

# IN THE SHADOWS

-IMPLEMENTING THE BEAUTY OF SHADOWS AS A DESIGN TOOL IN ARCHITECTURE

A MASTER'S THESIS BY

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Examiner: Morten Lund.

Supervisor: Peter Christensson



IN THE SHADOWS



2017

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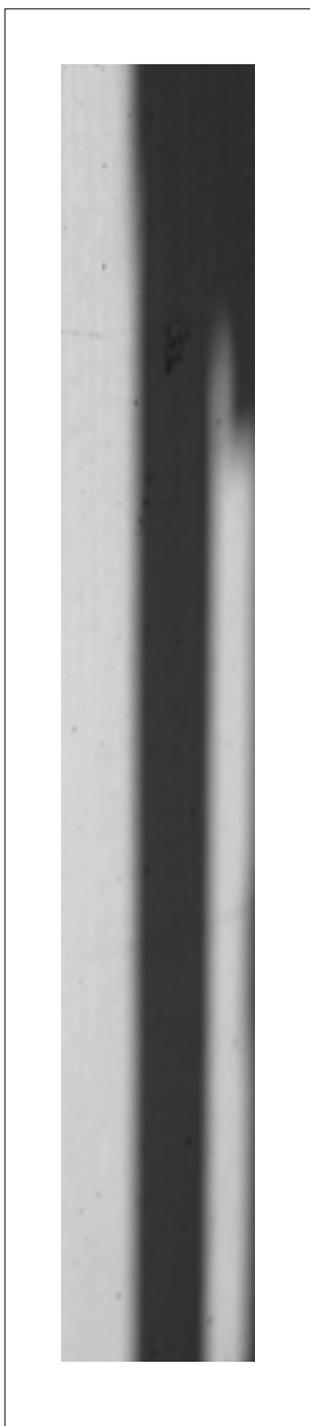
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SHADOWS AS THE MATTER  
OF BEAUTY



Figure 1, Shadow Play, Author's own copyright.

# INTRODUCTION

A shadow existing only as a pure image of the object it self, all dressed in black. That blackness varies as does the projections appearances, but one thing is certain, it is not reliable or of physical form. No matter how much we want it to stay it will always leave us- but maybe with the contentment of having to felt its presence for that time.

I wonder if this assurances with what I call every day beauty, triggers emotions within us that effect how we perceive and feel the shadows? Could

it just be so that the knowledge of that leaf falling just goes by unnoticed, like it never even happened. Architecture can use the beauty of the shadows as spatial features and as its esthetics approach. This could be created through structural elements of a design or by using the uncontrolled beauty of a surrounding. Through this design approach, the shadows become a important part of architecture- framed for everyone to perceive and appreciate.



Figure 2. Shadow Play. Author's own copyright.

# ABSTRACT

A Shadow exists only as a pure image of the object it self, all dressed in black. That blackness varies as does the projections appearances, but one thing is certain, it is not reliable or of physical form. No matter how much we want it to stay it will always leave us- but maybe with a contentment of having to felt its presence for that time. Could this encounter with uncontrolled beauty trigger emotions within us that effect how we perceive architecture?

Through architecture we can frame the shadows and use their beauty as spatial feature in our design, for everyone to perceive and appreciate. Enabling a more sparse and modest design to blossom with shadows as its facade cladding or as a internal spatial experience.

The Method for designing with shadows as design tool is a collaboration between the four Ss; the Sun, Site Specific Elements, the Build Structure

and its Shadows. The Shadow projections in this thesis are divided the in to two categories; External and Interior. External projection being site attributes that creates fluctuating projections on to the structure, becoming the revetment of the facade. Interior projection being when the build structure and the sun creates internal shadow projections and mutations: unexpected, distorted projections.

The Proposal is The Shaded Pavilion, adapted to a site at Oxsjön, Gothenburg. A Pavilion existing only with one purpose- to frame shadows. Its weaving together the four Ss to create interesting shadow performances, both external and internal, at this particular site.

Shadows are an image of beauty ever changing by matter, but since it existed in the world- left a permanent mark in our mind.

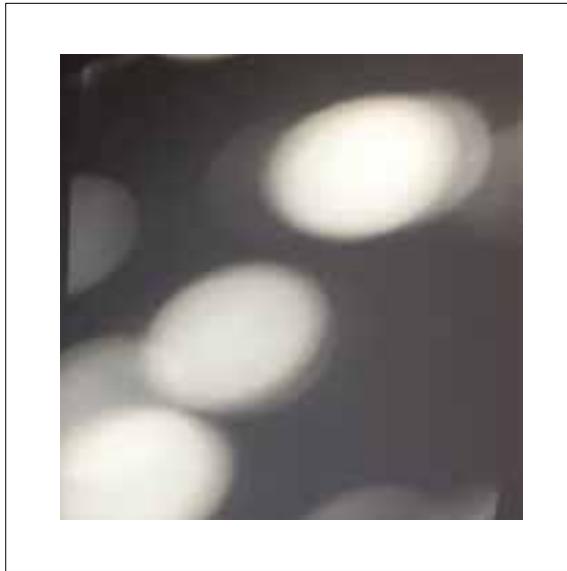


Figure 3. Shadow Play. Author's own copyright.

# CLAIM

I claim that the beauty of shadows should be considered as a powerful design tool in architecture. Through architecture we can frame and enhance the Beauty of a everyday shadow and use it as spatial feature in our design. for

everyone to perceive and appreciate. Enabling a more sparse and modest design to blossom with shadows as its facade cladding or as a internal spatial experience.

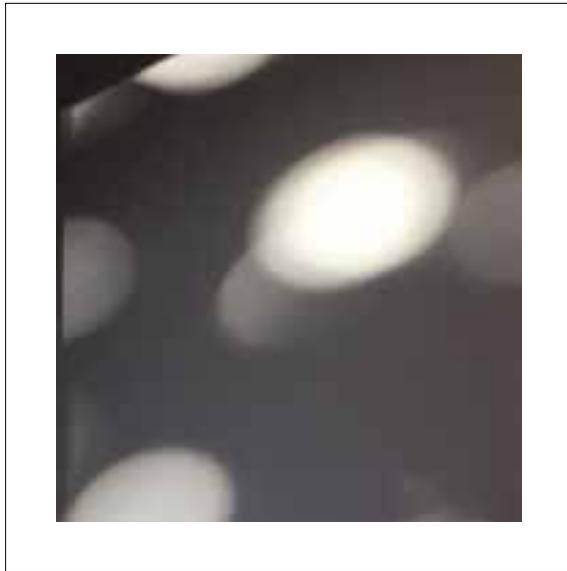


Figure 5. Shadow Play. Author's own copyright.

# AIM

I argue that architects could use the everyday beauty of shadows more often in our design and by doing so could enable a more dynamic and intricate design. But that it also could help raise awareness of the context that we design in and that a collaboration between architecture.

site and external matter could result in a higher quality of architecture.

But it could also help us see and appreciate the beauty of that everyday shadow that we walk by unnoticed today.



Figure 4, Shadow Play, Author's own copyright.

# METHOD

The Methods being used for this Master Thesis is physically testing shadow projections and mutations in models, drawings, 1:1 experiments and in digital models. All the conclusions from model investigations is documented, analyzed and put in to a context. My design proposal is a combination of spatial conclusions tested in a pavilion at a test site. I have combined

philosophical theories with artistic explorations. I have been testing shadows, perforations/ light intake in a structure, matter and materiality, darkness, aesthetics of the shadow, amongst some. My point of view was never to understand everything about the physicality of the shadow- but to frame its beauty through architecture.

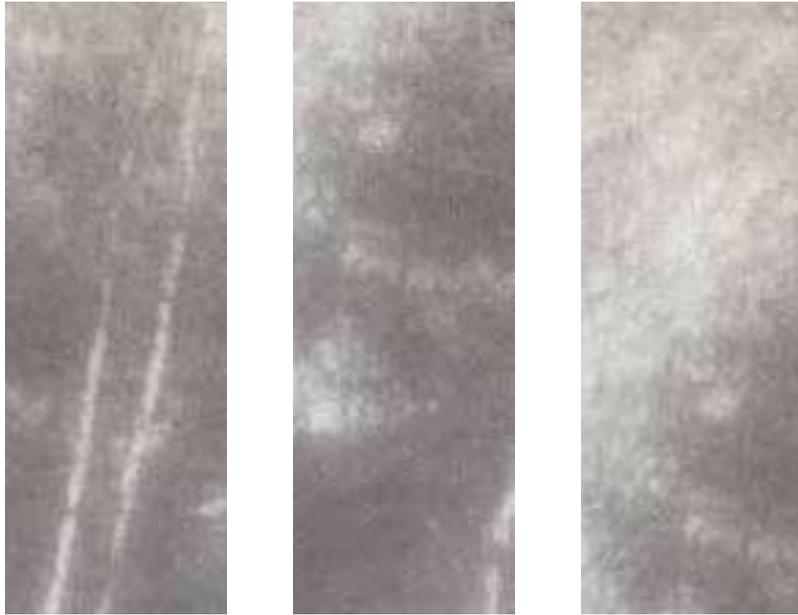


Figure 11. Branches Divided. Author's own copyright.

# INTRODUCTION

"...Matter exists just as it is perceived; and, since it is perceived as an image, the mind would make of it, in itself, an image." - H.Bergson.

Lets begin with a few words about beauty.

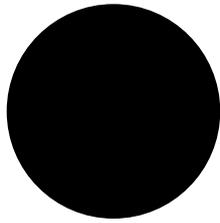
Science and facts can help us understand an use shadows in a controlled and orchestrated manner. But only when we let go and discover the beauty in shadows- by letting them exist without destroying them through dissection and complete understanding, will our view on the shaded object blossom. Allowing knowledge of shadows only to be a tool for displaying the natural essence of their beauty in architectural design. By connecting the physical knowledge with philosophical and poetic views we can have a more profound use of the shadows.

When we think or talk about beauty, we will, maybe unconsciously, think of it in images. The French philosopher Henri Bergson refers to matter as a aggregate of images and says that objects and images exists of matter. Therefore beauty is matter. When regarding beauty as an image, it will be affected by perception. Its characteristics

will therefore always differ depending on who is perceiving. But to us, people, beauty embodies it self as an image and welcomes perception and even depend on it to exist.

What could be beautiful with out something perceiving it as beautiful? And in this thesis, the image-, and the matter of beauty, embody it self in shadows and daylight, ready to be perceived by the visitor. (Bergson,1896)

There is a kind of mystery laying in the shadows. It is a contradiction of physicality and fluctuating space. I argue, in architecture, shadows and daylight can fairly represent the matter of beauty. As I see it, the challenge doesn't lay in understanding how the shadow come to exist, act, consists of or any other physicality-that we already know, but in how we can orchestrate them to make them become a part of architecture and the beauty in that. Shadows are an image of beauty.



