



# LITTLE ORDER

Reuse of gasometer

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CHALMERS



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Reuse of gasometer

**Thesis** - Master of Urban Design and Architecture  
Chalmers University  
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**CHALMERS**

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## PART I. theoretical background & research

This chapter contains all the theory that led to the final design, including the research that was made on an architectural system. In this way, for this project,

## abstract

The thesis project 'Little Order' investigates the ways an architectural reformation of an existing building envelop can create an interesting outcome which can be both context and content. The design finds its point of departure at the gasometer- 'Gasklockan', the 77 meters tall former gas tower in Gullbergsvass, an area neighbor to the east side of central Gothenburg. The result is a multi-use space of cultural character, a landscape inside the building. The idea starts from preserving the totally closed outer shell of the gasometer. How does the natural light come in? What kind of program could be established in this conditions?

The research is based on the admission that the image of Gasometer tower has to be preserved as an evidence of the industrial heritage of the city. How can natural light be introduced in a high and wide space without ruining its shell? The research focuses on the interpretation of the optic fiber using mirror cladded shafts. As soon as the light is directed to the place needed, the reflection properties of the glossy materials on the ceiling reflect or diffuse the light in order to be used. The prerequisite is the curved shape of the ceilings for better diffusion.

The design has to deal with the rules the lighting system has set and combine them into an entity that creates a landscape in the building's envelop. The form of the curved ceilings and floors include also the circulation with ramps and staircases with several routes leading to each space. This landscape includes closed spaces with cultural program. Those are two theatres and auxiliary spaces like workshops and study rooms, a multi-use aula, an exhibition room and an observatory on the top of the building. Between these closed spaces there are several meeting places with natural indirect lighting.

The goal of this thesis is to base the whole design on the idea of the indirect natural lighting and use the prerequisites of this idea to its fully potential.

Examiner: Morten Lund  
Supervisor: Kengo Skorick

# discourse

This master thesis deals with the question of how can existing building shells be reused in a creative way. It also proposes that by reusing an extant building envelop, further urban development might be triggered in the surrounding area.

The word reuse in architecture is a big chapter, however it needs to be explained that this project focuses on preserving the presence of a building in the general image of the area of Gulbergsvass and also generally of the city of Gothenburg. That would mean that the “Gasklockan”, the gasometer of Gothenburg is one of the last evidences of the industrial heritage of the city and this image is to my opinion what it needs to be preserved, rather than its former use as a part of the gasworks of the city or its value as a historical building.

This acceptance offers freedom which allows basically the designer to be experimental and confront the extant shell as a three dimensional space that provides limitations to the possibilities of the design outcome.

A further discussion would be the possibility of a trigger point of urban development. Designing through experimentation might end up into an innovative settlement that will attract the interest of the citizens to an abandoned area and possibly activate it.



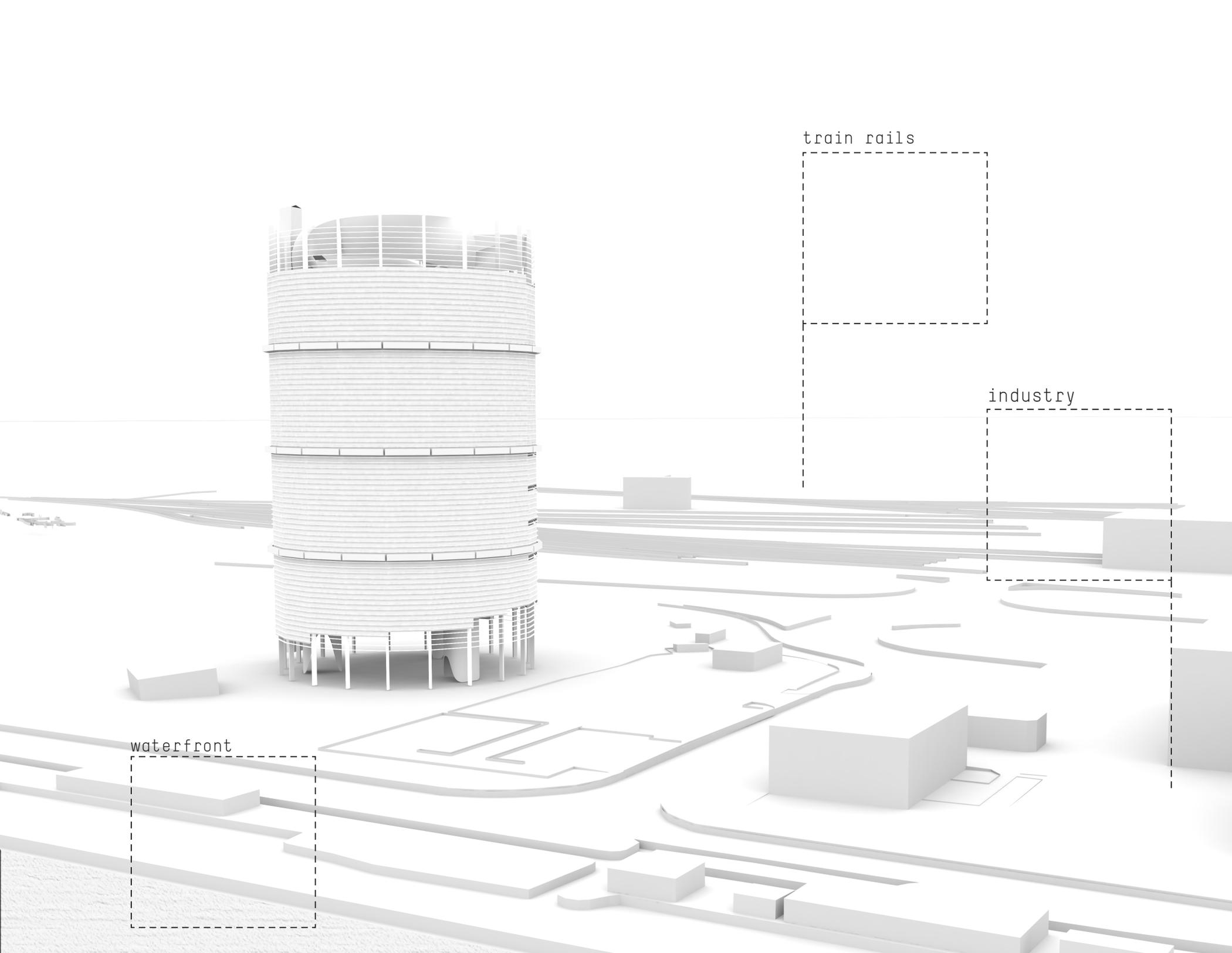
# Context analysis



The gasometer is situated in Gulbersvass, an area of about 1500sq.m. in central Gothenburg. The distance from the city center is only 1km. The area is characterized as an urban void since the built environment is sparse and the free areas are of undetermined character. A big contrast is evident between this area and the neighboring areas of Stampen, Nordstaden, Olskroken which have a coherent urban fabric.

The land use in the area is mainly parking lots and open areas. Also the railway infrastructure covers an important part of the area.

Gulbersvass used to be a quay on the Göta river. The gasworks of the city opened in this area in 1900 and closed down in 1993. The gas tower is the only evidence of the gas works.



train rails

industry

waterfront

*“An important element of the urban landscape and have a highly industrialized and historical value.”*



12

1933

The Gasklockan tower is built to work as a gas container, the forth of its kind

1993

Operations in the gasometer are closed down in 1993. The area is very attractive, and many proposals are being presented of what should be done with the plot. One suggestion is that the old clock should be demolished and replaced by a residential building with the same shape and character.

