ENDLESS JOINERY

2017 Jenna Ernestrand Chalmers School of Architecture Master Thesis in Architecture and Urban Design

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Endless Joinery
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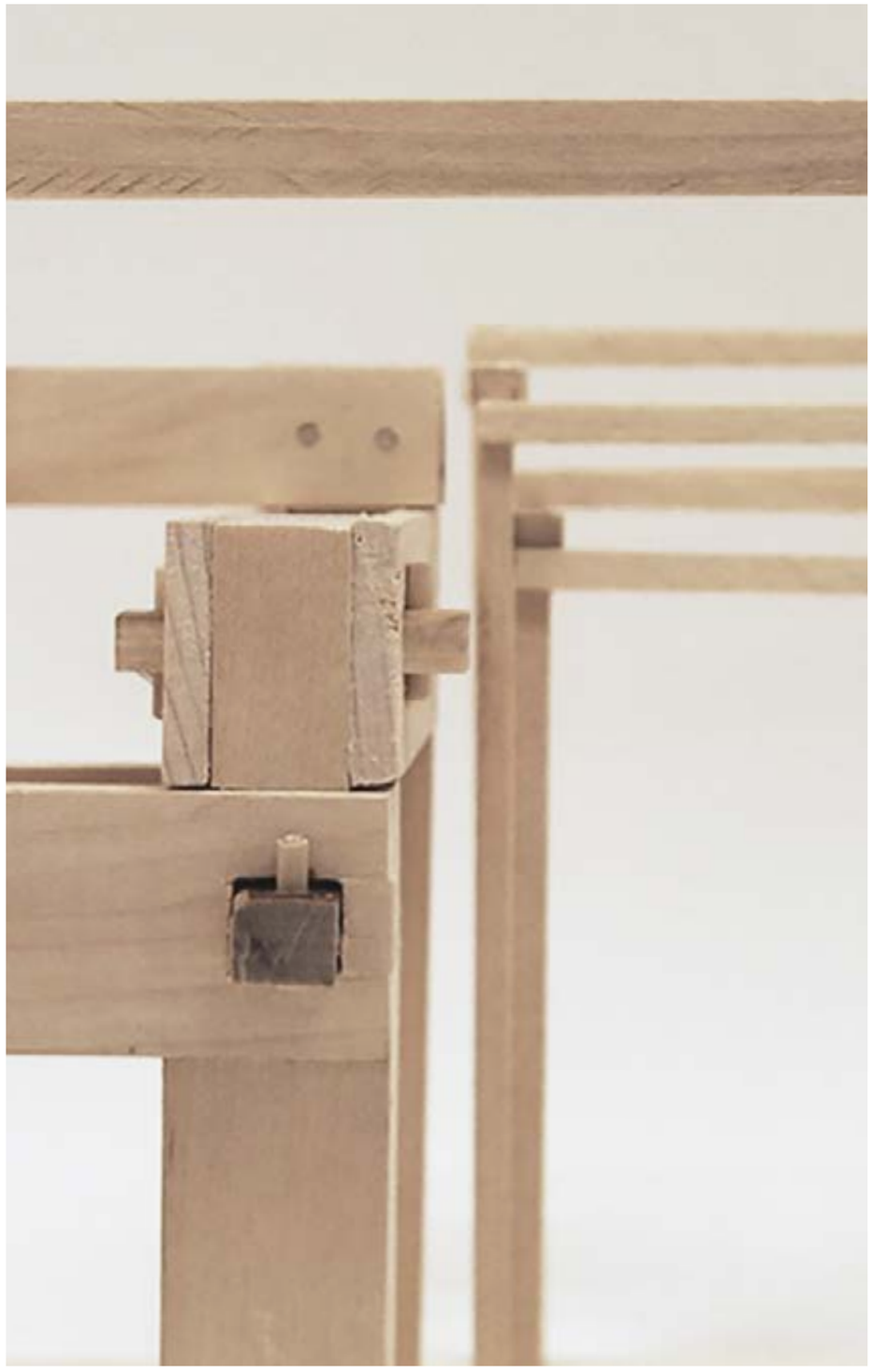


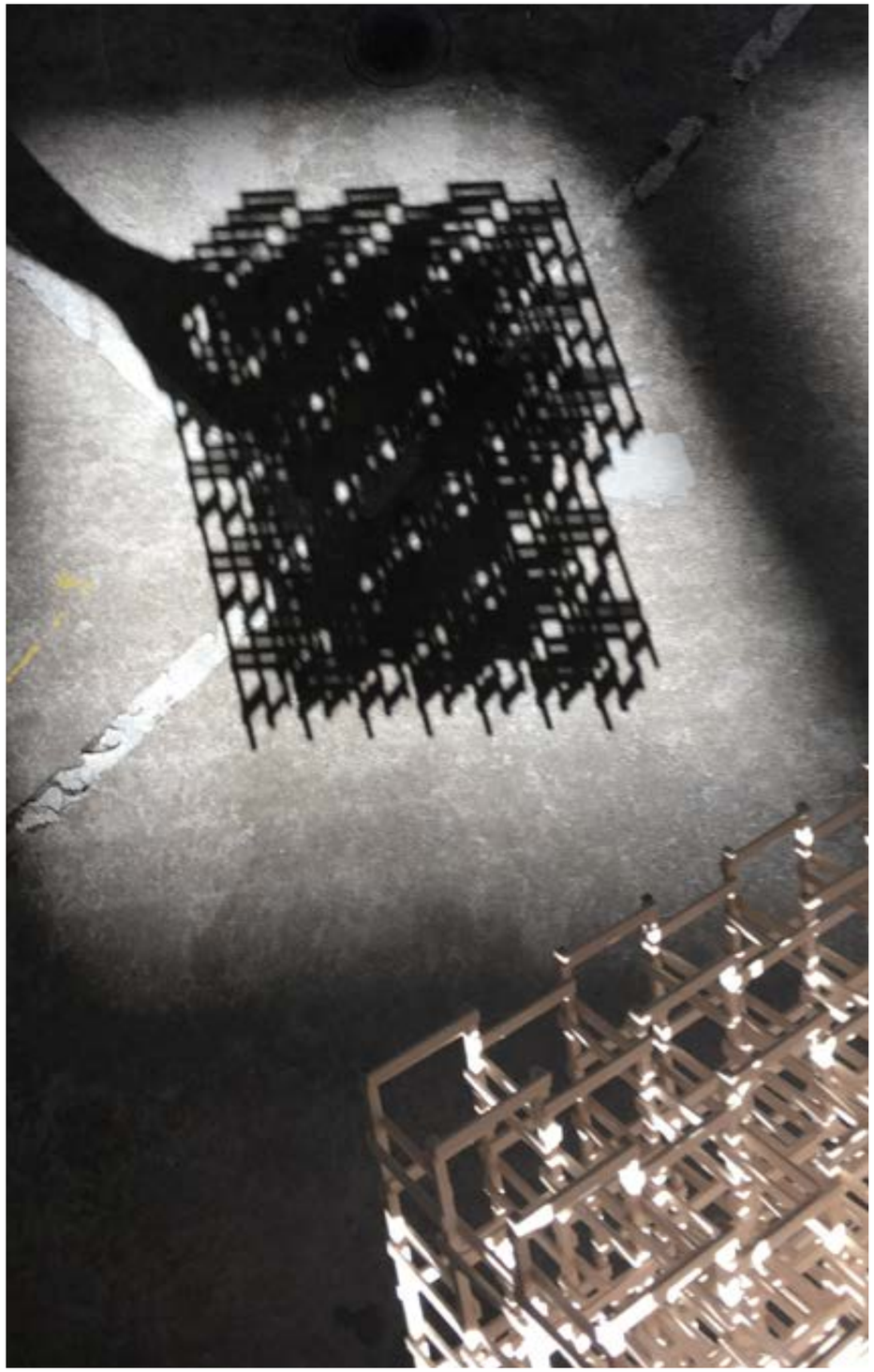
ABSTRACT

Endless Joinery

The focus of this thesis is to work with different scales as a way to approach craftsmanship and fabrication today since the presence of the hand and the making is slipping away in our society. It is an investigation on how to find a balance between different tools and how they can enhance each other. The material is wood, and the proposal is a wood workshop center in the forest of Dalsland. Situated in Bengtsfors, a municipality with ambitions to enhance the forest and its resources. Connected to the railway it is a link between the forest and the urban areas and will provide a place for experimentation and collaboration.

The project is divided in two scales; the strategy of the center and the connection to the surrounding forest. The smaller scale explores the joinery and the material. The investigations of joinery and fabrication is presented in the structures of the project. Different scales emphasizes different balances between the detail and the structure. To show different possibilities and diverse qualities between craft and digital fabrication. Not to compare the hand with the machine.

An approach to craft and fabrication through different scales and tactility of wood.



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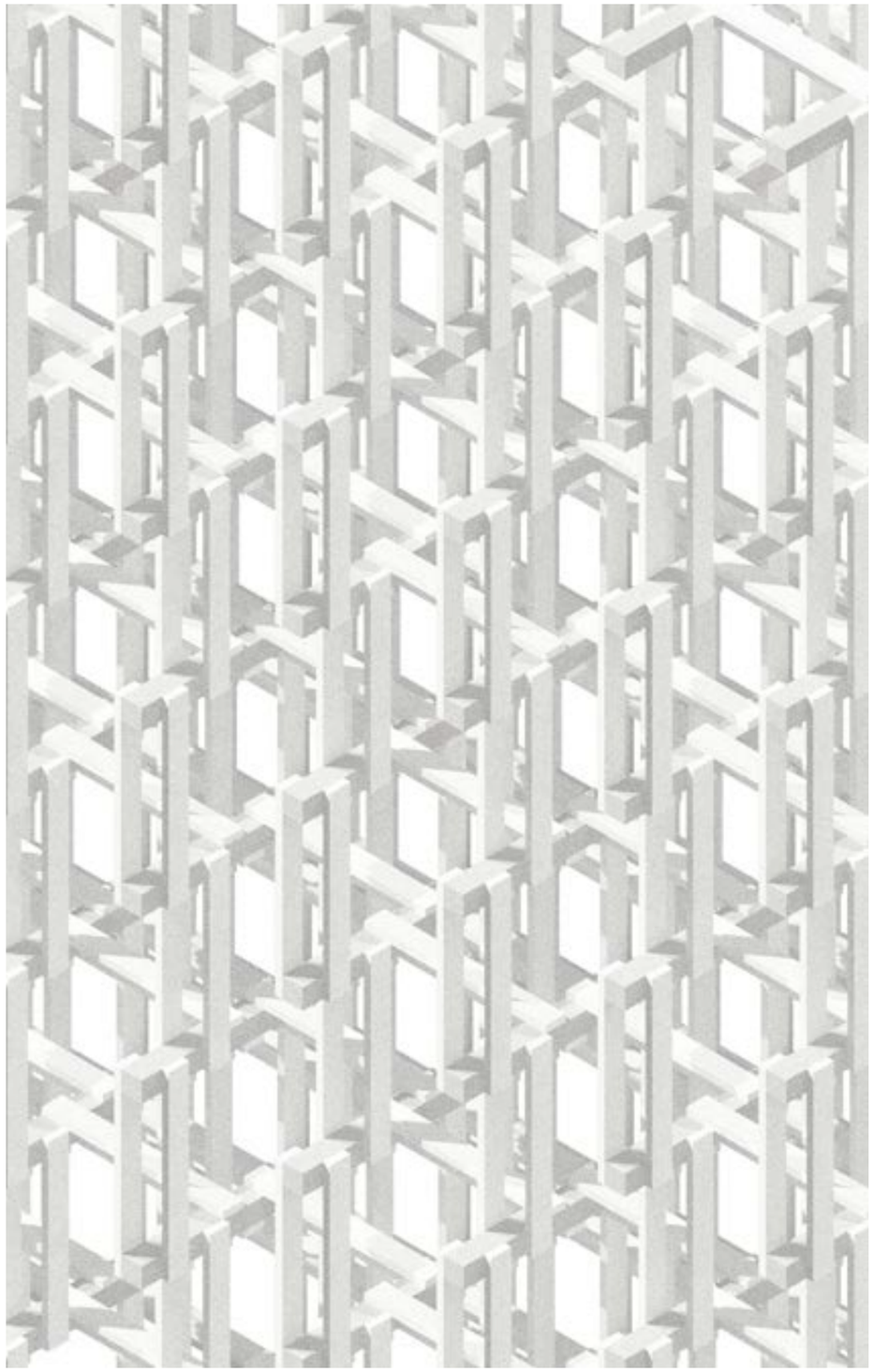


