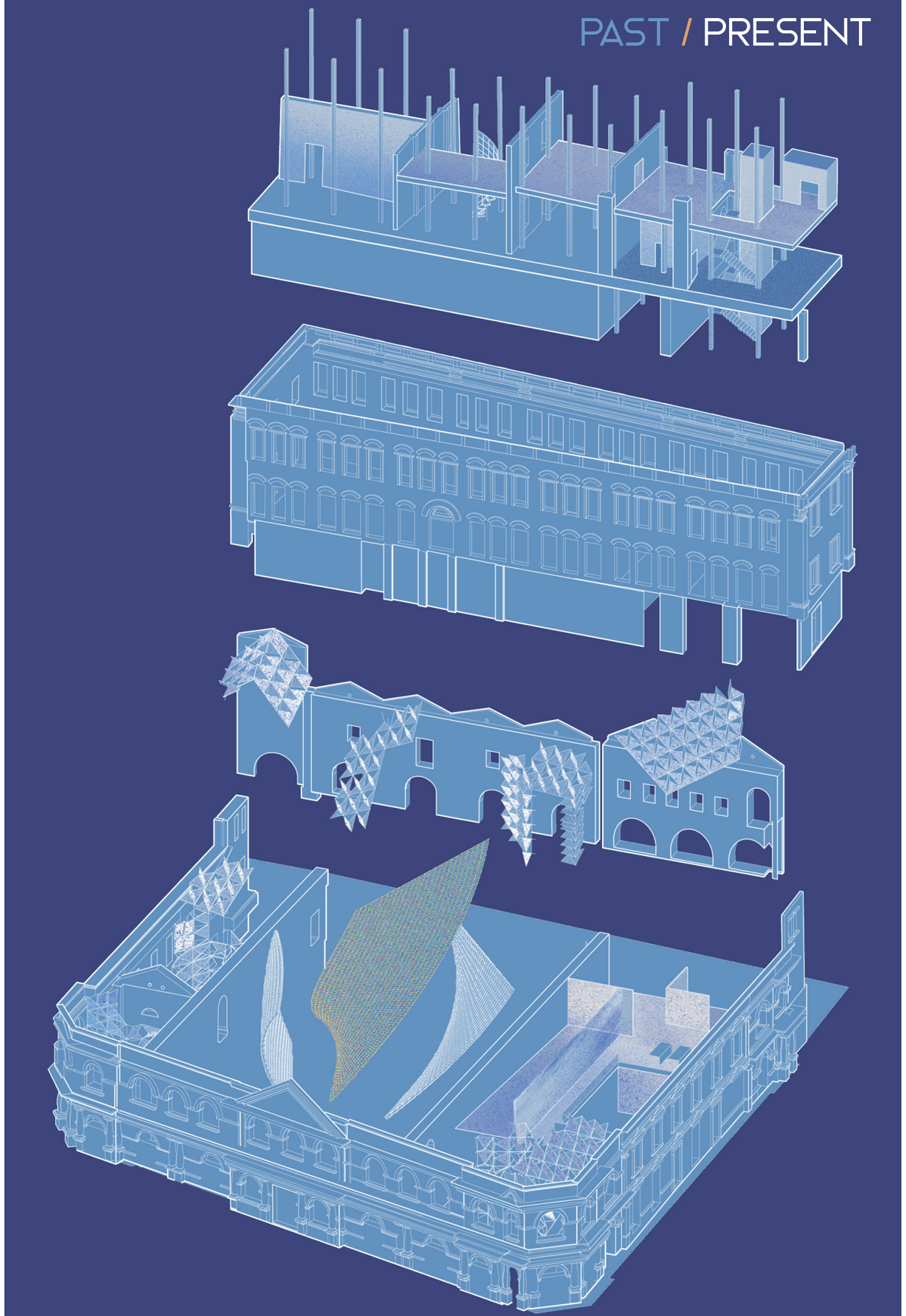
"Each stool takes around 60 cans, but catadores collecting cans around a football stadium on a match day bring in many thousands of cans" (Etherington, 2013)

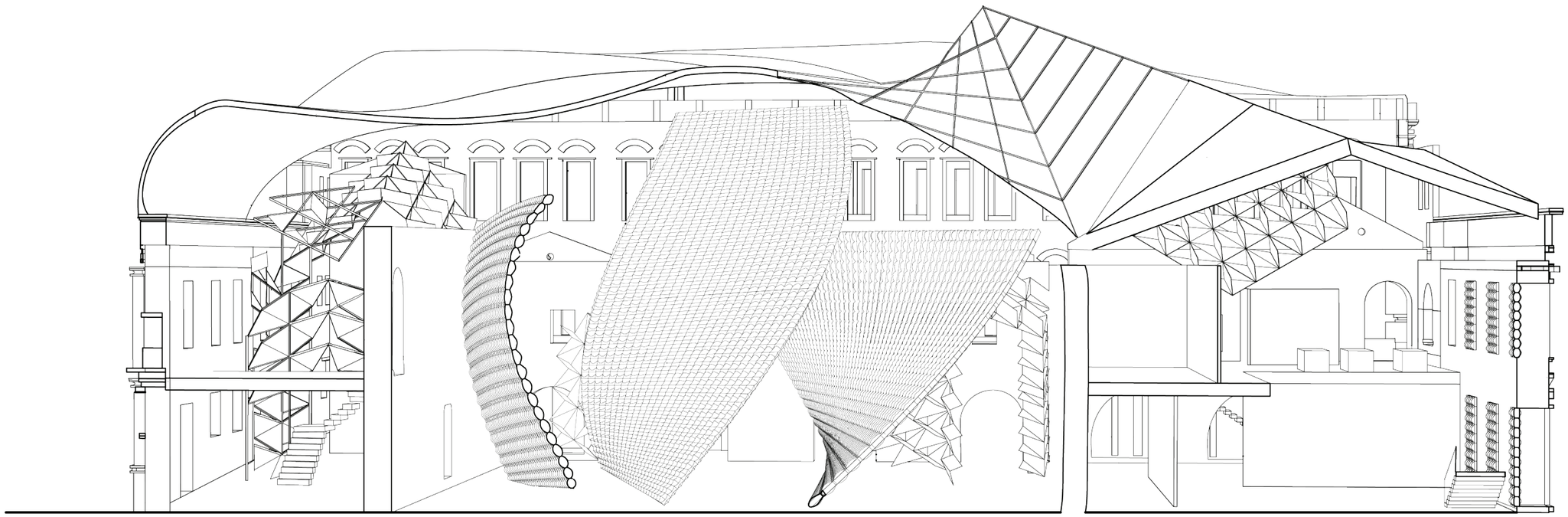
Images: Studio Swine, Can City 2013

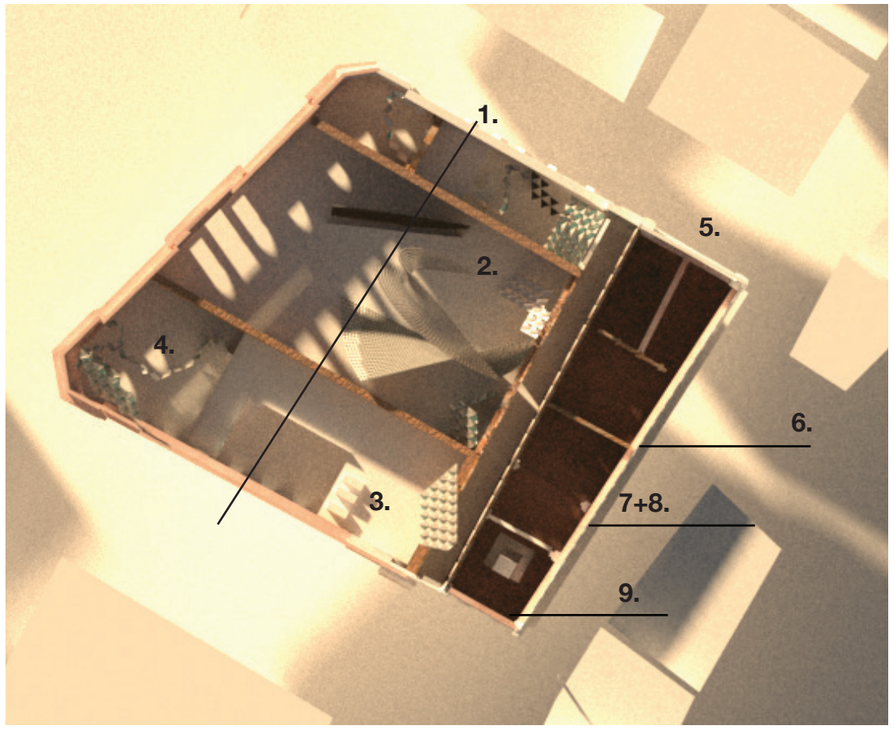


Using bricks and sand from discarded construction material they are able to sand-cast molten aluminium produced by the mobile foundry.

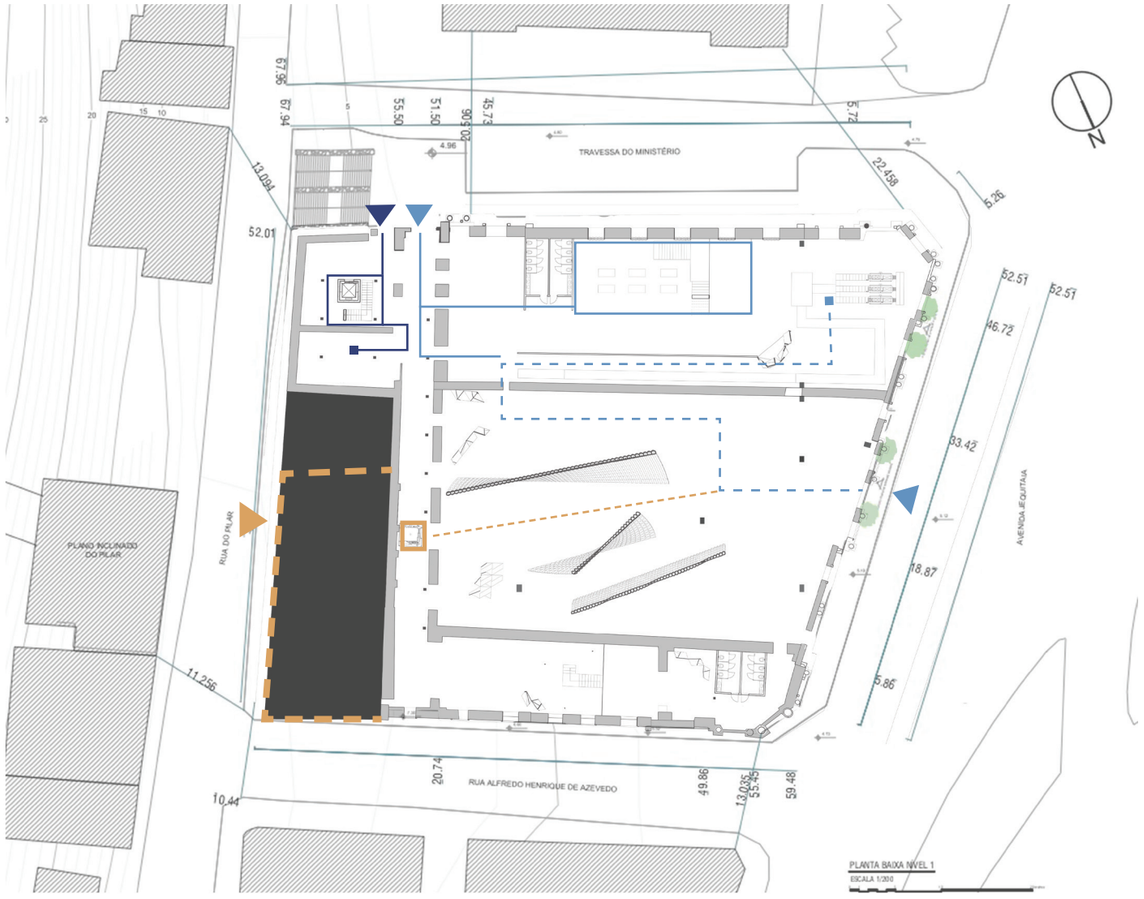
PAST / PRESENT







1. Learning spaces+ child care
2. atrium
3. glass studios+ recycling rooms
4. deposit for collected materials
5. communal kitchen + vegetable oil recycling
6. cafe
7. digital laboratory (2nd floor)
8. material labortory (3rd floor)
9. aluminum foundry + deposits



GROUND CONTEXT FROM LARISSA DE SOUZA
superimposed proposal for recycling lab

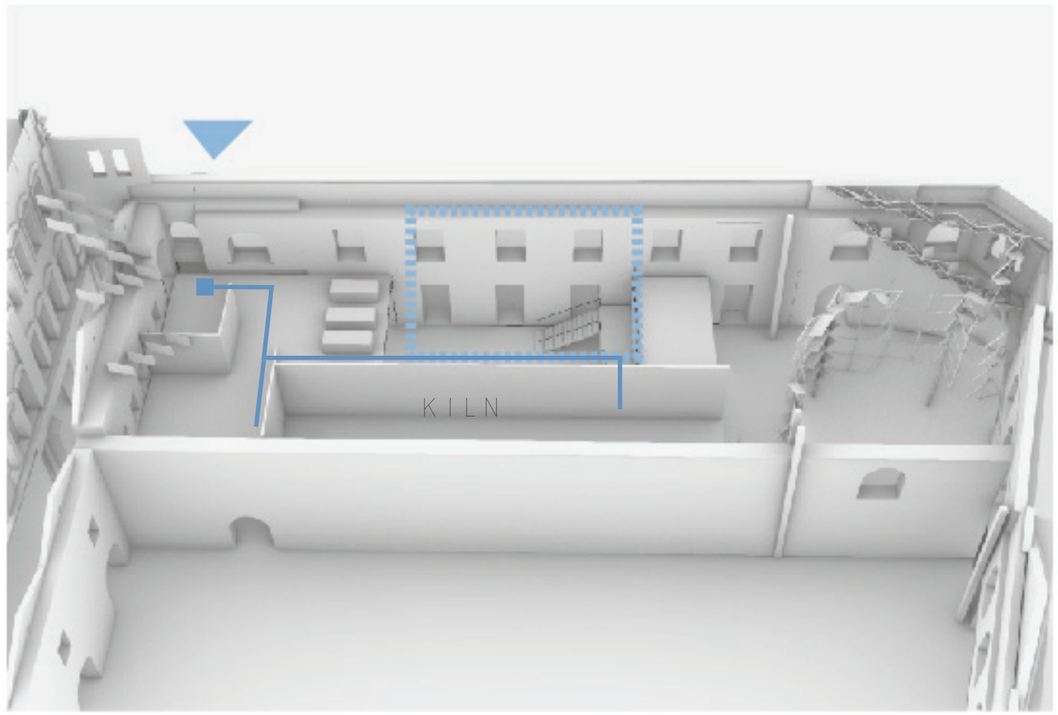
Glass Transformation

Aluminium Transformation

Communal Kitchen- Greenhouse- Food Waste Lab

Glass Storage

Aluminium Storage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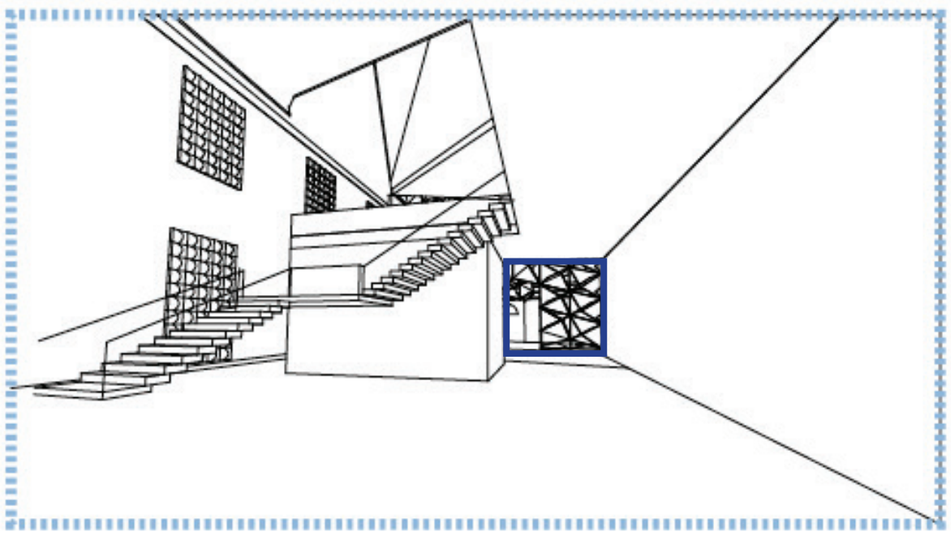
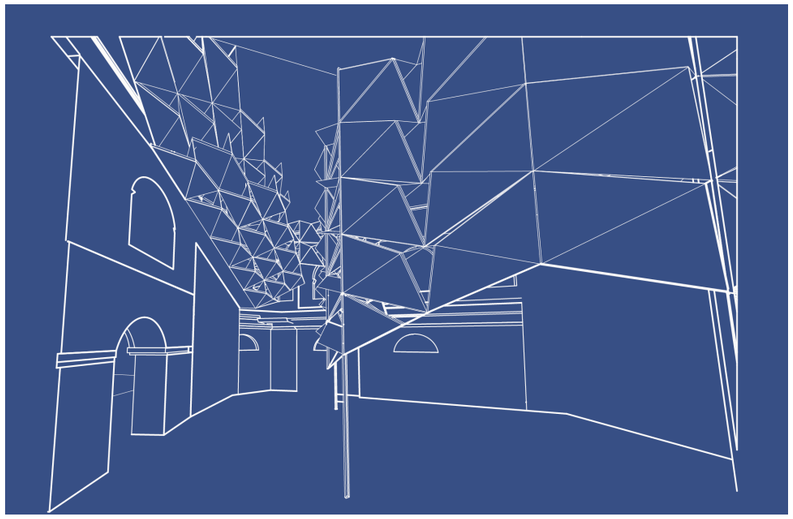
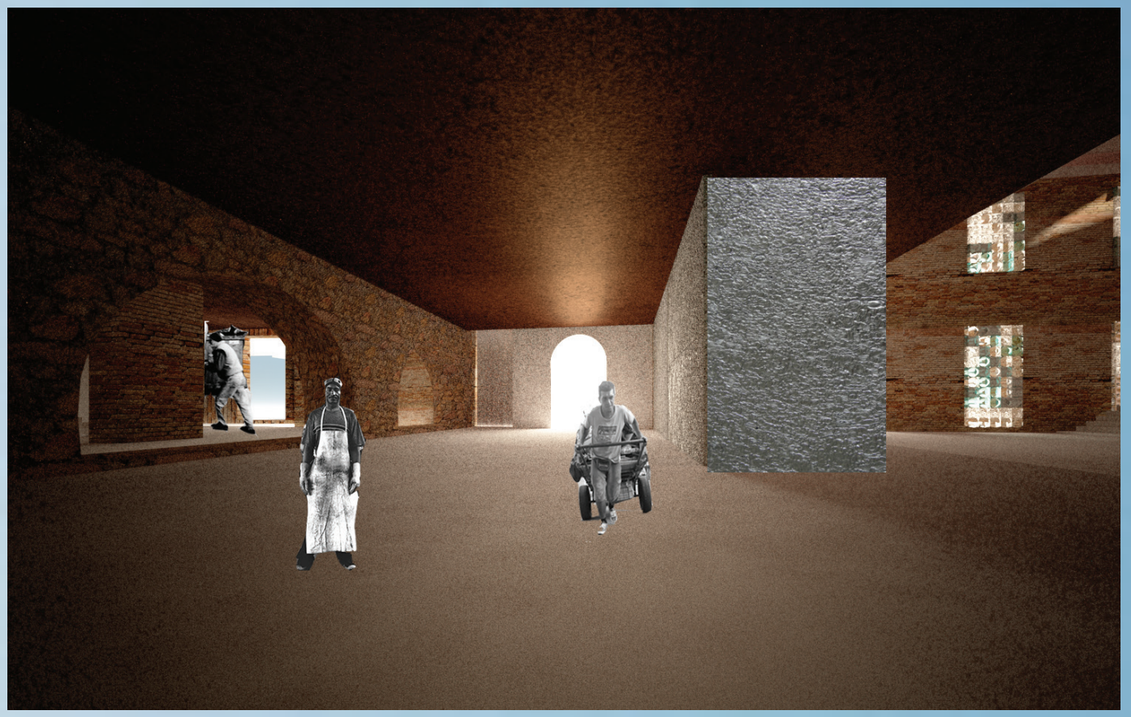
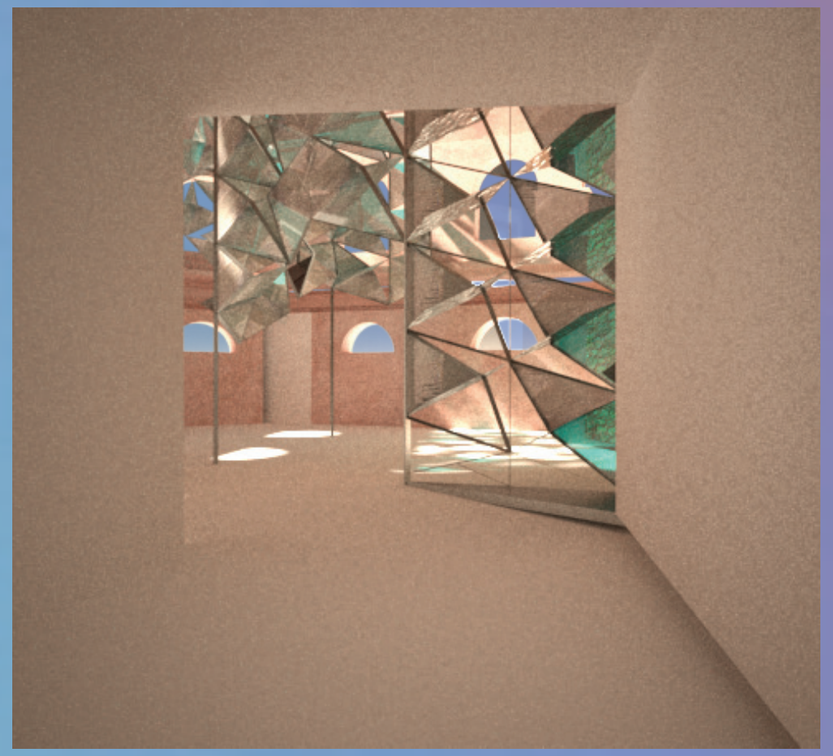
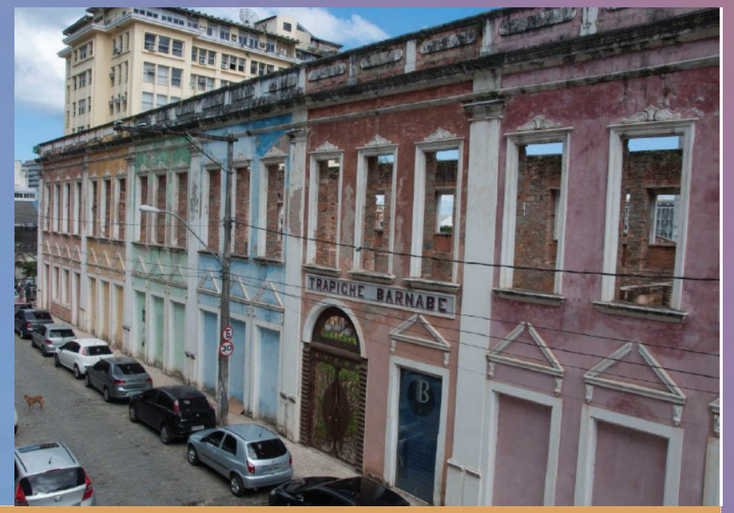
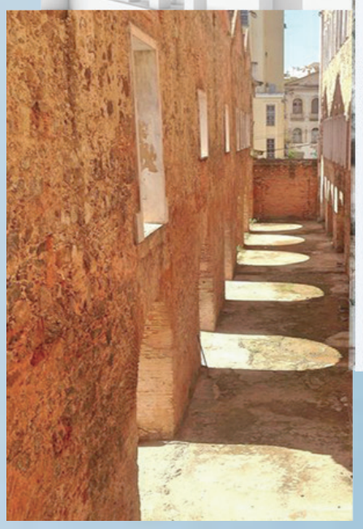