1999

Gasklockan is a part of the Conservation Program since it is being acknowledged as a one of the historically interesting places and buildings in the municipality of Gothenburg, a building that promotes local cultural identity

2013

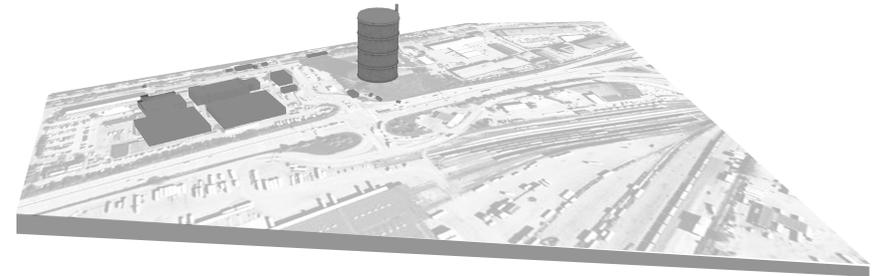
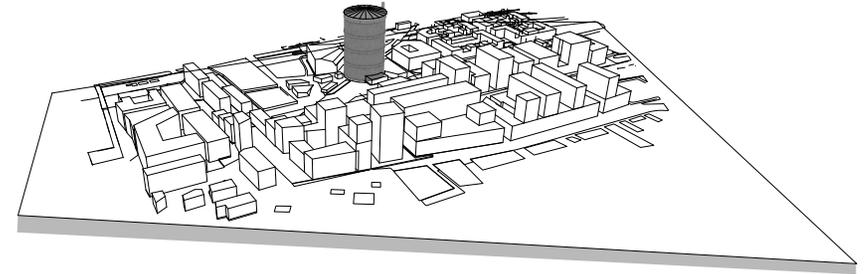
The demolition petition for the tower is confirmed by the Municipality even though Gasklockan is included in the conservation program of Gothenburg city has developed.

Creation of a self-referenced project that applies to the extant and the planned situation



**Now: a reason to visit the area**

**After: a trigger for urban development**



problem identification & conclusion

## PART II. exploring an architectural system

The architectural system is developed as much detached from the context as possible. In this way many possibilities can be explored without any restrictions from the site. After having explored the system and its full potential, the criteria withdrawn from the context will minimize the outcomes towards the best suited one.

# References & design tools

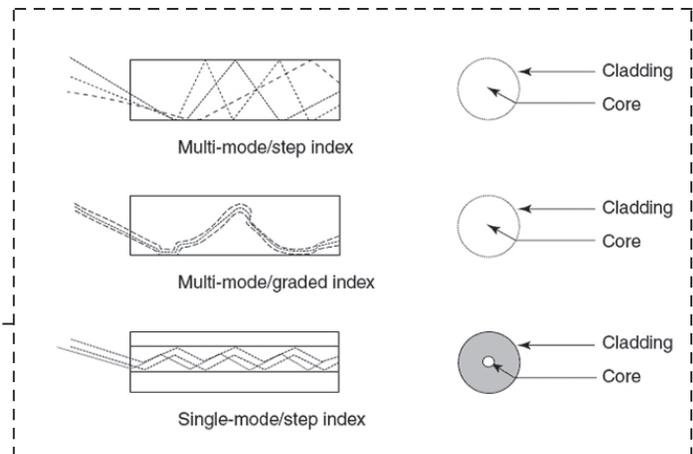
problematic- goal: creation of an interior environment by allowing the circulation and diffusion of light

The goal of the project is to solve the problematics that an elongated volume creates, by allowing the natural light to travel all along its width.



**LOW LINE PROJECT**

## REFERENCES



**OPTIC FIBER**

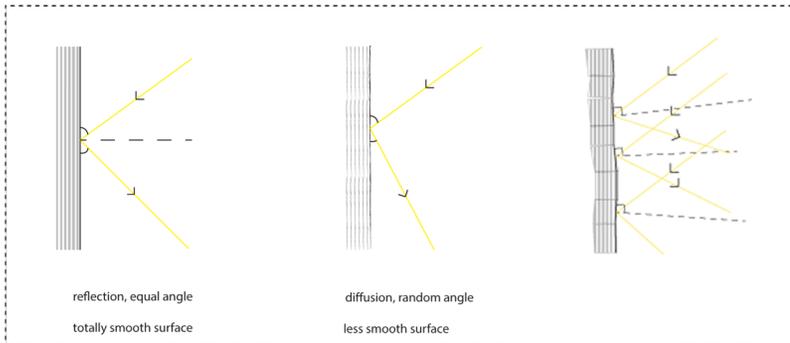
The initial idea for the development of an architectural prototype is to introduce natural light in the gasometer without perforating the outer shell in order to preserve its image in its context, an objective set already from the theoretical part of the project.

The mind is driven to mirrors and its properties of reflection. The project which is used as reference is the LowLine project in New York. The use of mirrors of planar and concave shape help to gather the natural light of the sun to one concentration point. That point is the beginning of an optic fiber that leads the concentrated light beam underground to an abandoned tram station of the lower East-side of Manhattan. The end of the cable drives the rays that now are going to almost every angle, on planar mirrors that reflect the light back to a wavy, double curved ceiling, clad with glossy material. This final stage disperses the light in the room creating an environment of indirect lighting as it would be overground.

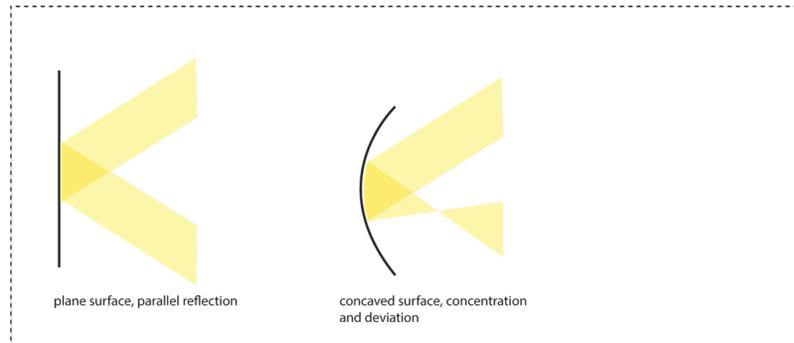
Elements that are being investigated withdrawn from the references are :

- \_The relation between reflection, diffusion and the respective spatial qualities
- \_The behavior of the light when meets with different types of surfaces
- \_The variation of an enclosed space and how this affects the behavior of the light

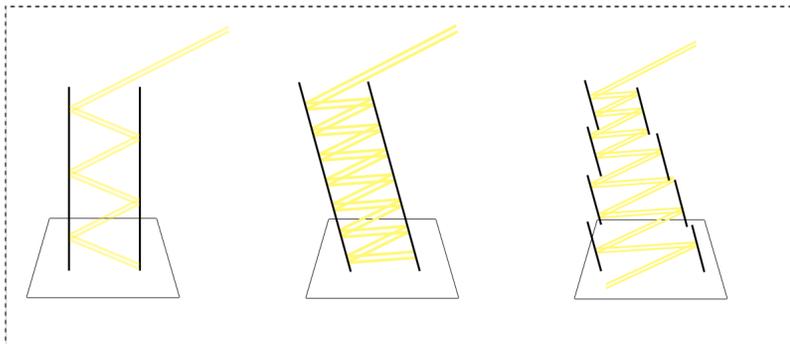
All this criteria are being experimented through physical and digital models in order to design the final architectural system. Of course, even though the sun rays are parallel to each other when meeting with the earth, the angle varies depending on the season and the time of the day. In the experiments, this variety is optimized to 10,30,50 degrees to imitate the change the time of the day.