# REFERENCES

DARKNESS, JUSTICE & ABSENCE

JUN'ICHIRO TANIZAKI

JUHANNI PALLASMAA

PETER ZUMTHOR

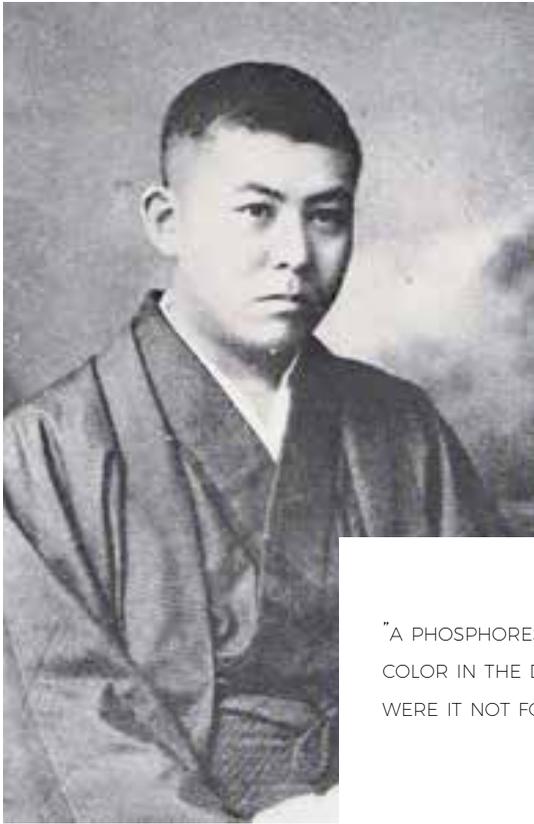


Figure 6. Portrait, Unknown (1913).

"A PHOSPHORESCENT JEWEL GIVES OFF ITS GLOW AND  
COLOR IN THE DARK AND LOSES ITS BEAUTY IN THE LIGHT OF DAY.  
WERE IT NOT FOR SHADOWS, THERE WOULD BE NO BEAUTY."

(J. TANIZAKI, 1977)

Tanizaki's writes about ordinary pleasures that the world offers- a sharp contrast to the functional, plastic, disposable aesthetic of the modern western life sometimes can give. Although his voluminous visions of beauty is associated with a cultural perspective markedly differing from western varieties, there is nevertheless something essentially familiar about them. He addresses the felt quality of experiencing the lived moment, not

just as an end in itself- but because each such moment belongs to a lifelong series, in which beauty and richness of experience are important components of the good life. The Shadows is not only a metaphoric representation of what is and what has been in Japan, I feel it is a reminder to us all to embrace the small, but so importance lights and pieces of beauty. (Tanizaki, 1977)



Figure 7. Author unknown.



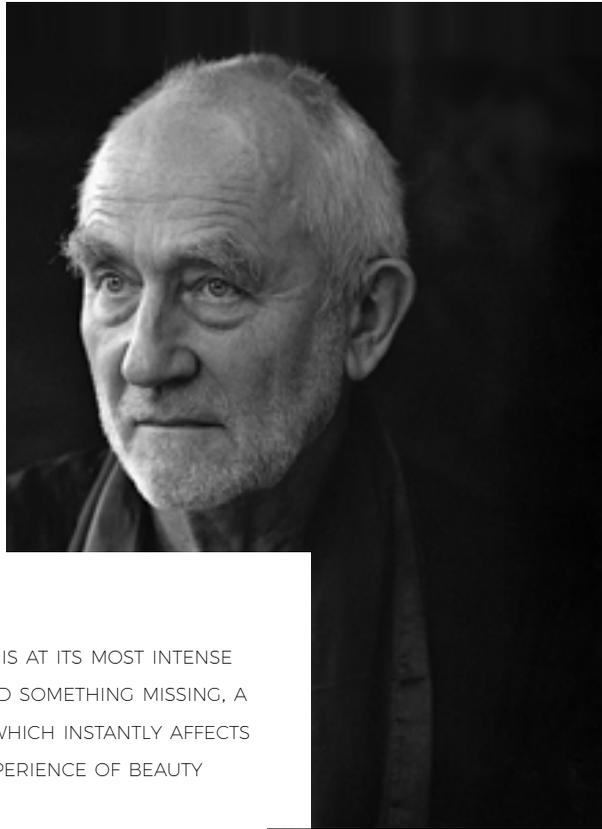
Figure 8. Portrait of Pallasmaa, Almas, I (2011).

"BEAUTY IS NOT AN AESTHETIC OR SENTIMENTAL MATTER. THERE IS AN ESTABLISHED INTEREST AMONG PHILOSOPHERS AND WRITERS IN A DIALECTIC INTEGRATION OF AESTHETICS AND ETHICS. THE NOTION OF BEAUTY FOR ME IS THE NOTION OF BEING JUST AND JUSTICE, AND IN THAT SENSE THE LOSS OF BEAUTY IN ORDINARY LANDSCAPES HAS A RATHER IMPORTANT MESSAGE."

(J. PALLASMAA, 2004)



Figure 9. Therme Vals, (1996)



"BEAUTY, I THINK AS I READ THESE LINES, IS AT ITS MOST INTENSE WHEN IT IS BORN OUT OF ABSENCE. I FIND SOMETHING MISSING, A COMPELLING EXPRESSION, AN EMPATHY, WHICH INSTANTLY AFFECTS ME WHEN I EXPERIENCE BEAUTY...THE EXPERIENCE OF BEAUTY MAKES ME AWARE OF ABSENCE."

Figure 10, Portrait of Zumthor, (2011).

(P. ZUMTHOR, 1998)



"APRICOT TREES EXIST, FERNS EXIST, AND BLACKBERRIES, TOO. BUT BEAUTY? IS BEAUTY A CONCRETE PROPERTY OF A THING OR AN OBJECT THAT CAN BE DESCRIBED OR NAMED, OR IS IT A STATE OF MIND, A HUMAN SENSATION? IS BEAUTY A SPECIAL FEELING INSPIRED BY OUR PERCEPTION OF A SPECIAL FORM, SHAPE, OR DESIGN? WHAT IS THE NATURE OF A THING THAT SPARKS A SENSATION OF BEAUTY, THAT GIVES US A FEELING A CERTAIN MOMENT OF EXPERIENCING BEAUTY, OF SEEING BEAUTY? DOES BEAUTY HAVE A FORM?"

(P. ZUMPHOR ,1998)

DOES BEAUTY HAVE A FORM?



Figure 12. About a Leaf part 1. Author's own copyright.

# THOUGHTS ABOUT BEAUTY

## PART 1.

In architecture, as well in life, beauty is not just man made and controlled. When working with shadows as a matter of beauty one can not just address it as a matter controlled by design but also one that is in correlation with its surroundings. There is beauty in everything, someone said. It lays in the littlest of things: in a tree leaf that slowly leaves its home in the tree crown to travel with the wind towards the ground. As it gets closer and closer to the ground the cast shadow become more and more intense until the leaf suddenly lands on top of it forcing it to vanish forever. I argue that some times, if were lucky, this occurrences of life leaves a mark in the world. This mark could be that of a temporary kind: a shadow

projection. The Mark only existing because it made a impact our mind and maybe even effected how we perceive leafs falling forever on. A shadow existing only as a pure image of the object it self, all dressed in black. That blackness varies as does the projections appearances, but one thing is certain, it is not reliable or of physical form. No matter how much we want it to stay it will always leave us- but maybe with the contentment of having to felt its presence for that time. Could this assurances trigger emotions within us that effect how we perceive our world? Maybe, maybe not. It could just be so that the knowledge of that leaf falling just goes by unnoticed, like it never even happened.



Figure 13. About a Leaf part 2. Author's own copyright.

# THOUGHTS ABOUT BEAUTY

## PART 2.

Maybe the beauty in the littlest of things needs to be framed and lifted to achieve purpose. I claim that the beauty in everyday life is a design opportunity that we as architects can frame and use in architecture.

There is no absolute answer to how one perceives the shadows and my intent is not to try to give one. The Shadows will have to speak for them self, allowing the viewer to make its own interpretation of its meaning. Philosophers and architects has talked about the meaning of- and the symbolism of the shadow for centuries. I have chosen one of them- shadows as a representation of time, to evolve around in upcoming sections of the thesis.

Architecture can use the beauty of the shadows as spatial features and as its esthetics approach. This could be created through structural elements of a design or by using the uncontrolled beauty of a surrounding. Through this design approach, the shadows become a important part of architecture- framed for everyone to perceive and appreciate.

By understanding the circumstances of the shadow one could receive manageable tools in how to design with shadows and therefore allow them to change the perception of a space by pure existences.



Figure 14, Trunks. Author's own copyright.

# THE MEANING OF

## SHADOWS AND LIGHT AS REPRESENTATIONS OF TIME

Henri Bergson expands on the matter of time in his book *Matter and Memory*. (Bergson, 1896) He claims time is divided into two categories: duration and real time; *la durée réelle* he calls it. It distinguishes between measurable time, time that is homogeneous and the same for everyone, and perceived time; duration lived by our consciousness and with its own rhythm. The first one being objective and quantitative and the latter being subjective and qualitative.

American philosopher; Susanne Langer expands on this theory and in her book *Feeling and Form*, and says that the measurable time (clock time) is one dimensional and the perceived time is filled with tension.

Langer describes perceived time in terms of music and makes similes to music and notes. A poetic description of music as a painter of the matter of time. (Langer, 1953)

I read chapters in the book and found that by changing the word music in the text, to another word associated with beauty, the meaning of the text stayed the same.

I always found shadows and light extremely beautiful and as an architect I wanted to test these words. Not only because they are beautiful but because light intake is something we can orchestrate and frame in architecture.

It became:

"Shadows spread out time for our direct and complete apprehension... It creates an image of time measured by the motion of forms that seems to give it its substance, yet a substance that consists entirely of shadows, so its transitoriness itself." -Henri Bergson

Conclusion:

Shadows and light is not mere beauty but could portray time as matter in its reflections.

The meaning of shadow projection could therefore create a deeper understanding of real time and perceived time by its fluctuation. By using a sequence of light and shadows in architecture one can create images of time that could bring a more profound spatial experience. Becoming an experience in itself.



# SITE SENSITIVITY



The Sun



Site Specific Elements



Built Structure



Shadows

# INTRODUCTION

## SITE SENSITIVITY

Could it be so that if we were helped to pay closer attention to the beauty of a everyday shadow-we would get a richer experience of our surrounding environment. And maybe of the illuminated object as well? It is important to feel that beauty exists in the world so in this thesis I wanted to focus all my attention towards the the Beauty of a shadows. When applying the concept of designing with shadow projection, its important to emphasize that one is designing together with environmental characteristics and elements (old or fabricated) at the site. The Method for designing

with shadows as tool is a collaboration between the four Ss; the Sun, Site Specific Elements, the Build Structure and Shadows. Taking a sites shading elements and the relationship with the sun in consideration when placing, dimensioning and designing the structure becomes a crucial moment. The Design mirrors and absorb its surroundings through the shadows, capturing the fluctuating matter of beauty on and in its body. There fore the same architectural structure will never look or be perceived the same even if the body is of the same flesh.