INTRODUCTION

This thesis is about wood and emerge from a fascination to learn more about the material. This combined with an interest in craft and how things are being made is affecting and is visible in the result. Since joinery is the part of a structure that enables different expression the focus of the studies lays here. How to enhance different types of making through the joint and how it is perceived in different scales. The focus has been on trying to explore a balance of craft and digital fabrication. Craftsmen usually has a high aspiration for quality in the work which enhances the practical part of architecture combined with the digital technology today that enables larger quantities.

The proposal is a wood workshop center in the forest of Dalsland. Situated in Bengtsfors, a municipality with ambitions to enhance the forest and its resources. Connected to the railway it is a link between the forest and the urban areas and will provide a place for experimentation and collaboration. The center will function like a small production line along the railway which is a reference to the layout of a saw mill. And though the product, or the result is an aim, it is not the most important thing. Is about the steps on the way, the understanding of the process of the timber and how that affects the design.

The project is divided in two scales; the strategy of the center and the connection to the surrounding forest. The smaller scale explores the joinery and the material. The investigations of joinery and fabrication is presented in the structures of the project. Different scales emphasizes different balances between the detail and the structure. To show different possibilities and diverse qualities between craft and digital fabrication. Not to compare the hand with the machine.

WOOD AND DALSLAND

TIMBER

Brief overview of the decline of timber in the urban environment of Sweden

The timber building techniques is a part of our geographical heritage and the knowledge has been transferred verbally over generations. Corner log timbering is a technique used to build massive wooden structures with a joinery that creates a stable corner. Because of the expansion of the wood overtime, it creates a strong and thermally secure construction. Until the middle of the 19th century this was the most common building technique used in Sweden, but then it rapidly decreased. Of course, the factors that led to a reduced usage of this technique are many and complex, but industrialization and the establishment of sawmills is one of the reasons the technique did not make its way into the cities. In the outskirts and on the countryside they kept building this way but fire regulations in the city more or less prohibited the wooden craft to enter the urban environment. Incidents of heavy fires in cities like Sundsvall, which burned down completely, and Umeå which was partially destroyed the same day in 1888, created a policy change which discouraged massive timber constructions. In 1874 the Swedish government issued a nationwide building policy charter that drastically changed the judicial grounds for building. The charter named "Byggnads- och brandstadga för rikets städer" had several policy changes which affected the use of timber construction.

Paragraph 34 of the charter decrees that:
"*Building of stone or there of comparable non-flammable material may be constructed on the border of a neighbor's property. Other building may not, even if such otherwise should be allowed, be built closer than fifteen feet to a neighbor's property, unless it is supplied with a firewall or other satisfactory protection material against fire hazard, as in the building order is decided.*" (Oscar II of Sweden, 1874 p.19).
Paragraph 35 of the charter decrees that:
"*Building may not be covered with straw, peat, chip, boards or other incendiary materials; but shall be clad with brick, slate, plate or other material, that is tested in the aspect of preventing fire hazard.*" (Oscar II of Sweden, 1874 p.19)

The regulations now demanded for a firewall security and a ground floor in stone or cladded in a non-flammable material. This meant that construction in cities no longer could be done solely in wood. These regulations and the fact that sawmills provided new dimensions of timber, changed the way we build with wood. In combination with a large urban growth and urbanisation and a heavy population growth, a large part of the new construction would onwards be built mainly in stone, brick and other fire-resistant material in these areas.

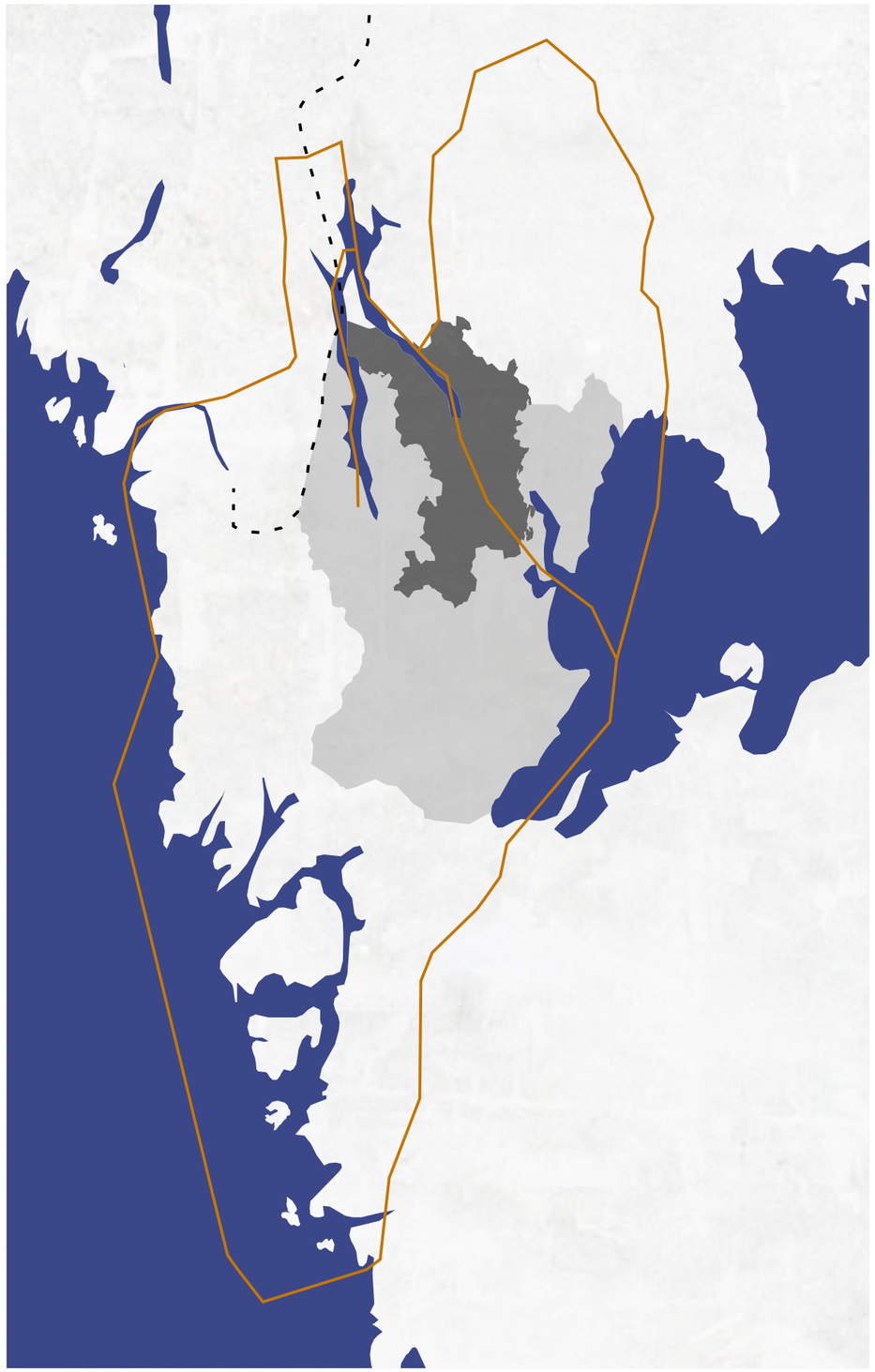
TIMBER AS A SUSTAINABLE SOLUTION

A revival of wood and an ambition to create awareness

Parallel to the greater general awareness of climate changes, the interest of building with wood have increased. There is a big community that is trying to incorporate wood back into the building industry. It is happening globally and in Sweden, but due to our regulations and the structure of our corporate building industry, the change is slow. So far we have mainly seen smaller scale pilot projects but wood has recently become a marketing purpose for companies to profile themselves (for example, the Swedish housing company Folkhem only build in wood). Around the world, we see pavilions, enhancing spaces only in wood, showing possibilities with the new technology and with a ambition to create an awareness about wood. The pavilion Forest of Venice is a collaboration of Folkhem and Kjellander & Sjöberg architects and was a part of the Venice Architecture Biennale 2016. It highlights wood, but it also tries to discuss the relationship between nature and the city. This pavilion is a part of the Biennale, accessible for everybody, especially attracts and aims towards the architectural profession. How do we change the current situation and turn up the speed of change? We can se that some municipalities in Sweden do change the requirement of architectural competitions but as a profession we also need to gain more knowledge about the material. As the choice of wood is not as safe and controlled as other construction materials that the building industry might prefer.

"Sustainability is the capacity to endure" as mentioned by Emma de Jong (de Jong, 2015), she discusses the qualitative aspects of sustainability; it is not only about measurable values in terms of material use and cold bridges, it is the fact that a building should endure over time. If it's not appreciated by the people that inhabits the space, it will not last long enough. If no activity will take place, or no one is attachted to the space, it will simply be abandoned. Numbers and calculation will not impress in the long run, but an appreciated space will. Timber buildings do have a certain warmth and feeling of honesty, and wood as a material has strong building traditions. It is not only a good choice in terms of calculations and renewable sources, it is also a material that is highly appreciated and has the capacity to last because of that.