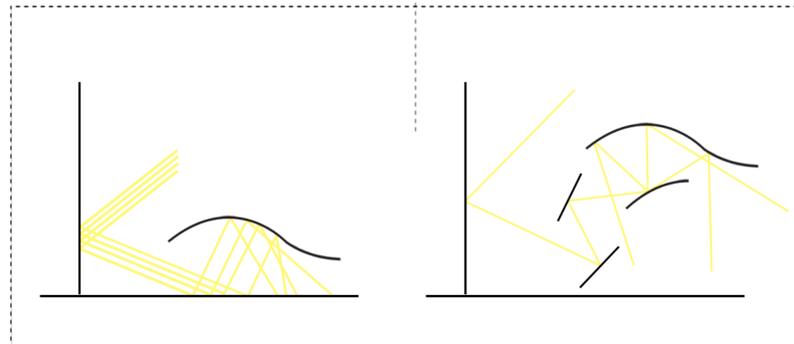
**/MATERIAL**



**/SHAPE**



**/DEPTH**

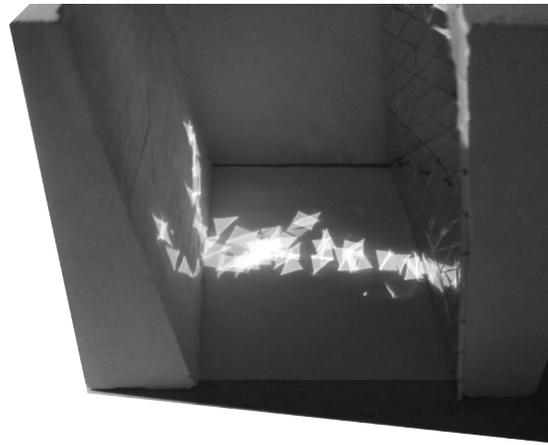


**/WIDTH**

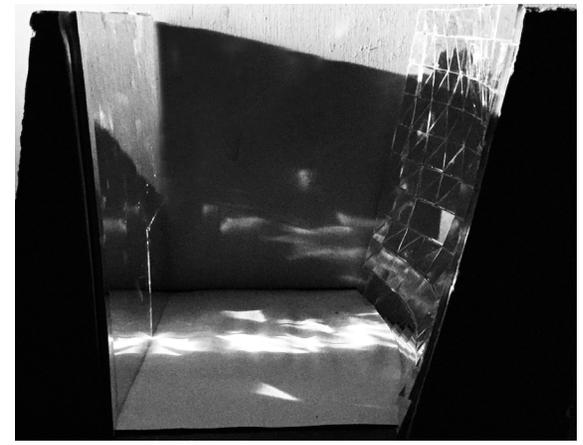
# lighting effect experiments

18

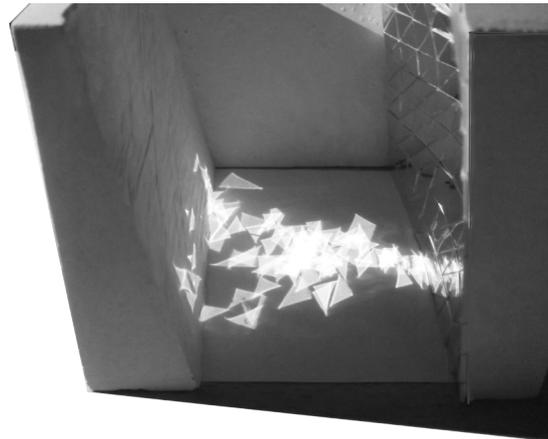
The interior environment is studied by creating an enclosed space. The boundaries are clad with material with different properties concerning the inclination, the fragmentation of the material, the degree of reflectivity. All the variations are a result of combining three kinds of “walls” of trapezoid profile.



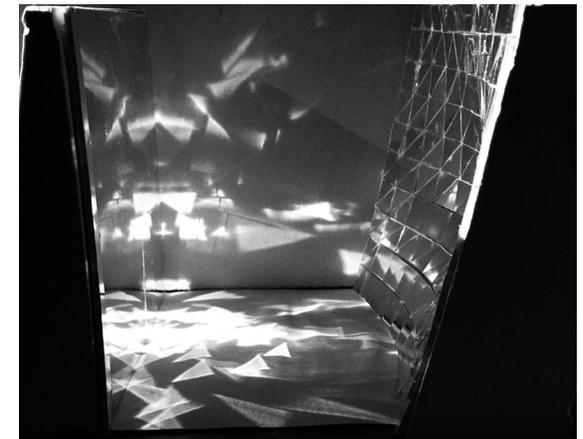
Reflection / Fragmented Concaved - 10deg



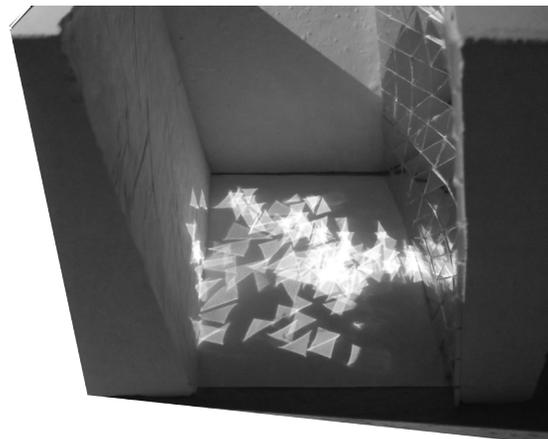
Reflection / Fragmented Concaved - 10deg  
Reflection / Plane



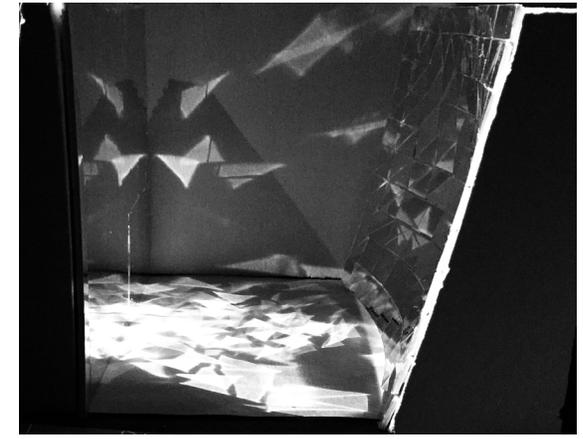
Reflection / Fragmented Concaved - 30deg



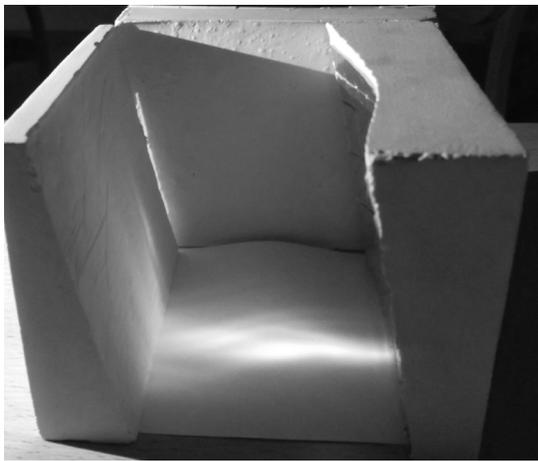
Reflection / Fragmented Concaved - 30deg  
Reflection / Plane



Reflection / Fragmented Concaved - 50deg



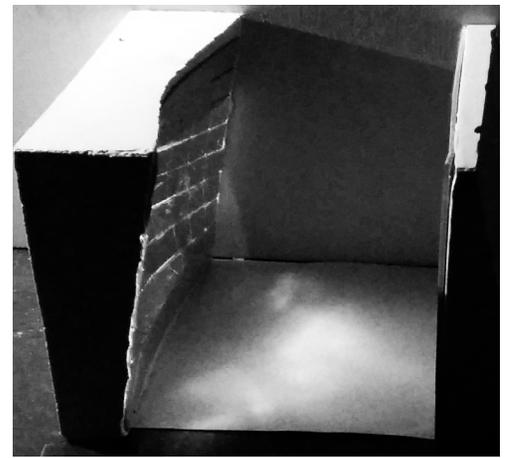
Reflection / Fragmented Concaved - 50deg  
Reflection / Plane



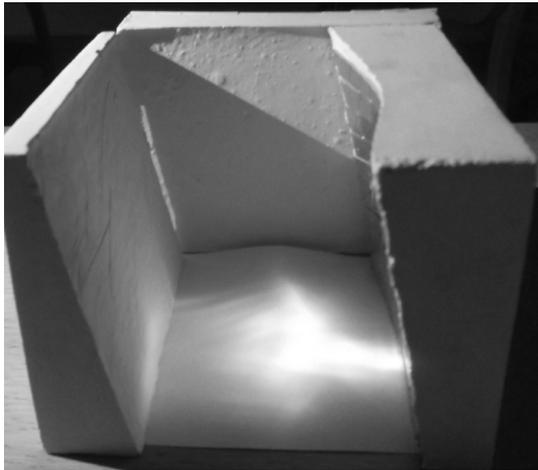
Diffusion / Fragmented Concaved - 10deg



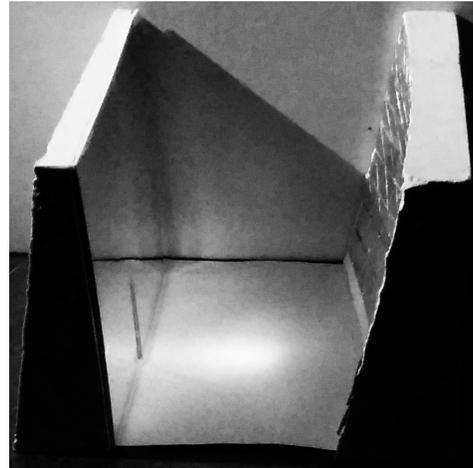
Diffusion / Fragmented Concaved - 10deg  
Reflection / Plane