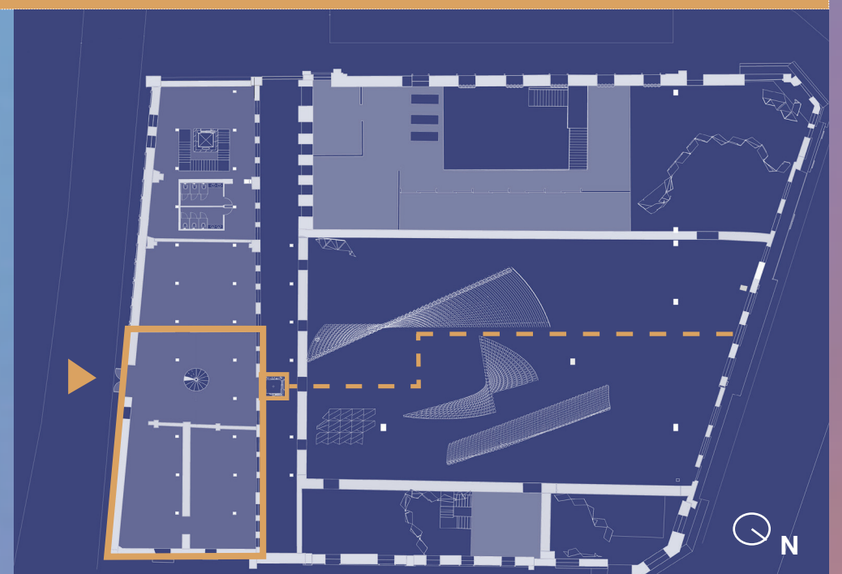


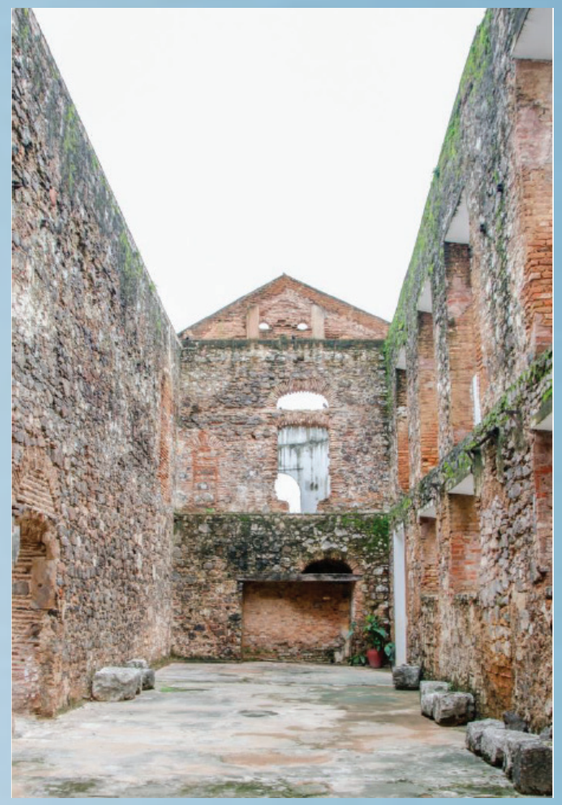


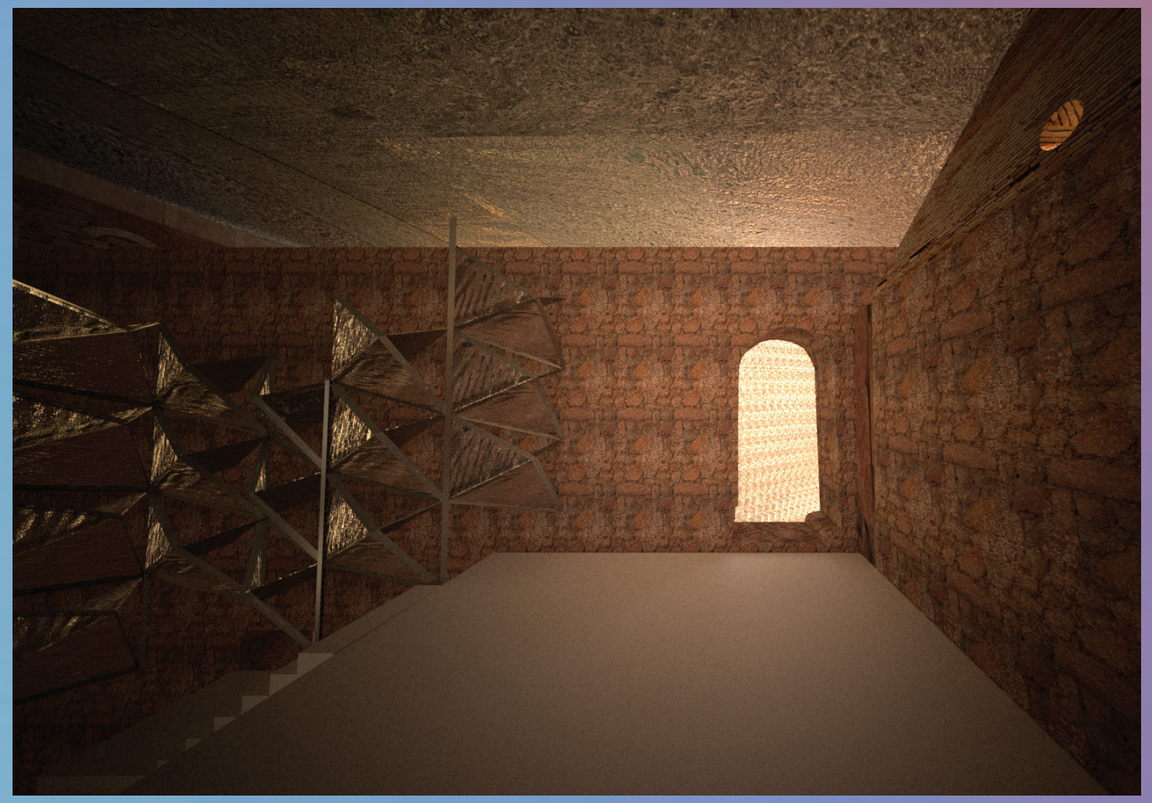


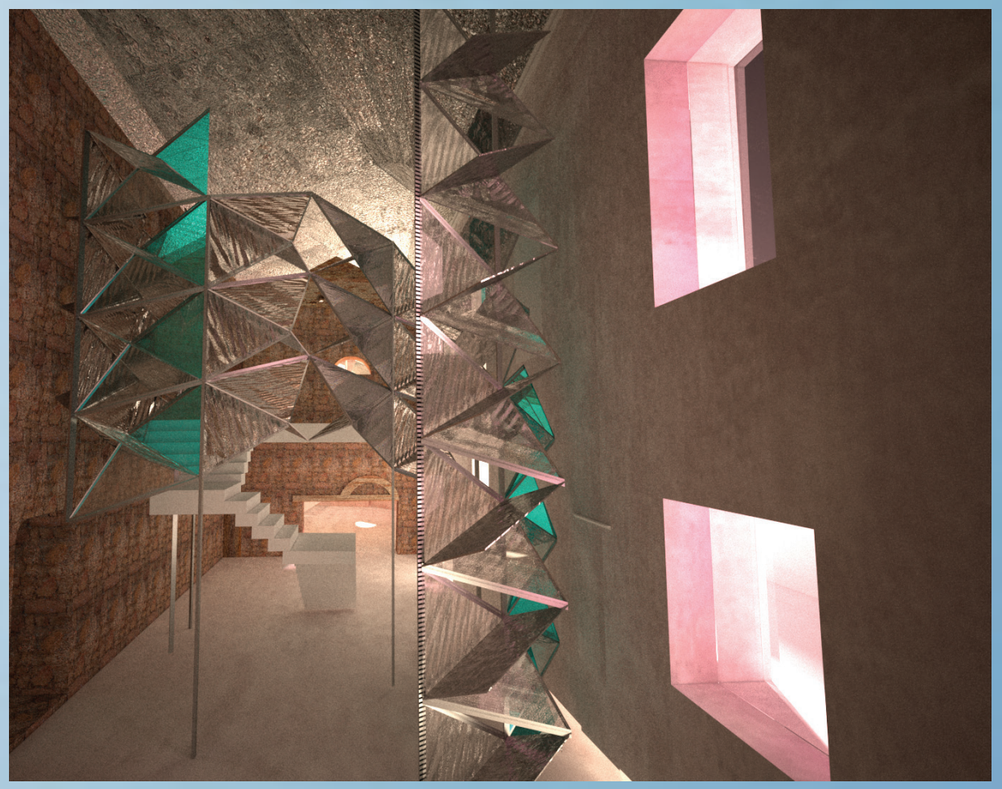


Rua do Pilar
entrance
from cable car

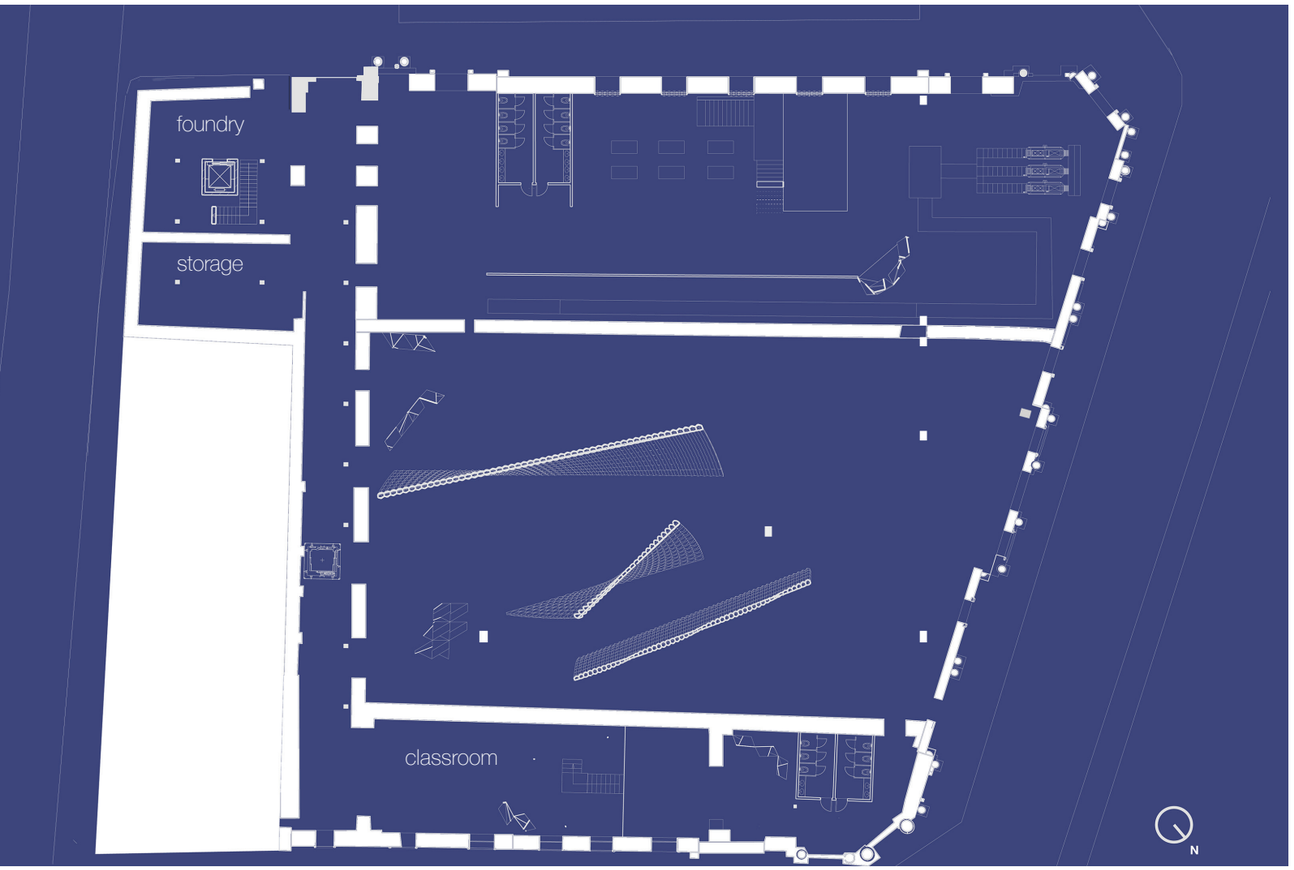




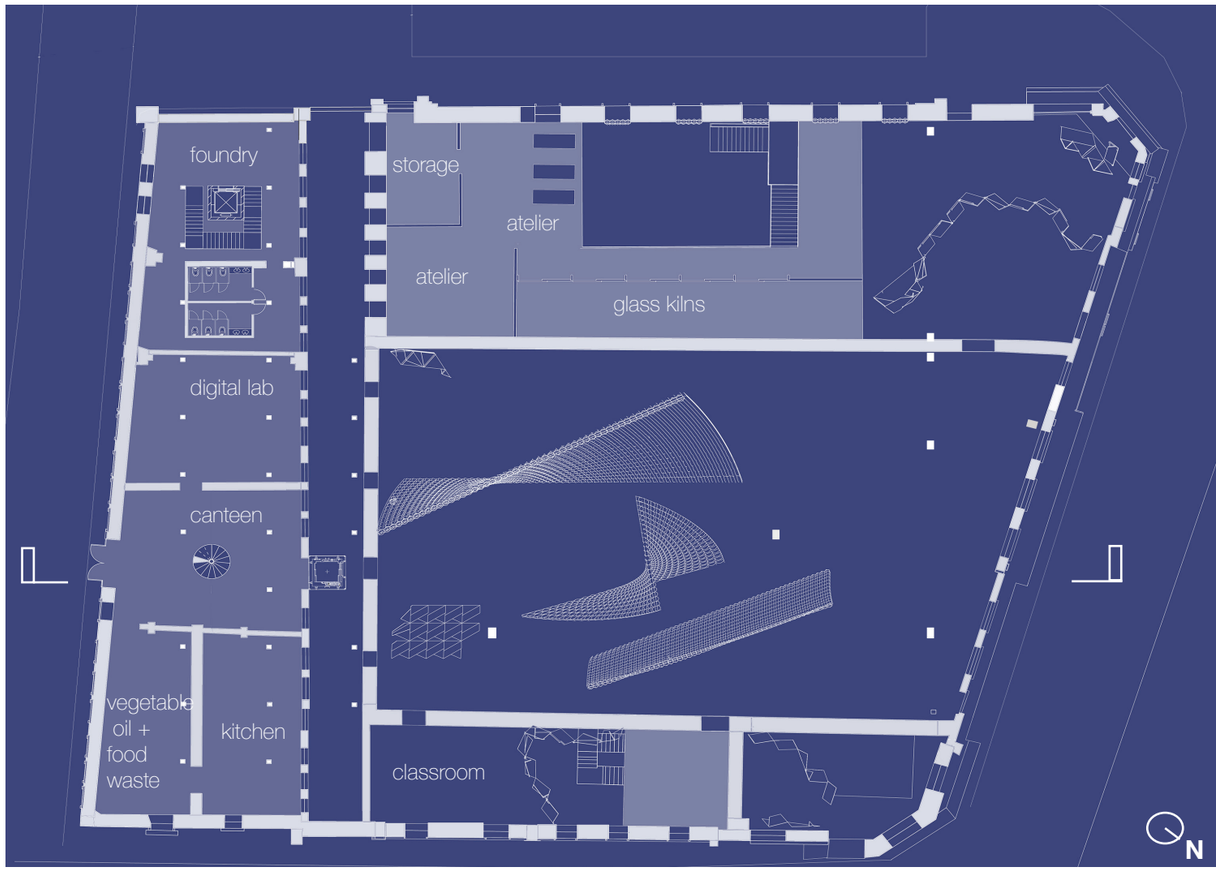




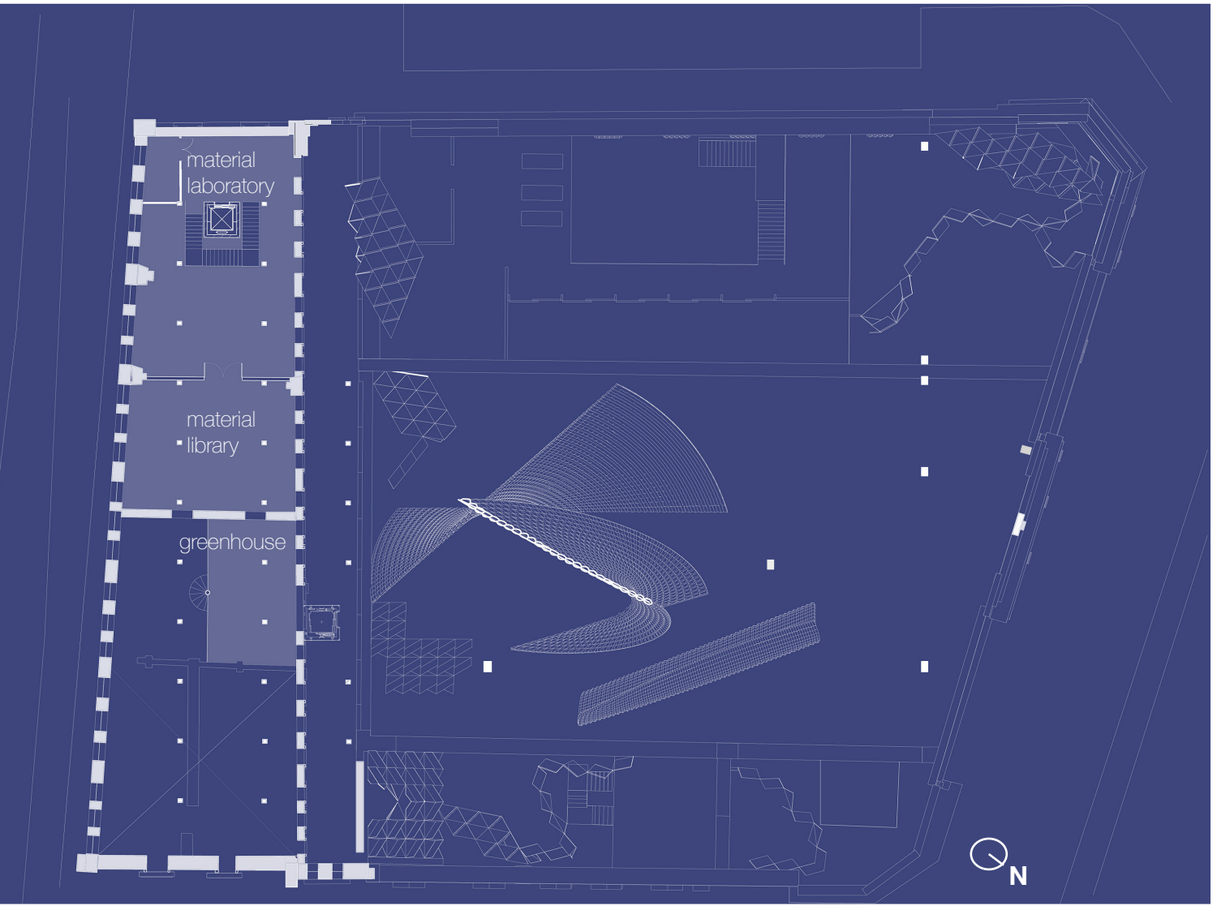
GROUND FLOOR

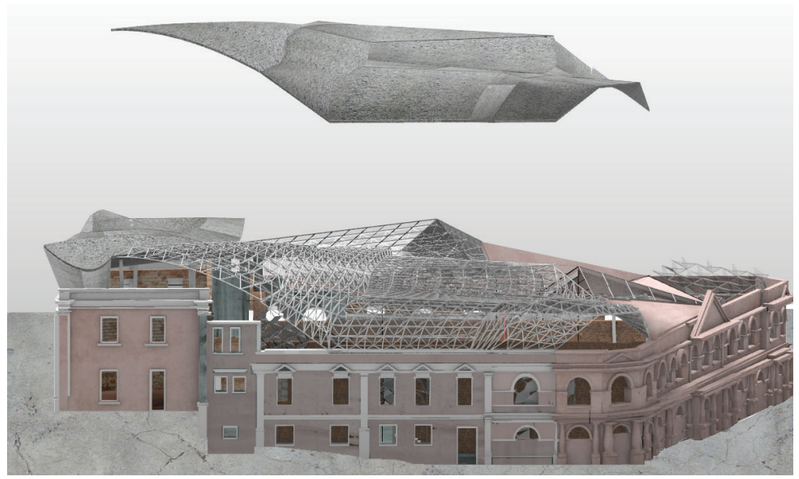


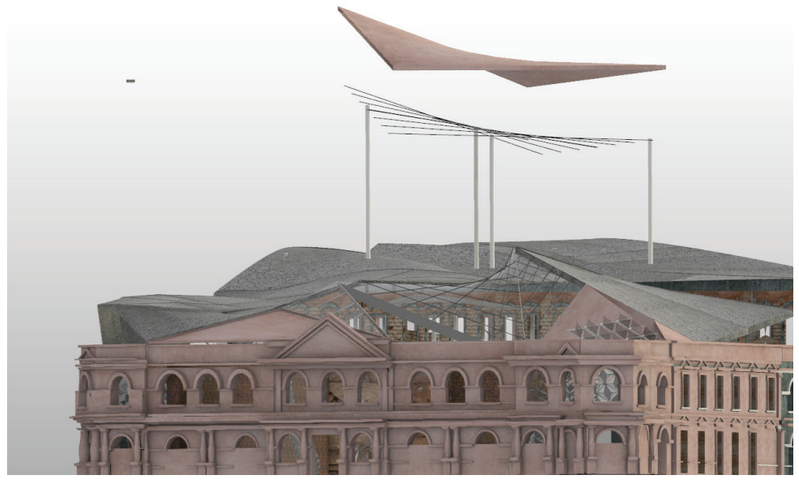
SECOND FLOOR



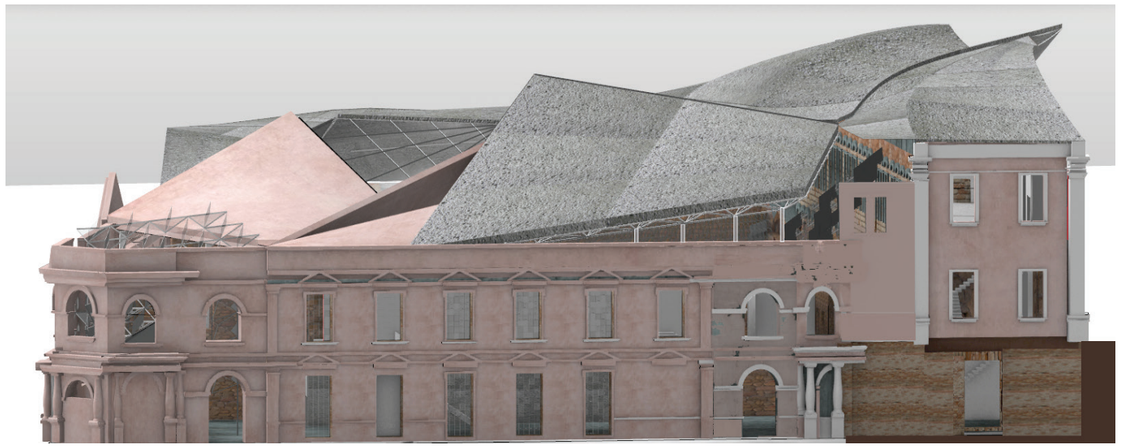
THIRD FLOOR

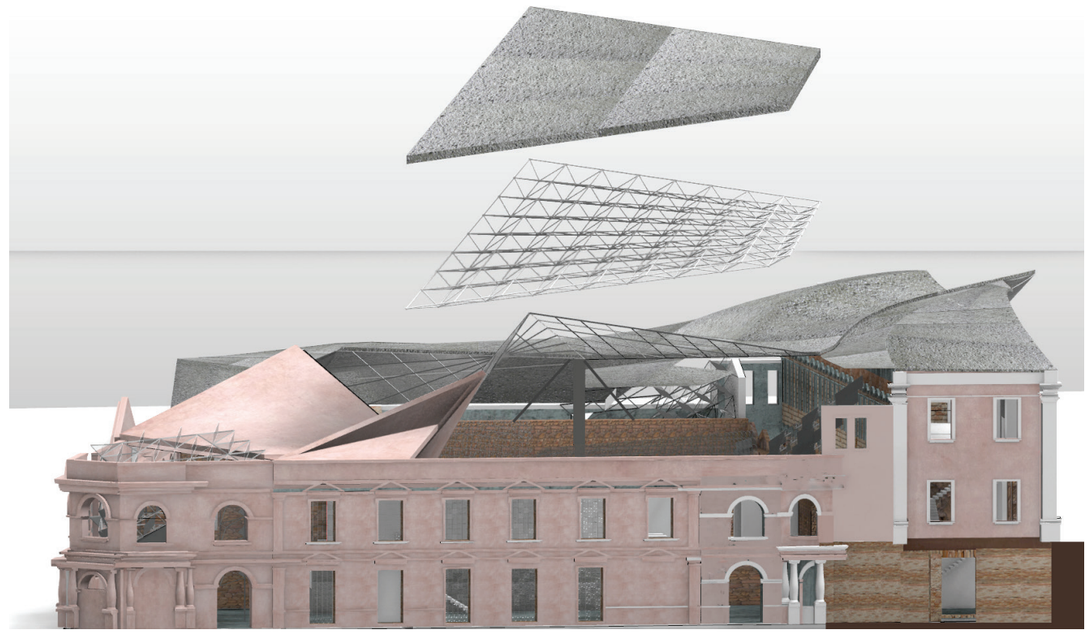






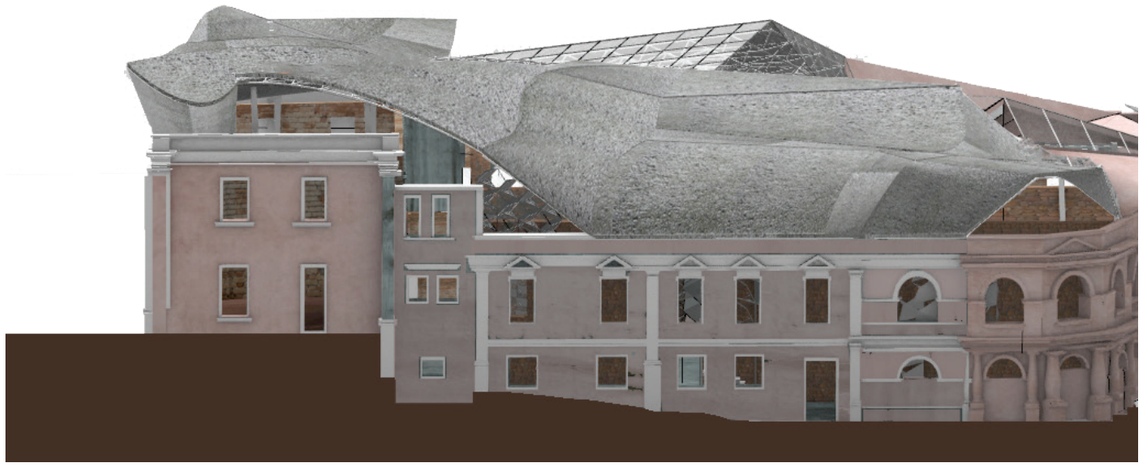
(Dudu Assuncao 2018)

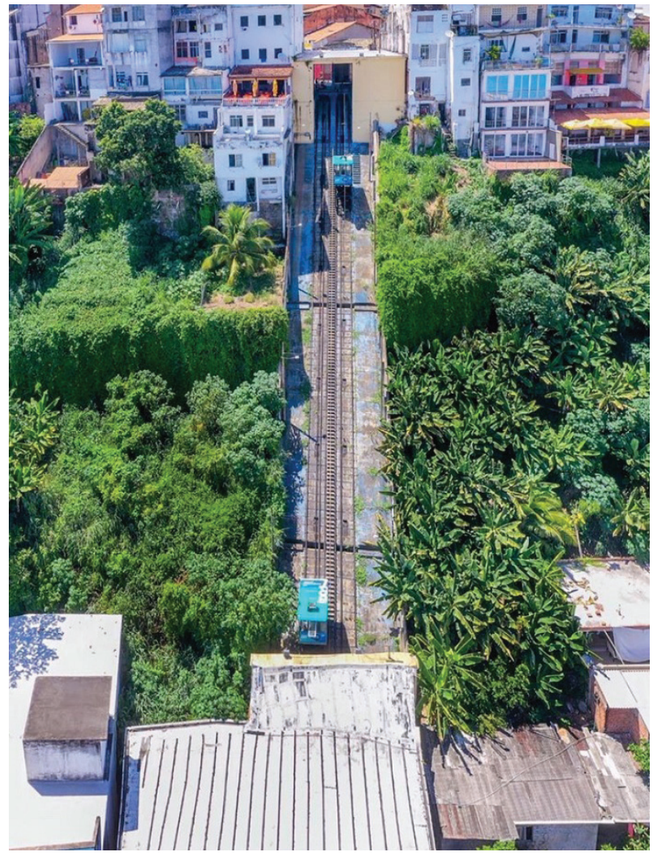




Google Maps Accessed May 14, 2021

Google Maps Accessed May 14, 2021

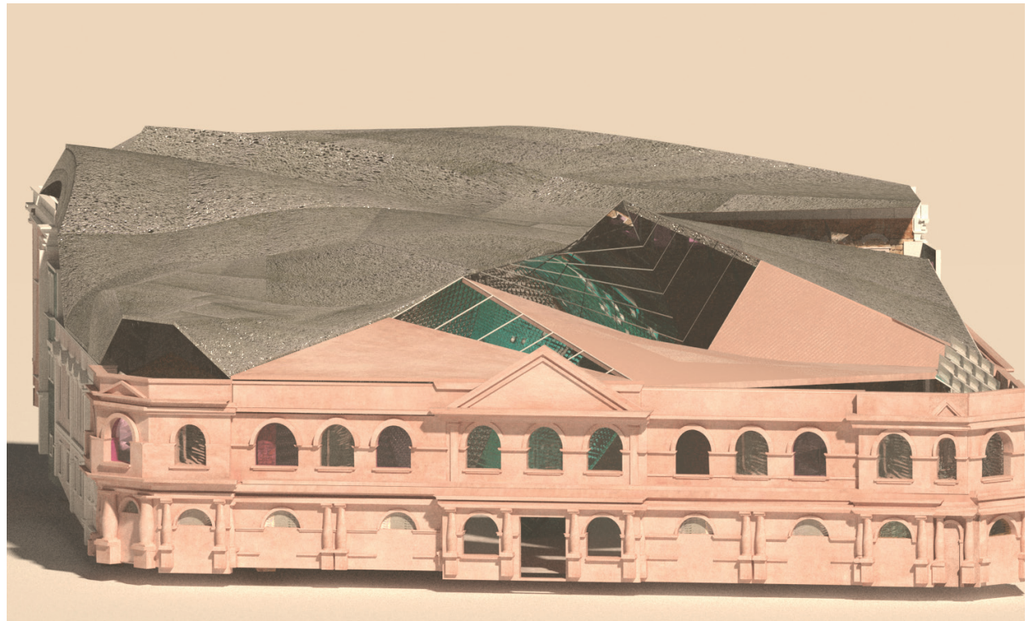


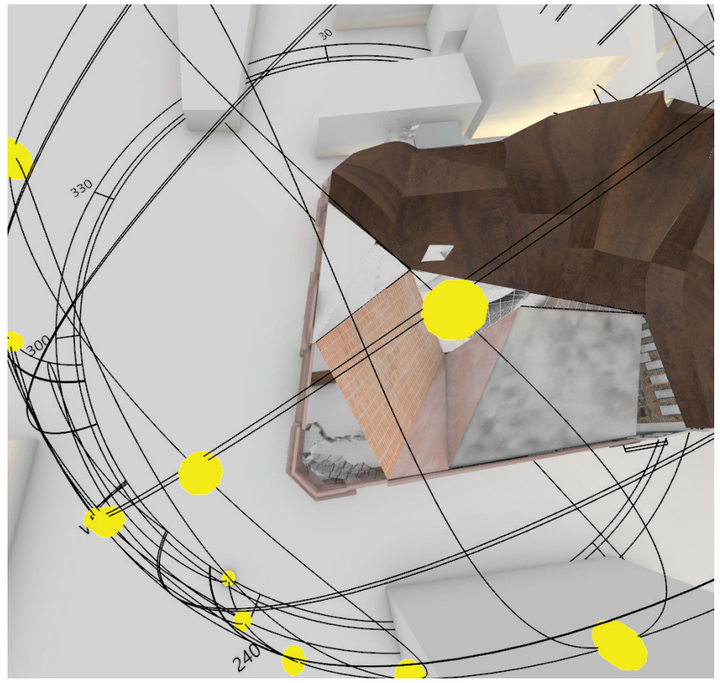


Prefeitura Municipal de Salvador
Pilar Urban Elevator

One of the initial factors that drew me to this site was its connection to the upper city from the port via a cable car. Its iconic location and the transition from above was a unique way to perceive the building especially as a ruin. Due to the constant sun of the tropics it was necessary to keep out the sun in areas such as the glass ateliers, material libraries or classrooms. This had diminished my hopes to have the design opportunity to experience