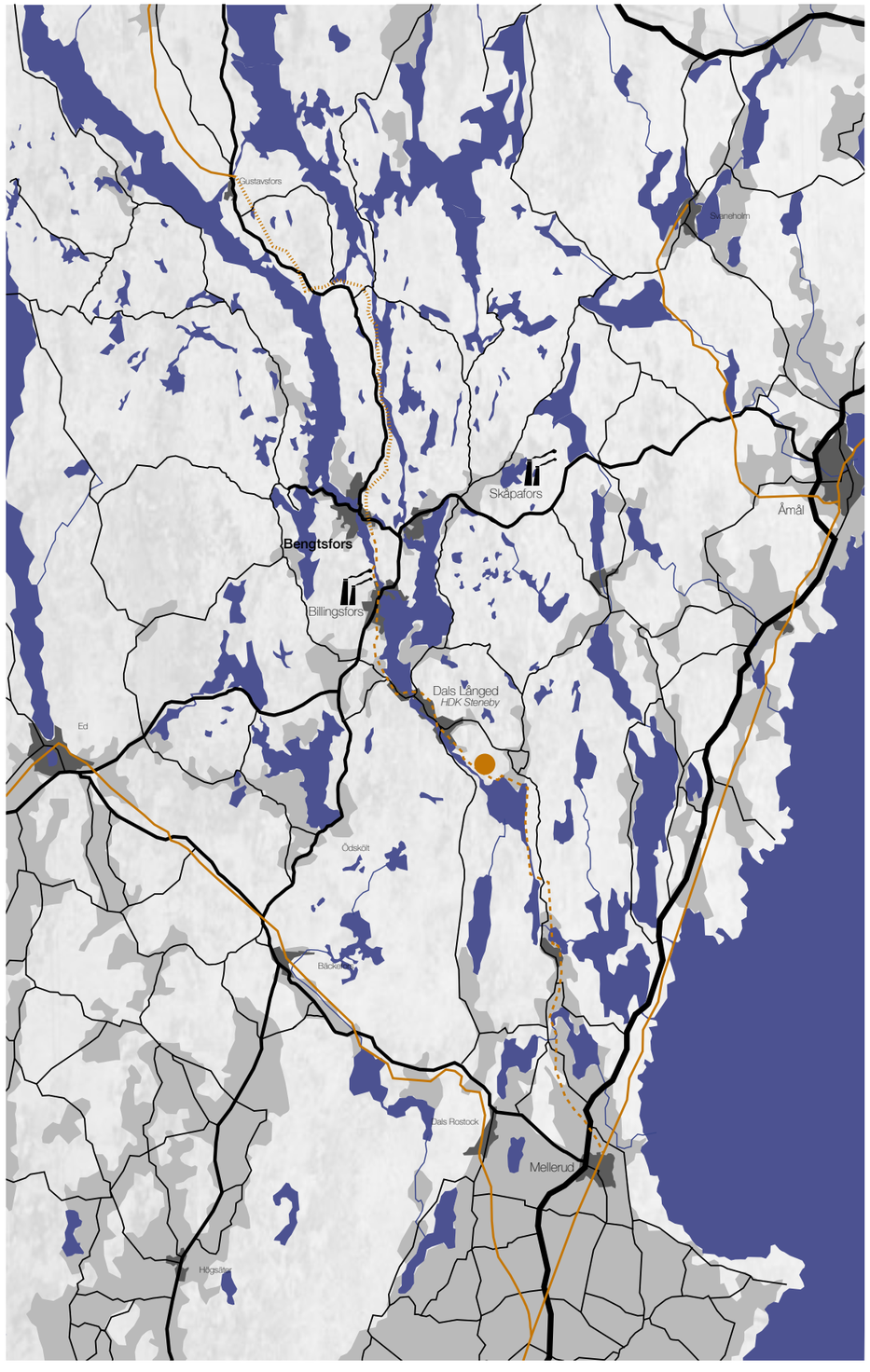
Timber waiting to be picked up on the egde of the site in Dalsland.



DALSLAND

Canals, from forest industry to summer turism

In the 18th and 19th century the mills around the area of Dalsland had more and more difficulties with transportation. Dalsland consist of many small lakes and demands for building a canal that would connect the lakes grew, but long discussions of location and direction delayed the construction. They started constructing the first canal in 1863, more than 100 years after the first proposition. The costruction was faster than expected and was finished in four years. The waterborne route is more than 250 km long and 12 km is constructed canals. Around the time of the finishing of the canals the railway was built as a part of the industrial revolution. The importance of the canals were not as great as first expected and in 1970 the last cargo ship passed the canal. The canal system is a part of the cultural and industrial heritage in the region and is today an tourism attraction.



Site location

BENGTSFORS

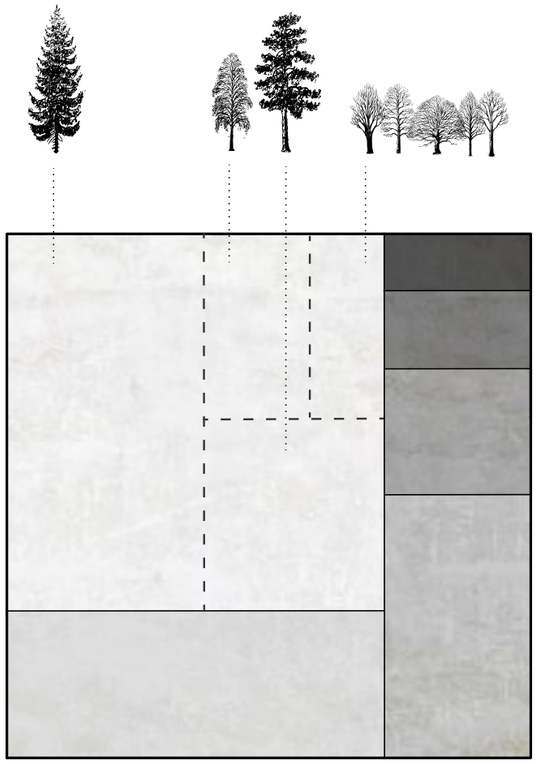
Sweden, Dalsland, Bengtsfors

The municipality of Bengtsfors has, after a period of population decline, a focus in increasing culture activities in the region and the ambition to become the main capital of Dalsland by 2030. Bengtsfors is located 1,5 hours from both Gothenburg and Oslo and is highly depending on the communications and infrastructure since many citizens are commuting to work. The craft school HDK Steneby is highly regarded from the municipality and they value its presence. The ambitions and goals for 2030 mainly focuses on the school, the timber and paper industry and tourism.

"*2030 har Stenebyskolan, som en del av Göteborgs Universitet, med sina nischade utbildningar inom design och konsthantverk ytterligare stärkt sin position som utbildningsanordnare och kreativ mötesplats. De traditionellt starka textil- och träutbildningarna har fortfarande stor betydelse både lokalt, regionalt och nationellt, men nya materialbaserade utbildningar har numera stor omfattning..... **Till Stenebyskolan har också knutits ett skogsligt utvecklingscentrum som arbetar inom forskningen på skogsråvara.***"

HDK Steneby is an opportunity to connect the rural town of Bengtsfors/Dals Långed to urban areas in Sweden such as Göteborg and also a possible way to collaborate with the industry.

Photos from visit in Dalsland. The railway on the site is used only once a week to transport lumber to Mellerud. In the summer it is used more often for tourism.



DIVISION OF LAND

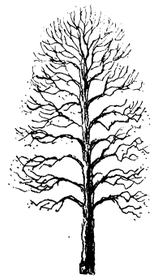
Fyrbodals distrikt (Dalsland and parts of Västra Götaland)

52% Productive forest
20% Farmland
14% Mountains
7% Other
4% Fen
3% Protected land

WOOD SPECIES

Statistics from Riksskogstaxeringen

54% Spruce
26% Pine
12% Birch
8% Other (Aspen, Alder, Goat Willow, Oak, Ash)

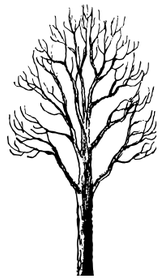


Alder (Al)

Alnus glutinosa

Relatively soft. Changes fast in color to more redbrown. May have certain patterns in the stub. Durable in wet conditions but not in contact with the ground. Easy to work with and to dry.

Dry density: 550 kg/m^3
Bending stength: 78-95 MPa
Compression strength: 39-52 MPa
Tension strength: 92 MPa
Shrinkage: 4,3-4,7% radial, 9,3-9,7% tangiel
⌀ 15-29 cm (most commonly 20-24 cm)

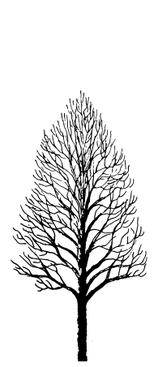


European Ash (Ask)

Fraxinus excelsior

Strong, especially with wider growth rings. Quite free from twigs. Clear distinction between spring and summer wood. Sapwood light yellow-grey with a heartwood that becomes darker with age.

Dry density: 550-800 kg/m^3
Bending stength: 80-120 MPa
Compression strength: 38-58 MPa
Tension strength: 165 MPa
Shrinkage: 3,8-5% radial, 5,4-8,4% tangiel
⌀ 35-45 cm (most commonly 45+ cm)



Aspen (Asp)

Populus tremula

Fast growing. Used for matches. Straight and long fibers. Light growth rings and retains the brightness. Sensible while drying. Doesn't absorb heat. Stable in shape but easily rot.

Dry density: 490-540 kg/m^3
Bending stength: 75-82 MPa
Compression strength: 42-47 MPa
Tension strength: 110 MPa
Shrinkage: 3,1-4,5% radial, 8,5-9,6% tangiel
⌀ 15-44 cm (most commonly 35-44 cm)

Birch (Björk, Glasbjörk)

Betula pubescens

Standard length 3 meter but also up to 5,5 meter. Not very visible heartwood and smooth in appearance. Generally quite easy to work with.

Dry density: 630-670 kg/m^3
Bending stength: 107-123 MPa
Compression strength: 54-60 MPa
Tension strength: 137 MPa
Shrinkage: 4-5% radial, 7,8-10% tangiell
⌀ 0-44 cm (most commonly 15-19 cm)

Goat Willow (Sälg)

Salix caprea

Mainly used for woodfiber boads. Changes from white/yellow to dark redbrown. Not particularly lasting. Soft. Easy to bend.

Dry density: 530 kg/m^3
Bending stength: 57-63 MPa
Compression strength: 35 MPa
Tension strength: 60 MPa
Shrinkage: 3% radial, 8% tangiel
⌀ 0-45+ cm

Norway Spruce (Gran)

Picea abies

Not very visible heartwood. Usually straight fibers, especially if fast grown. Similar to pine timber. Varies a lot in density depending on speed and location of growth. Sensible to rot. Risk for deformation while drying.

Dry density: 300-480 kg/m^3
Bending stength: 66-84 MPa
Compression strength: 35-44 MPa
Tension strength: 99 MPa
Shrinkage: 3,6-4,2% radial, 7,8-8,8% tangiel
⌀ 15-44 cm (most commonly 25-27 cm)

Oak (Skogsek)

Quercus robur

Strong and lasting. Heartwood lasting against rot, sapwood not as much. Becomes more straight if grown in forest surroundings. Strong patterns. Dries slowly with risks for cracks.