Figure 12. Naturrum Fulufallet, L. Pagés(2003)

# REFERENCE

## NATURRUM FULUFJALLET

Project by White Architects in 2003.

Architecture working together with a site with a clear goal of making the building blend with the surroundings. Using trees and site specific elements shade the facade- letting it act like the mirror of the forest.

The Materials are chosen to be able to return to nature's cycle without leaving any visible traces behind. (Hagberg. 2003)

A Collaboration between architecture and nature.



Figure 15. The Board. Author's own copyright.

# FRAMING SHADOWS

## A SPATIAL EXPERIMENT OF MATTER

A Full scale experiment took place at the test site- near the lake Oxsjön in Sandsjöbacka natural reserve. I wanted to frame shadows projected by exciting elements at a site. But also investigate how shadows react to a architectural surface. I placed a 2.5x2m gypsum board at the site and filmed the events.

Observations.

What first fascinated me was the layers of blackness of the shadows on the board.

The Shadow of the large Birch trunk in the center almost controlling the whole image through its blackness with such power.

And the smaller trunks and branches that the wind grabs making there shadow sweeping over the gypsum board with changing sharpness and opacity.

The Blackness of the shadows react to the material of the gypsum board really enhancing its sense of materiality and texture.

Some other conclusions from this investigation that fascinated me deeply was the Suns complete

control over the projections existence and opacity.

But it also that it was like there was a respectful collaboration between the sun, the trunks, the shadows, and the gypsum board- and with my self. This experience of the shadows was something different- it was an experience with the beauty of a shadow in a new way for me.

When framing the shadows I became much more aware of the surrounding environment but also how the shadows react to materiality and external forces.

The Investigations in this thesis is meant to be used as a toolbox for making shadows a powerful instrument in architectural design. One could adapt single parts of the investigations in new projects or to get more inspiration of how to use shadow projection in architecture.

The Shaded Pavilion is an extension of this collaboration. It is used as a way of designing with shadows in architecture.



Oxjón, March, 2017, 10:50



Oxjón, March, 2017, 10:52



Oxjón, March, 2017, 10:34



Oxjón, March, 2017, 10:36



Oxjön, March, 2017, 10:38



Oxjön, March, 2017, 10:40



Oxjón, March, 2017, 10.30



Oxjón, March, 2017, 10.32



Sweden, Oxsjön, Latitude: 57.6064°, Longitude: 11.9656°

# THE SITE

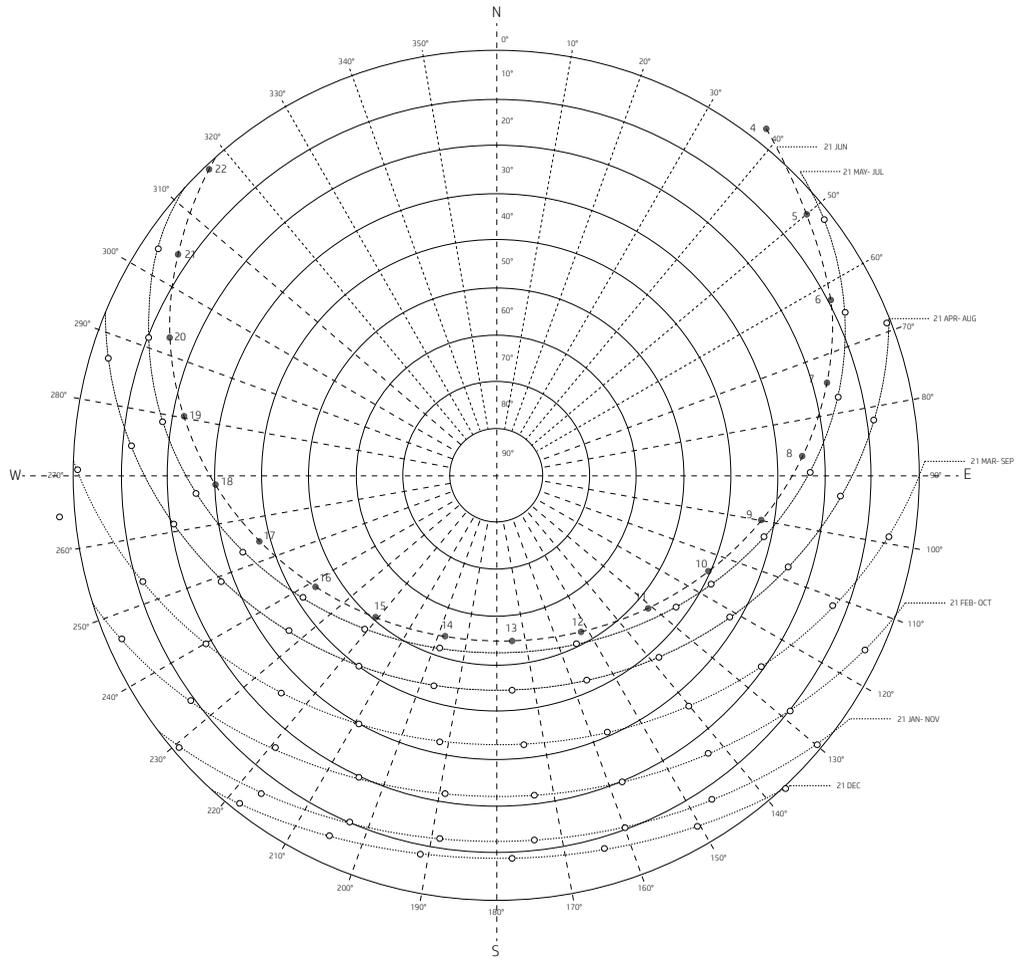
The Proposed structure is adapted to a test site at Oxsjön, Gothenburg. Its weaving together architecture, shadow projection and mutation with the sun at a specific site situation.

The Site that I have chosen to work with for my design is located in the nature reserve Sandsjöbacka in Gothenburg, near the lake Oxsjön. The Lot is approximately 20x20m surrounded by woods, a hiking path and a open mountain landscape. There are no houses or car roads in close distance to the lot, leaving the site to be a quiet space. A Site where people walk, bike or run by everyday to exercise- maybe not even noticing the beautiful shadows laying on the

ground.

But the proposal could be situated anywhere. It is not design to fit this specific site. Defining a site is only a tool for establishing and investigating how one could use a sites shading elements to design with. A site enables parameters and guidelines in terms of elements, coordinates and knowledge of the suns path, from which one can adapt and understand the shadows from.

The Proposed structure is not a absolute combination of parameters to create the perfectly shaded structure but to frame the beauty of what shading can be in architecture.



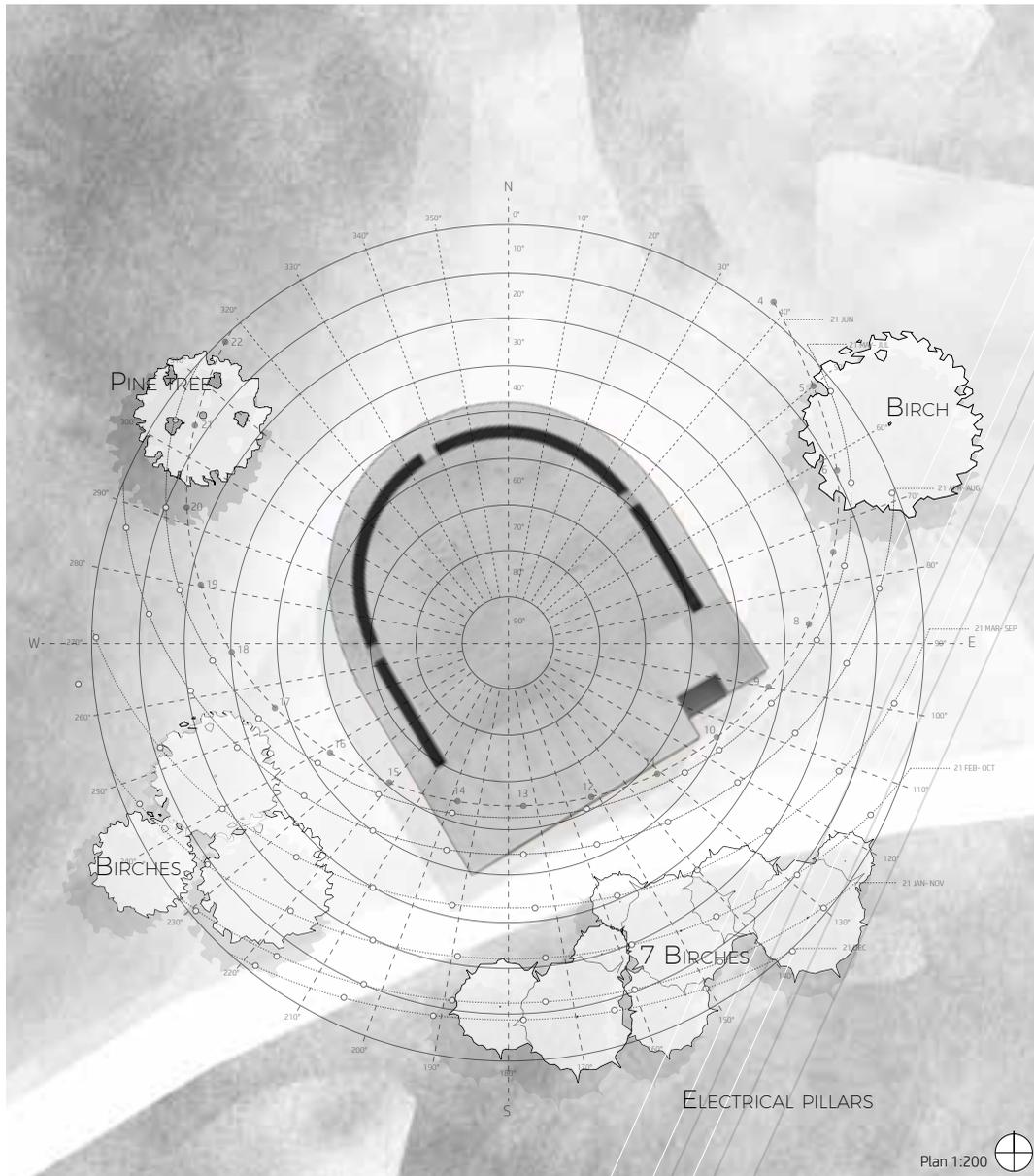
# THE SUN

## THE MOVEMENT AND PATH OF THE SUN AT OXSJÖN

Using a sites coordinates in a sun diagram provides one with data of the suns position at that perticural site. (sunearthtools.com)Displaying the month, time and wind, in relation to the suns angle: azimuth, and vertical position; elevation. With this information a specific shadow projection can be forcasted and framed in a architectural design.