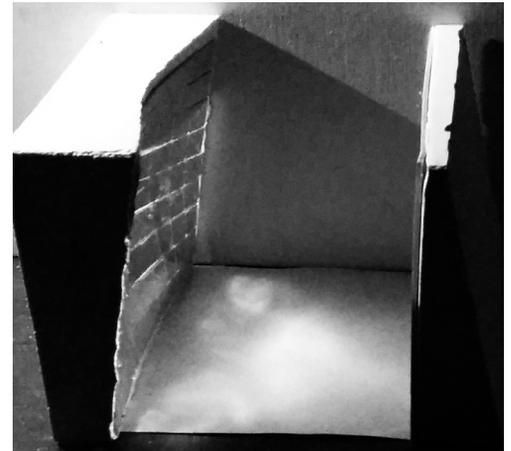
Reflection / Plane - 10deg  
Diffusion / Fragmented Concaved



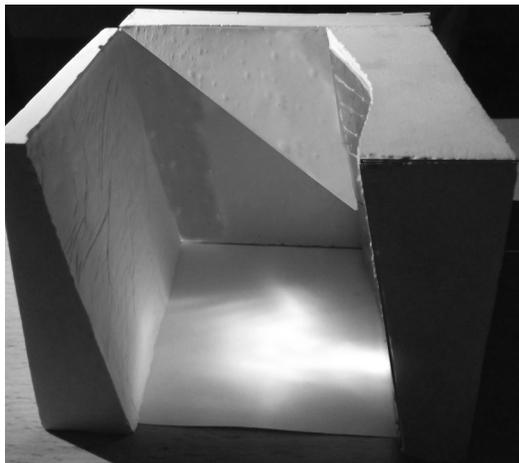
Diffusion / Fragmented Concaved - 30deg



Diffusion / Fragmented Concaved - 30deg  
Reflection / Plane



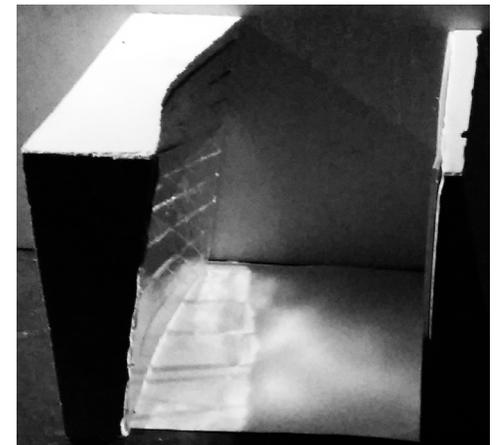
Reflection / Plane - 30deg  
Diffusion / Fragmented Concaved



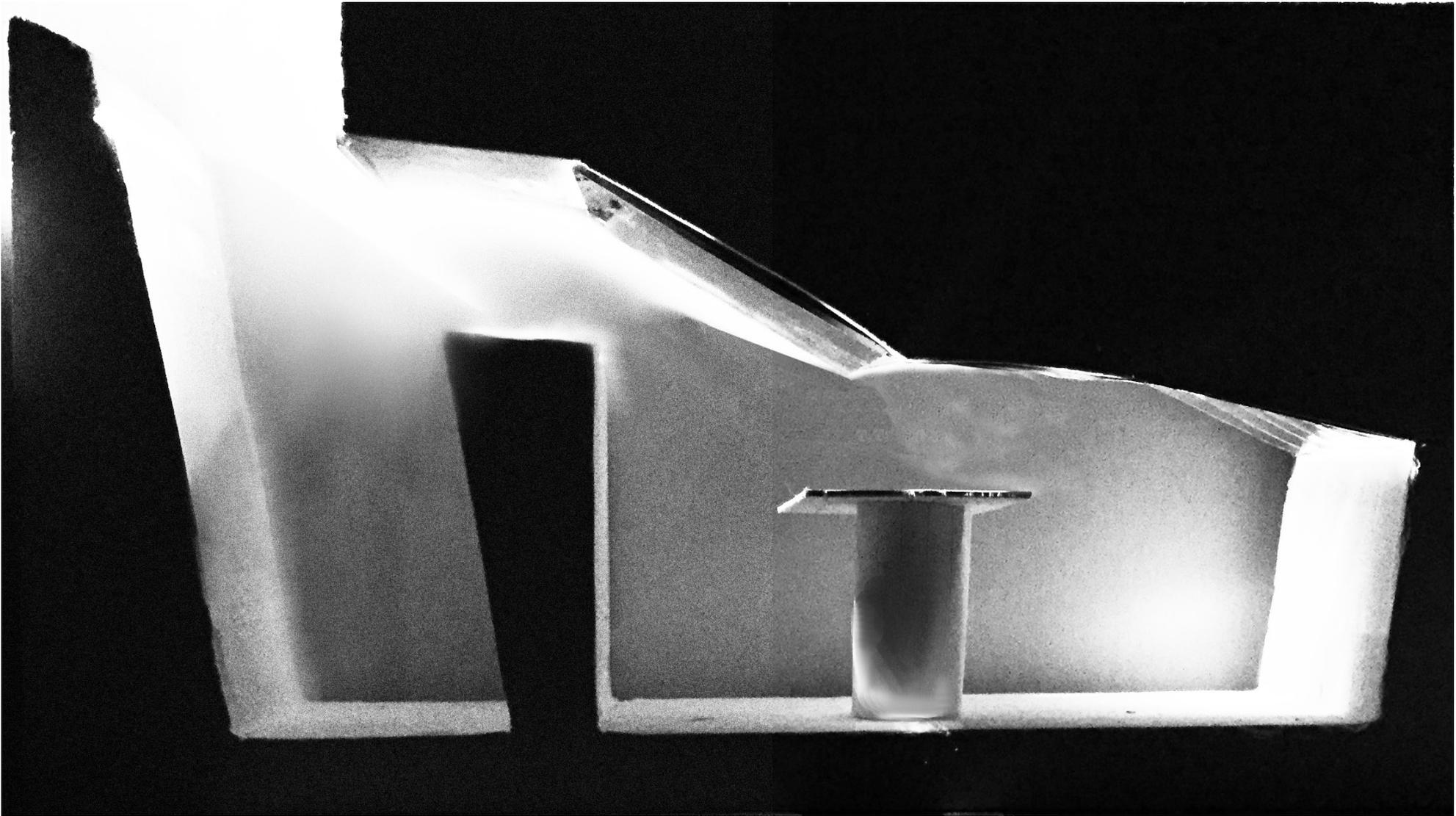
Diffusion / Fragmented Concaved - 50deg



Diffusion / Fragmented Concaved - 50deg  
Reflection / Plane

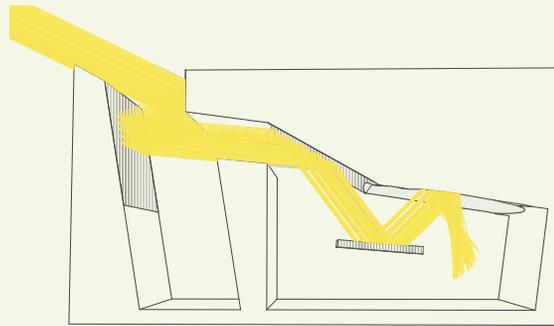


Reflection / Plane - 50deg  
Diffusion / Fragmented Concaved



# architectural prototype

Digital means allow the study of complicated situations and multiple settlements for the final result to be determined. Mosquito\_plug-in in Grasshopper is the software that calculates with detail the reflection of the ray beam.