structural color from the cable car. The dual structure color seen from above is distinct from the eye level view. The iridescence of purple and green is much sharper. The roof originally was meant to reference the topography of Salvador as an intersection of nature, materiality and territory. It also was a way to join the language of the Sobrados on the Rua do Pilar.

ROOF

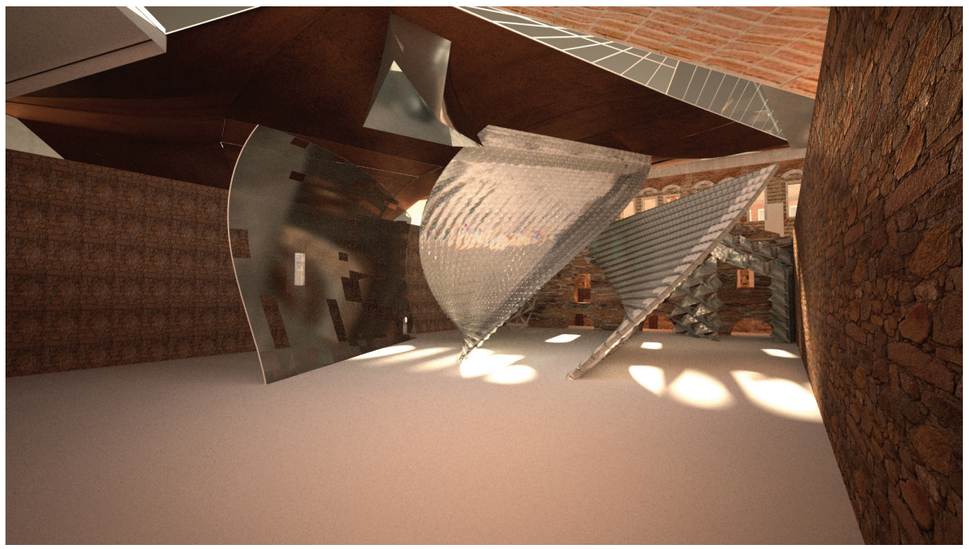


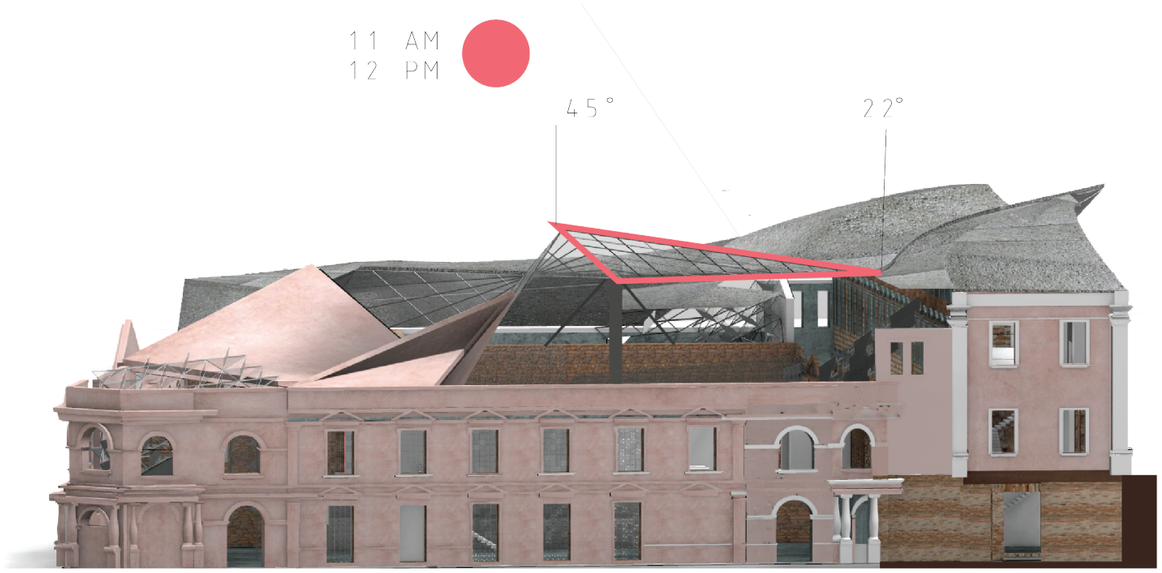


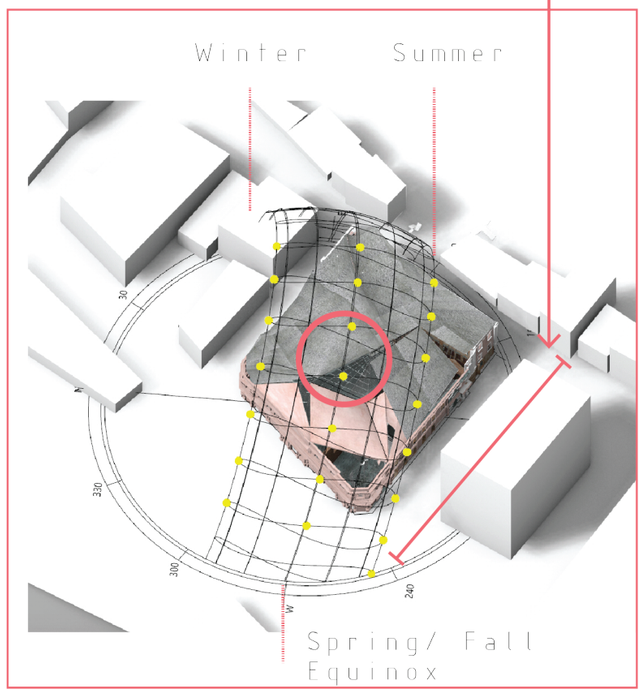
Earlier iteration of the roof summer sun is blocked. Sunset is open to natural light. Using Tokugin Yoshioka an Bompas I use steel to create more holographic light.

However, The 45 degree angle seen on the next page was necessary and thegeometry is change and the height of the roof in the back decreases. I join the roofs better visually and the helices have more interaction with another rather than other materials.

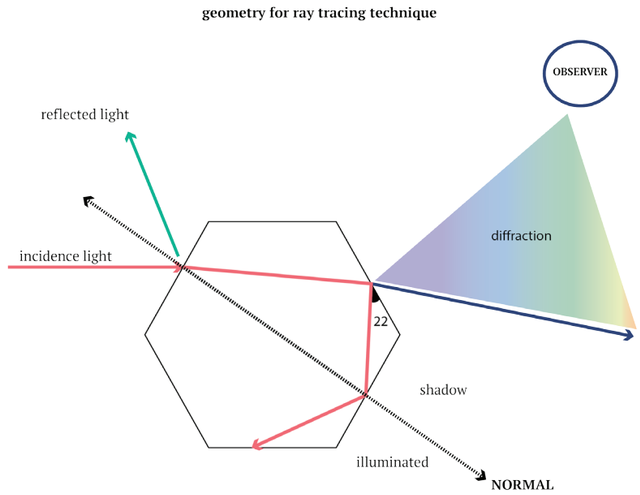
The changes are explained in the following pages.There is less shadows in the interior but structural color from above and street level.

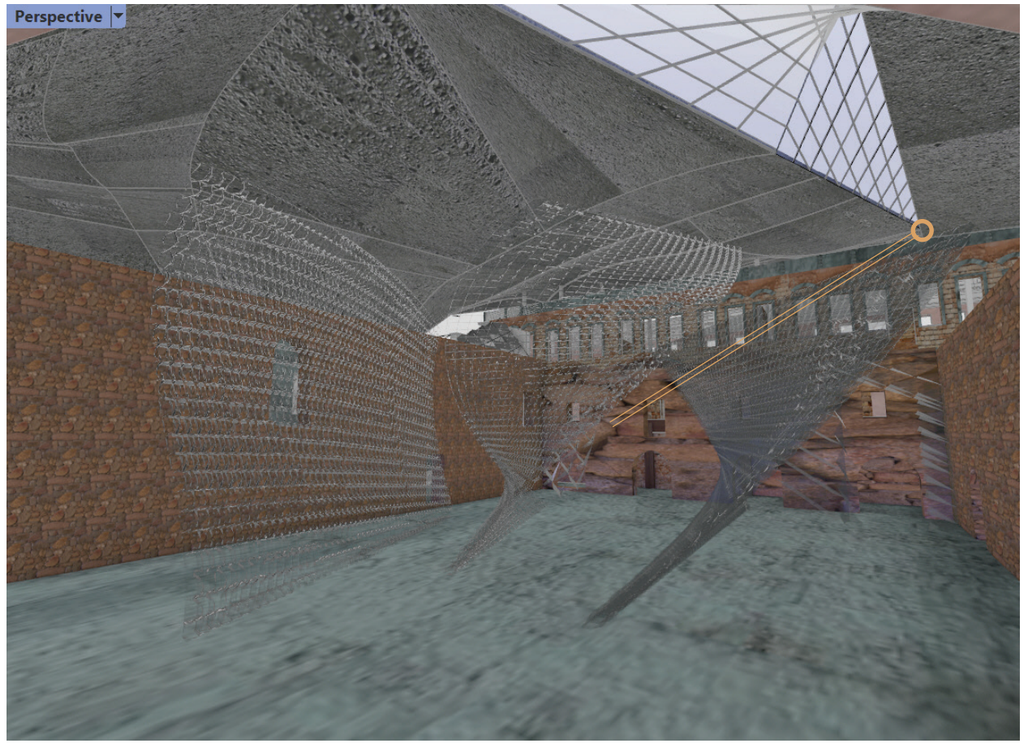




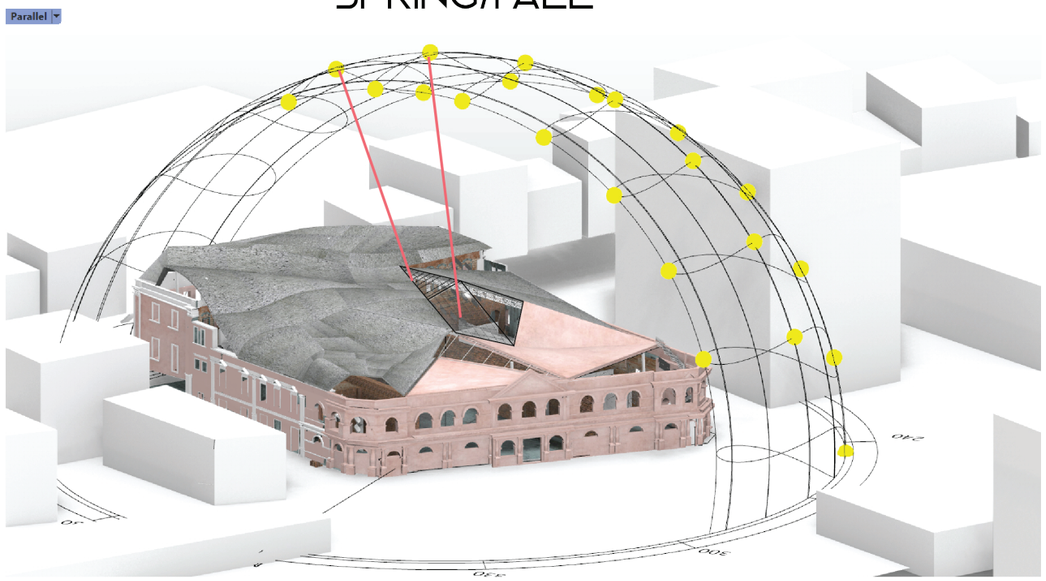


From the back of the helix the roof is at 22 degrees replicating how ice becomes a prism when the sun is low. Explained in the diagram below