The Sun at peaks in June, leaving the sun to be up for approxomently 17h hours a day. There

are more sun hours per day during the spring and summer period in Sweden and the sun stands tall. This enables the shadow projection and mutations to be more frequent and intense. But in Sweden and at Oxsjön, a large part of the year consists of dull, dark, days due to number of sun hours at fall/ winter time. But even if the frequence of shadow projections is lower- the projections is there. As subtile, long, projections and mutations- only to be experienced at



PLACEMENT. SITUATION.  
RELATIONSHIP. ELEMENTS

# SITE SPECIFIC ELEMENTS

## ELECTRICAL PILLARS



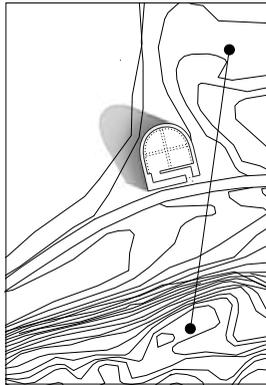
Element:  
Electric Pillars and its Wires

Placement:  
A: 70 ° W: NE

Characteristics:  
Approximately 35m high, 4 wires

Shadow projection on Pavilion over E: 20 °  
The Wires and the Pillars

Shadow projection on Pavilion under E: 20 °  
Wooden Pillars



# SITE SPECIFIC ELEMENTS

## ONE LARGE BIRCH TREE



**Element:**

One Large Birch

**Placement:**

A: 240 ° W: SW

**Characteristics:**

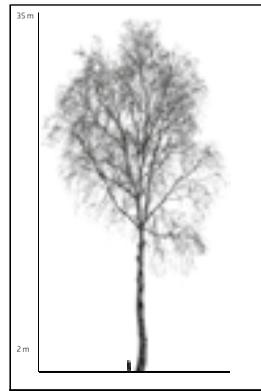
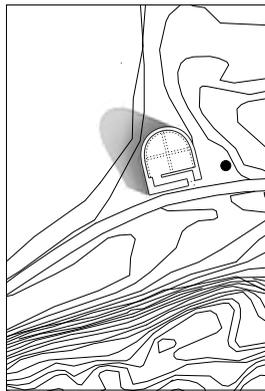
Approximately 35 m high.

**Shadow projection on Pavilion over E: 20 °:**

Branches, Trunks

**Shadow projection on Pavilion under E: 20 °:**

Trunks



# SITE SPECIFIC ELEMENTS

## SEVEN BIRCH TREES



**Element:**

Seven Birches

**Placement:**

A 160 ° W: SE

**Characteristics:**

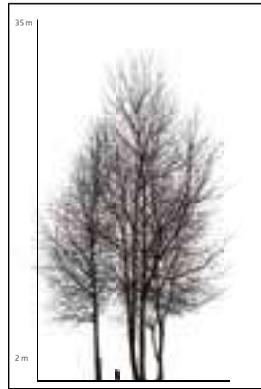
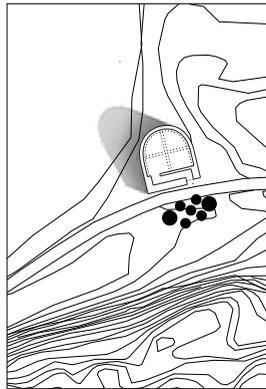
Approximately 15-25m high.

**Shadow projection on Pavilion over E: 20 °:**

Branches, Trunks

**Shadow projection on Pavilion under E: 20 °:**

Branches, Trunks



# SITE SPECIFIC ELEMENTS

## ONE PINE TREE AND SMALL BIRCHES



**Element:**

One Pine Tree and Small Birches

**Placement:**

A 330 ° W: NW

**Characteristics:**

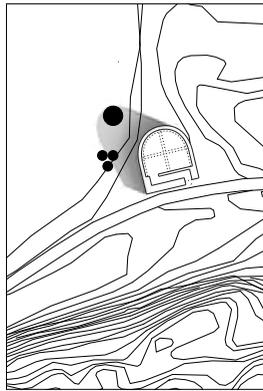
Approximately 20 m high.

**Shadow projection on Pavilion over E: 20 °**

Branches, Fir needle, Trunks

**Shadow projection on Pavilion under E: 20 °**

Small branches and Trunks





# THE SHADED PAVILION



Figure 16. About Projection, Author's own copyright.

# CONCEPT

## PRINCIPLES

The Purpose for the shaded structure is to enhance and frame the beauty of shadows in architecture and to intrigue other architects to use it more in their designs.

Together with the sun, the structure it self and the elements on the site creates the shadow projection and shadow mutation. Thus the shadow form I will be studying is the cast shadow. Leaving the design to be a collaboration between external and orchestrated shadow projection, composed to illustrate some of the possible ways of designing with shadows in architecture.

For the purpose of enhancing shadows on and inside of my structure, I have chosen to design a minimalist, prototypical pavilion where the different qualities of shadows are in focus.

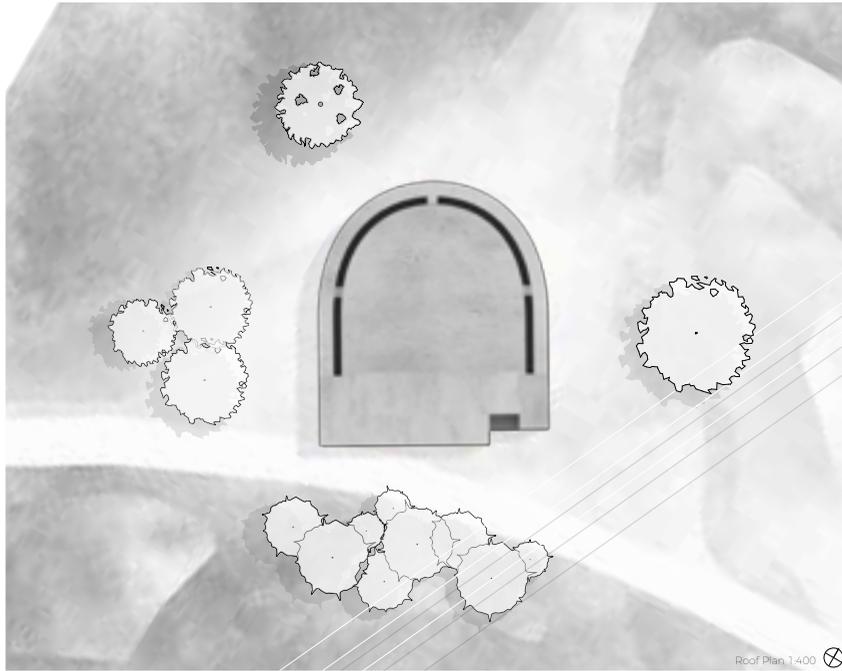
The Characteristics of the shadows displayed and

investigate in this design are:

- The Castes projections.
- A Structures ability of shadow mutation.
- The Blackness, blurriness and layers of the cast shadows in relation to spatial perception and matter.
- Shadows ability to transform and move in relation to daylight.

This enables a structure without a functional program. Instead with a clear purpose of existence- displaying shadows through daylight.

In this proposal the structural design will be designed according to the important parameters for shading.



# EXTERNAL PROJECTIONS

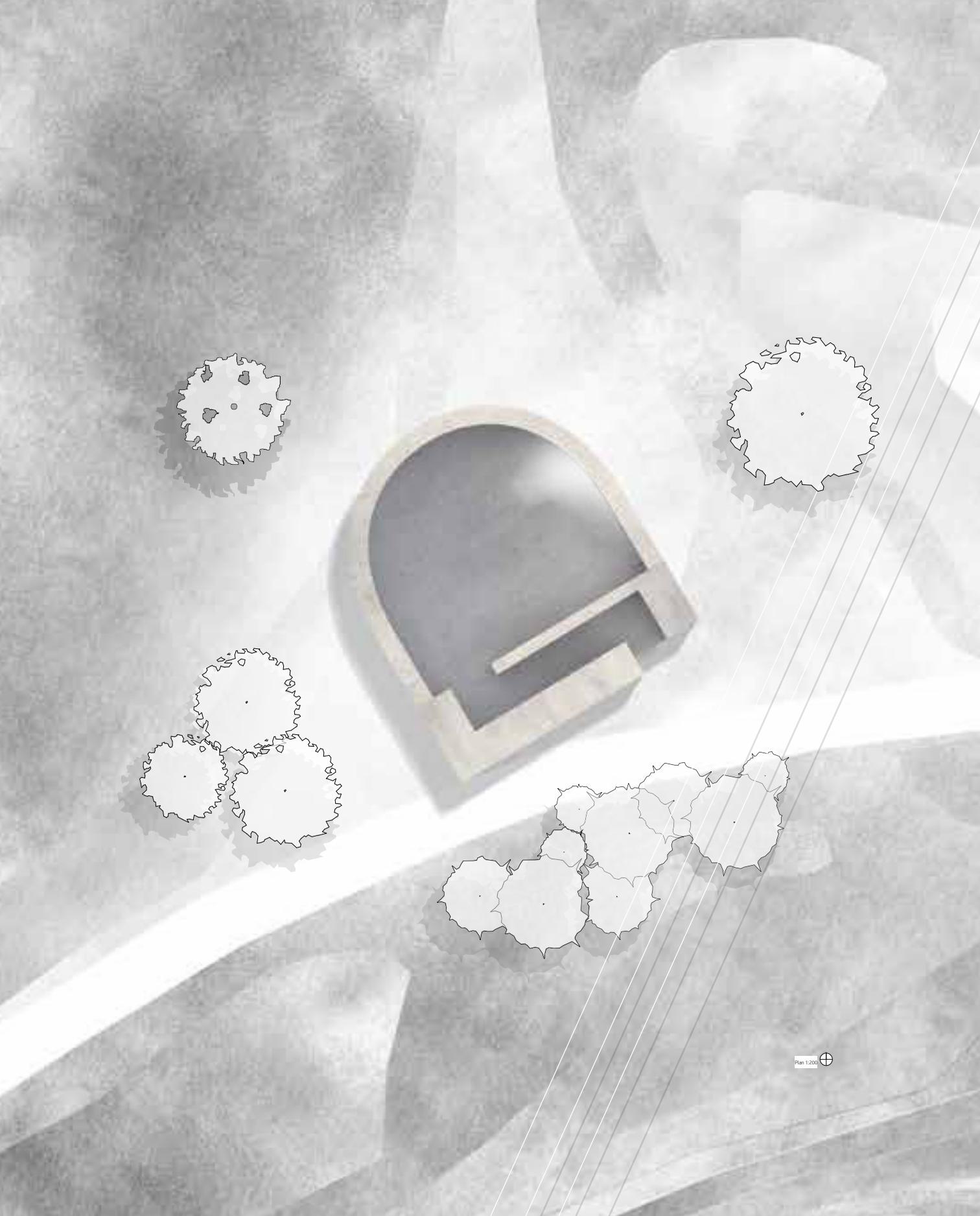
## SITUATION THE PAVILION

The Shadows becomes a part of an architectural design in the Shaded Pavilion. Translating the experience of the Gypsumboard to a build structure where the shadows becomes a spatial feature and a canvas for shadow projections. This translation is prospected as "The Shaded Pavilion" a small structure, approximately 13x20 m, that exists with only one purpose- to help people have a more intense experience with shadows both external and internal.