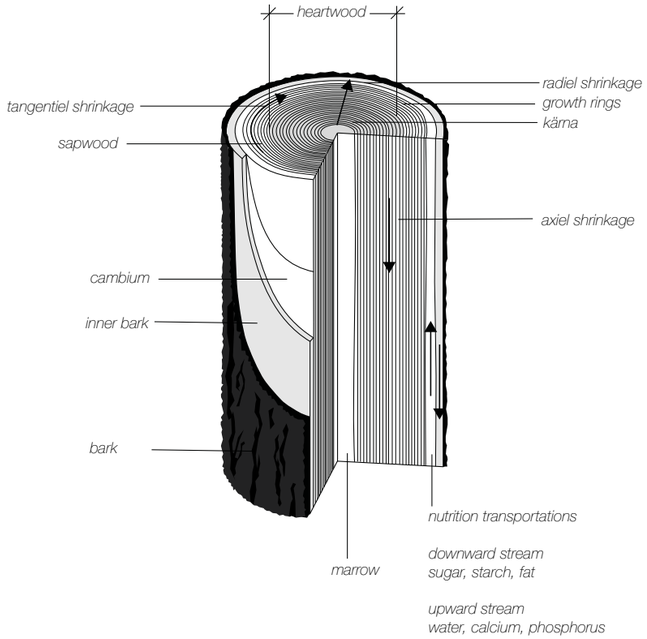
Dry density: 690-720 kg/m^3
Bending stength: 90-100 MPa
Compression strength: 53-65 MPa
Tension strength: 90 MPa
Shrinkage: 4-5% radial, 7,8-10% tangiel
⌀ 25-45+ cm (most commonly 45+ cm)

Scots Pine (Tall)

Pinus Silvestris

Very common. The timber is usually full of twigs. Higher quality is limited. More visible heartwood than the spruce. Drying process should start directly.

Dry density: 480-530 kg/m^3
Bending stength: 83-89 MPa
Compression strength: 45-47 MPa
Tension strength: 104 MPa
Shrinkage: 4% radial, 7,7% tangiel
⌀ 15-44 cm (most commonly 35-44 cm)

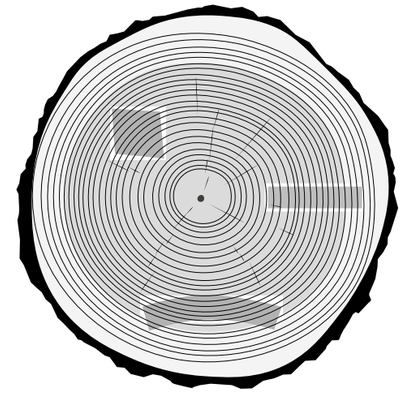


A PIECE OF TIMBER

General terminology

The heartwood is more resistable to moisture due to a higher percentage of harts, but it generally has a lower density which affects the strength. In the direction of the fibers, wood is strong in tension. But generally the tension strength is affected by non-straight fibers and twigs. In compression it is around half as strong as in tension, but it is not as sensible to defections and twigs.

The light part of the growth rings is the growth during the spring/pre-summer. It consists of cells with thin walls and greater cavity. The darker rings is called summerwood due to growth during summer/early autum. The cells have thicker walls and less cavity which makes it harder (higher density). The thickness of the growth rings varies a lot between species but also between the individual trees.



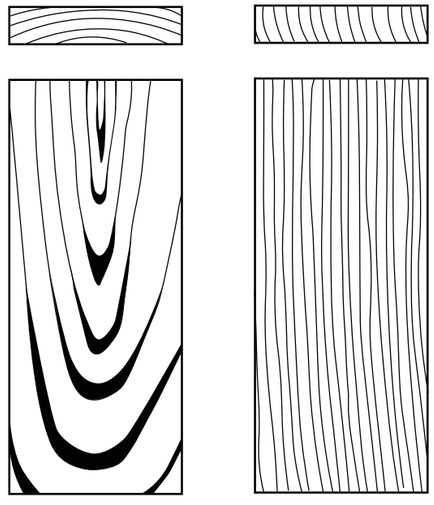
MOISTURE

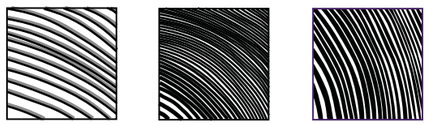
Changing in shape and size

Wood is an organic material and changes with the level of humidity. It will absorb or desorb moisture until it's in equilibrium with its surroundings. The drying process is sensible and if rushing risks for cracks occur.

The moist in the sapwood is 100-200% compared to the heartwood which is 30-35%. This affects the deformation when the timber is drying (the heartwood is more formstable), also the direction of the growth rings affects the shape the piece of wood will get while drying.

Moisture levels recommended in wood:
Partly outside (windows/doors): 12-15 %
Outside but covered from rain: 14-18%





QUALITY ASSESSMENT

Traditional standards

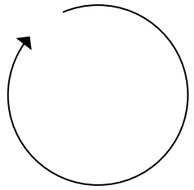
Depending on desired properties of the wood in different locations of the structure, different pieces of the timber can be used. The demands of the quality on the material can very a lot. Some qualities are more general (strength, form stability, durability), and previously these properties were demanded on the material itself, through specific forest growth, but also on the forest industry production. Each step of the way is focused on finding these types of qualities and sort them in order to make sure that the right type of wood can be used in the right parts of the struction.

Today, in the larger wood industry, wood is treated more as a homogenous material while syntethic wood alternatives are produced to fulfil all demands with one product. If the piece is containing heartwood or sapwood is not beeing concidered or the density of the growth rigns.

The illustration shows the different properties that differs due to the position of the growth rings. The three pieces of wood has the same measurements but different properties.

1. Wide growth rings, 2/cm has a density of 343 kg/m^3
2. Dense growth rings 609 kg/m^3
3. 5 growth rings/cm, 625 kg/m^3

The last one has the highest density due to more harts in the summerwood which will make it the most durable. But the first one is easier to work with due to lower density.



Winter: Felling

When the activity is low within the wood. Low temperature decreses damages on the lumber

Spring: Sawing

To avoid long storing and for the timber to be ready for drying during summer

Summer: Drying

Climate allows for drying outside under a simple shed

Autum: Inside drying

The timber dries in a unheated space for a longer period of time. Last couple of months preferably inside the workshop to adjust to indoor climate humidity levels

Felling

Now done with more machines with risk for damaging the lumber.

Wet storing

While waiting for sawing the lumber needs to be kept humid so large amount of water

Sawing

Because of the wetstoring it needs to be artifically dryed straight after

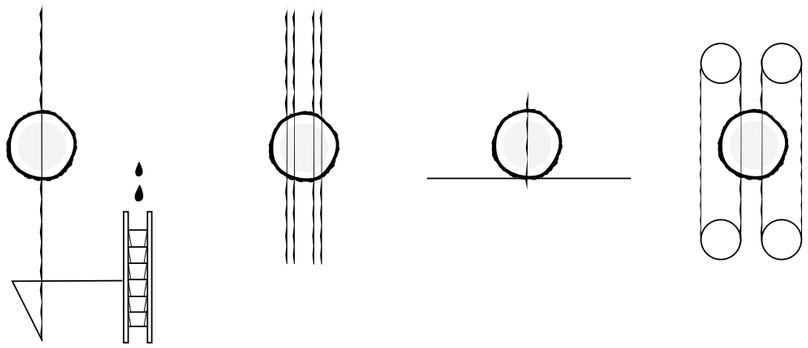
Drying

Fast process

SAWMILL PROCESS

A long drying process is not considered profitable enough in the modern sawmills. Artificial drying has therefore been a part of the process for a long time and different research programs is always trying to lower the amount of drying time. But for the quality of the timber a longer storing (and drying) process is creating more harts which is a natural impregnation, and obviously very positive.

The forest industry, the felling of the lumber, transportation and sawing has a impact on the quality of the end product. The modern timber production is different from the traditional that allowed for individual assessment and manual corrections. The bigger, more uniform production today is not following the seasonal changes and therefore another type of drying is needed to control the timber.



SAWTYPES

The first step of determining shape and size

1. Mechanical pitsaw

First powered by two people.
Later on powered by water power.

2. Frame saw

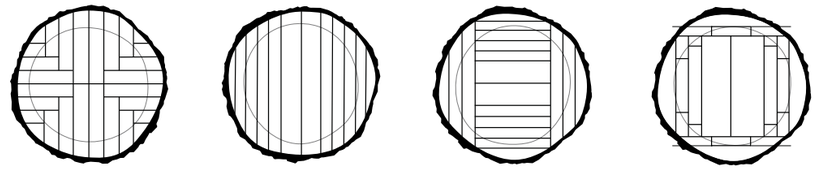
Increased the production speed
and became the most common
alternative in the sawmill industry.

3. Circular saw

Gives a greater flexibility in sawing
patterns.

4. Band saw

Larger logs. One saw is usally station-
ary and one is flexible. Easy to adjust
dimensions.



SAWING PATTERN

First step of determining shape and size

1. Quartersawing (kvartersågning)

Gives timber that will shrink more evenly.

2. Thrusawing (genomsågning)

Gives 50% formstable and 50% timber that will
shrink unevenly (sapwood area).

3. Blocksawing (Blocksågning)

Gives timber that will shrink unevenly, except
from the two heartwood pieces.

4. Foursawing (fyrsågning)

A way to get utilise maximal heartwood.

JOINERY AND STRUCTURE

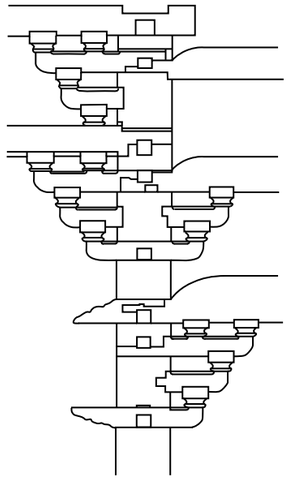
WHY JOINERY?

Function and expression

The joint is the part of the structure that offers space for expression. The joint is not only the material and its properties, it has a great function and is also a weak spot. It demands attention and care.

The decoration factor of the joinery began to develop more once the carpenters began to understand the structural principles properly. First, the main task was of course to ensurve that structure fulfilled its purpose (Zwerger, 2015). But as the joint being the smallest component in the structure, its also where we can se the development and the chancing idea of decoration and aesthetic values. The carpenter tried to compensate for the lack of new constructional challenges by showing more than what was allowed. It was a way to distinguish from the colleagues and create an individual expression. In Japan the way to do this was to make the viewer come more closer and follow the line around the column so the joint was often placed in eye level.