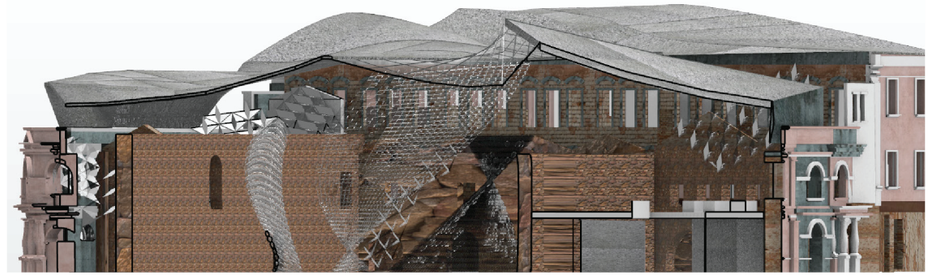


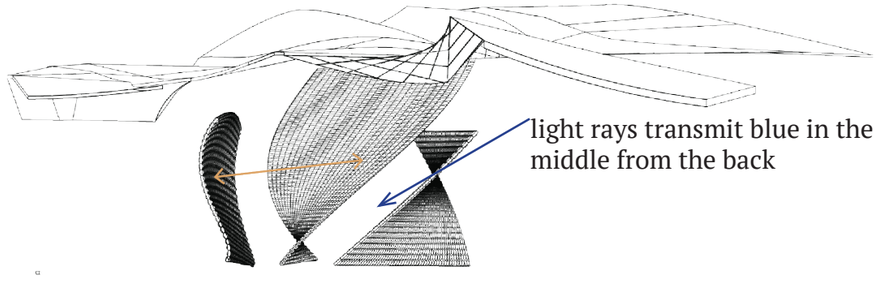


SPRING/FALL

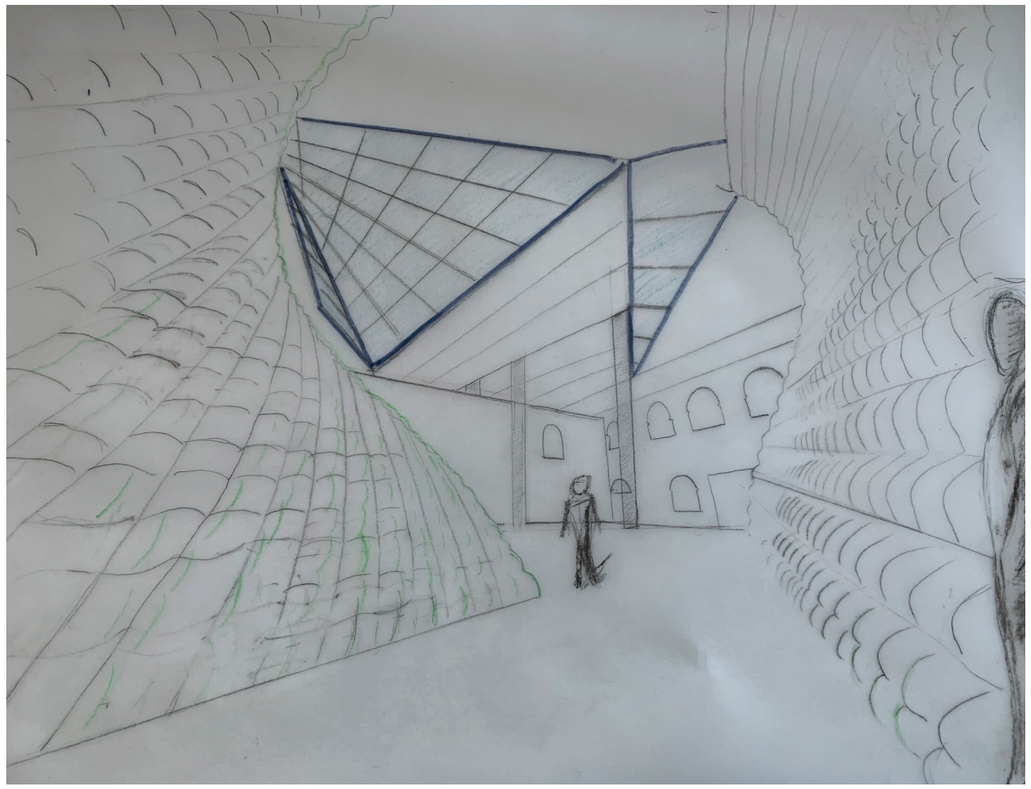


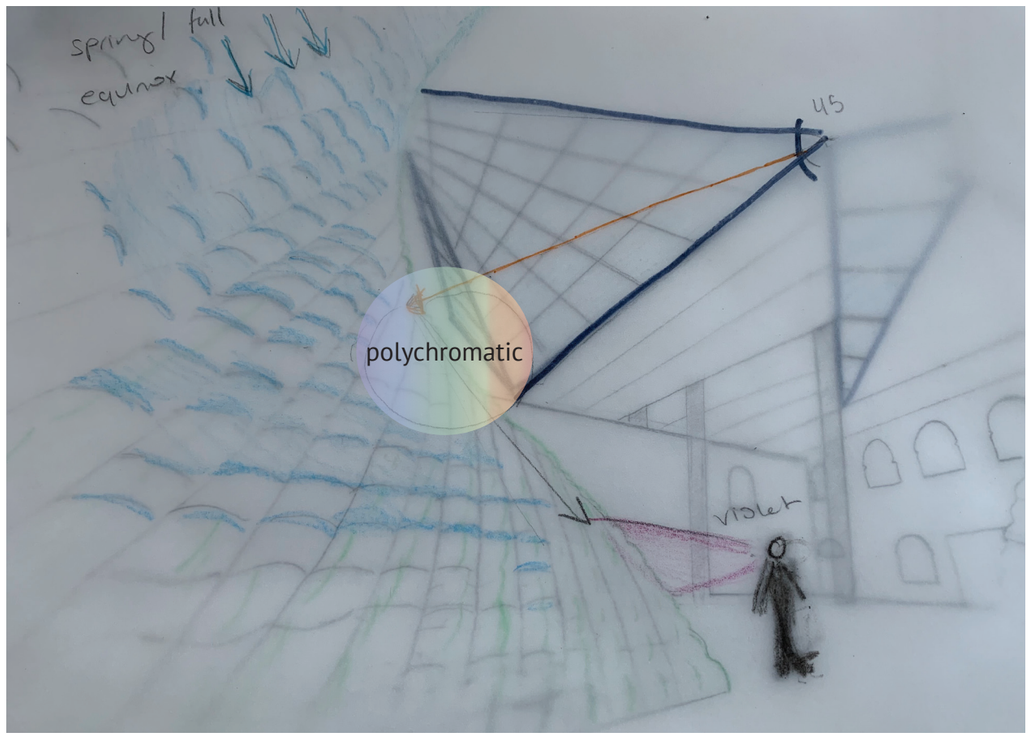
most dynamic
interactive light

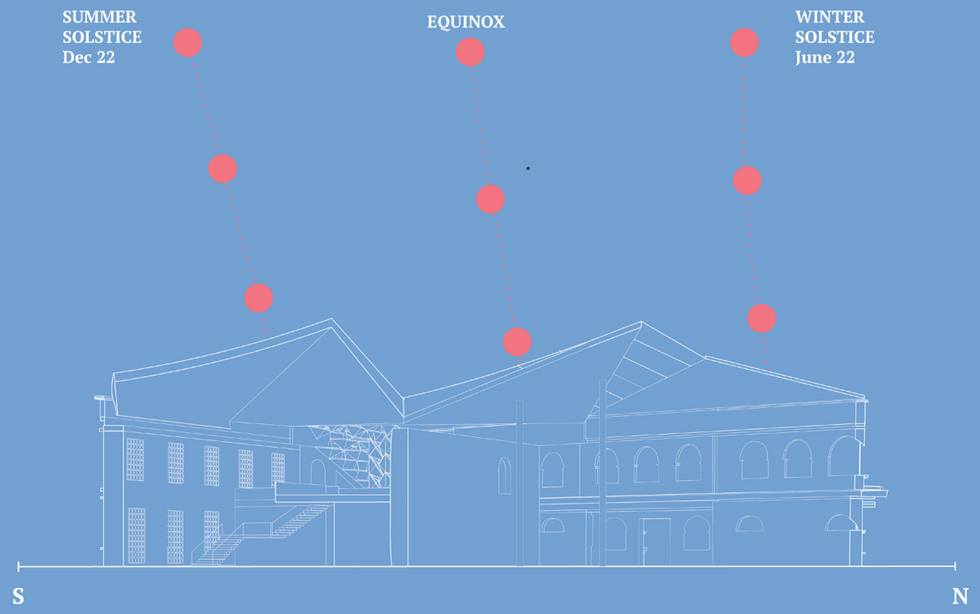


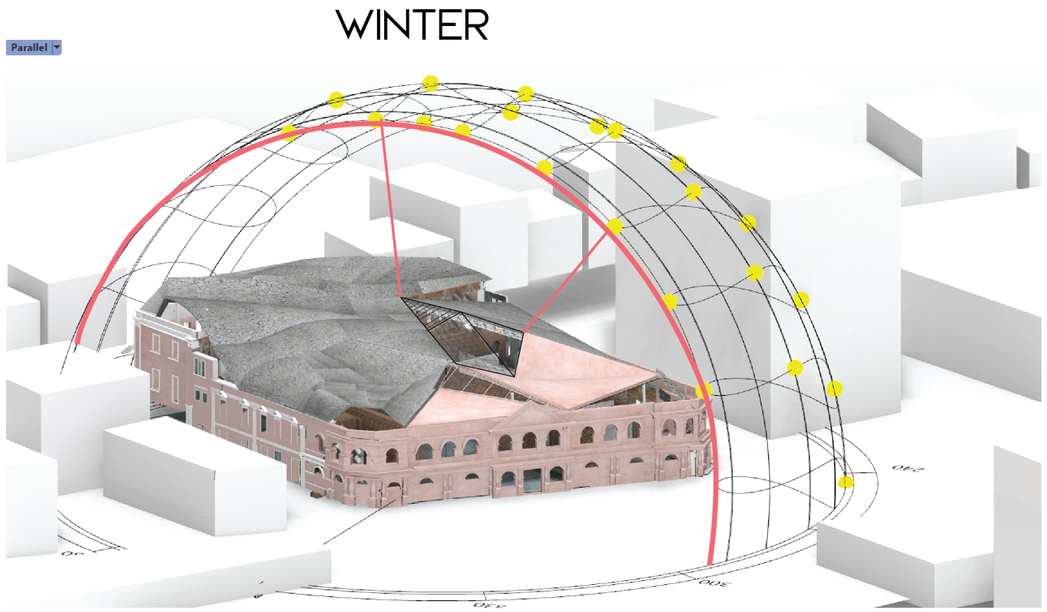


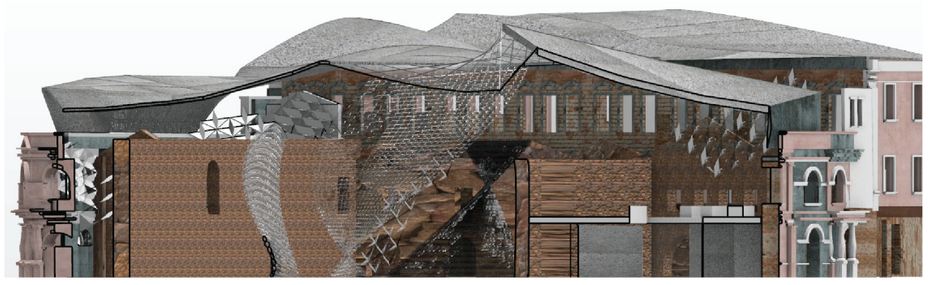
light rays transmit blue in the middle from the back

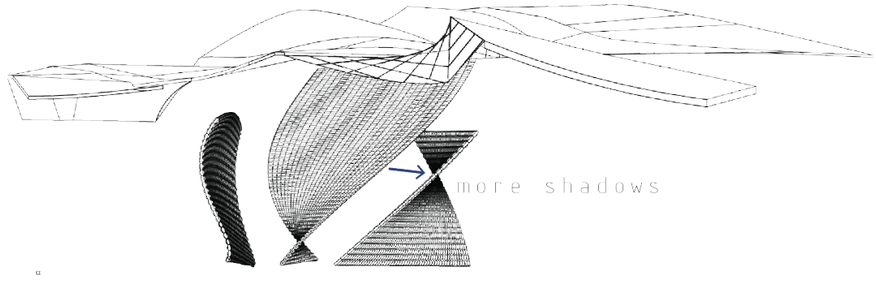






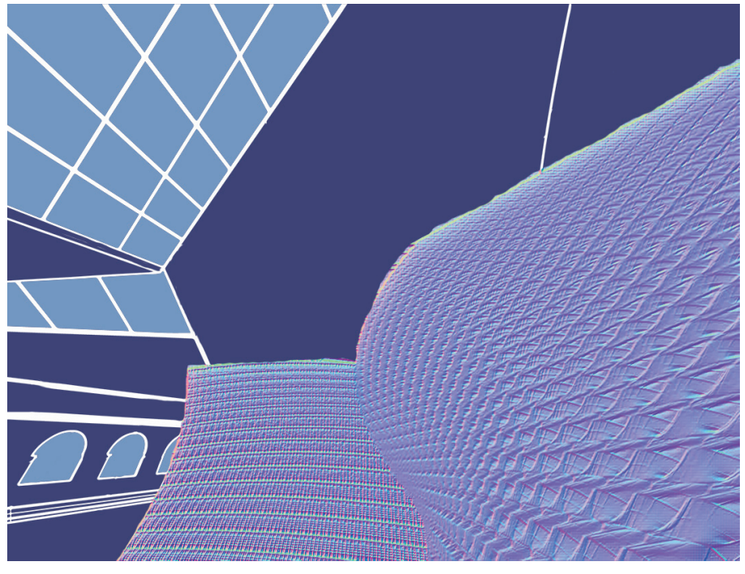


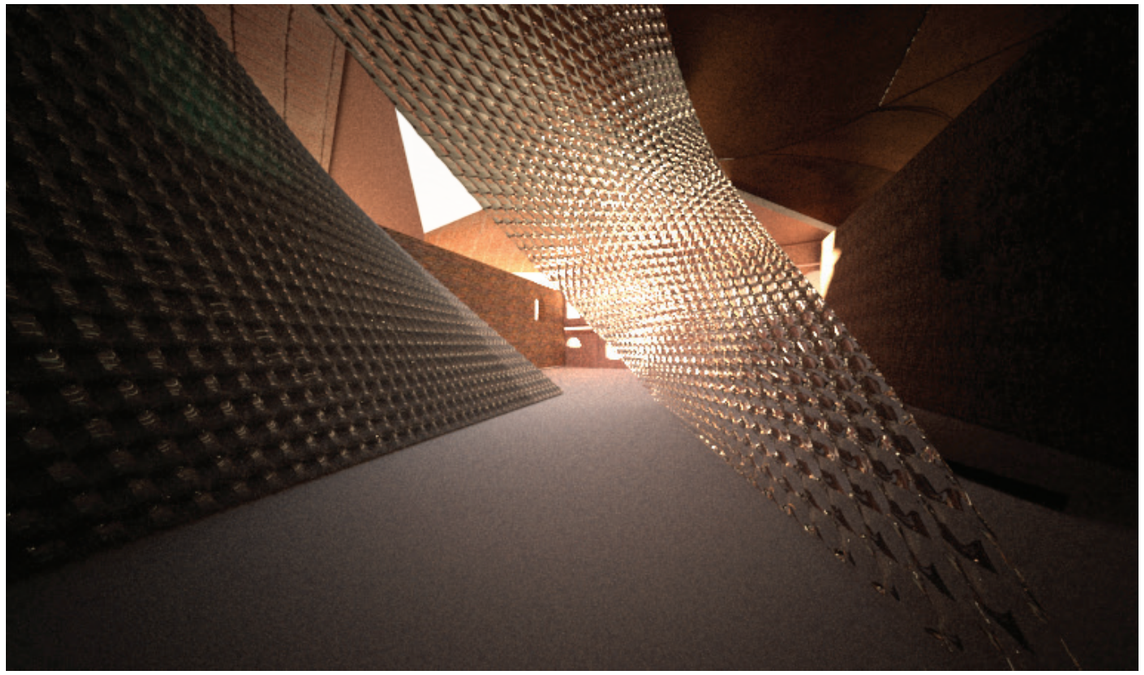




skylight front helix

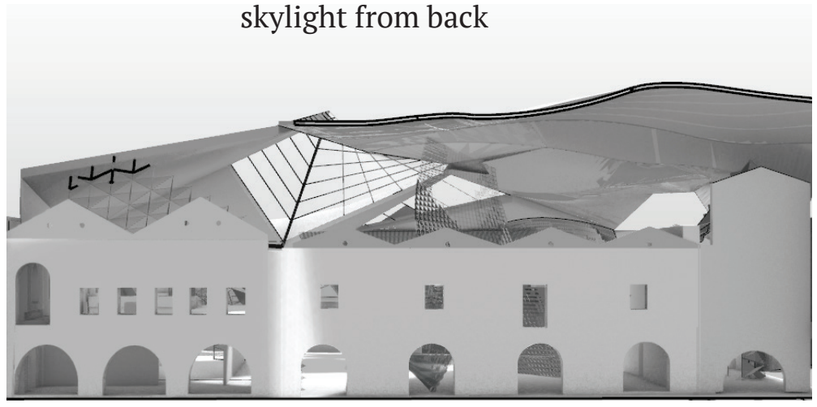
Like our vision, pixels generate an image with red, green and blue. A normal map associates red, green and blue to X, Y and Z. It allows the recreation of color and volume without a polygonal mesh.
I took a screenshot of the model to analyse the geometry could effect reflection. The helix creates diffused light. The wave on the left light travels through the x and y direction and appears polychromatic / holographic . On the right, the middle helix the x and z predominate but has a more defined topography.



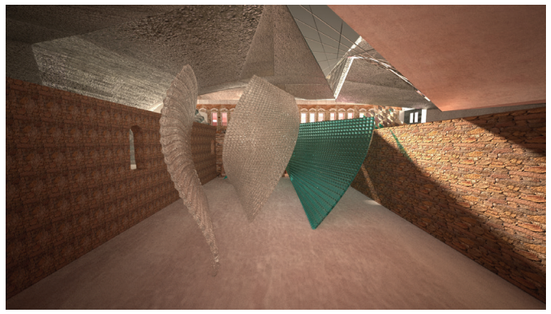


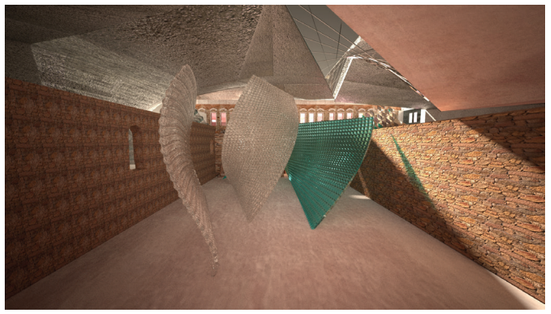
passing through
the helix of the
aforementioned effect

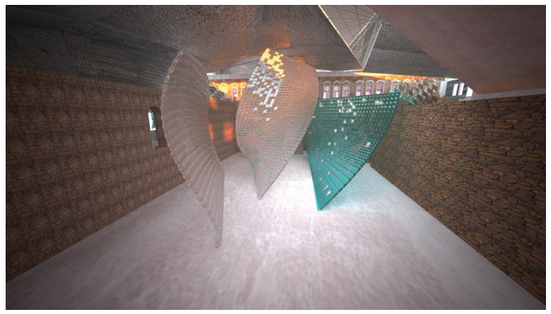
skylight from back

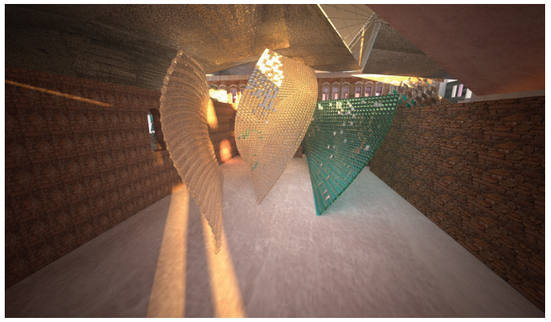


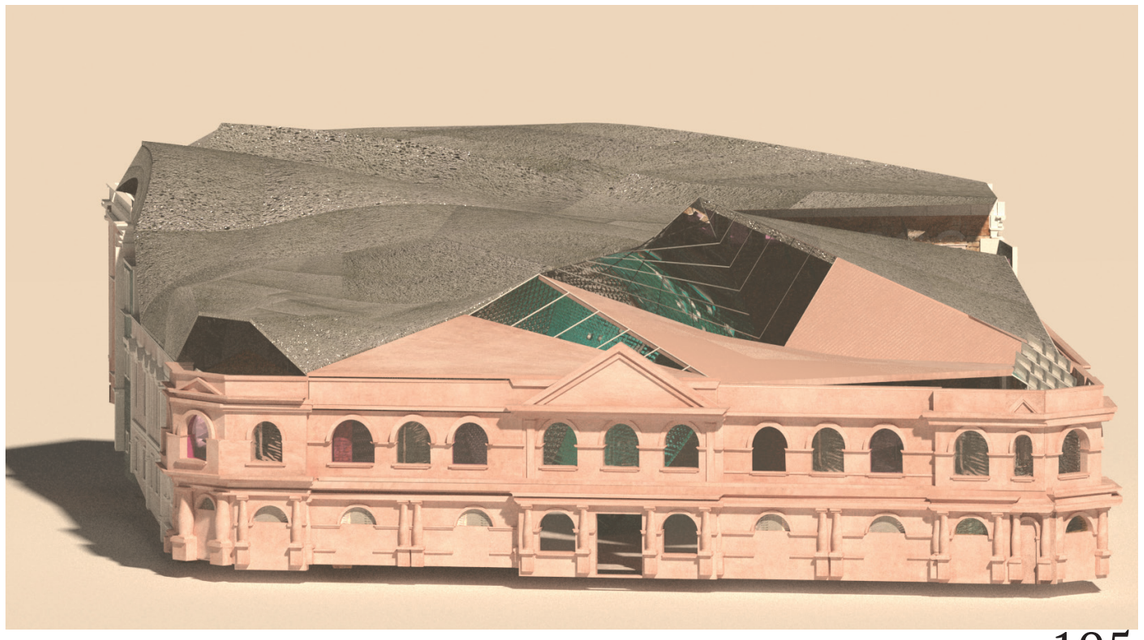
The transmission in percent for every wavelength is specified in 1 nanometer steps for angles of incidence in five degree steps from 0 to 45 degrees. When the incident angle was set at 5 degrees,peaks were observed at 500 and 750 nm, of which the reflectance spectrum corresponds to that of the green .