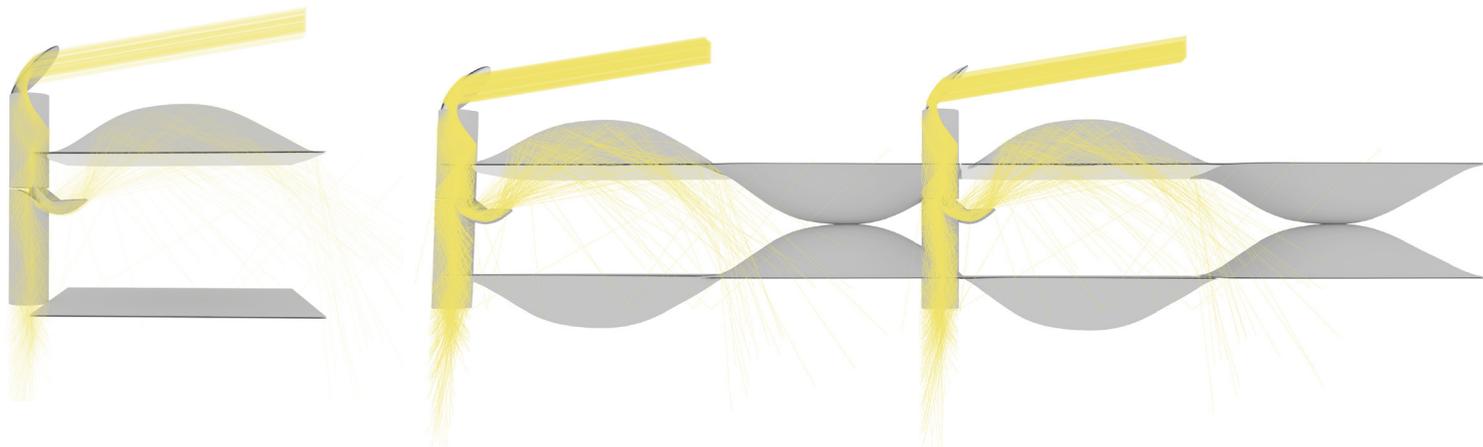


The architectural prototype that is developed using all the data from the experiments, the physical and the digital ones, a physical model is used to check another time and comprehend even further the effect of the design on the light behavior. The picture shown on the previous picture shows how the right part of the room is lit from a light beam that would normally not be able to pass all the obstacles.

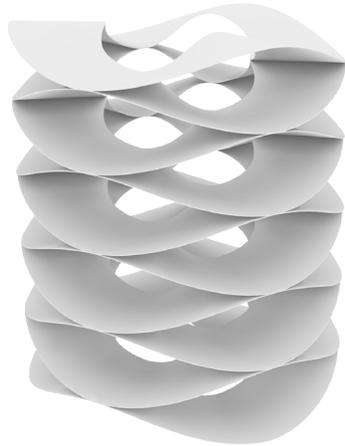
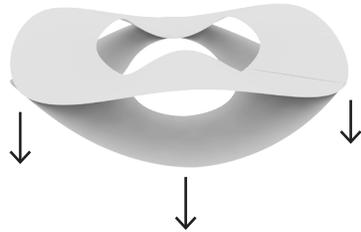
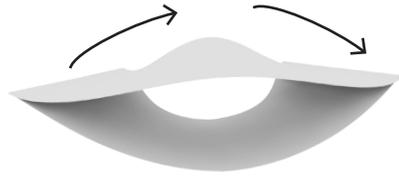
## PART III. proposal

The architectural system is interpreted into its elements in order those to be used in the context. This will allow some freedom to reconsider the design factors through the filter of the context criteria. However the key elements of the architectural system will be the point of departure for the final design. In our case there are the spacial characteristics that divide the system into the vertical/linear part where the light travels and the horizontal one where the light is actually used. The materiality is connected to this division. For directing the light, materials with high degree of glossiness are used such as mirrors whereas in the part that the light is dispersed, slightly more matte materials are needed such as a metallic surface.

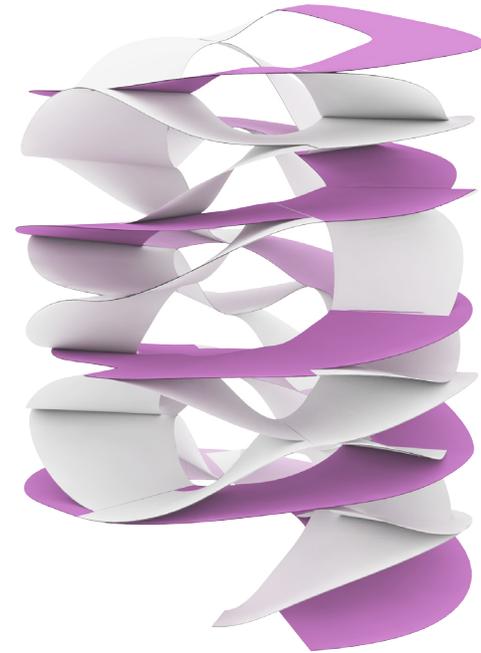
The spacial key elements are the elongated shaft where the light rays are concentrated by a concaved mirror to travel towards the perpendicular direction. Some of those rays are reflected again to a double curved ceiling.



# form development



As shown on the previous image, when the system is multiplied there is the potential of creating some symmetry by preserving the elements needed for the system to work. By using the same logic of the double-curved top part also for the bottom part of the enclosed space this symmetry can be accomplished. Finally this symmetrical shape is accepting the criteria of the context and that leads to the final design. The final stage indicates the distortion of the symmetry by introducing inclination that could fit with a walkable ramp, variation of heights of the enclosed spaces that on further stage could accept some use.

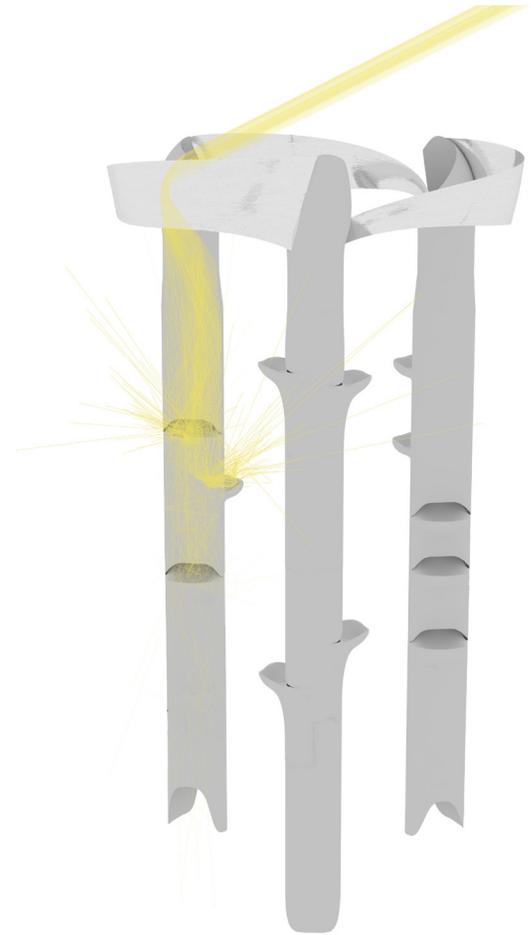
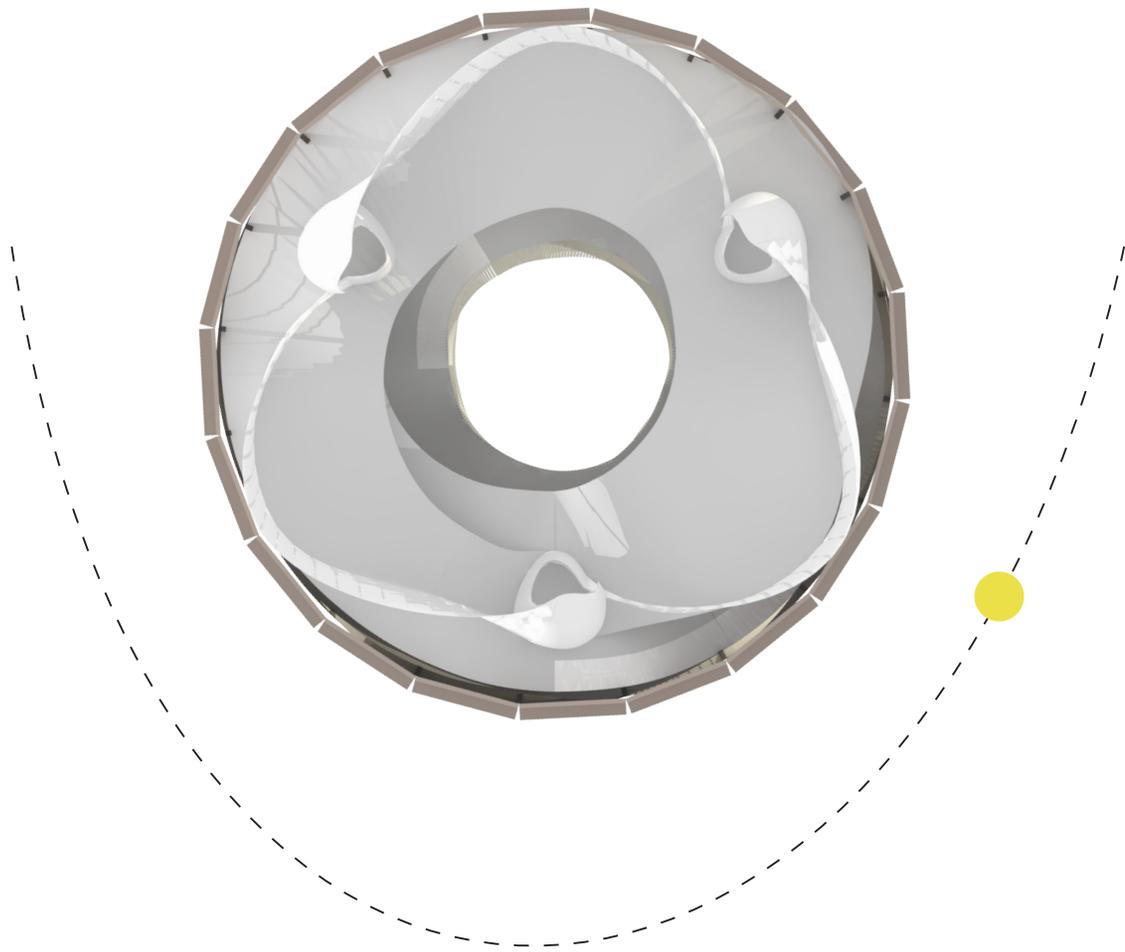