"Wood joints are also an expression of the high regard for the worked material. It is not up to mankind to pass judgement on the transitoriness of the material, at least that is the Japanese view. Mankind has intervened in the natural lifecycle by felling the tree. Now mankind must do its utmost to handle the material as carefully as possible and do its utmost to preserve it." (Zwerger, 2015)

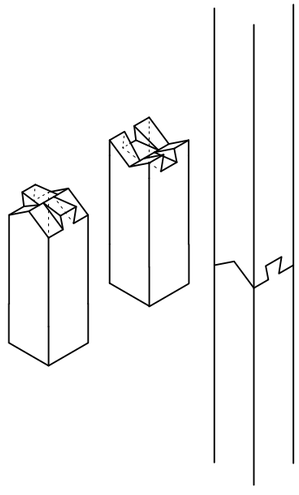


DAIBUTSOYO

Growing cantilevers

"*...The degree of complexity of the assembly reaches such a level, still within the area exposed to the viewer, that we are reminded of a puzzle, completely forgetting the real purpose of the construction*" (Zwerger, 2015)

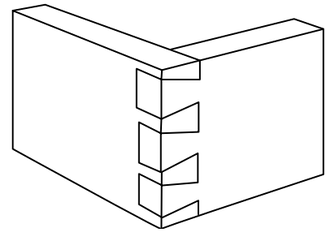
Growing cantilevers emphasizing the upward curve of the roof of this Japanese temple and the complexity shifts the focus from the individual joint to the overall structure and the pattern it creates.



MEISTER-WITZE

To fool the viewer

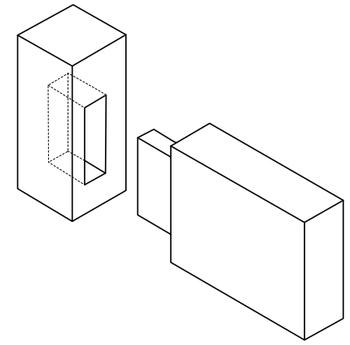
These "impossible joints" are called Masters pranks. The point of this was to vizualize the joint. So it was placed in eye-level and it was important to walk around the column to be able se this puzzel and to not understand it. To raise a wonder about the craft behind it and how ithe joint worked.



DOVETAIL JOINT

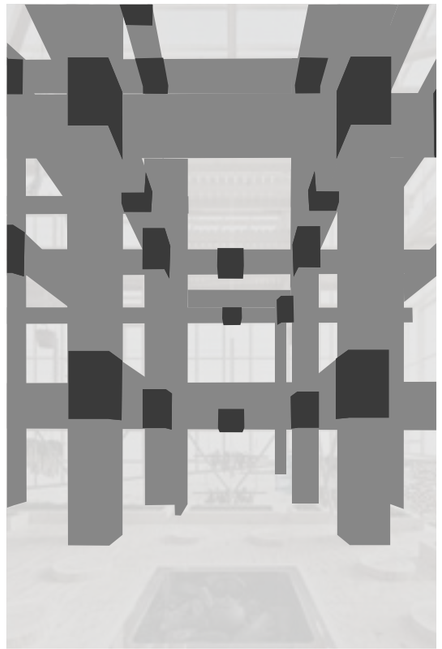
Laxknutning

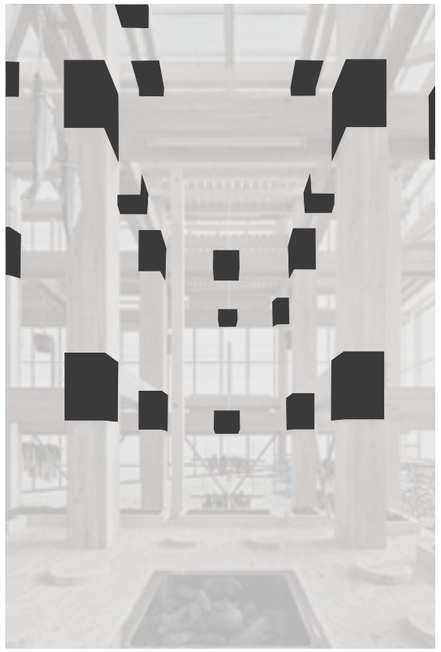
Common in furniture but is also the technique used in traditionally corner log timbering. Usually used to connect the sides of a drawer but has a good tensile strength due to its interlocking joints.



MORTISE AND TENON

Thousands of years old technique of a wooden joint. usually the connection is 90 degrees and the mortise is the hole and the tenon the tongue.





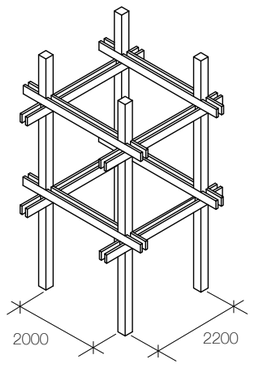
MATERIAL DOMINANCE

To work with materiality as experience

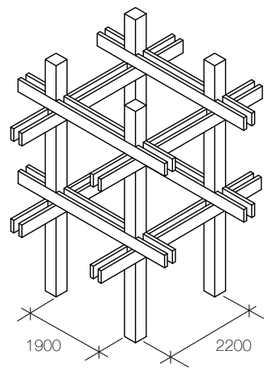
Architectural Reference, Nest We Grow,
Kengo Kuma and Associates, 2014

This community center was built to bring the local people together around food. The architecture plays an important role for explaining and show the process and lifecycle of the food, the purpose of the building. Local Japanese carpentry technique was translated to create the composite column structure which all elements are connected to. The materiality is dominant in the space and the detailing is visually strong. The use of the material is over proportioned which increases the perception of the wood and the tactility and warmth of the material becomes the main factor.

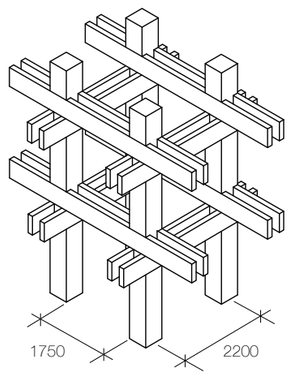
The left illustration highlights the wooden structure and the second one only the parts of the column where the joints are. The space is dense with wood and the detailing is placed in eye level, hence its enhanced even more.



200x200 mm



300x300 mm

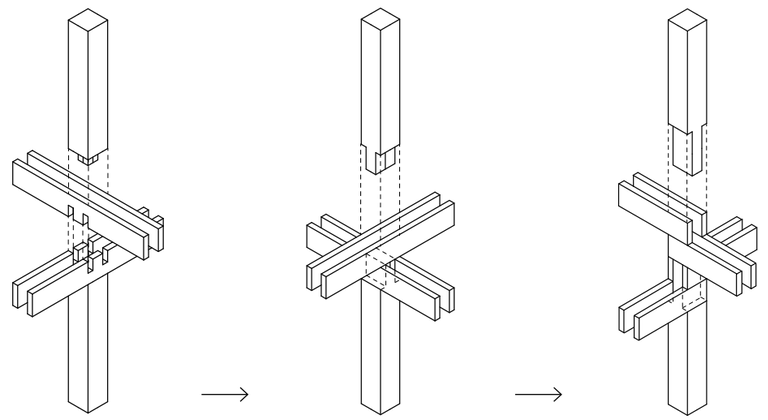


400x400 mm

STRUCTURE AND EXPRESSION

Structure proportions and material density

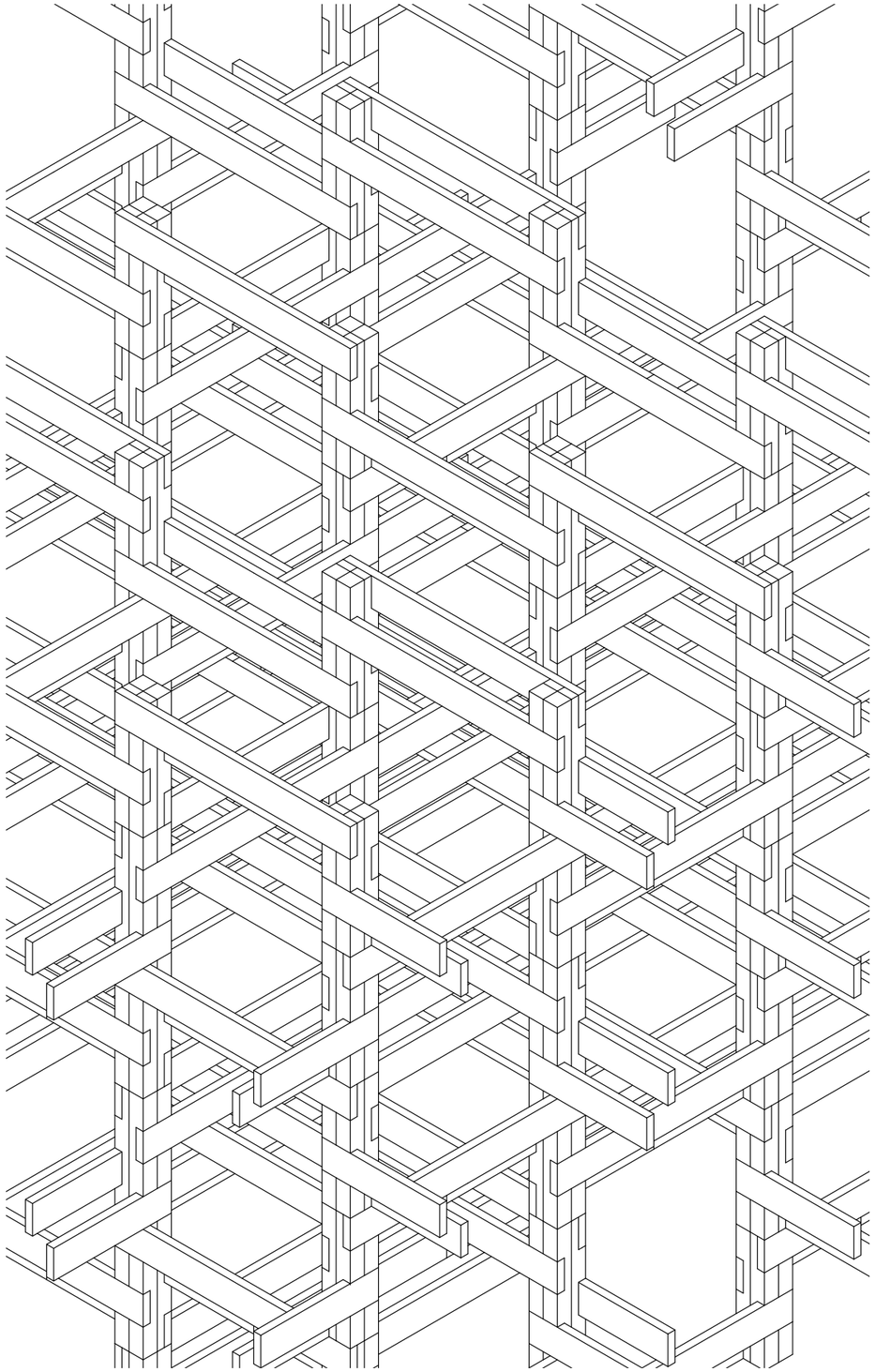
To enhance the materiality and the joinery even more than the reference project the proportions needs to be changed. To increase the dimension of the joinery, without changing its composition will affect the total dimension of the structure. The beams and columns will increase as well as the material perception of the space. The dimensions of the grid is still 2200x2200mm but the size of the structural components is changing which increases the amount of material used, and gives a less usable and flexible space.