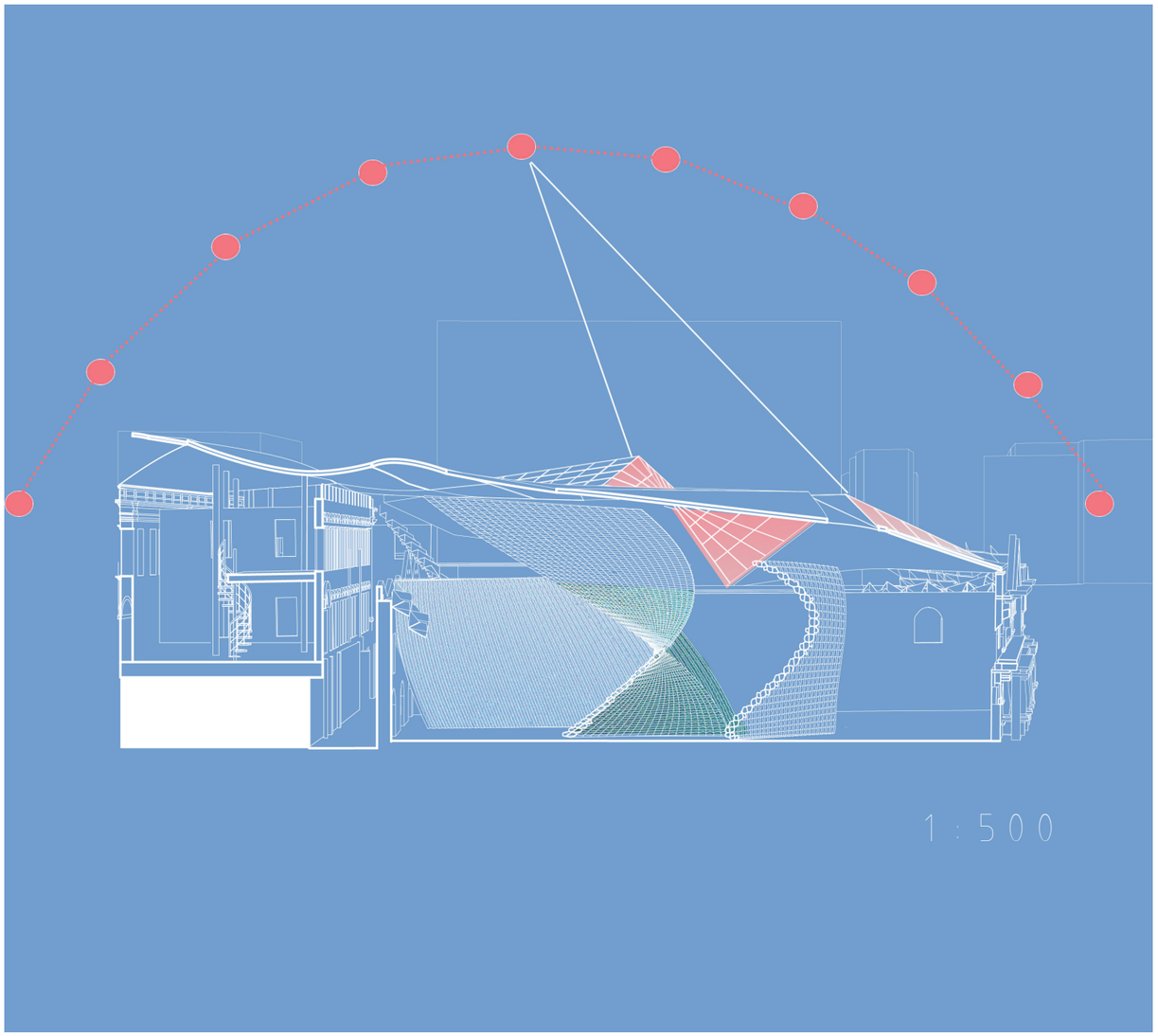




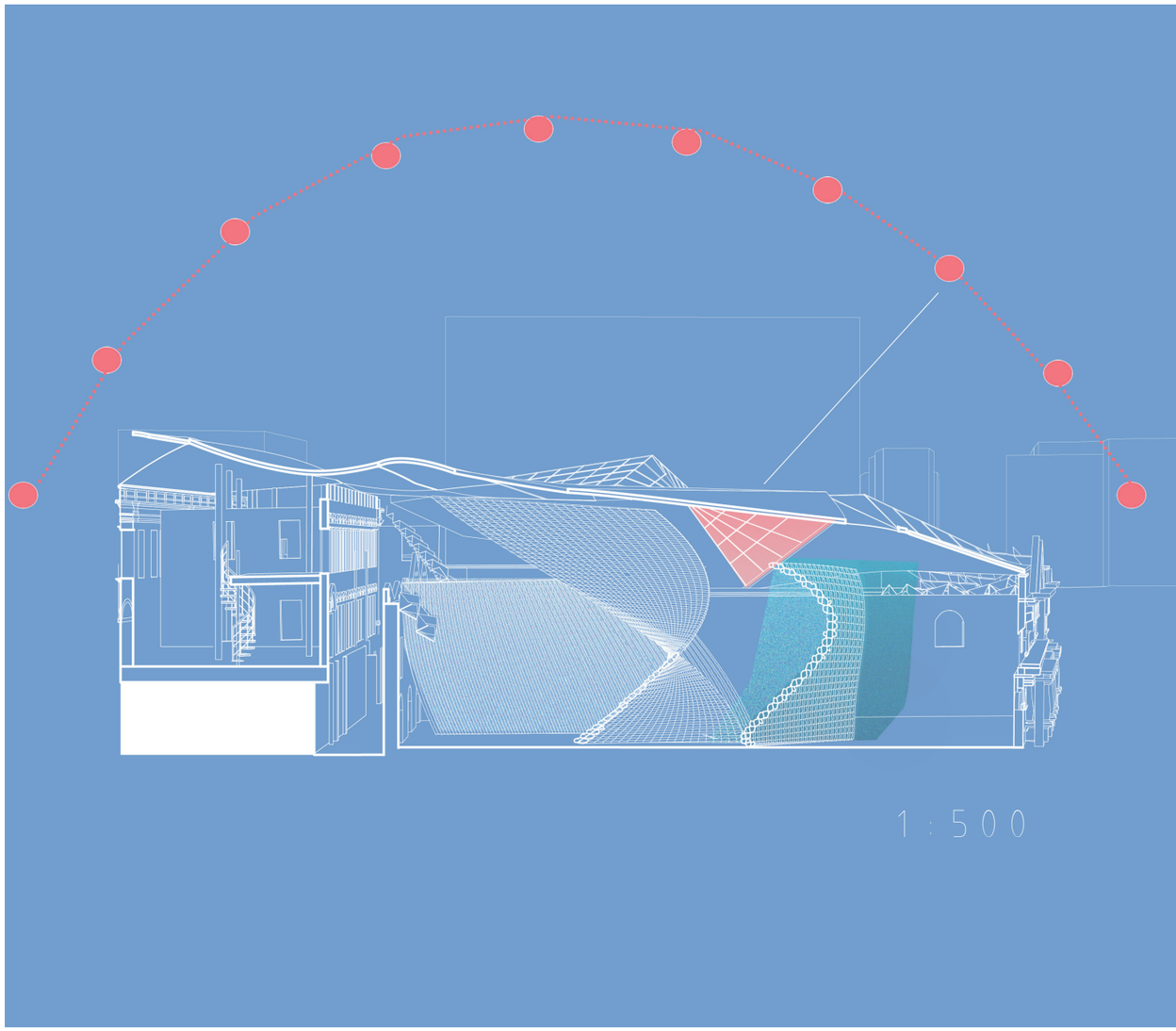




NOON SUMMER EQUINOX

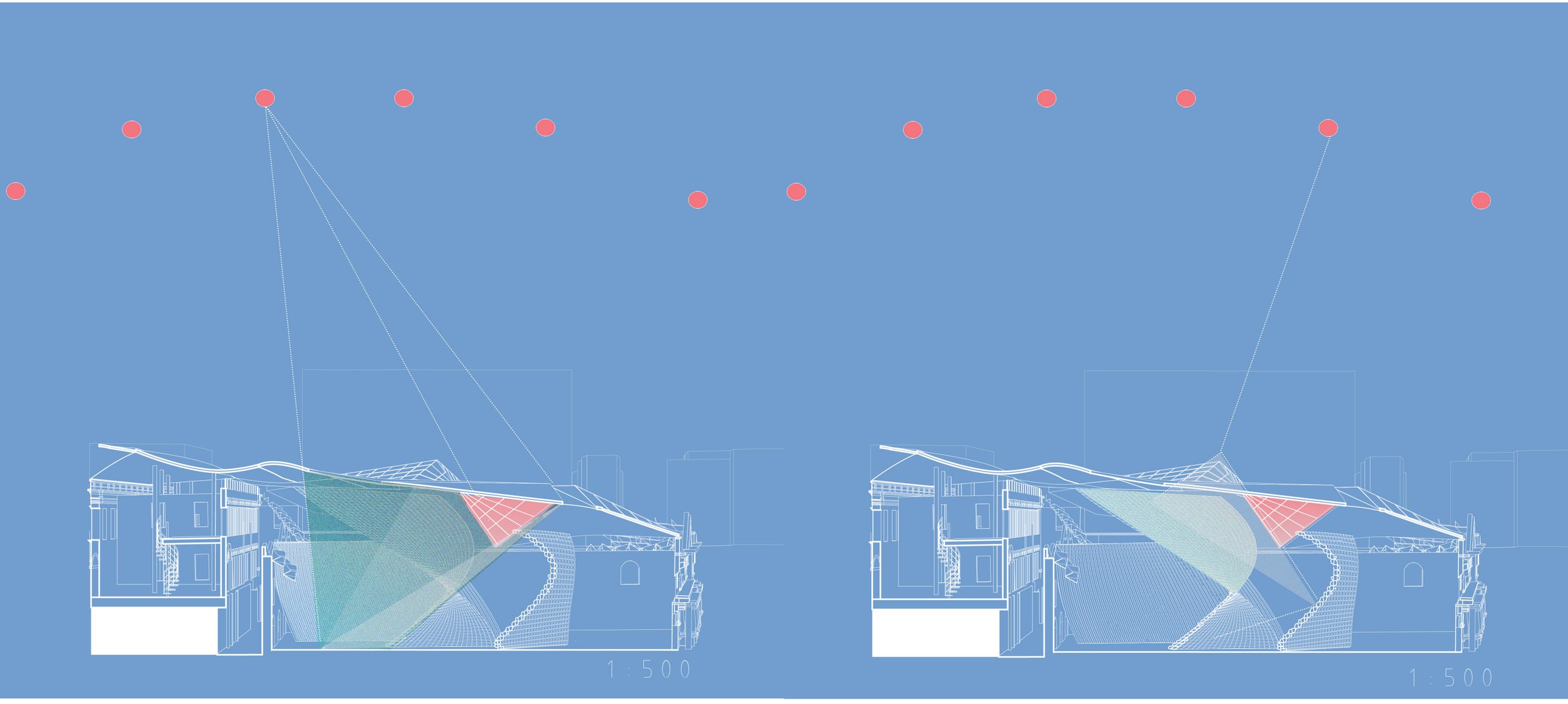


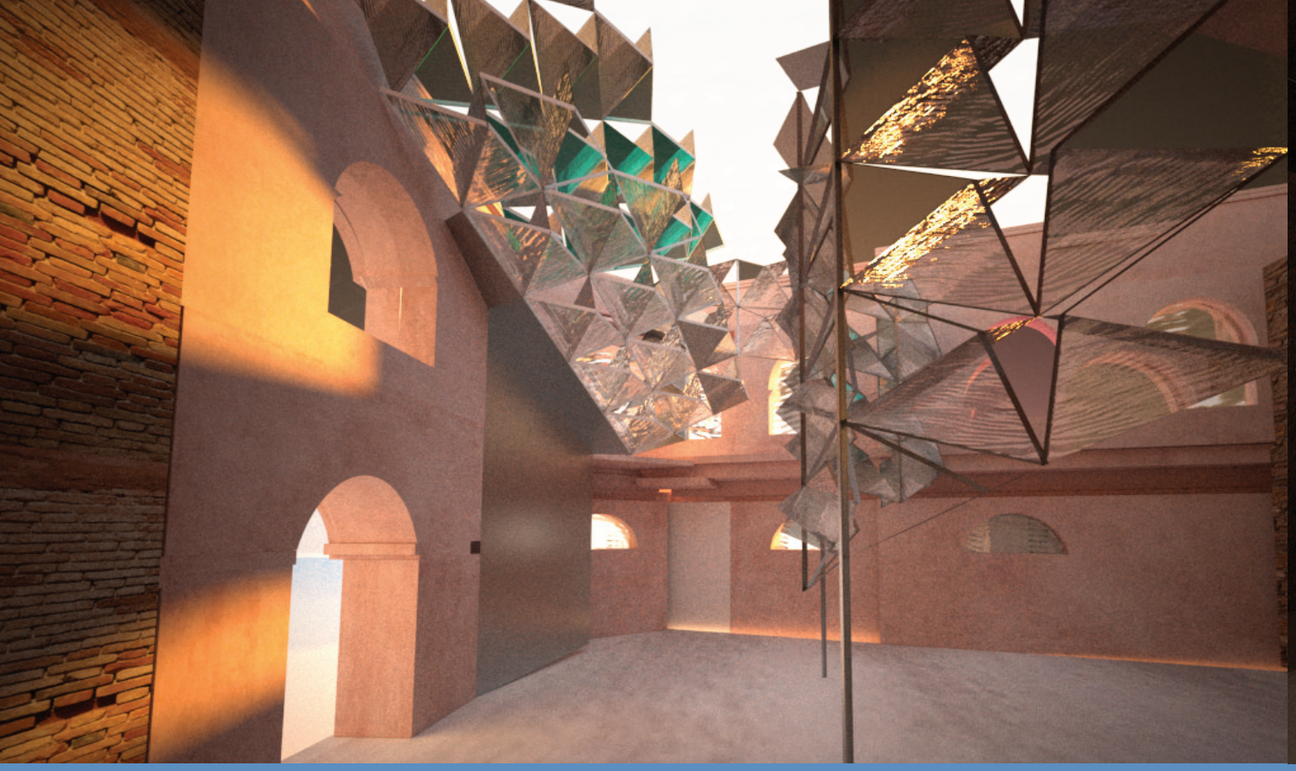
15:00 SUMMER EQUINOX

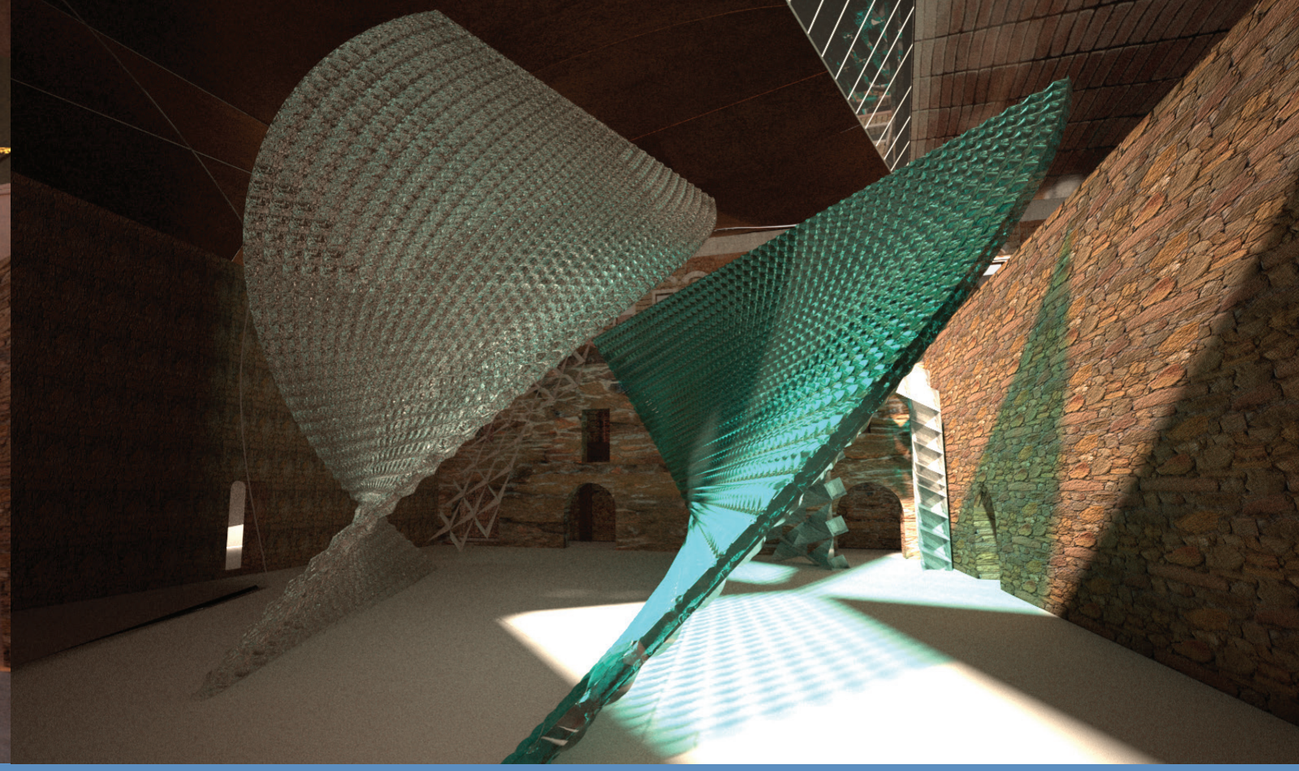


NOON WINTER EQUINOX

15:00 WINTER EQUINOX







PART II. LUX

GEOMETRY AND LIGHT

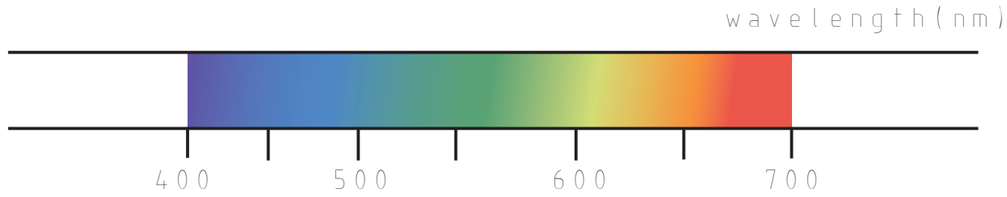
Structural color is the result of selective light reflection and absorption of light, the color is determined by the geometry of the structure and scattering of light occurs at interfaces between materials of different refractive indexes .

Gestalt psychologist David Katz describes volume colour as “colours which are seen as organized in and filling a tri-dimensional space”. True volume colour according to Katz is transparent. (Katz, 2014)

The angle of incidence depends on the the position of the viewer and the beam of light intensity upon the subject. The angle of incidence equals the angle of reflection. It produces the most possibilities of interference and specular reflection. This was the strategy that could be most easily applied to architecture because of its simple geometry.

The amount reflected is also dependent on the angle at which the light hits the surface. The intensity of the light incidence on an object is divided into three categories: specular reflection, transmission, and absorption of light by the object. (Brachlow, 2008)

The condition of the surface creates incoherant scattering such as the sky or the ocean. Irregularity of structure creates diffraction such as holographic/ iridescence.Diffraction can be created through blazed geometry at a 45 degree angle or through sinuousoidal and wave like surfaces.



The human eye can identify a visible spectrum that varies between wavelengths of light from 380 nm to 700 nm. Short wavelength light often appears blue or violet while red is the longest wavelength.One nanometer is a billionth of a meter. What determines whether a particular wavelength of light is visible or invisible
depends on what your eyes can detect. For example, under the right atmospheric circumstances we can see an aurora borealis but they are still there even when there is poor visibility. A camera’s longer exposure can capture brighter hues while we see shades of gray in the case of an aurora at night. Sight is bound by natural limitations that shape our perception.

To produce the illusion of color this chapter studies how light depends on geometry and material behavior. Luminance is what was not controlled and transformed the space throughout the day. Since the project relies on sunlight versus controlled studio lighting it is not pure white. As the sun intensity increases long -wave length has a yellow hue. While short wavelength light turns blue-green. This is known as the Bezold -Brücke hue shift. (Albers, 2013)

Materials are responsible for refraction- when light passes from one material of different density to another the light changes speed. The refractive index is how fast light travels through a material that is the speed of light divided by the phase velocity of light. It determines how much light is bent when entering the material. This value varies with wavelength and the refractive index effects the dispersion and transmission of light. This speed change defines Huygen's principle when the speed change causes the light to be refracted and to enter the new medium at a different angle.

The transmission in percent for every wavelength is specified in 1 nanometer steps for angles of incidence in five degree steps from 0 to 45 degrees.

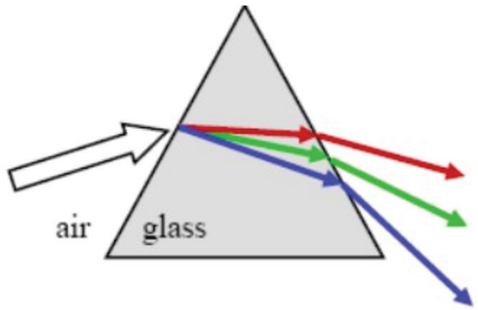
Dispersion splits light into colors when refraction of two materials occurs. This phenomenon of is seen in rainbows when light comes in contact with air and water. Artificially we can produce this effect with a prism.

Periodicity is a common factor in most structural color in photobiology. Periodicity optical conditions are angle dependent and has recurring intervals where refractive indices meet as a result of structure or air gaps where reflection and transmission create different colors via polarization. It is formed by multiple layers of materials of increasing refractive index or a periodic variation. A Bragg mirror is a structure that consists of an alternating sequence of two different optical materials and can be color selective due to the refractive index contrast.

PRISMS

The geometry of prisms cause dispersion of light. Optical prisms are of then an extruded triangle shape of polished transparent surfaces- of which one must be angled. This splits white light into spectral colors. The index of refraction of glass increases as the wavelength decreases. Newton's experiments with prisms demonstrated colors existed in white light and travel at different speeds. He also discovered that with another prism and lens you could recompose the spectrum into white light. In regard to dispersion this is the most universal form that we can grasp and scale into a larger context.

Ice crystals become a prism when the sun is 22° above the horizon. Lower than that angle we see only a "halo" effect of light. (Liou and Yang, n.d.) The refraction where air meets water also creates dispersion present in rainbows at 129° and 137.7° . (Sassen and Zhu, 2008) Over 120° you achieve scattering where short wavelength light is abundant and appears blue.



Blue light is refracted at
larger angle than red:

normal dispersion

MIT Optics, Isaiah Hickey
2004

TYNDALL SCATTERING

The Tyndall effect describes the phenomena when transmitted light is transparent and the reflected light appears blue. In scattered light due to small particles such as dust or tiny water water droplets , shorter wavelengths predominate. Shorter wavelengths always refract, or bend, at sharper angles than longer wavelengths. Direct sunlight can appear yellow or transmit red (longest wavelengths) from the opposite end of the light source.

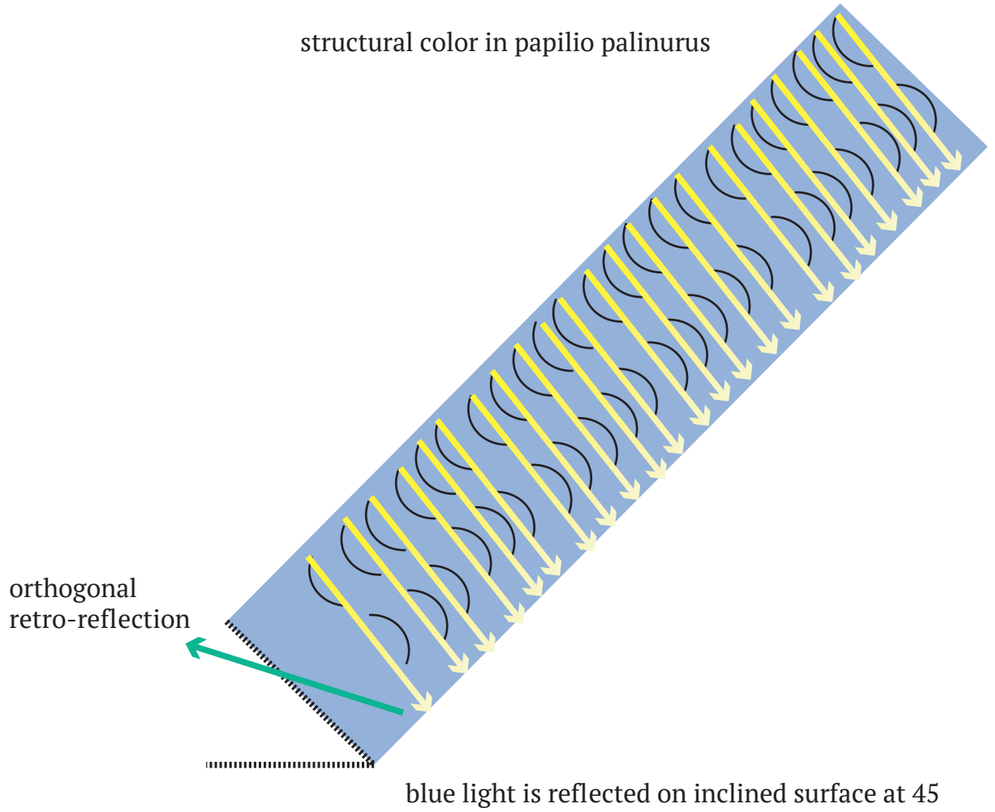
John Tyndall observed this when he wanted to discover how scattering explains the color of the sky. He constructed a glass tube that simulated the atmosphere with a source of white light in the end. He introduced smoke and the beam of light appear blue when looking at one side of the tube and reddish on the the other end of the tube opposite the light.