A Concrete structure where the walls function as

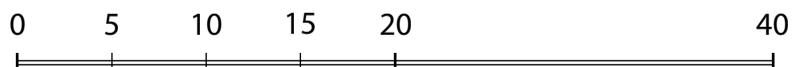
projections screens both internally and externally.

Externally the translation of the gypsum board is the most apparent. By letting the shadows become the facade cladding of the structure- it becomes dynamic and ever changing by surrounding matter. The shadows can here be in focus and be perceived by people walking by. Once inside the Pavilion there is a large room with what I call a performance space where all the internal projection take place.



# EXTERNAL PROJECTIONS

PLAN, FACADE AND SECTION 1:400



1:400







Facade East 1:400 ⊕









Figure 17 , Serpentine Pavilion, P. Zumthor(2010)

# SPATIAL CONFIGURATION

## THE ENTRANCE

A Versatile shadow projection, changing as the sun moves. The Shading frames and draws attention to the subtle and narrow entry situation.

A Corridor, which structures hides the inner core of the pavilion, leaving something to be discovered as you walk in.

A Darkness, to enhance the shadows and the light, drawing focus to them.

All sides of the walls should work as projection screens where there is space for shadow play.

A important reference when designing the entrance is Peter Zumptors Serpentine Pavilion i London 2010. He placed the walls as a overlapping structure which hinder a direct visual contact with the garden inside, leaving it to be discovered. But the openings also function as a catalytic of light. The walls in between shade and the openings lets light in. A Beautiful dance between he cast shadow and the day light. I find it interesting how the light can work together with

the structure itself to, through shadows, direct and lead the visitors in. The Shadows forming a dark fluctuating space on the floor, walls and on the ceiling.

It is important how the walls are dimensioned, placed and that they are in relation to each other in order to get shading on all of the walls at different times of the day. Creating a transforming, changing shadow projection. The Sun should move the shadows as it moves it self, leaving the entry situation a different experience each minute.

Together the roof and the overlapping walls creates a darker entrance, even when the sun is at its highest. The Darkness is wanted thus it enables a increased contrast between light and shadow making the shadows more apparent to the visitor. The Entry situation should therefore be dark with specific lighted situations that enables shadow existent.



Figure 17. Narrow Passage. Author's own copyright.



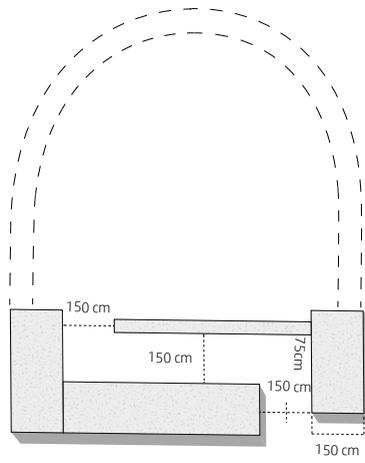
Figure 18. Narrow Corridor, Author's own copyright.



Figure 19. Breathable Passage. Author's own copyright.



Figure 19. Breathable Passage. Author's own copyright.



# THE ENTRANCE

## SPATIAL DISTANCES

### Conclusions.

Measurements in the entry has been tested on perception of space, bodily emotions and movement.

Experiments in scale 1:1, in model and according to analyses of Zumthors Serpentine Pavilion has been done.

The Result- A narrow and dark entrance that capsule and highlight the little light that accrue in the pavilion. The Light enables the shadows and together with the darkness they are framed. One of the walls are pushed in 75 cm to block the visual contact and to enable the structure itself to shade the opening.



# THE ENTRANCE

## DESIGN PARAMETERS

The Shading and spatial qualities of the structure are tested in models. To achieve the architectural qualities wanted in the entry, spatial attributes is investigated in models.

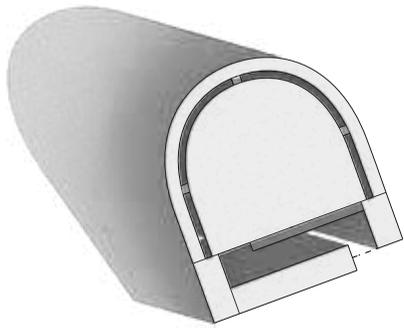
Parameters investigated are:

- Thickness of the walls: 1.5m, 1m and 0.5m
- Placement of the walls: In line with each other or overlapping. 1 and 2 being

overlapping.

- Width of corridor, 1m and 1.5m
- Width between walls in entrance: 1m and 1.5m

To achieve a comfortable composition of the walls in the entry, three different compositions of measurements was tested in a spatial study in which the relationship between length and width were investigated and perceived.



# THE ENTRANCE

## SHADING SCENARIOS PART 1

Month:	August
Azimuth:	105.6
Elevation:	25.6
Time:	07.00
Wind:	East

In the early hours of a august morning the sun is just high/ low enough for the structure to shade its own space with a triangle shape that frames and leads the visitor in to the pavilion.

The Gleam of light surrounded by a contrasting shadow is powerful. Here the Electric Pillars and the Birches will project on the facade.



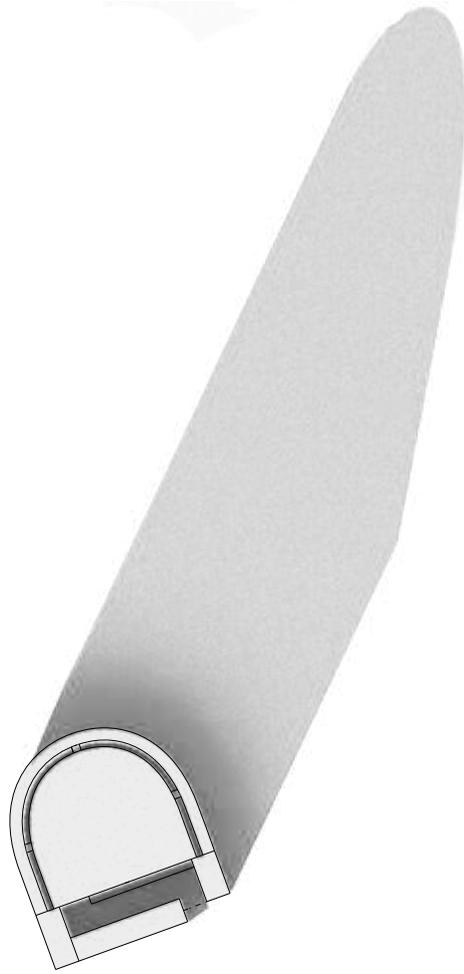
# THE ENTRANCE

## SHADING SCENARIOS PART 2

Month:	October
Azimuth:	158.4
Elevation:	19.0
Time:	09.30
Wind:	South East

As the sunrise settles in a October morning, the front of the structure is completely exposed to the sun. Making it extremely susceptible to shadow

projection. The Low setting of the sun at the fall enables shadow projection from the surrounding Birches trunks and branches.



# THE ENTRANCE

## SHADING SCENARIOS PART 3

Month:	December
Azimuth:	205.3
Elevation:	5.8
Time:	13.00
Wind:	South West

Sun is rising but not to far. It halts at its maximal capacity and due to lacking daylight in the Swedish winter time that's not high. But its just enough to create a long, extensive cast shadow

from the Birches- drowning its surroundings in its glory. The Poor light conditions and the low setting of the sun also enables shadow projection from people passing by on the path way.



Figure 20. Wide Enough. Author's own copyright.

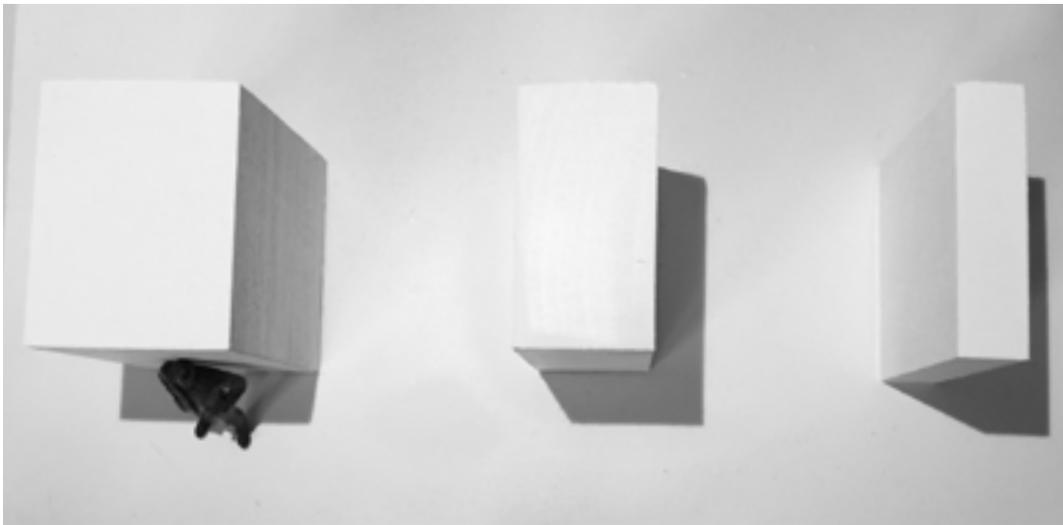
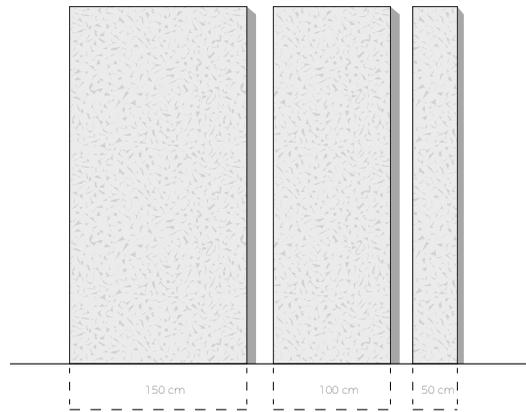


Figure 21. Objects own shadow. Author's own copyright.



# THE WALLS

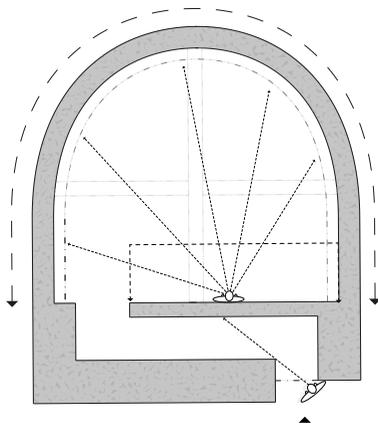
## CANVAS

The Measurements of the walls are chosen because they are wide enough to act like the projection screen for external projection they are meant to be. The External elements cast their shadow on to the structure and the thickness of the walls enables them to frame the beautiful image of the trees- all in black. I translated the grey box to the gypsum board, to a concrete structure after several experiments.