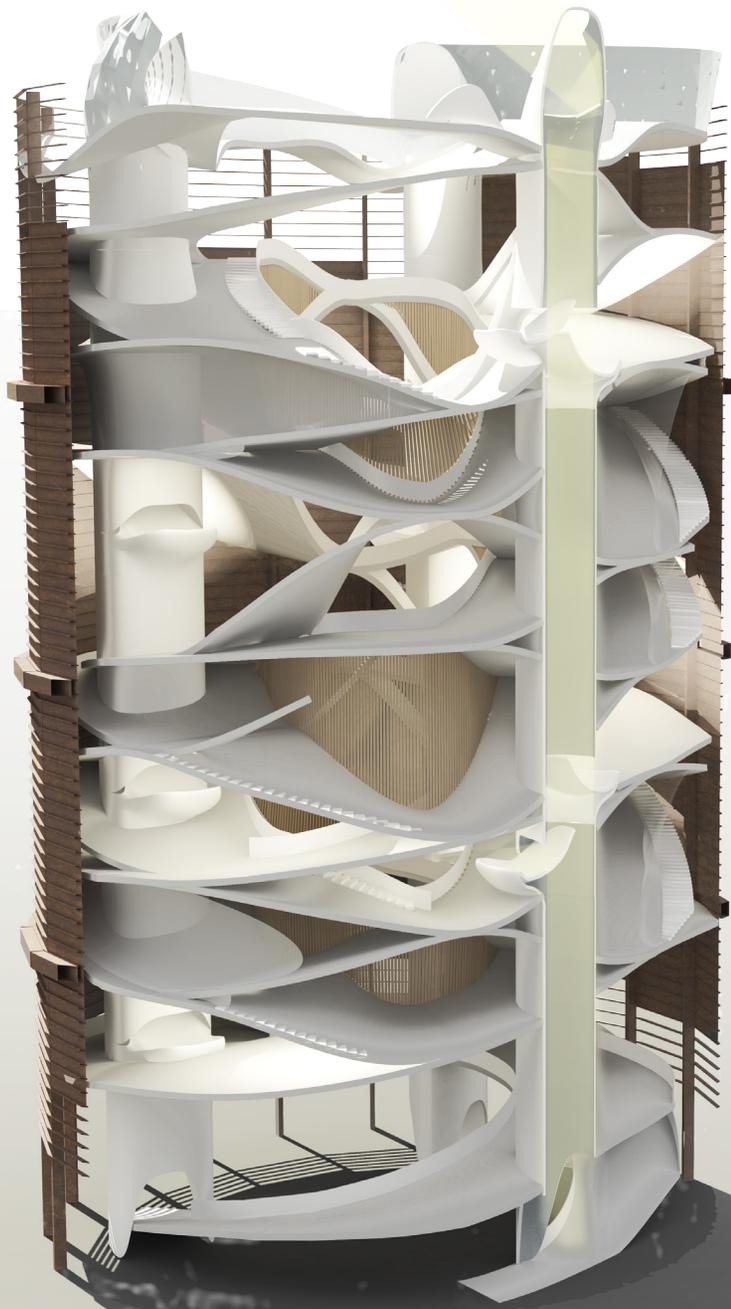
# Lighting system

The lighting system is mainly three elongated volumes, three shafts that run through all the height of the tower. The light enters the three shafts by the concave mirror-clad surfaces that stand on the roof. The roof of the tower is designed in a way that would be interesting for the visitor to explore and understand how the system works. For that reason the roof is possible to visit and plays also its role to the building being an observatory for the city's panorama.

The mirrors are put in this way in order to capture the maximum possible sun radiation during the day. Of course, since there is not a mechanical support the variation of the sun radiation will be evident in the interior environment during the day, a fact that adds quality to the final lighting effect in the interior.

On every shaft, at the points that the shaft interacts with an enclosed space there is an opening where a concave mirror gathers some of the light and reflects it on the respective ceiling to create the indirect lighting. Depending on the material on the ceiling the effect varies as examined in the research phase with the lighting experiments.