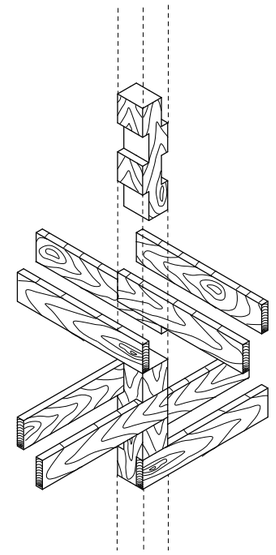


JOINERY AND PROPORTIONS

Splitting the joints to change the detailing perception

Instead of increasing the amount of material used, and affecting the flexibility of the space, the joint can be splitted to increase the visible detailing part of the column. This gives an elaborated and tactile sensation of the space. The wood is still as dominant, but by increasing the detaling one can enhance the craft behind the joint more. By splitting the beams twice as much area on the column becomes a part of the intersection and can be elaborted more.

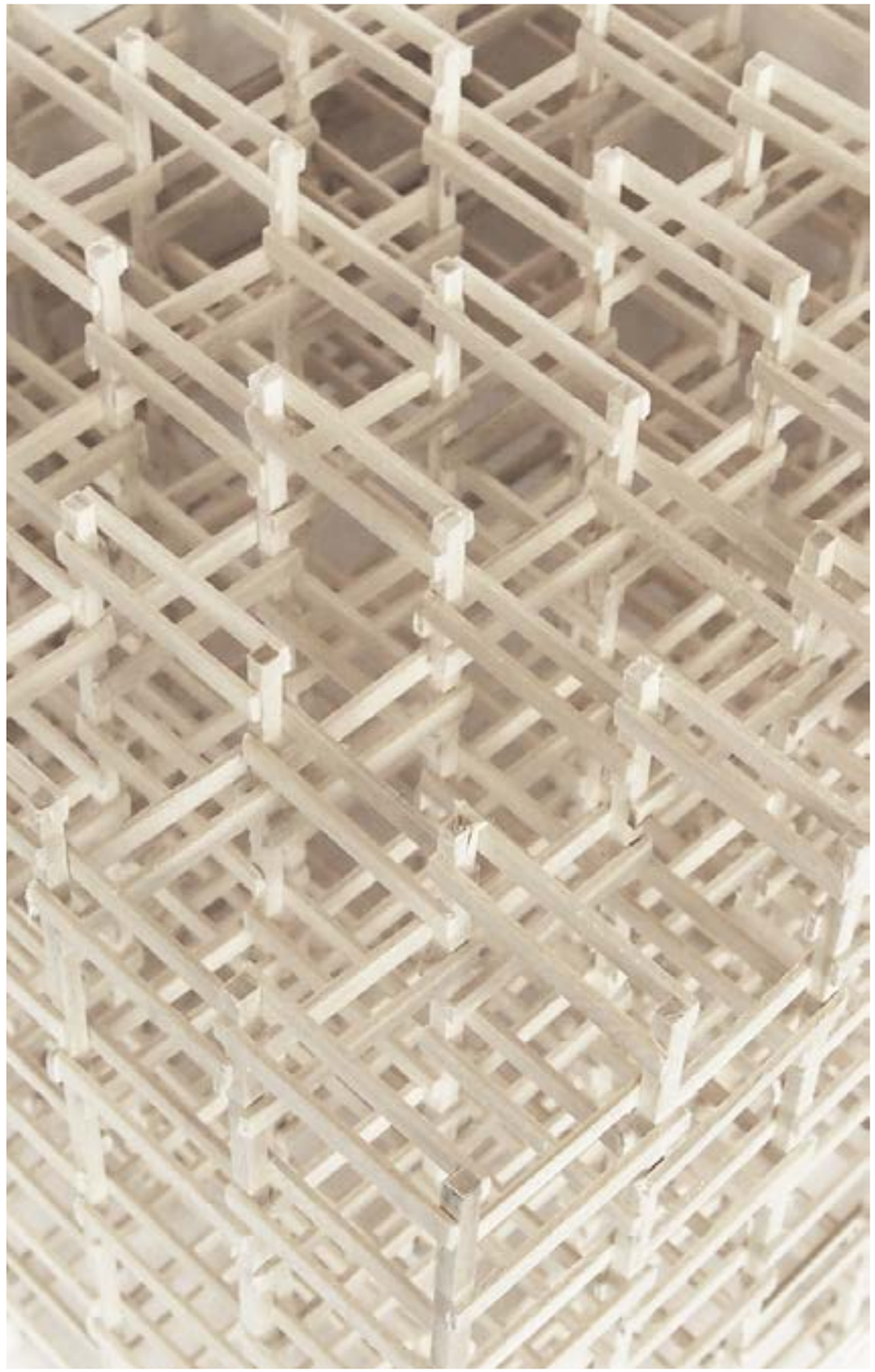


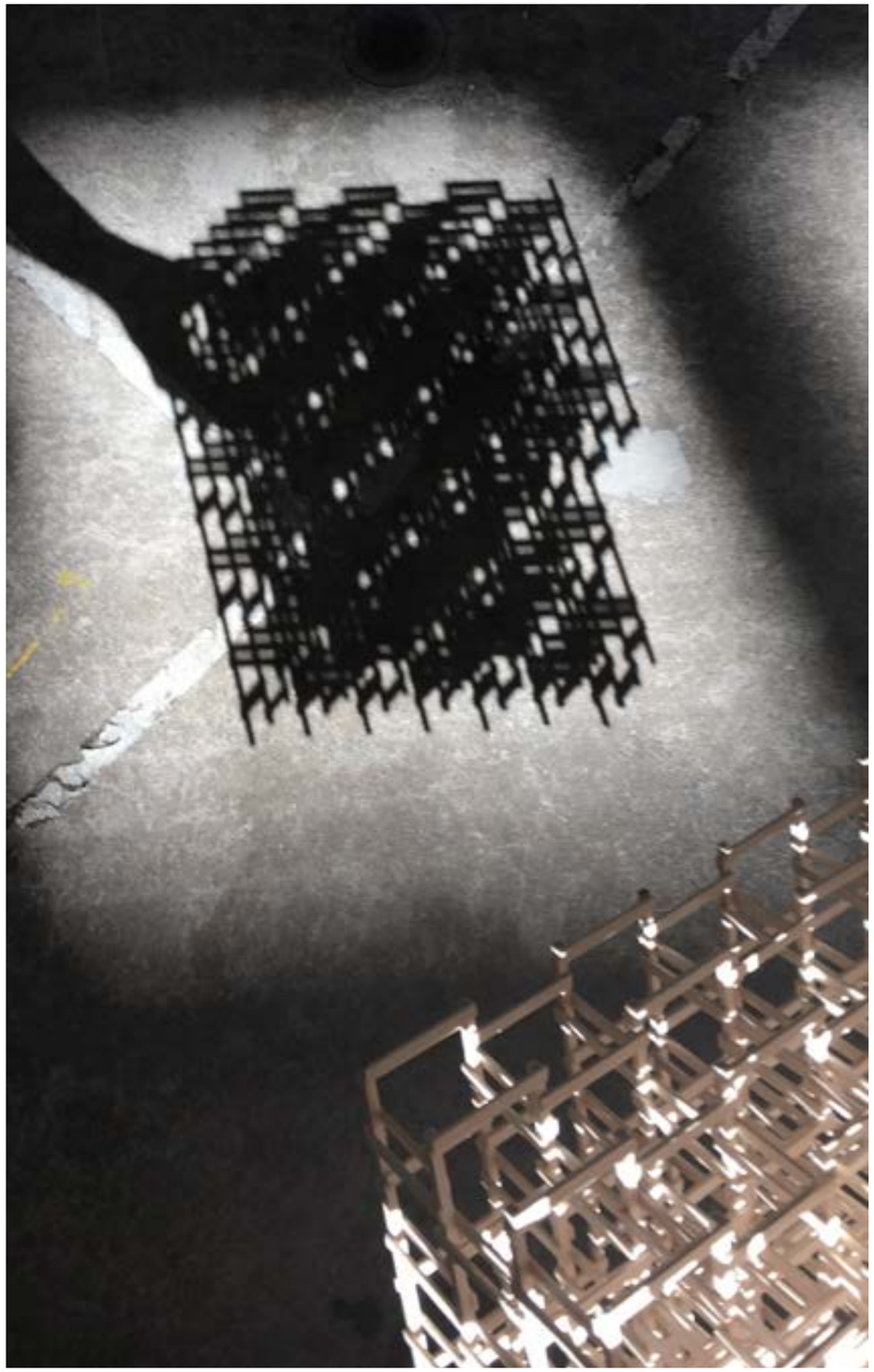


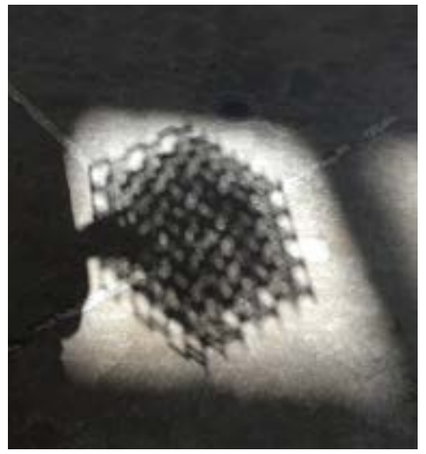
ENDLESS JOINERY

Joinery and expression

By continuing splitting the horisontal elements a system of connections is created. The vertical element, the “column” is disapperaring and is only a connecting surface of joints and horisontal “beams”. This creates a system with sequences of spaces growing from smaller to bigger and can change depending on how the horisontal elements are placed. The system consists of many connections and no large span which makes it structurally behave like a truss.







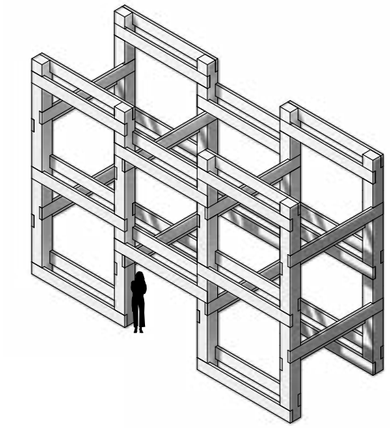
Appearnce of the structure changes with the direction and distance.

PERCEPTION OF THE SYSTEM

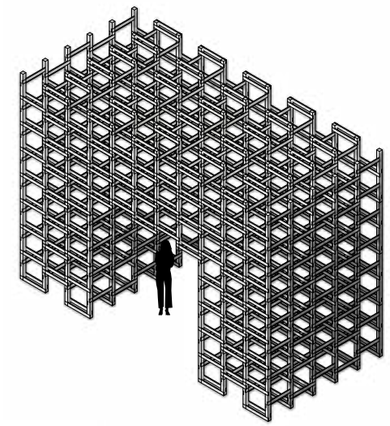
From tactility to visual offers a gradient of craftsmanship

A model which explains an approach to craftsmanship. What is close to the body (enlarged in the model) will be crafted and more elaborated in the detailing. What we can experience with our touch and feel and the tactility in the material and the joinery. Then what is further away, that we visually experience, will be made in a more industrial efficient way. The emphazise is not in the workmanship but in a more efficient making. Together they will create a balance and also show the possibilities and developement within wood and carpendry. Not to compare but to show varities and also emphazies different kinds of materiality within wood.