So the walls function as projection screens both internally and externally. Externally the translation

of the gypsum board is the most apparent. By letting the shadows become the facade cladding of the structure- it becomes dynamic and ever changing by surrounding matter. The Shadows can here be in focus and be perceived by people walking by.

The Walls are pre fabricated concrete blocks, without isolation but that are heated with water heating. This gives an unexpectedness in terms of materiality and preconceived assumptions about how the concrete structure feels when touched.



# THE WALLS

## THE CURVED WALL

The Curved wall is what enables the shadow to mutate- become something other than a reflection of an object. But something unexpected and powerful. If the Wall were to be straight it would act like a mirror absorbing the projections but the curved wall plays and engages with the shadow designing a

performance.

The Wall has contradicting functions. One side of the wall is blocking the view of the performance, when entering the pavilion. The other side is allowing the observer to lean against it to have full visual contact with the shadows.



A: 183.1° E: 55.7 W: SE

Section of the Roof

# THE ROOF

## STRUCTURE

The Shaded Structure is the load bearing structure of the ceiling and also the only internal element in the pavilion that casts shadows. So the beams are what enables the shadow mutation on the performance wall. The Steel beams shaped as a cross are integrated in the concrete roof, so the cross is not a design feature. Its cross like shape is

only to enable the ejected parts of the structure in the selected winds. The Beams are ejected in three winds, N, E and W, leaving S to be covered due to people leaning on the wall placed in that wind. And that space should not be exposed to external circumstances such as rain.



A: 122.74 °E: 28.8 °W: SE  
2016 June, 10:00



A: 230.67 °E: 31.68 °W: SW  
2016 June, 16:00



A 82.57° E: 5.66 °W: NE  
2016 June, 07.00



A 175.76° E: 41.17 °W: S  
2016 June, 13.00



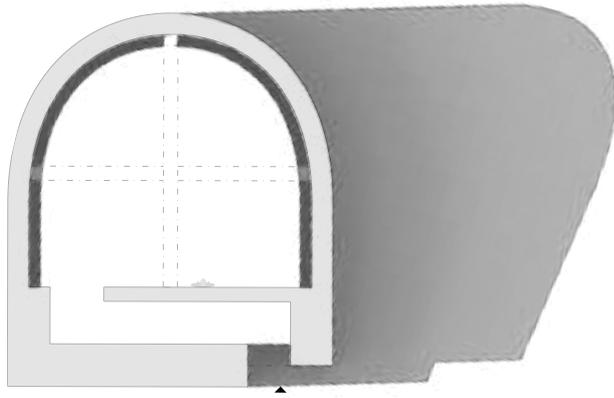
A: 183,1 ° E: 55,7 ° W: SE

# THE ROOF

## INCLINATION

In the Entrance the wall is 3m high but inclining to become 5m high at the curved wall inside of the pavilion. The Inclination helps framing the shadows for the observer when leaning towards the horizontal wall. The Perception of a space that

large also gives a sense of greatness and solidity. The Walls being as thick as 1.5 m and the height of the roof at 5 m can almost over power ones self- leaving nothing to do but to stay quiet and observe the shadows with in this space.



A: 25.2° E: 253.5 ° W: SW 2016 April.

# THE ROOF

## THE GAP

The Roof covers the whole part of the entrance but in the performance space the roof is retracted 30 cm. around the whole room. Leaving a gap towards the sky- unprotected by glass- where the

rays of the sun can pierce through. And as the light beams hit the concrete beams the shadow play begins. The Whole room becomes a spatial experience ready to be explored.



# SHADOW MUTATION



Figure 22, Discovery. Author's own copyright.

# CONCEPT

A Shadow mutation is then the cast shadow is distorted- no longer mirroring it self it its reflection- but portraying something unexpected. The relationship between the curved wall and the structural beams distorts the cast shadow, mutating it to a different shape than its original reflection. The Light beam becomes curved and the shadow framing it by its contrasting ability. This happening becomes a beautiful performance

cast on the walls in the Pavilion leaving nothing to do but to observe it. It may happen slowly- requiring several visits to see the different projections. But it could also change rapidly, with a cloud sailing over the sun and away again. Displaying internal projections on the performance wall in June at the most intense hours of the day. Each time correlates with a specific wind.

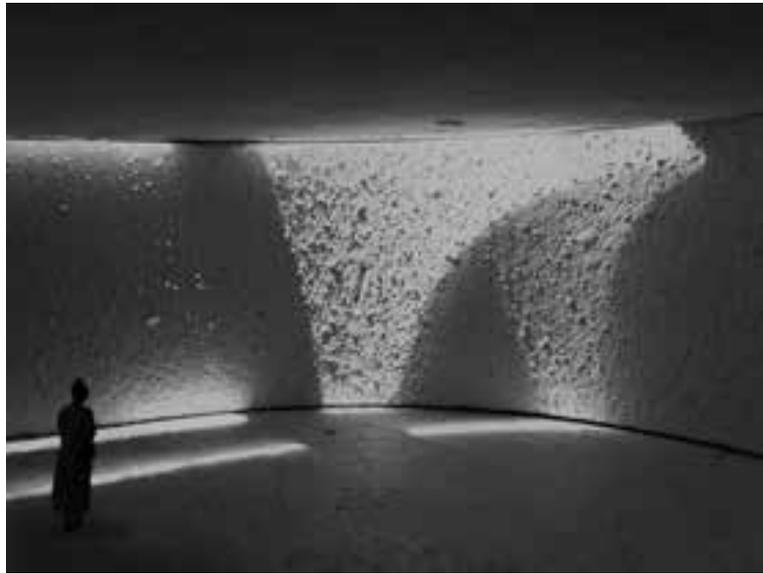


Figure 23. Unexpected. Author's own copyright.

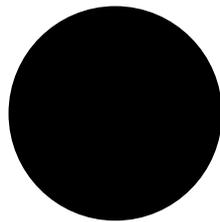
# THAT OF UNEXPECTEDNESS

Cast shadows are often a direct reflection or a mirror image of the illuminated object.

Interpenetrating and mimicking the objects every move.

But I often experience that the unexpected features of life often are intriguing and beautiful as

well. So when designing an internal experience of shadows I wanted to achieve a more unexpected shadow projection. As a contrast to the Pavilions exterior- I designed the structure so that the cast shadow would mutate instead of reflect.



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LIGHT, COLLABORATION & OWNERSHIP

TADAO ANDO

STEVEN HOLL

LOUIS I. KAHN

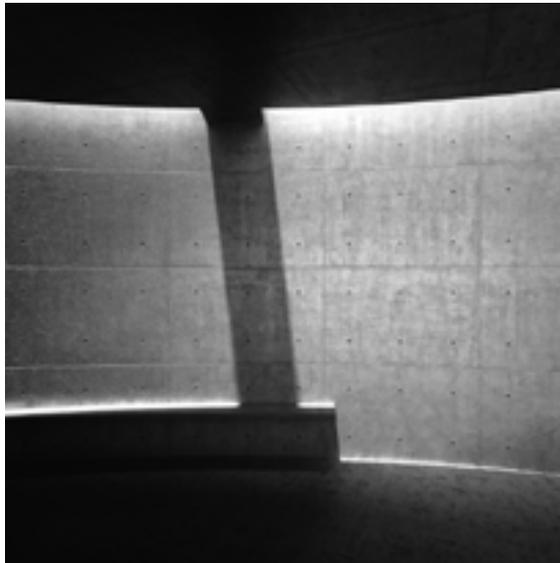
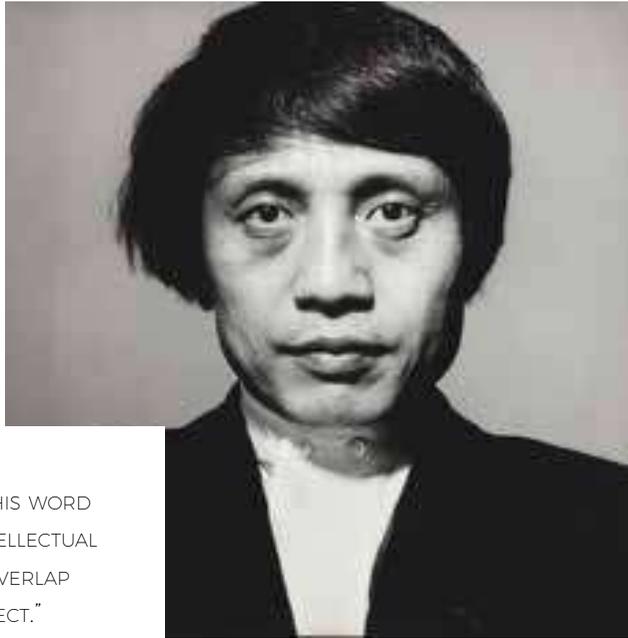


Figure 24. Koshino House, T. Ando(1998)



"PEOPLE TEND NOT TO USE THIS WORD  
BEAUTY BECAUSE IT'S NOT INTELLECTUAL  
- BUT THERE HAS TO BE AN OVERLAP  
BETWEEN BEAUTY AND INTELLECT."

-TADAO ANDO

Figure 24. Portrait, T. Ando(1993)

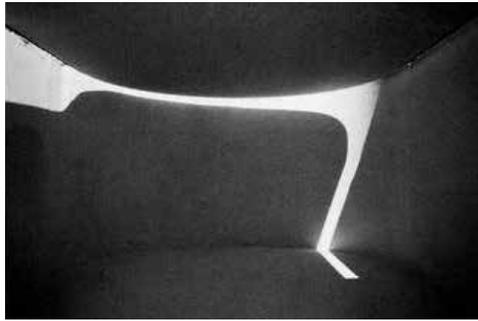
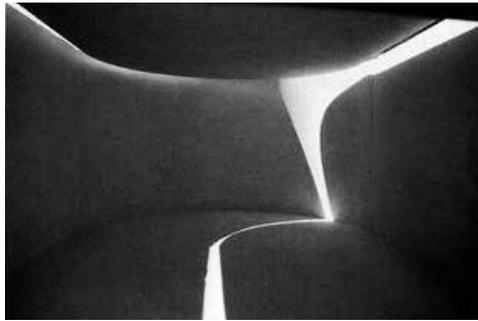


Figure 25-26. Museum of the City, S. Holl(2007)

ARCHITECTURE IS BOUND TO SITUATION.  
AND I FEEL LIKE THE SITE IS A  
METAPHYSICAL LINK, A POETIC LINK, TO  
WHAT A BUILDING CAN BE.