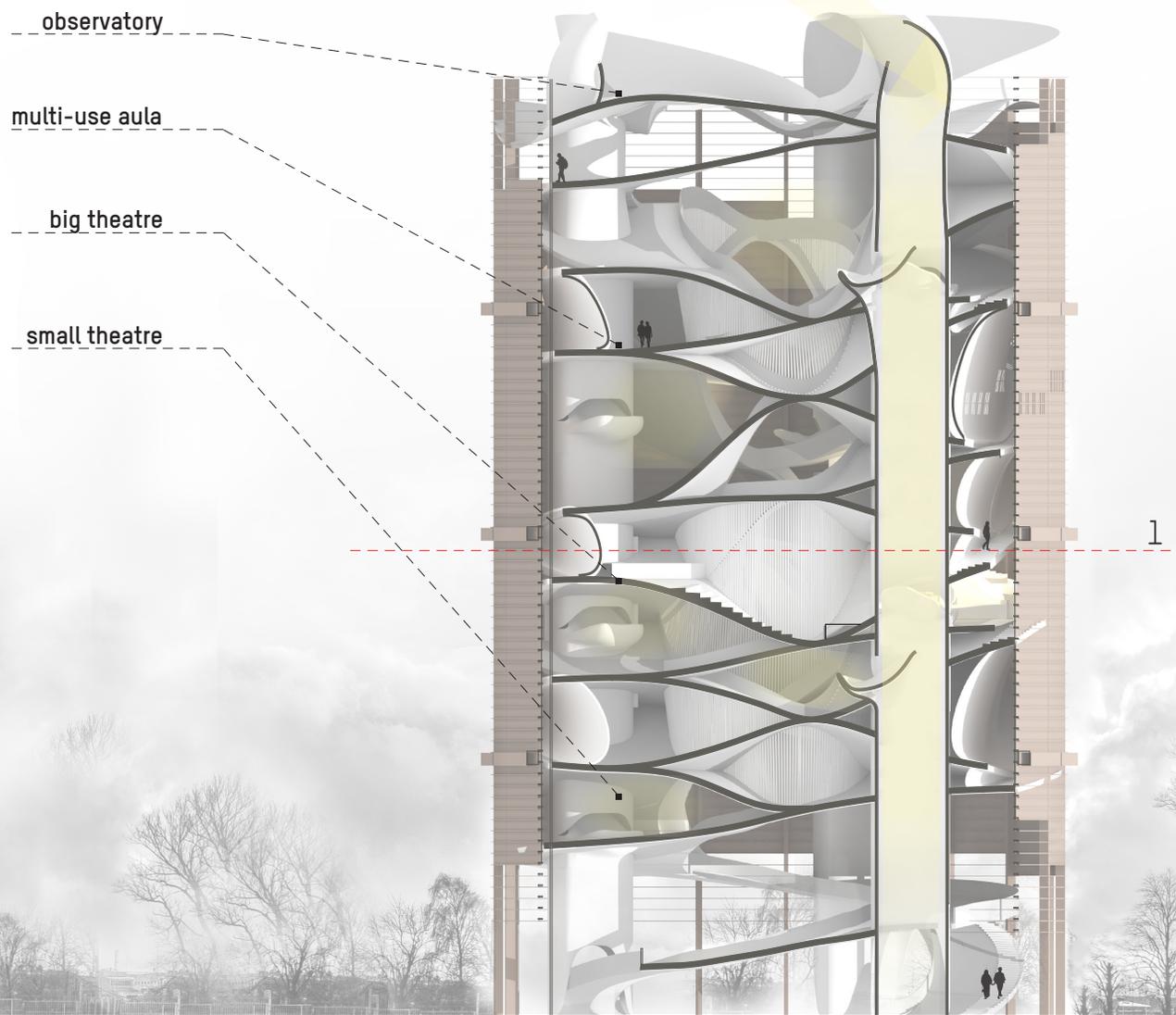
# Spatial classification

The whole building is basically consists of three types of spaces with different properties. There is the movement network, the closed and the open spaces.

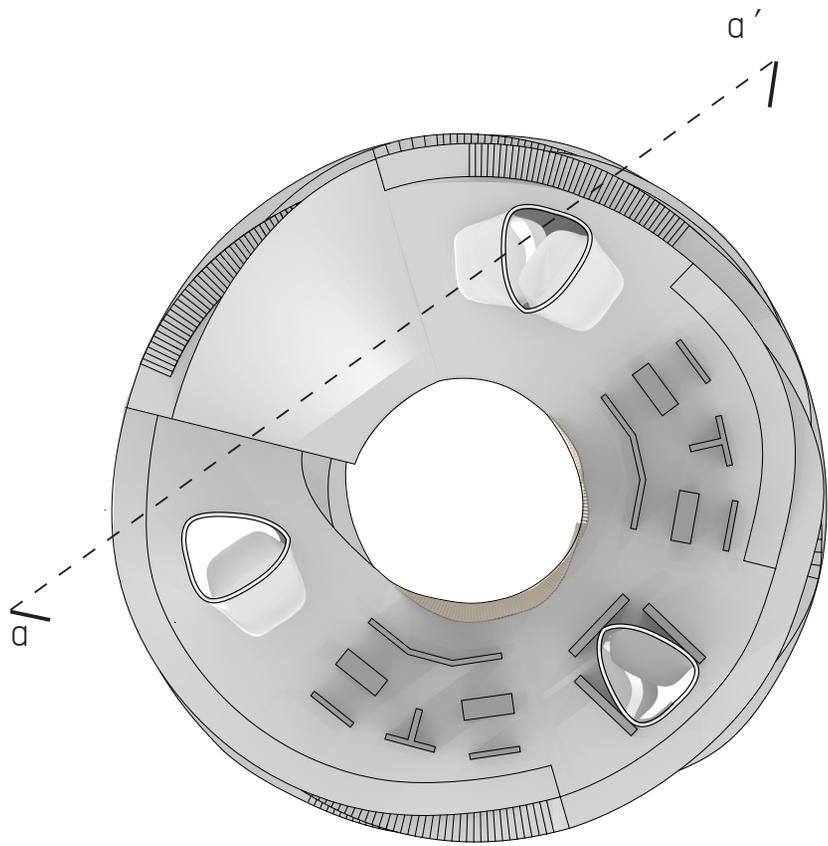
The movement network is found on the edges of the slabs on both sides- next to the central atrium and next to the outer shell- and connects all the spaces with each other through stairs, ramps and corridors.

The closed spaces are the ones that have cultural use such as theatres, exhibitions. The idea is that since this rooms are closed with wooden planks towards the atrium and glass towards the outer extant shell, the proposed uses will be all these places that by definition work by avoiding the natural light, basically because it is difficult to manage.

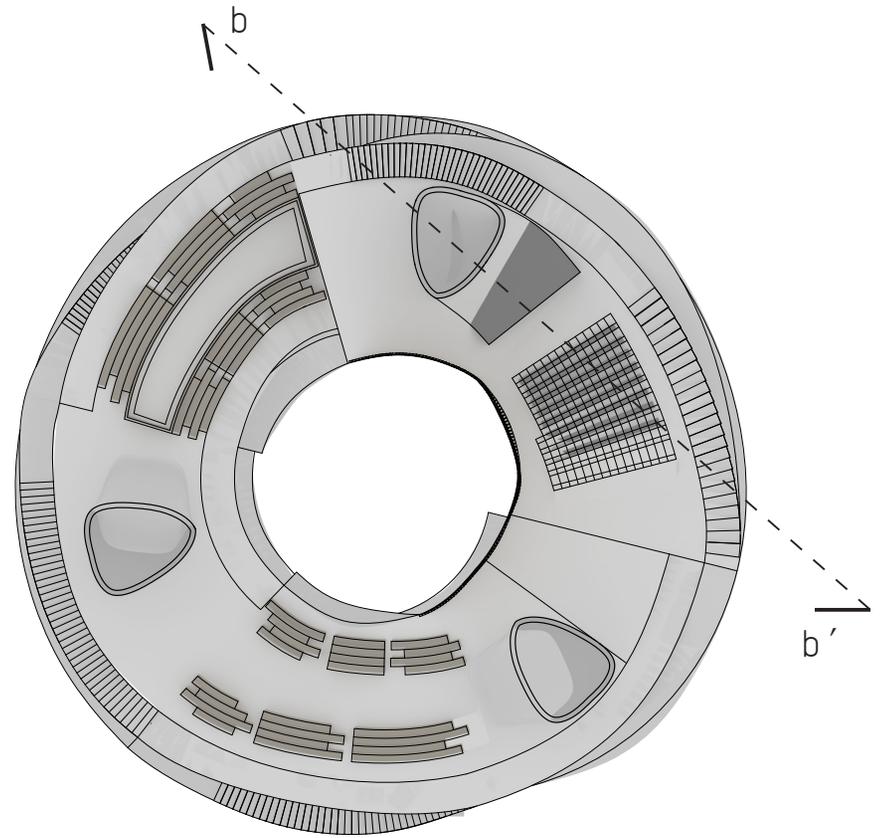
Finally the open spaces are working as public, between the movement network and the closed one, as spaces for social interaction, for exploring the lighting system and how this building works concerning the indirect lighting effect.



section bb'



plan 1



plan 2

The plan are free standing, meaning that the visitor is able to wander around each slab. That means that the only elements that divide the spaces are only the ones of the geometry and the vertical elements wich produce the closed spaces as explained previously.

The space configuration for the exhibition consists of free standing elements where different pieces are to be exposed. The lighting system as mentioned does not work here, meaning that there is not any outlet for the rays of the shafts as an exposition hall by definition avoids the natural light. The visitor is able to appreciate the materiality of the extant outer shell of the gas tower through the glass wall that encloses the exhibition hall.