All the material behavior tests resulted in Tyndall scattering despite the different geometries. This is probably due to using real sunlight versus controlled light simulations.

POLARIZATION

Through geometry another possible light phenomena could create structural color through polarization. Structural color could be partly reflected and part transmitted to create an indirect mixture. The butterfly Papilio palinurus exhibits structural color that is green to human vision.

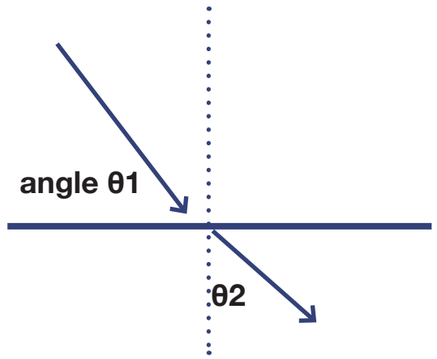
The double reflection of orthogonal sides of a concavity due to the structure of its wing scales create orthogonal-surface retro-reflection. (Sun, Bhushan and Tong, 2013) The wing scales form a continous layer of juxtaposed concavities. Yellow color is produced at theincidence of the normal by the reflection of the center of concavity. Across each opposite side blue forms a double reflection because each side is angled while the surface is orthogonal opposite to the concavity. Blue light is normally reflected from a 45° inclined surface The diagram can be seen on the following page (right.)



SNELL'S LAW

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

n_1 = incident index
n_2 = refracted index
θ_1 = incident angle
θ_2 = refracted angle



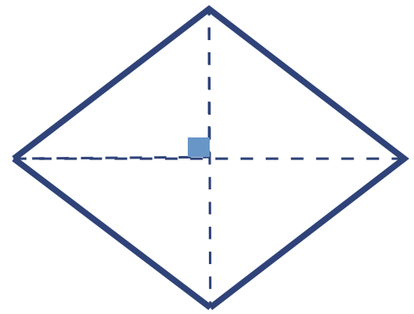
The previous pages explain the theory of refraction and how the speed of light changes at interfaces. Light travels in straight lines then the refraction index changes at the boundary that determines a new direction.

"Snell's law implies that, if n increases, the sine to the angle of refraction decreases,and therefore the angle itself decreases. When a light beam enters an optically denser medium it is deflected towards the normal, while the ray is deflected away from the normal when passing from a more dense to a less dense medium." *Light, Color, Vision* (Valberg, 2010)

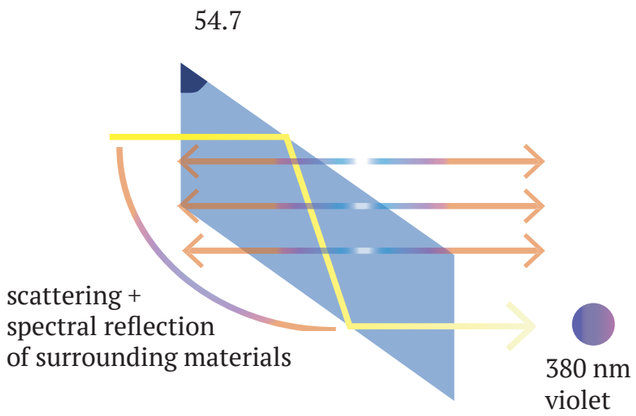
Understanding incident light and refractive indices was the first step to the process of defining the boundaries of light and space at different scales.

Understanding the equations that involved light optics the first form that was defined as a way to manifest spectral color was the prism and Fresnel. When researching structural color in the natural world at 45 degrees- reflection produced structural color. (Sun, Bhushan and Tong, 2013)

For glass with a refractive index of 1.51, Fresnel calculated that a 45° phase difference between the two reflection coefficients. The fresnel rhomb manipulates the polarization of light. The incident light is linearly polarized at a 45 degree angle to the place of incidence. The two internal reflections create a 90 degree phase difference between two perpendicular components of polarization. The light that travels out of the rhomb is circularly polarized.



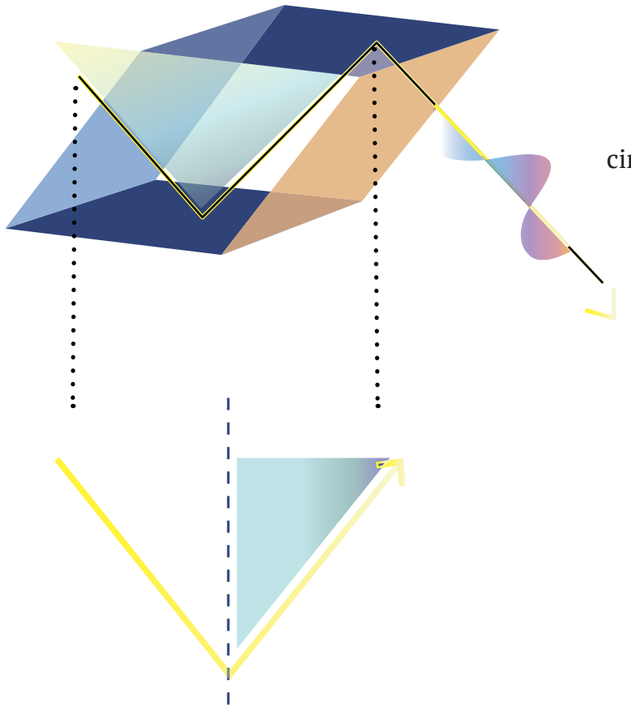
BREWSTER'S ANGLE OPTIMIZES ORIENTATION OF LIGHT



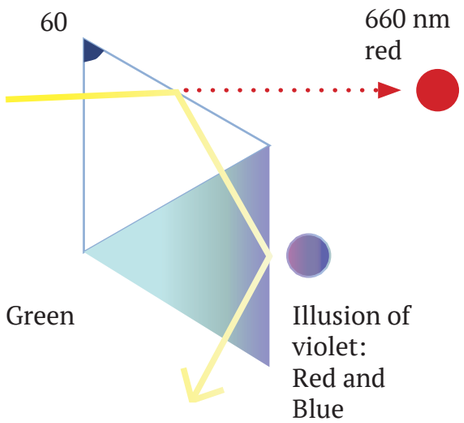
The condition for the Brewster's angle can be derived by forcing the reflection to be zero, which in terms of Snell's law can be written as $n_1 \cdot sin\,(\theta_i) = n_2 \cdot sin\,(\theta_t)$,

(Emery and Camps, 2017)

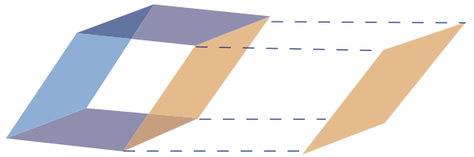
FRESNEL RHOMB PRISM+ SURFACES

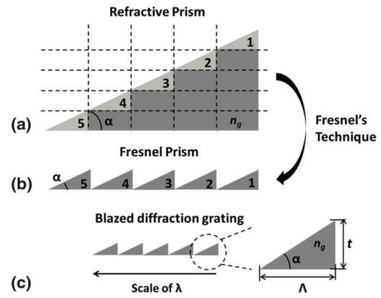


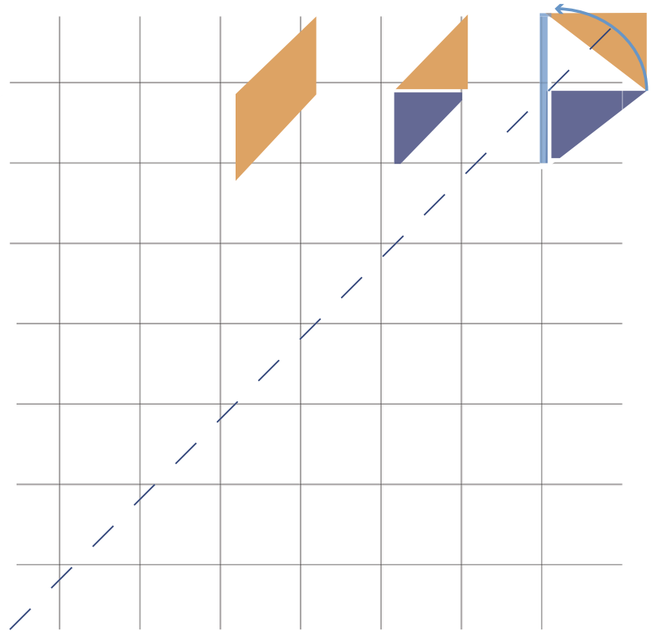
circular polarization



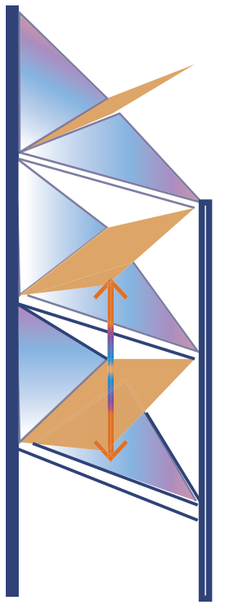
Yellow light is deviated and the spectrum is separated into red,blue, green

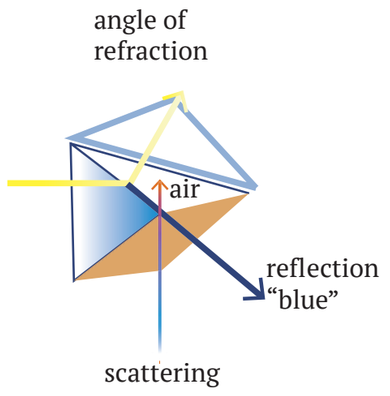


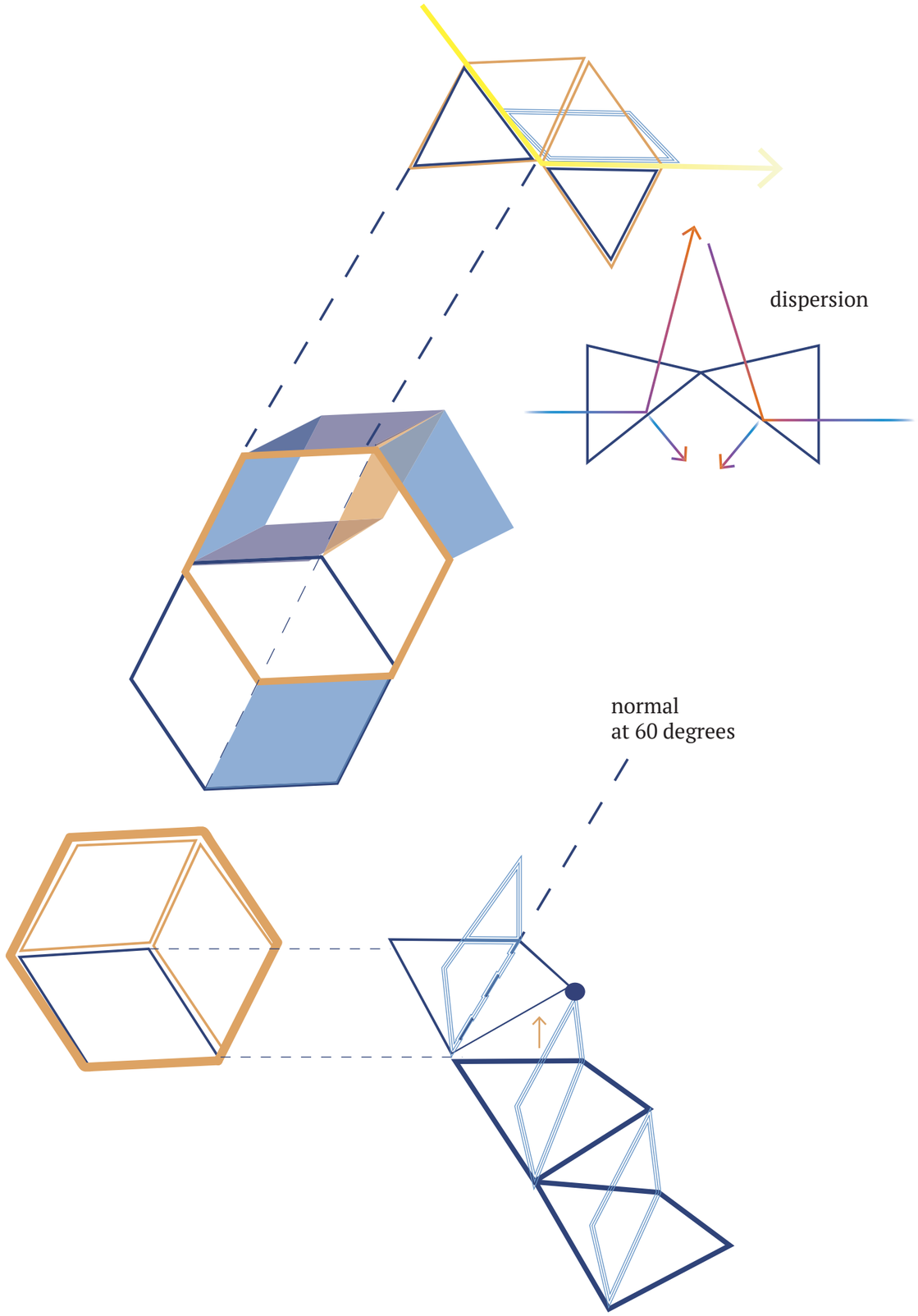


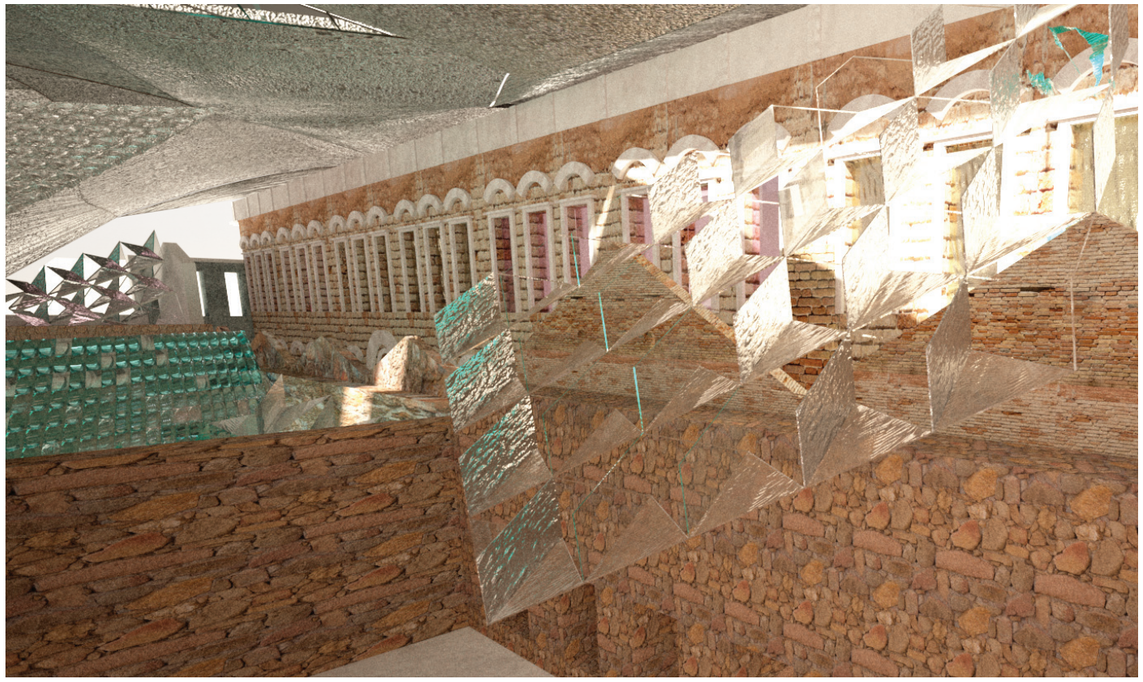


The graphic on the top left made think of a grid that could apply Snell's law and blazing. Instead of a surface with a diffraction grating it would be a space that would reflect structural color. It began a a rectangular grid with a 45 degree rhombus was placed diagonally (also across 45 degree line) and then the rhombus would be split by a normal which connected it to the row below. The normal could vary the refractive indices and each rhombus had an air gap. The result led to polarization where it is part transmitted and part reflected.

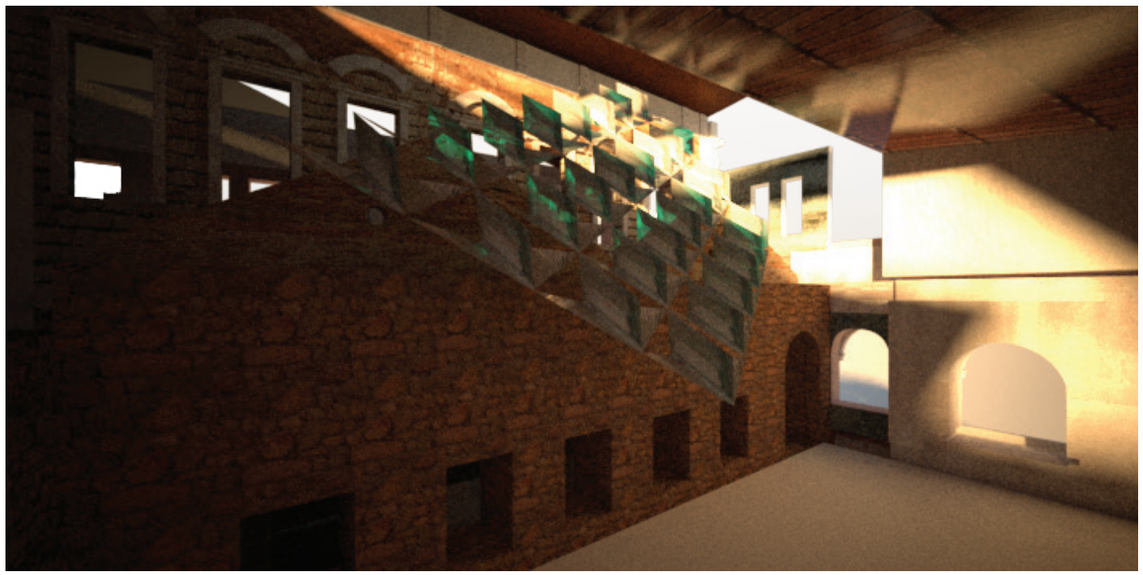




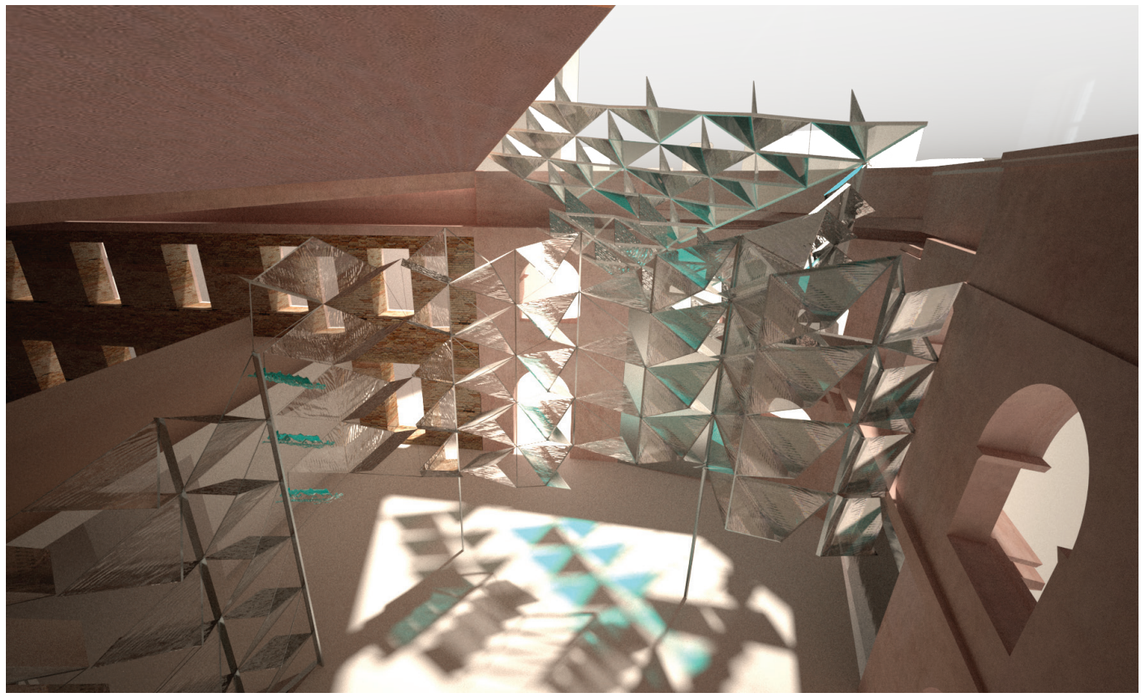




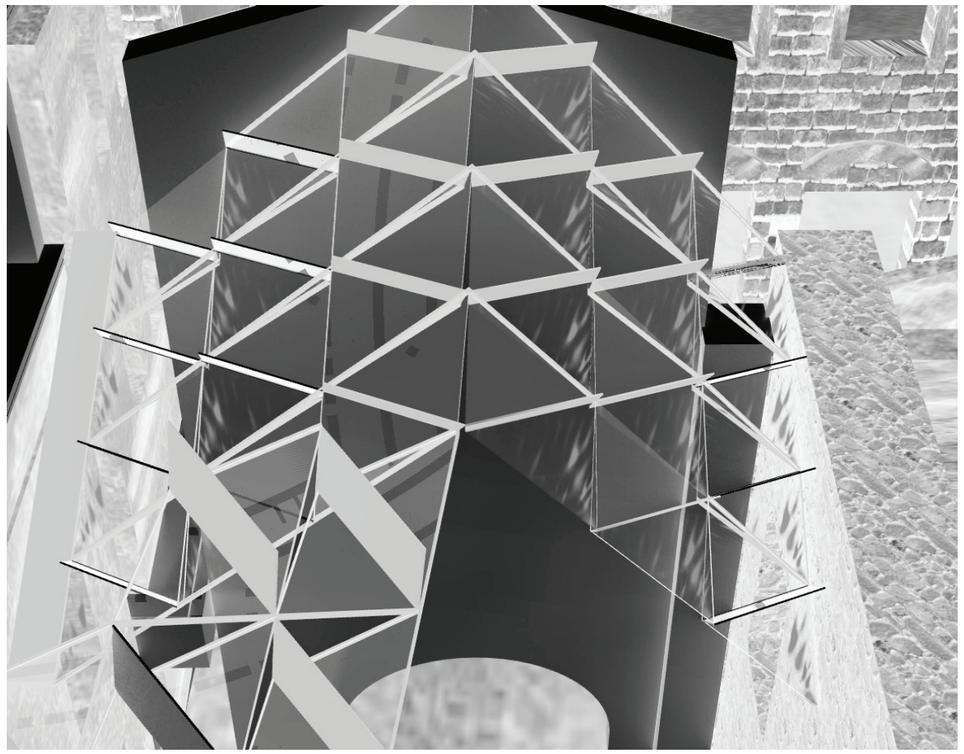
noon summer solstice: incidence from south