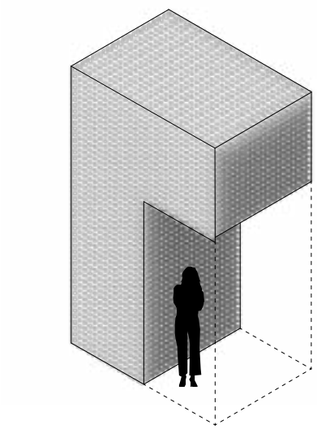
The joinery that is made in the model is a representation of a gradient of crafted to more advanced fabrication. The chosen details are not necessary how one would continue but is showing different techniques which requires more or less work by hand.



Grid 2560 x 2560 mm
Elements 320 x 320 mm
320 x 80 mm



Grid 640 x 640 mm
Elements 80 x 80 mm
80x 20 mm



Grid 80 x 80 mm
Elements 9 x 9 mm
9 x 3 mm

SCALE AND PERCEPTION

Relationship between body and structure

The approach to craftsmanship is regarding the scale of the structure. The same system appears different depending of the relationship between the structure and the body. The scale determins the visibility of the joint and the system is changing fromappearing as a dense wall to as in the larger scale where every element is defining the space on its own.

A man who works with his hands is a labourer.

A man who works with his hands and his head is a craftsman.

A man who works with his hands and his head and his heart is an artist.

Louis Nizer (1902-1994)

“Craftsmanship names an enduring, basic human impulse, the desire to do a job well for its own sake”
Richard Sennet, The Craftsman

DEFINING CRAFT

Importance of craftsmanship

Talking about craft may at first seem comprehensive and clear. But just translating the world between english and Swedish (Craftsmanship - Hantverk) different emphases occur. It is related to words as skill and handmade. But today also technology is a craft. It can be interpret as mastering a process, whatever it is physical or digital.

Maybe its easier to say what craft is not. Mass fabricated without material consciousness and with no trace of production. Just a factory stamp. To talk about is to differ from the throw away culture. Both in everyday life and in architecture. What we make and how its made is defining the standards and how the object or product is used. A crafted object has an relationship with the maker and the time that was put into it is present in the matter (Rossi, 2017). It can be the irregularities of something handmade that makes you feel the process or something that simple creates an understanding of how the thing was made. Relating to architecture an expression in the detail scale is something we can relate to, that we can experience with our hand with the touch and feel of the materiality. The importance of craft is also in the practical part of architecture and the built matter. The presence of skilled labor that has a connection to the specific material.

The situation today is of course very different from before the industrial revolution and technology offers bigger production and emphasizes efficient methods of manufacturing. Craft is easy to romanticize but I do think that it is of importance that the scale and presence of the hand do not disappear from our spaces and whatever we consume.

“The flatness of todays standard construction is strengthened by a weakened sense of materiality. Natural materials - stone, brick and wood - allow our vision to penetrate their surfaces and enable us to become convinced of the veracity of matter. Natural materials express their age, as well as the story of their origins and their history of human use” (Pallasmaa, 1996) is a quote from the book Eyes of The Skin by Juhani Pallasmaa where he discusses tactility and association in the material and matter. For me it is about the importance of materiality as a tool for the architect, and the layers of time and history they tell. To acknowledge this as an factor and as a part of the perception of the space, and within this lays the craft that is connected to the materiality.

HANDCRAFTED

Assosiations of handcrafted and workmanship

The Scale

The expression in the detail
Presence of the body and the hand
Touch. Smell. More senses

The Tool

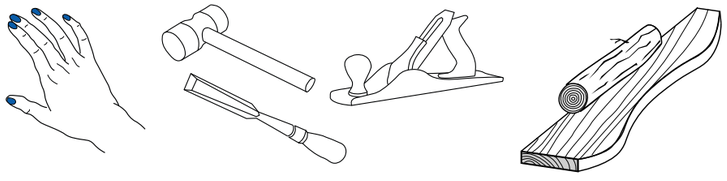
The size of the hand. Limitation
Individual expression
Chisel

The Procedure

Understanding the procedure, process
Personal expression. Uncontrolled
Individual procedure. Learning by repetition

The Material

Material knowledge. Shapeble
Imperfection of the tools. Diverse



DIGITAL FABRICATION

Assosiaions of industrial fabriaction

The Scale

Not in the expression of the detail.
Visual and percived in a distance.
Related to the material dimensions.

The Tool

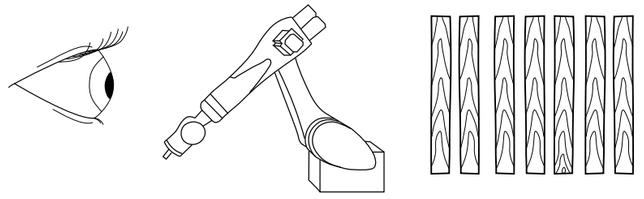
Digital. Robot. Repetition. Controlled.
Limitations and possibilities within the digital.
Shapes, angles, complexity.

The Procedure

Try-outs until satisfying. Planned. Controlled.
Repetition.

The Material

Efficient. Low-cost. Faster.
Dimensions depending on the digital tools.



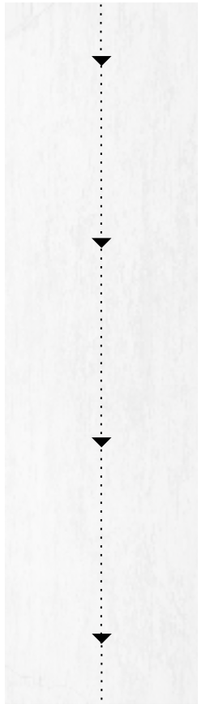
EXERCISE IN CNC MILLING

Limitations (and possibilities)

To use the CNC mill to make a joint calls for knowledge about the machines limitation that will affect the design. The drill at Chalmers School of architectures diameter is minimum 3 mm and maximum 6mm. The smaller the drill, the longer the time also. The mill at the school is not a represent of the actual amount of time it takes to make a CNC milled joint. Preferably a robotic arm with a attached mill and a turn table would be used that can detect the size of the timber to not having to stabilize the piece in the machine every time it needs to be rotated.

During the tests I discovered that more connection surfaces makes the fitting harder. The curved one that was a digitalization of a dovetailing had way to many surfaces and did not fit. Also the preciseness of the mill is to specific. Extra measurements needs to be added to make the joint fit.

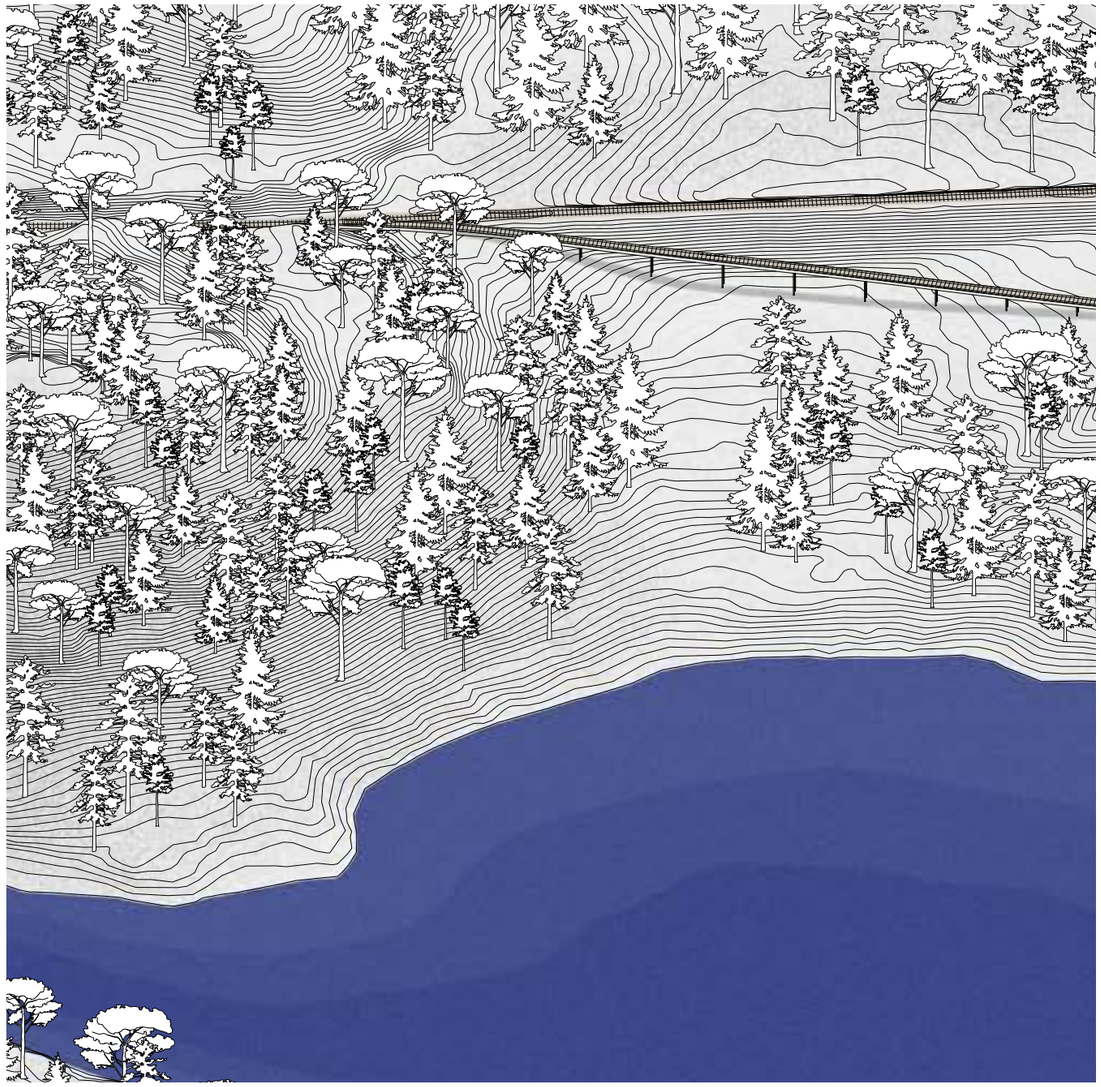
DESIGN PROPOSAL



A WOOD WORKSHOP

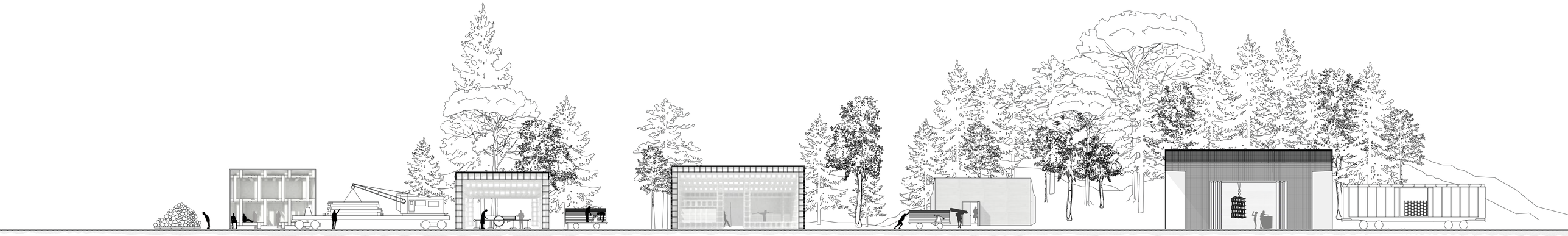
To create a place for learning about timber and wood architecture the proposal of this thesis is a wood workshop center in Dalsland. Situated in Bengtsfors, a municipality with ambitions to enhance the forest and its resorces. The center will be merging knowledge between the forest industry and the universities. Connected to the railway it is a link between the rural and the urban areas and will provide a place for experimentation and collaboration. Both with craftsmanship and building tradition combined with new technology and fabrication.