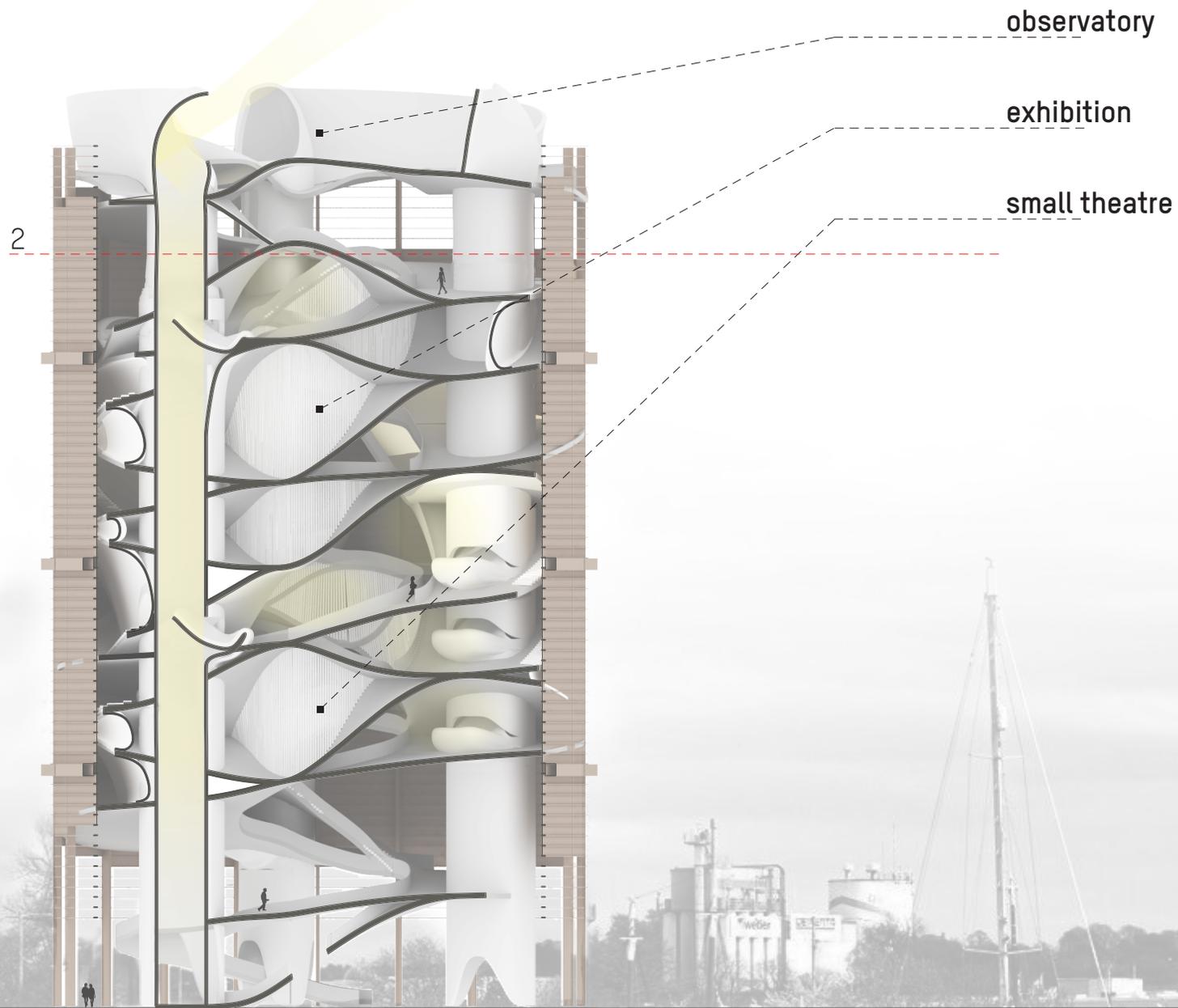
The floor follows the global geometry of the design by being inclined making the exhibition to have different altitude and the two sides as moving around in the tower. In that way, going up to meet the observatory as a final destination, the different uses are a part of this journey.

The same feature exists also at the enclosed space that the use of a theatre is proposed. Given the need of an aphitheatrical set-up, the room is exploiting the already inclined slab of the global geometry of the design. A 250 seat theatre fits in this enclosed space. The visitors can again have a glimse to the metallic shell of the gasklock-an through the glass facade.

The lighting system is not used neither here as the function of a theatre demands controllable lighting, a fact that does not fit with the variety of the natural light.







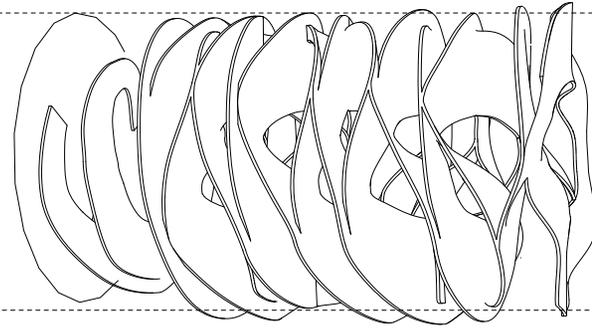
section aa'

# elements in perspective & materials

closing volumes

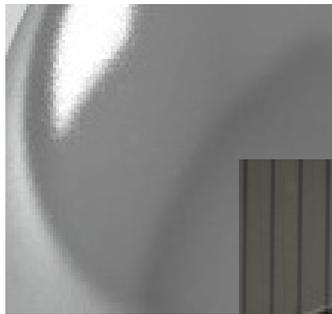


slabs



concrete

36



glass

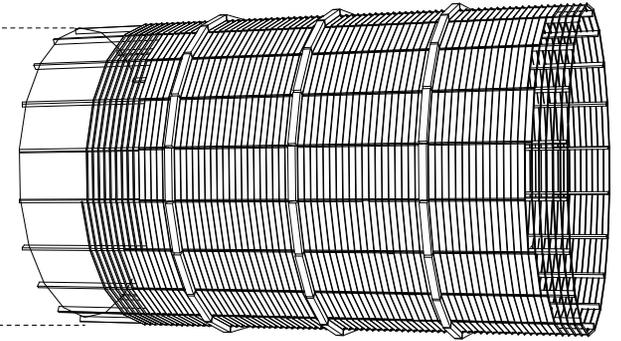
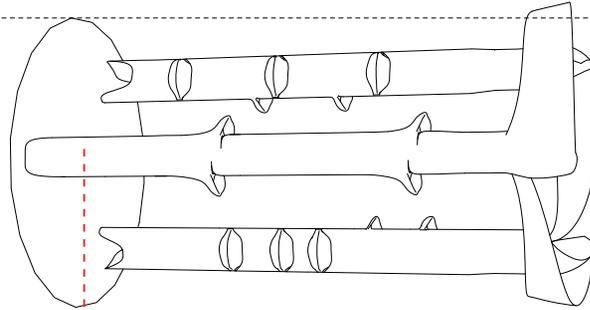
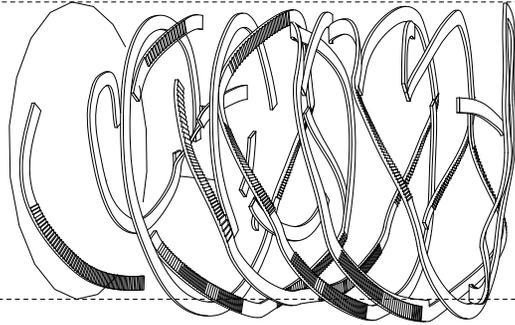
wooden planks



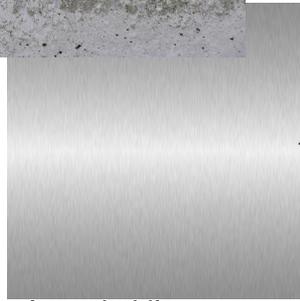
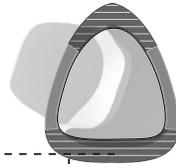
circulation

system of indirect lighting

extant coating

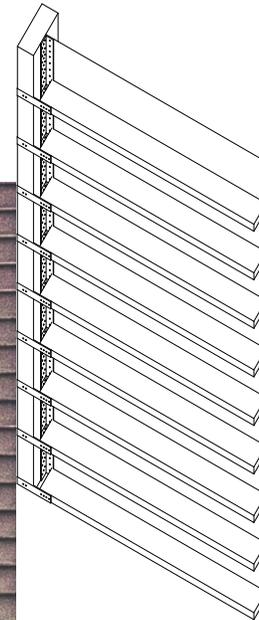


concrete



mirror cladding

metal



The materials of the extant building shell and the new configuration in the inside compliment each other. The main structure, which has its own static system and does not depend on the self-bearing outer envelop, is made of concrete.

The three shafts work as pillars and the double-curved slabs connect with them. The shafts are also made by reinforced concrete and they are cladded with mirrors on the inside surface.

The vertical elements that create the closed spaces are made by wooden planks towards the atrium and from a glass facade towards the outer shell. This facade is curved, bending inwards in order to create a movement indication since the network passed from this kind of situations almost at all cases.

The metallic structure, that is reminiscent to the technique of cladding a ship in the beginning of the century, is prominent at all occasions.