-STEVEN HOLL

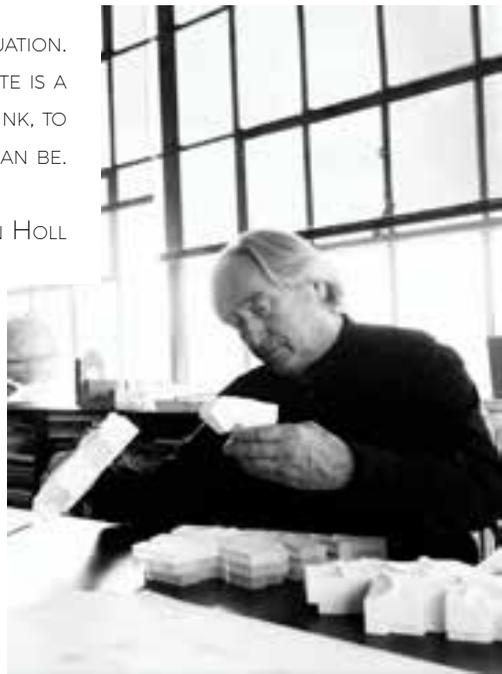


Figure 27, Portrait, S.Holl (2003)



Figure 28. Salk Institute, L.Kahn(1965)

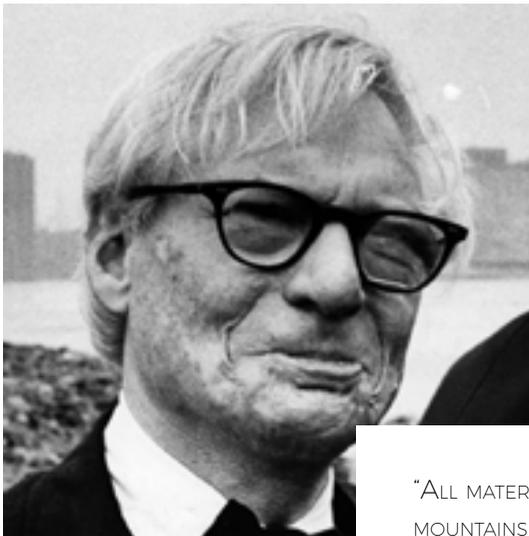


Figure 29, Portrait, L.Kahn

"ALL MATERIAL IN NATURE, THE MOUNTAINS AND THE STREAMS AND THE AIR AND WE, ARE MADE OF LIGHT WHICH HAS BEEN SPENT, AND THIS CRUMPLED MASS CALLED MATERIAL CASTS A SHADOW, AND THE SHADOW BELONGS TO LIGHT."

-LOUIS I. KAHN

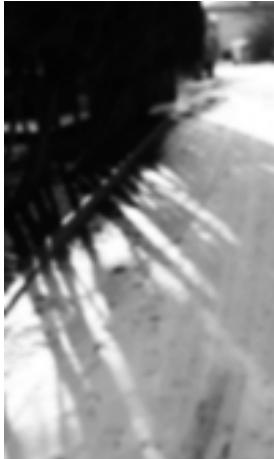


Figure 30. Hovás, Author's own copyright.

# SHADOWED FACTS

## THE COMPOSITION OF A SHADOW PART 1

Scientists touching the matter of light and shadows has established that light always appears accompanied by two different kinds of shadow: its own; the form shadow and the castes projection, which provide information about the illuminated object, playing the roll of a environmental mirror. The objects own shadow, also known as form shadow, tells the story of materiality and spatial characteristics of the illuminated object. This shadow is a integrated part of the illuminated object itself. The range of space masked by this shadow depends on the shape of the illuminated object, the direction of daylight and, to a lesser extent, on the distance from the source of light. This kind of shadow is less receptive to modification or mutation. Intensity of shading depends on the color of the subject and the background on which it is located. The edge of a form shadow gradually transitions from the light side of the surface to the shadow side. This transition is makes the edge of the form shadow appear softer, creating a smooth edge.

The smoothness of the edge depends on the pace of the transition from light to shadow that depends on the surface shape. a sharper edge, such as the edge of a wall, will appear harder than a rounded surface such as a colon. I find that the second form is more expressive, the cast shadow. It is the darkest of shadows, formed behind the objects own shadow. It is a mass of darkness that infuse the space, and exists only at the time of contact with the surface on which it is cast. This shadow can be very intense, almost black, although its color to a large extent depends on the color of the base on which it falls. Due to diffraction; the intersection of light waves at the edges, the shape of the shadow may differ depending on the distance from the light source. The longer the distance, the more blurred it becomes. Because the cast shadow is created by the outer edges of a object, the shadow does not have the gradual transition like the form shadow, instead hard edges with a abrupt ending- leaving the shadow just as hard. (Kaufman, 1975)



Figure 31. Hovás. Author's own copyright.

# SHADOWED FACTS

## THE COMPOSITION OF A SHADOW PART 1

This layering of the cast shadow is divided into Umbra, Penumbra and Antumbra and are three distinct parts of the cast shadow, created by any light source after striking a opaque object. (For a point source only the umbra is cast.)

Umbra: The darkest and blackest area of the shadow in which all light is cut off. Penumbra: The area in which only a portion of the light source is covered by the lit object. Antumbra: The area from which the lit object appears entirely contained within the frame of the light source.

Inside the shadows you will see the effects of reflected light. When the path of the light is interrupted it is reflected. When reflected, the light bounces off the surface in many directions, back towards the light source, towards the viewer, and towards other surfaces to be reflected again. One of the directions the light is reflected towards is into the shadows.

Knowledge of shadows existence enables one to use it as a artistic tool in architecture. One can implement light and shadow play into

architecture with a controlled outcome.

Applying this in to architecture, using the Christ Pavilion in Germany. The light from the window behind the mullions hits the surface of the mullions and bounces around in different directions the shadow areas. The shadow then isn't a single shade, it is actually made up of different shades. In the form shadow closest to the the light side is furthest away from the source of the reflected light and least affected by it. This area appears darker than the rest of the shadow. This darker area becomes the core of the form shadow (The core shadow is the dark core of the mullion). The rest of the shadow gradually lightens as we move away from the core shadow into the area closer to the source of the reflected light. The same applies to the cast shadow. The area of the cast shadow closest to the object blocking the light, the mullions, is least affected by the reflected light. It will appear darkest near the object casting the shadow and will be lighter the further the shadow is from the object.

AFFECTED BY.

EVOLVED FROM.

BLOSSOM THROUGH.

# MATTER AND TIME

## THAT OF SURFACE PART 1

As The Rain, hail, snow and sun uses the concrete structure as its shield- the sense of matter and materiality grows. The Surface changes- becomes darker, patchy and uneven. A Beauty caused by external matter. The Presence of a time that passed, seasons that has changed gives the material patina and a new layer of dignity. But the Shadow continuous to adapt on to the surface- enabling them to look and be perceived different due to matter.

The different molding method gives the surface its identity and a variation and combination of these are used in the pavilion.

- Smoother surfaces on the leaning wall.
- A heavily structure is used on the curved wall to enhance the perception of distortions of the shadows.
- A medium structured surface is used in the rest of the pavilion.

AFFECTED BY.



Cracks



Moss



Mold

EVOLVED FROM.



Heavily structural surface  
Caste in a wooden board mould  
15 year old



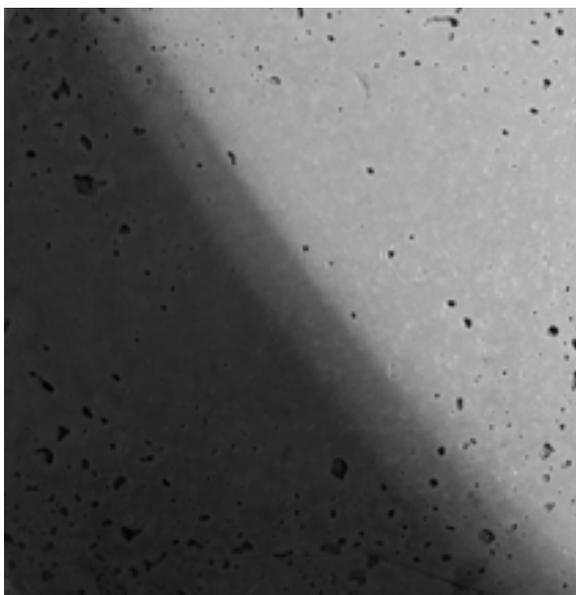
Structural surface  
Caste in a wooden mould  
10 year old



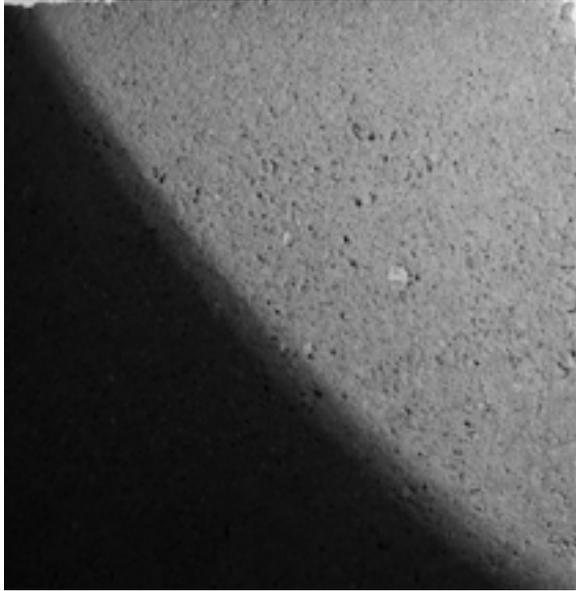
Smoother surface  
Caste in a plywood construction mould  
10 year old

# MATTER AND TIME

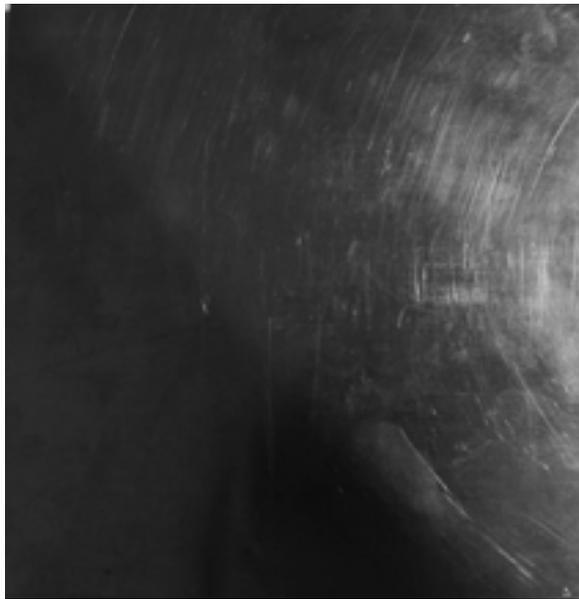
THAT OF SURFACE; PART 2. SHADOWS ON MATERIAL