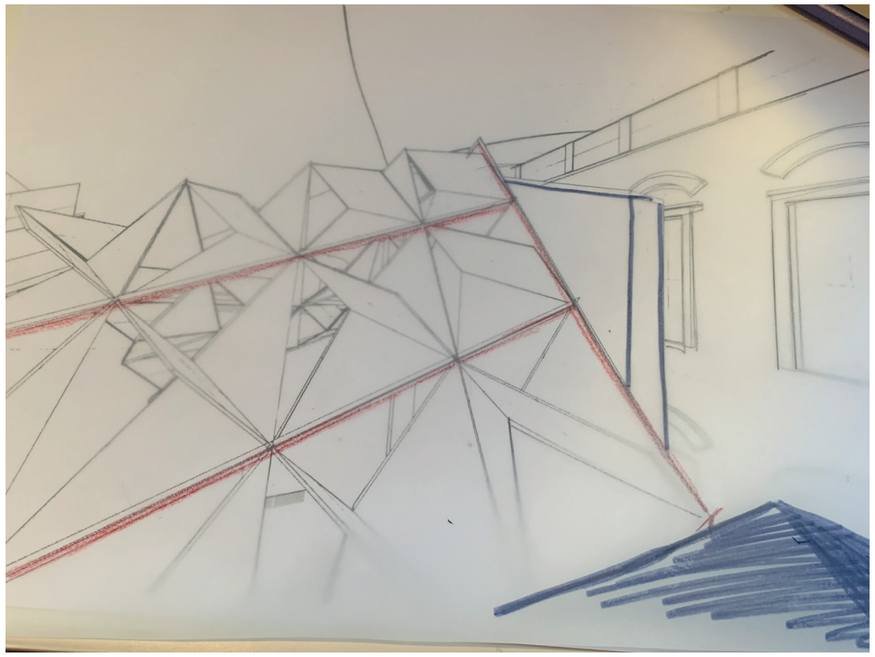
sunset winter solstice incidence from north

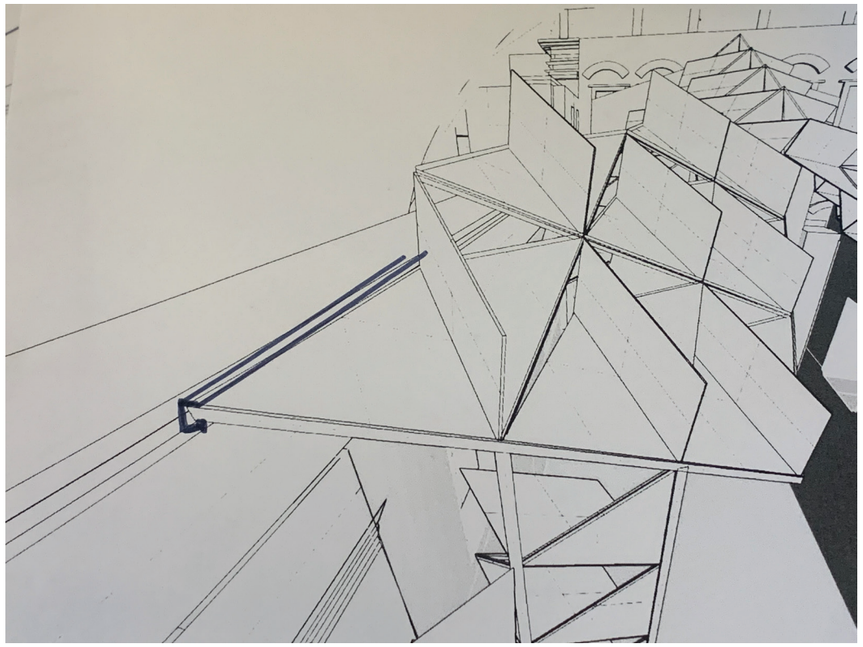


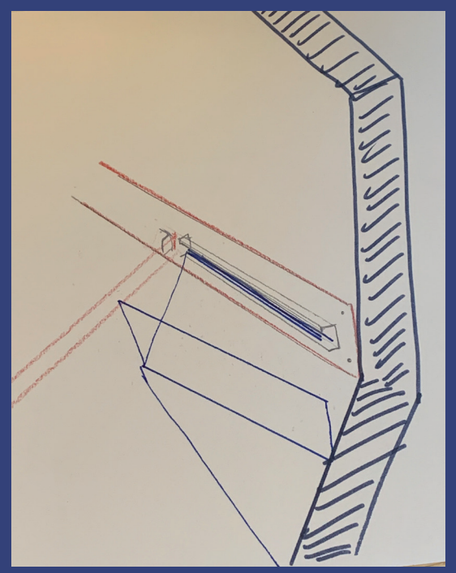
Recycling deposit

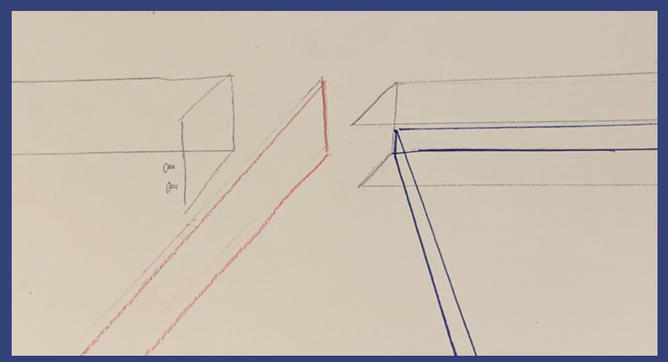


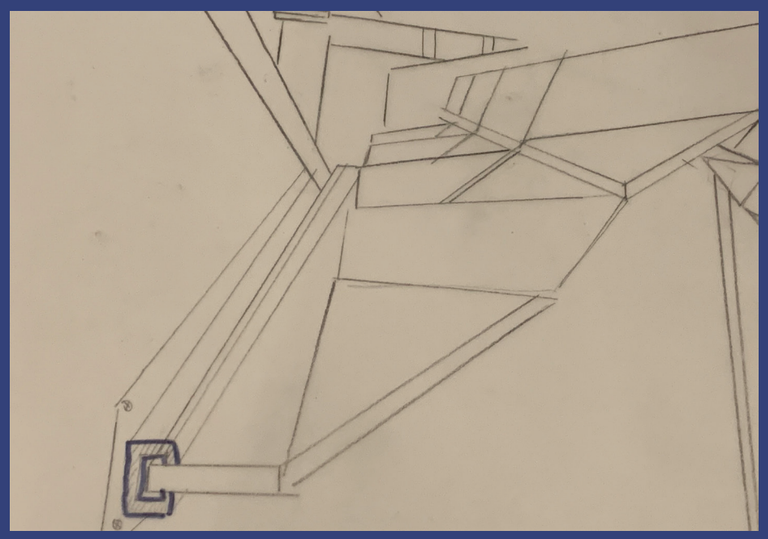
Top View: Classroom
Taken from Rhino Render



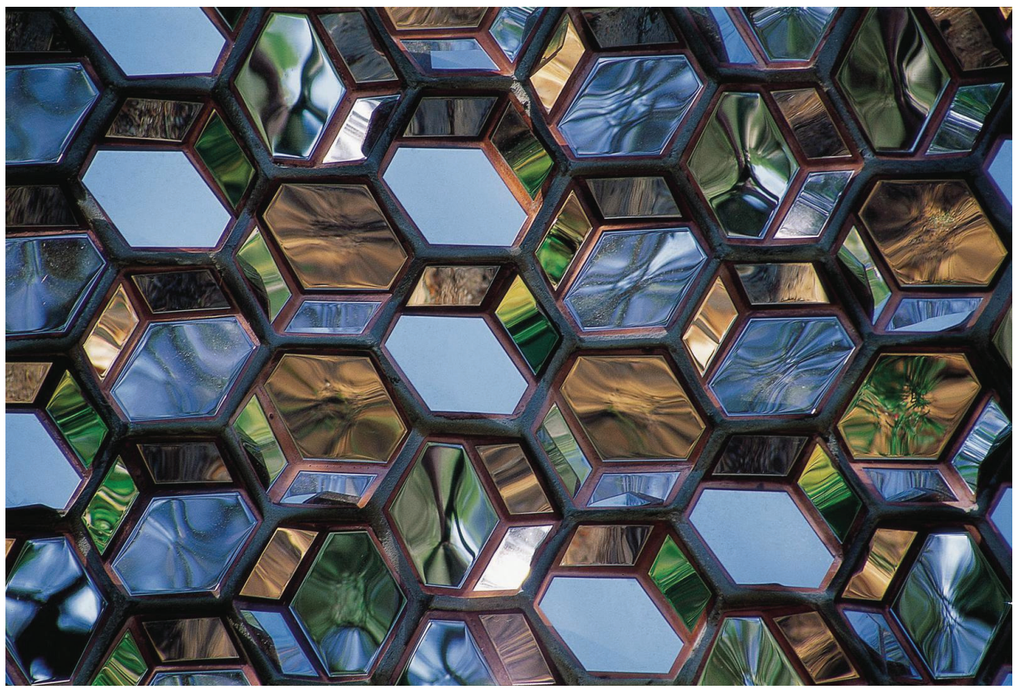




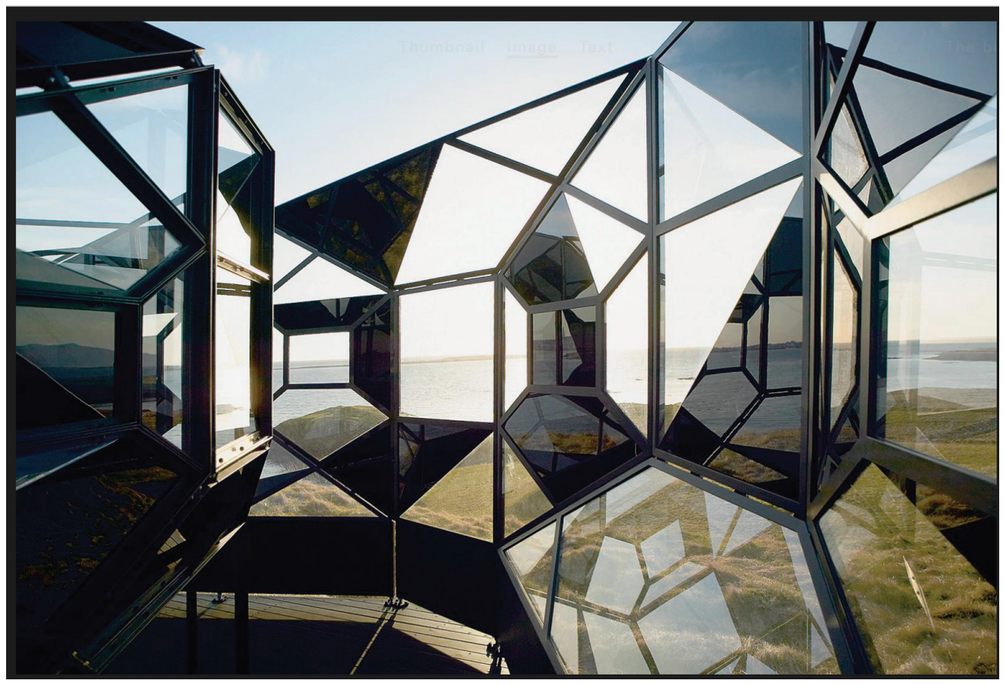




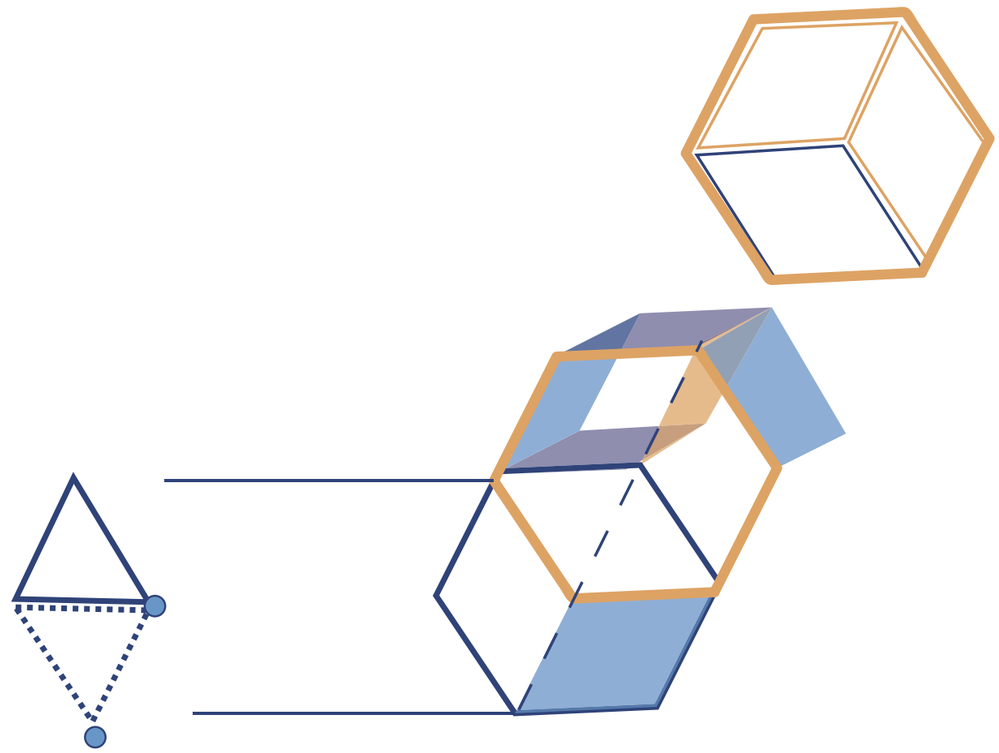
PRECEDENTS

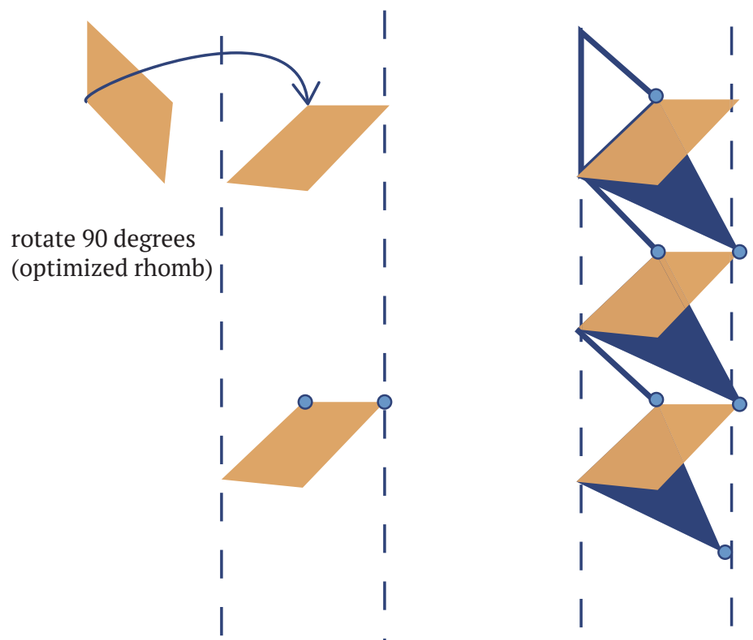


Quasi brick wall, 2002
Fundación NMAC, Cádiz,
Spain, 2006
Photo: Gaetane Hermans



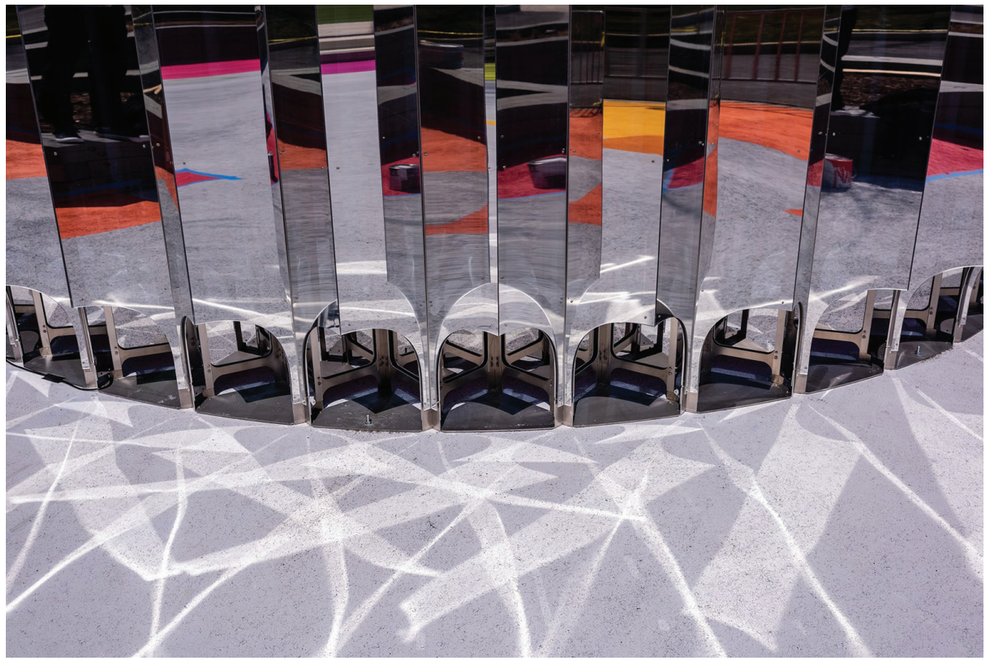
The blind pavilion, 2003
Videy Island, Iceland, 2005
Photo: Fridrik Orn





STRUCTURAL/ CONNECTION PRECEDENTS

Wall Detail and Support
Richter Musikowski- Futurium Berlin



Floor Support
Soft Lab “Mirror Mirror” Photos by Alan Tansey

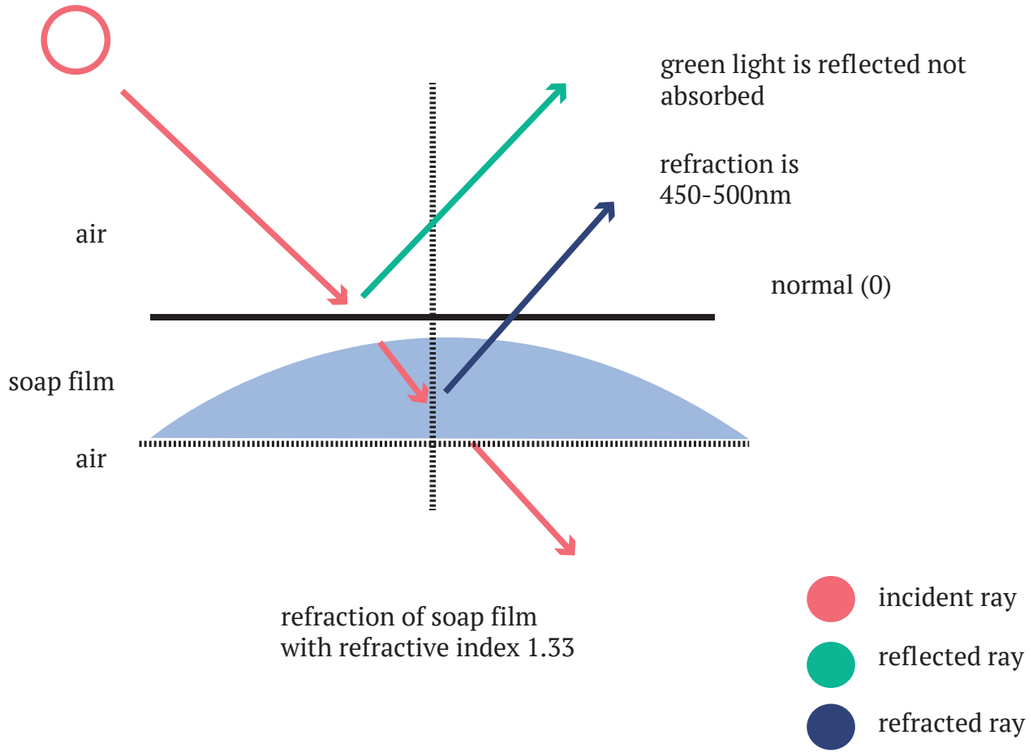
Concave forms bend light by principle and is probably the most widely used glass element for optical properties. It was the most interesting shape that could create different caustics. Although, wave-like sinousoidal diffraction has been applied to a surface I wanted to create a wall that appeared that if it where moving as the light travelled through it. I also wanted the viewer to also have a distinct experience as they approached and confronted it. To create a surreal, kaleidoscopic passage through the building that had life of its own.

Pallasmaa refers the resemblance of glass and water as an image. “There are,” he continues, “great poets among glass designers, artists architects and engineers, all capable of imagining enchanting dreams in glass… able to express the multiple essences of the material, its simultaneous brittleness and malleability, hardness and fragility, immateriality and solidity, heaviness and weightlessness.” (Juhani Pallasmaa, 2011)

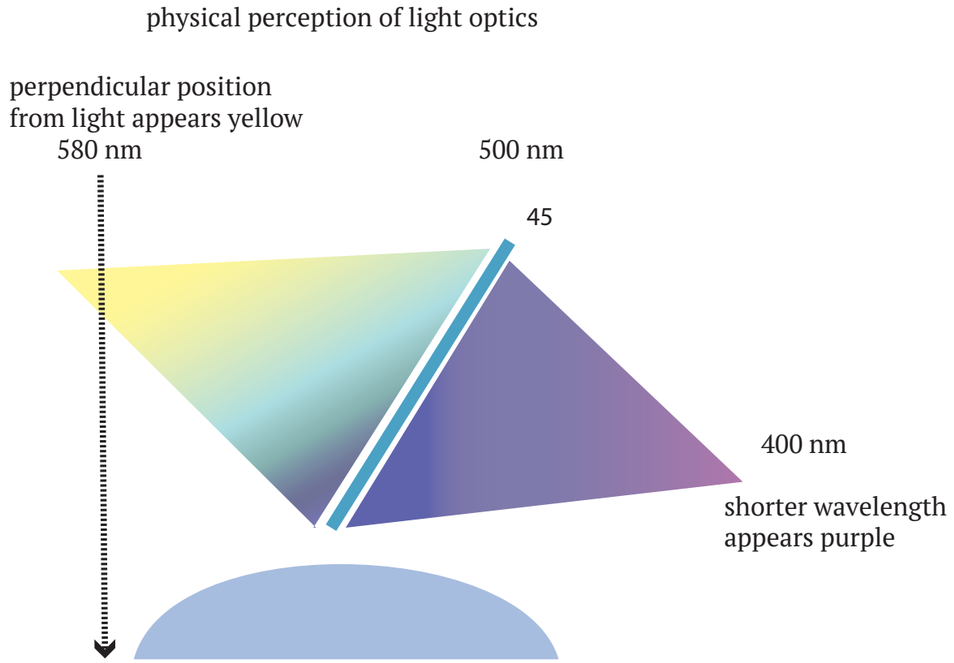
If we think of the surface of the water as an image it would be defined as a series of positive and negative lens. All light, whether visible or invisible, is a kind of wave. The surface morphology of the wave is composed of a network of positive light allows us to see the bottom and the negative light refracts light and increases contrast.

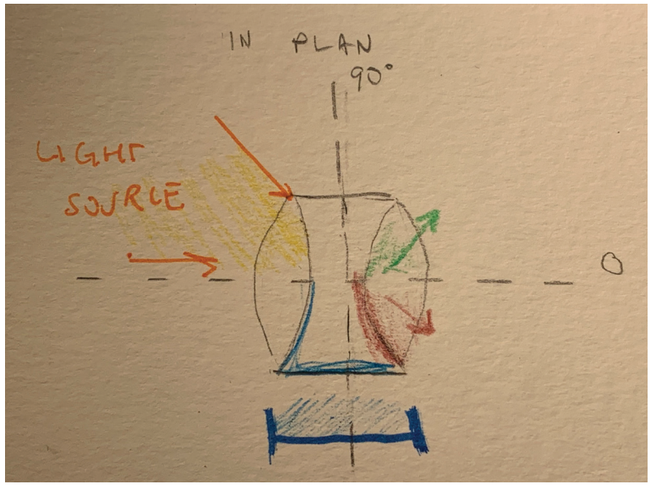
A hexagonal cell creates a network of geometry that creates holographic light that reflects light due to the inclination for 45 degrees and it is lofted to create an element of juxtaposing concavities to create a double reflection similar to the illusion of the butterfly Papilio palinurus. It comes alive however due to the position of sunlight and the structure that holds the bricks.