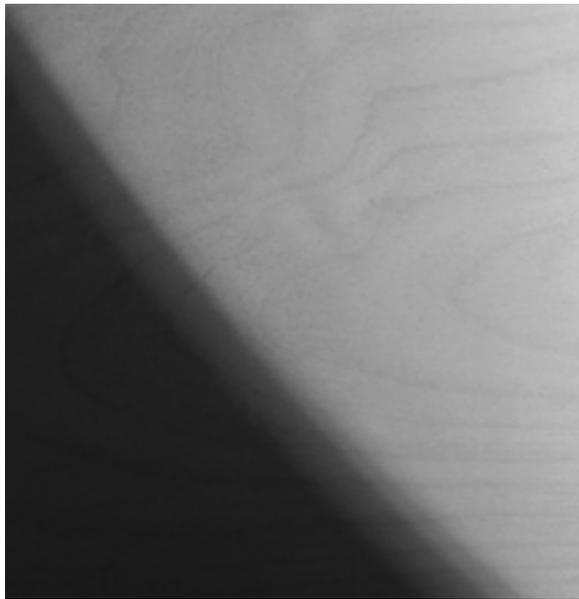
Smooth surfaced concrete



Rough surfaced concrete



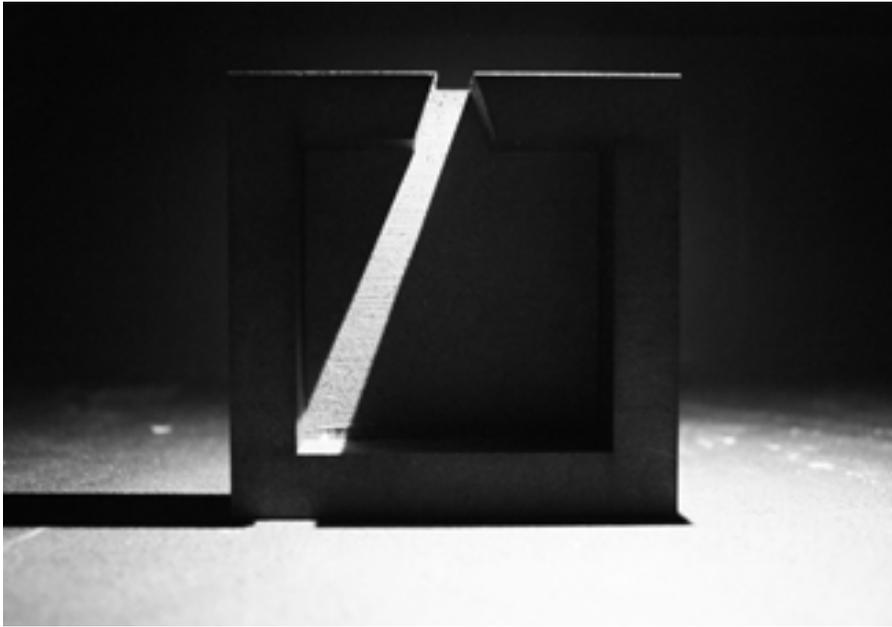
Metal



Plywood





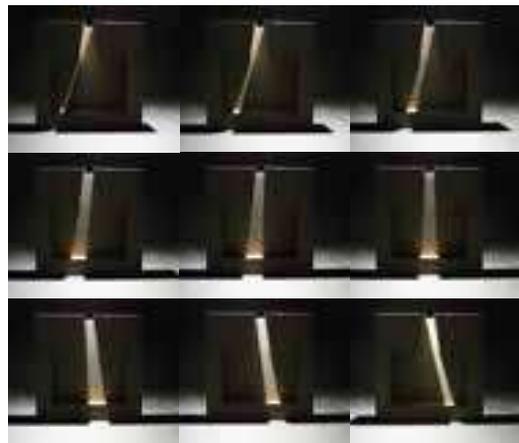
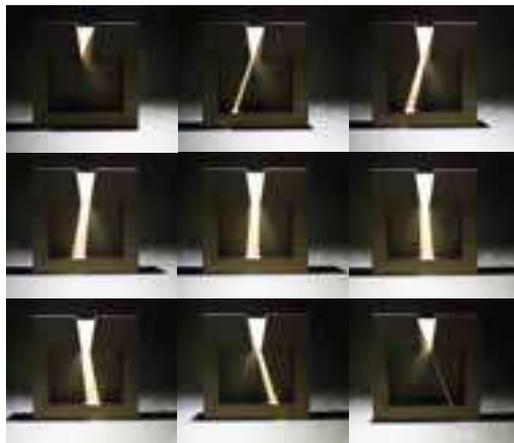
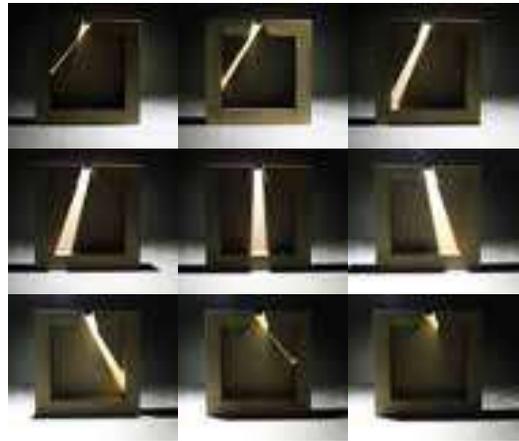
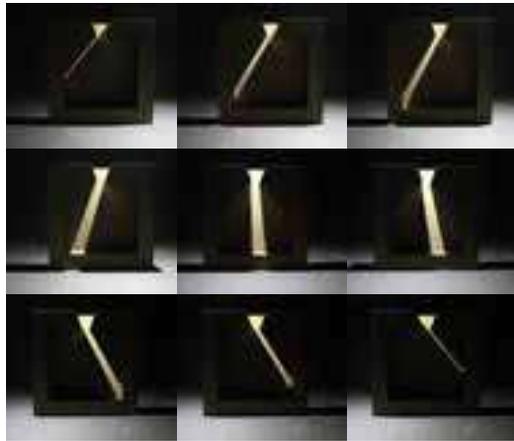


# ORCHESTRATED PROJECTIONS

Another important design feature is the shape of the edge of the roof, from where daylight is allowed in to the structure, is an important design feature for controlling the appearance and length of light and shadow. When a structure is located in a site with limited

access to daylight, due to trees and other external elements blocking its rays, such as Oxsjön, it is beneficial for the cut to be diagonal or straight to let more light in. Different cuts give different spread of the light and different appearing shadows.

MODEL STUDY OF PERFORATION



MODEL STUDY OF PERFORATION

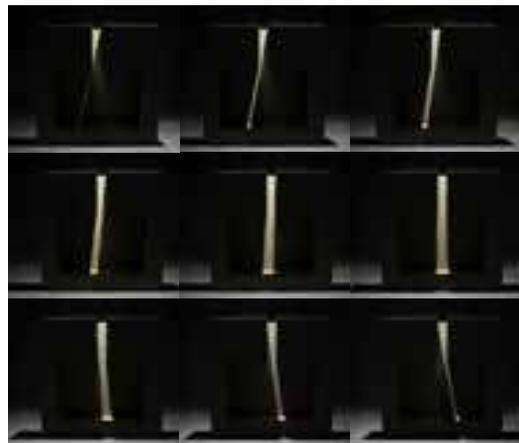
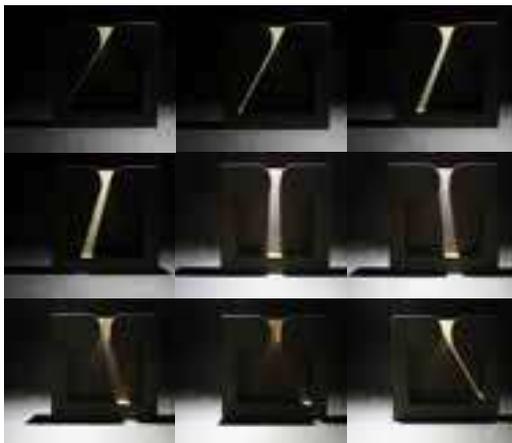
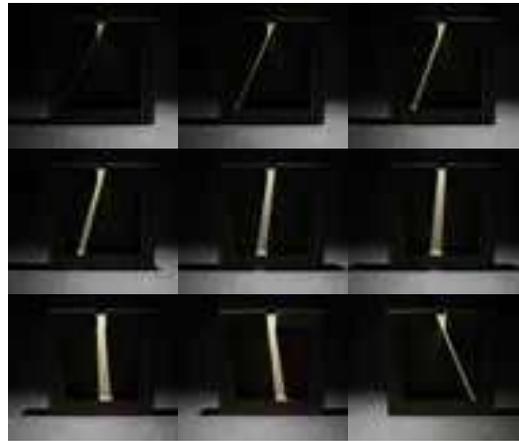




Figure 32. Church of Light, TAndo(1999)



"...STRUCTURE IS THE MAKER OF LIGHT.  
WHEN YOU DECIDE ON THE STRUCTURE,  
YOU DECIDE ON LIGHT."



Figure 33. Yale University Art Gallery L.Freedman(1953)

-LOUIS I. KAHN

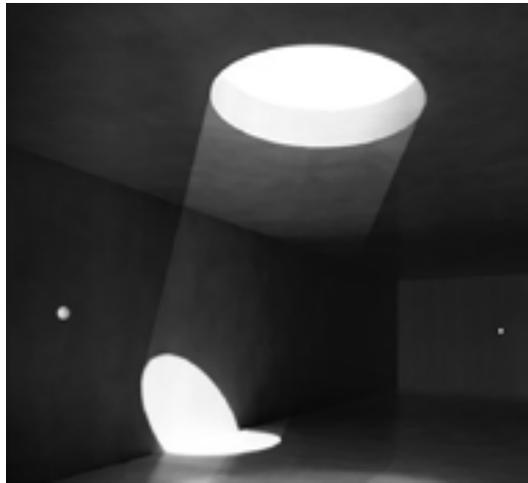


Figure 34, Romanian Pavilion, R.Crillo (2010)



Figure 35. Koshino House, T. Ando(1998)



# CONCLUSION



# THOUGHTS

Now it is time to conclude this thesis.

This thesis has evolved around the beauty of a everyday shadow projection and how the experience of the shadow could change or be more intense if framed by architecture.

This thesis has displayed ways of using the beauty of a shadow as facade cladding on a build structure but also as a spatial experience through mutations.

This thesis has explored how materiality could be enhanced through the shadows.

I claim that architects could use the everyday beauty of shadows more often in our design and by doing so could enable a more dynamic an intricate design. But that it also could help raise awareness of the context that we design in and that a collaboration between architecture, site and external matter could result in beautiful architecture good for the soul.

**But it could also help us see and appreciate the beauty of that everyday shadow that we may walk by unnoticed today..**



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- [https://sv.wikipedia.org/wiki/JunichirÅ\\_Tanizaki#/media/File:Junichiro\\_Tanizaki\\_1913.jpg](https://sv.wikipedia.org/wiki/JunichirÅ_Tanizaki#/media/File:Junichiro_Tanizaki_1913.jpg)
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- [http://images.adsttc.com/media/images/5037/f3cd/28ba/0d59/9b00/064c/large\\_jpg/stringio.jpg?1414206110](http://images.adsttc.com/media/images/5037/f3cd/28ba/0d59/9b00/064c/large_jpg/stringio.jpg?1414206110)
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## THANK YOU

The two greatest loves of my life; Theodor and Tomi  
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