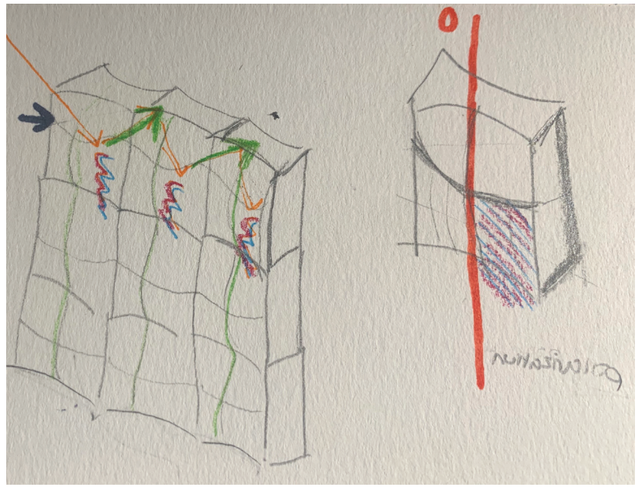
The structure becomes a metaphor for how light meets water. We are drawn to the reflection of light for our instinct for water. The negative light “ concave lens” that refracts and creates contrast draws a parallel to the glass bricks illuminating the contrast between waste and art.

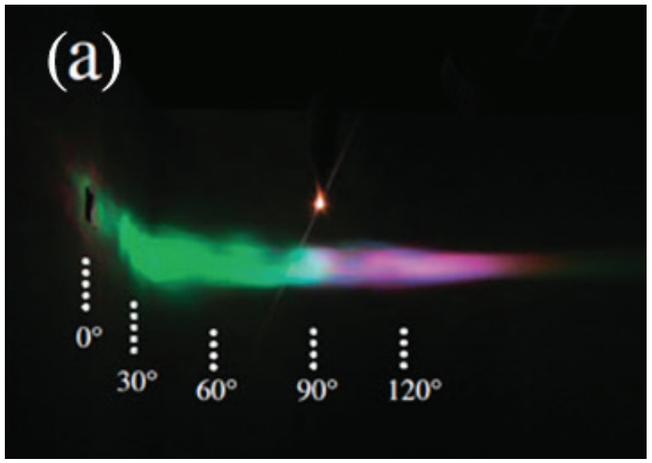


refraction of soap film
with refractive index 1.33

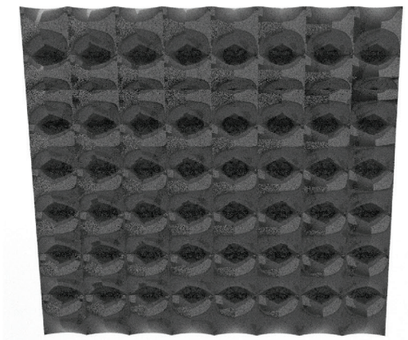


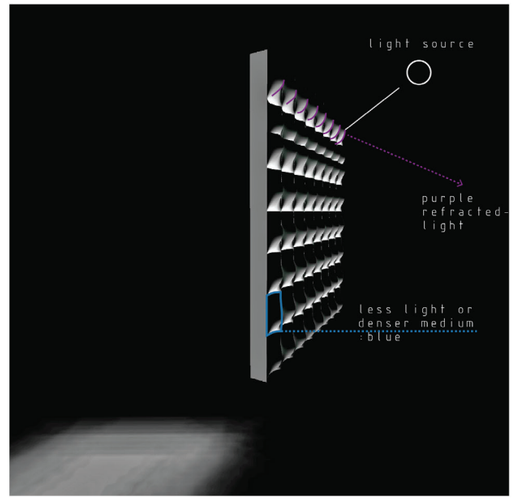

IN PLAN
90°
LIGHT SOURCE
0

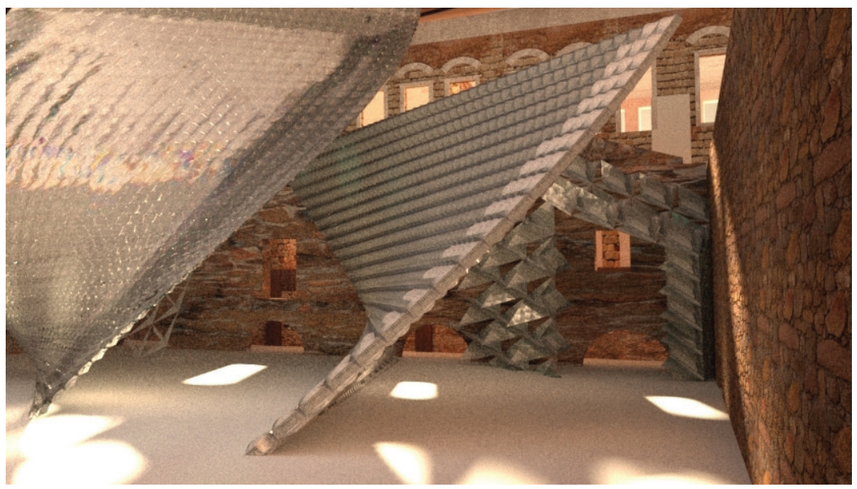

0

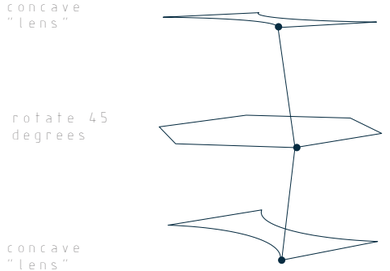

(a)
0°
30°
60°
90°
120°

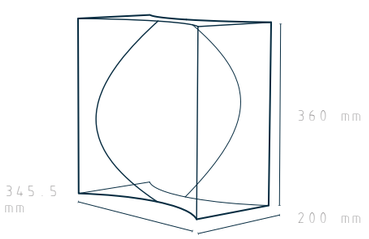
2x2 WALL



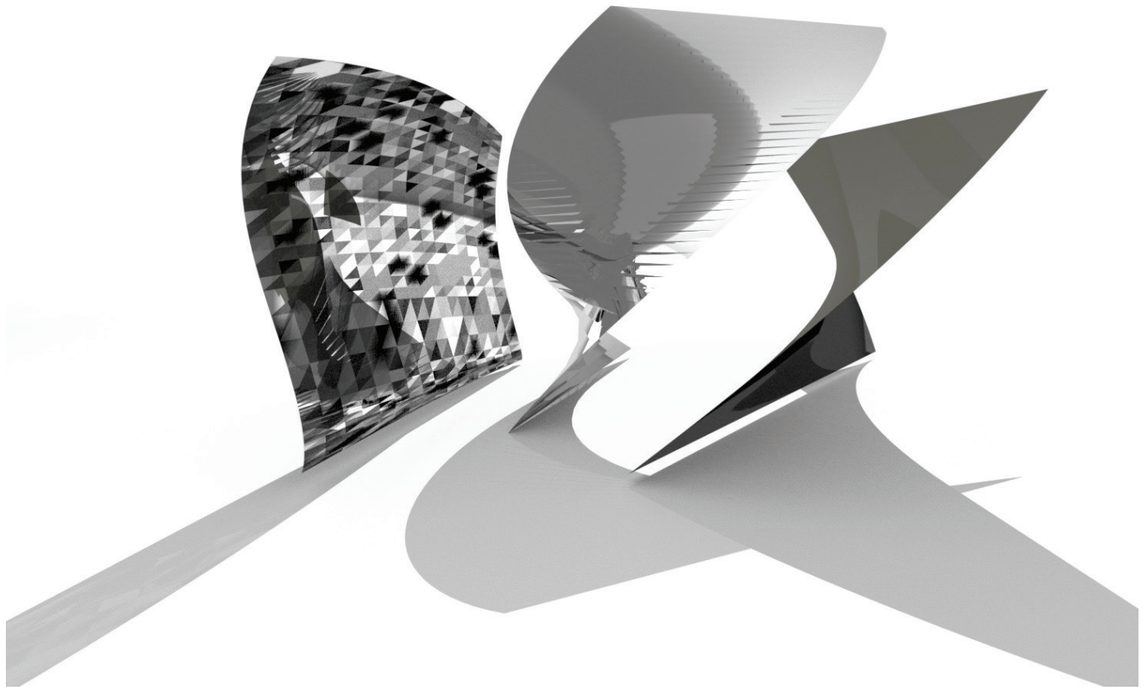

light source
purple refracted light
less light or denser medium blue



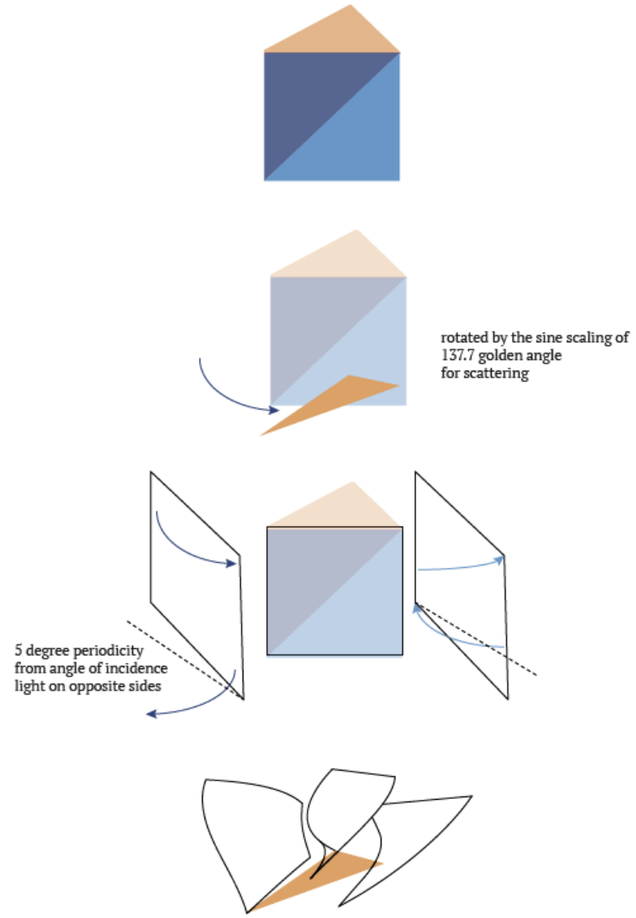

concave "lens"
rotate 45 degrees
concave "lens"

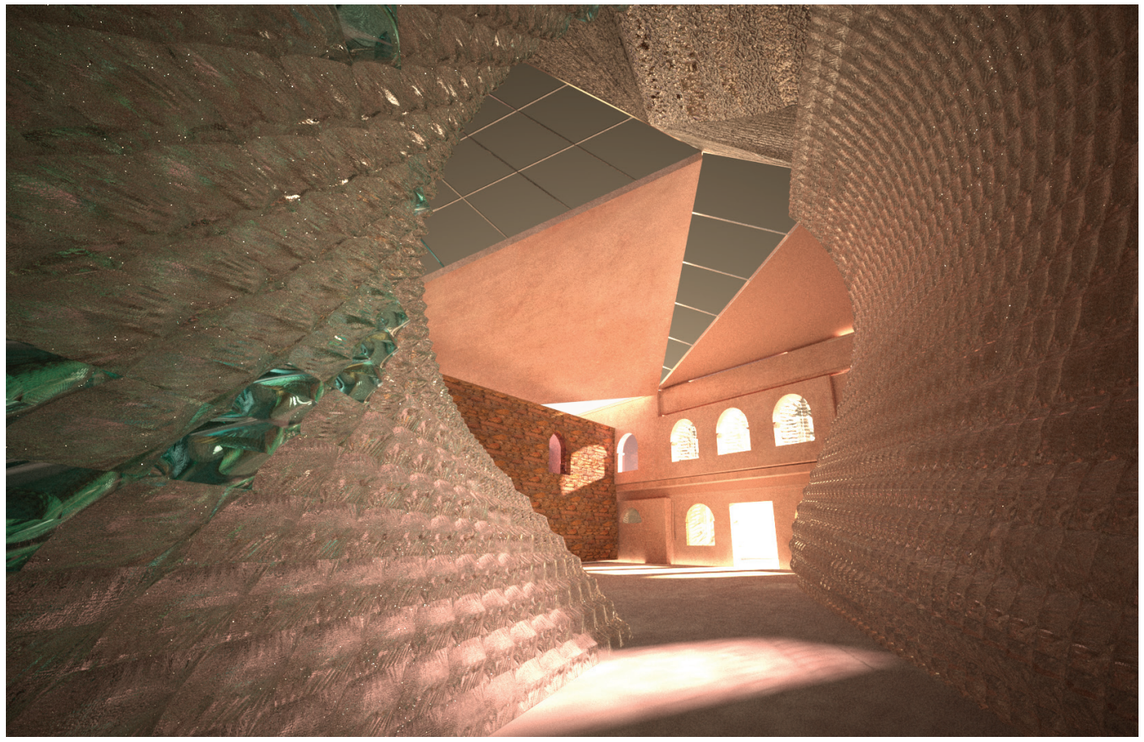

360 mm
345.5 mm
200 mm

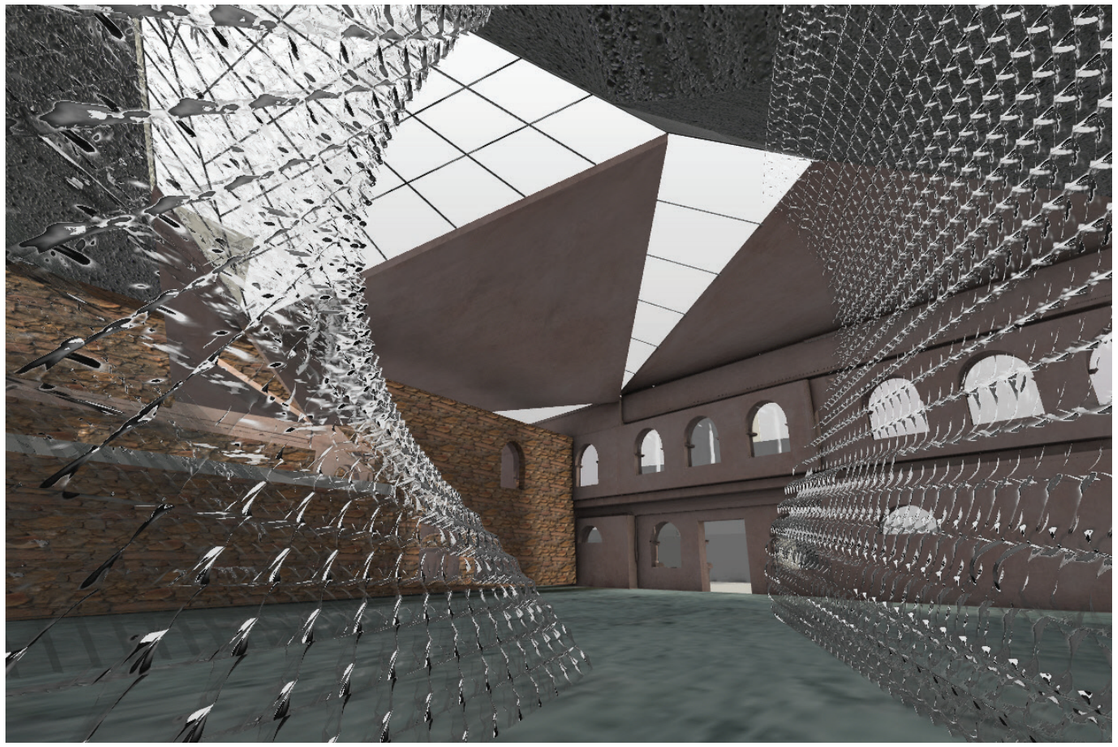
RAYTRACING



To the left we see the contours of that contribute to the optics, it plays a role during sunset, during winter or long wavelength light. This ellipse creates interesting caustics which is compounded by the reflection of warm light. This warm light also creates a Bezold Brucke Shift in the middle helix appearing more green. Here the middle helix is cut in order to see where the two concave curves create polarization.



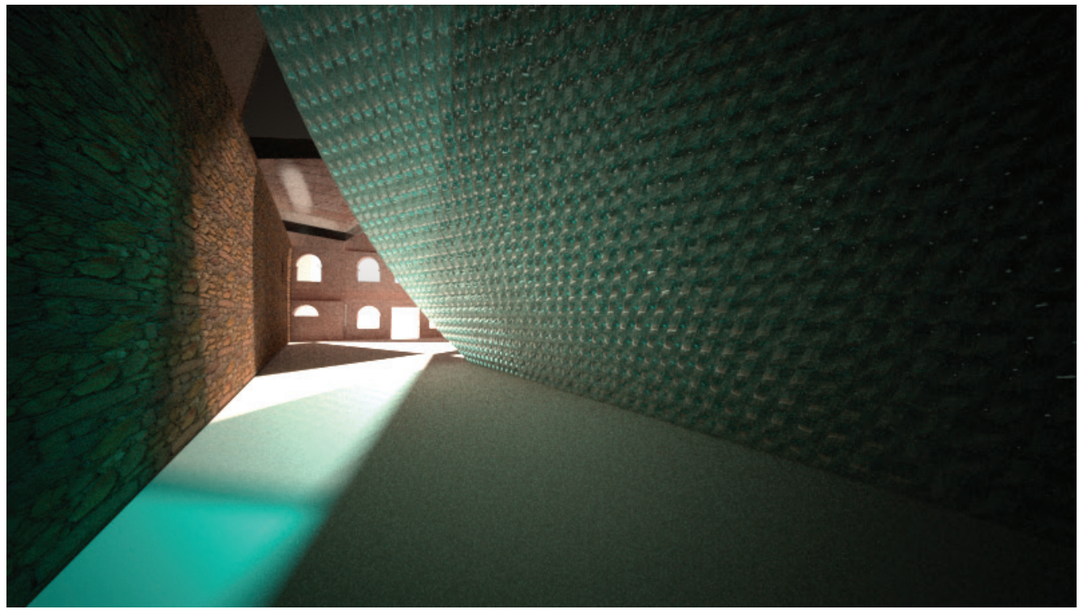




Spring Equinox 18:15

shortest wavelength reflected purple

CONCLUSIONS + ILLUSIONS



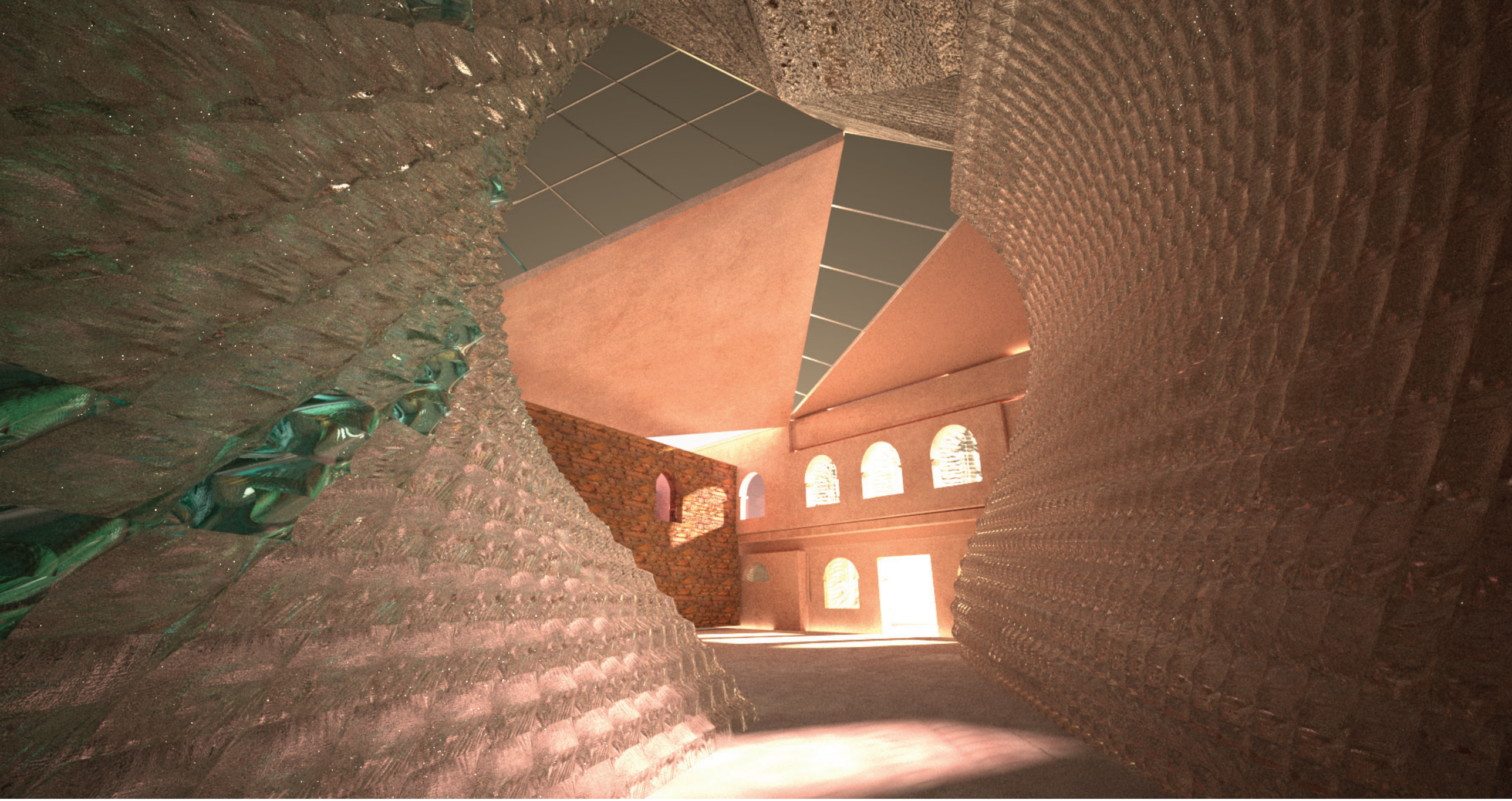
“Real is always recurring, but at the same time its never fully there. The real in that sense, is utopia, we all search for it and the more we search, the more we have to acknowledge that the real is a construction.”

Olafur Eliasson (2016)

Light enables us to perceive our relation to objects within space. The same principle that applies to sight- becomes a tangible reality for our relation to objects and consumption in the present. Waste is transformed and suspended in a fluid, transparent structure- it is the daylight conditions or on the viewing angle that create a sense of movement and the illusion of color.

Distorting reality using our natural limitations, in this case visible light using form and materials to induce refraction to confront the image of waste and the value of the catadores. The intervention materializes blindness by illuminating the transformation of waste and simultaneously recognizing the magnitude of their social responsibility. Glass creates a reflection of a collective unconscious. It debates if our progress is an illusion.

Light and color shift through space: their essence is temporary. It is just like the glory of the past in Comercio. The historical footprint of the built environment remains and the Trapiche is a product of the growth of Salvador. The trapiche is a mediator between flux and lux. Flux encompasses the historical continuity, as well as the local and universal reality of the presence of waste. The catadores, their labor and the recycling lab establish a physical place in the eyes of the city. The “civilization of survival” as Lina Bo Bardi stated is critical to popular culture. The intersection of the natural laws and popular culture are manifested in the program of the building: as laboratory for waste transformation and learning space for circularity. Urban alchemy becomes the first law of thermodynamics: “Matter cannot be created or destroyed, simply transformed.”



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