The center is located on a detour from the existing railway between Bengtsfors and Mellerud. The railway transports wood only once a week and is an unused potential of the area. In this proposal, this railway regains its importance with a new small scale transportation and production to activate the rural area and connect the craftschool located only a few kilometers away to the wood center. Its organized like a small production line, reminding of the process of the saw mill.



AXONOMETRIC OVERVIEW

Every structure along the production line represent one stage in the process of the sawmill. All these structures relates to one of the scales earlier introduced and depending on location, indoors or outdoors different scales is preferred. I've zommed in on three interiors where the system, Endless Joinery is creating different spaces and in the next chapter, they are reffered to as small, medium or large.



ENTRANCE / SORTING

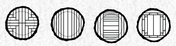
First stop

The timber enters the site and is sorted out in the hardwood speices and the conifer that is growing in the area. The structure offers spaces for the first step in the design process to sketch and plan the ideas to bring forward along the production line.

SAWING

The first step of determining shape

With a small saw mill the possibilities of diverse projects increases hence it allows to control the dimensions and the waste, and to work with wet timber. A circle saw suits for smaller saw mills due to more flexibility. Illustrations of the most common patterns shows how different qualities of the timber is preserved when sawing.



DRYING & STORING

A shed for the first parpart of the drying that is takinking place outdoors. The ıe structure is crossing thg the railway and on the othother side there is an indoorloor drying space with posossibilities to control the humumidity for a more stable dryirtrying process.

CARPENTERS WORKSHOP

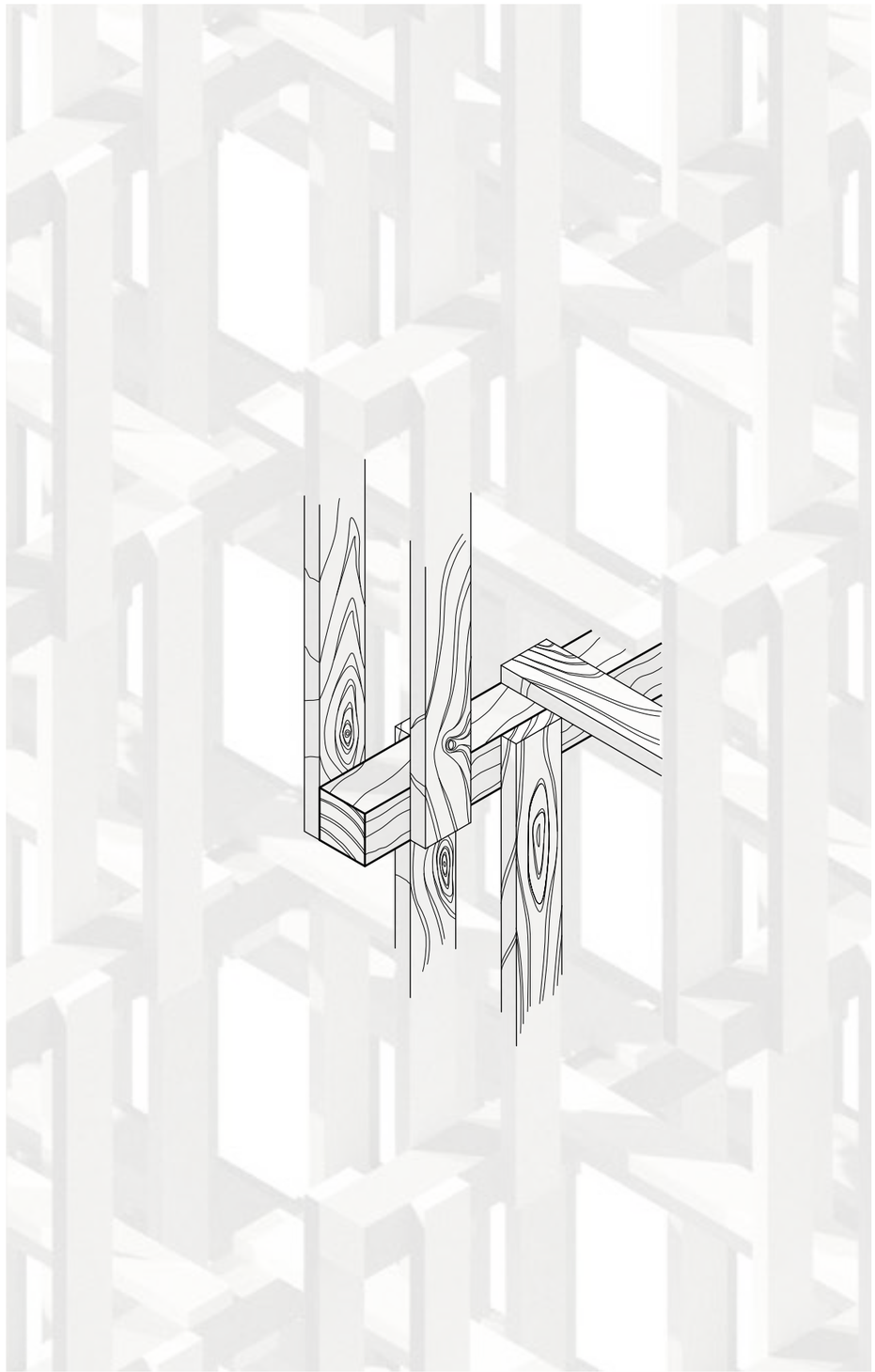
Manual craftsmanship

The carpentry is withdrawn from the railway to provide a calmer space for focused workmanship. All the wood is transported on the railway on small dresines.

ASSEMBLY HALL

Digital craft and assemblying space

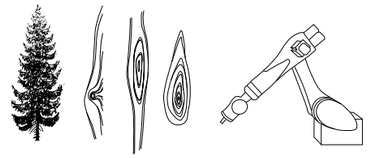
The assemblying hall is the space for digital tools and and assemblying what will be shipped away on the railway again. Two robotic arms offers the possibilities for bigger productions and in other scales than what is done in the carpentry.



Axonometric detail in scale 1:1

SMALL

Simple but many



Wood specifications

Sapwood and youth wood from Norway Spruce. Lower density, uneven properties with twigs. Texture and materiality appears in the quantity of pieces and the structure they create.

Joints

Simple but many. Such small dimensions would make a intersected joint sensible. Addition: Glue, no endgrain connections.

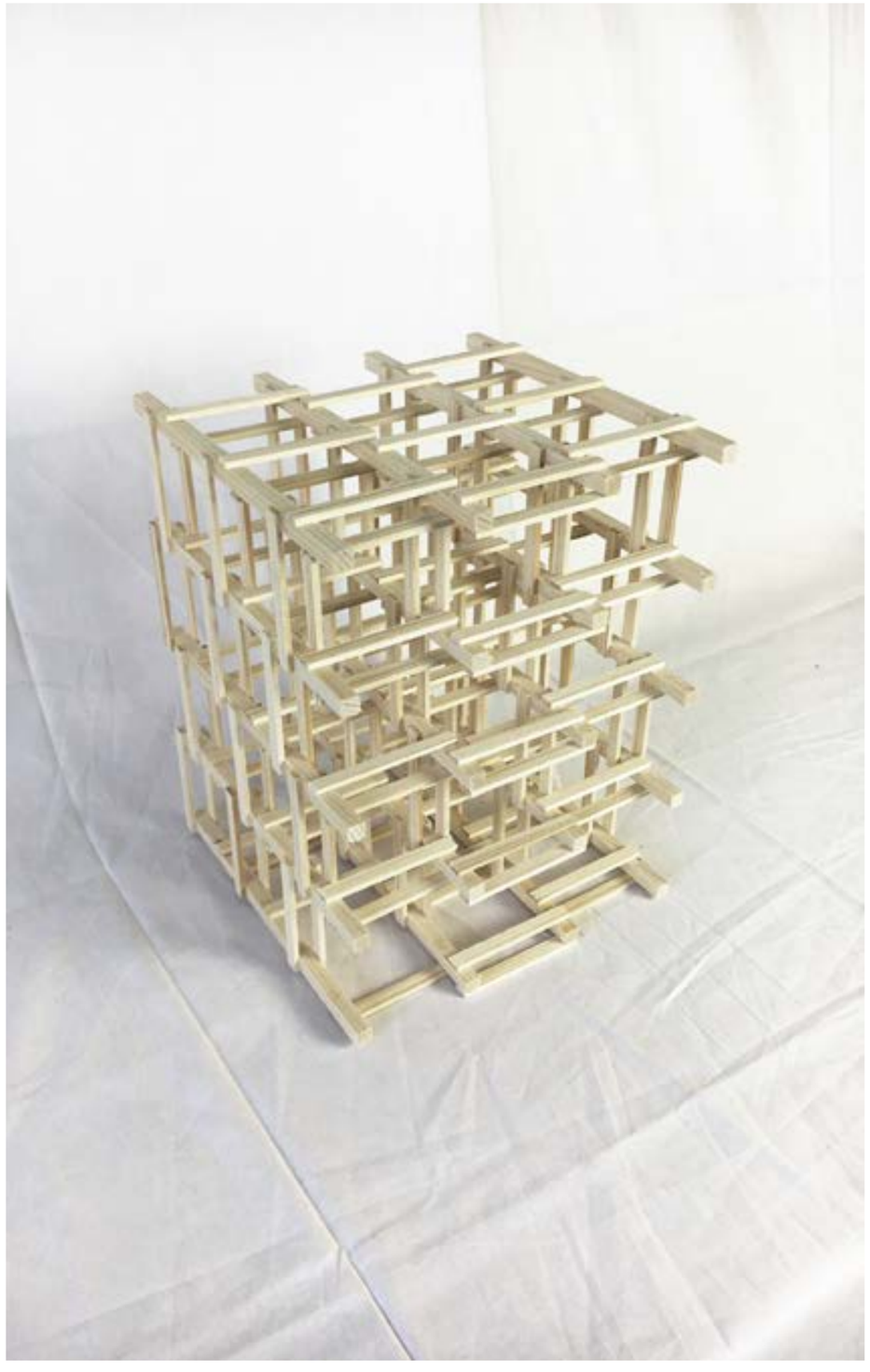
The process

Industrially produced pieces. Robotic assembling in elements.

SMALL

The Assembly Hall

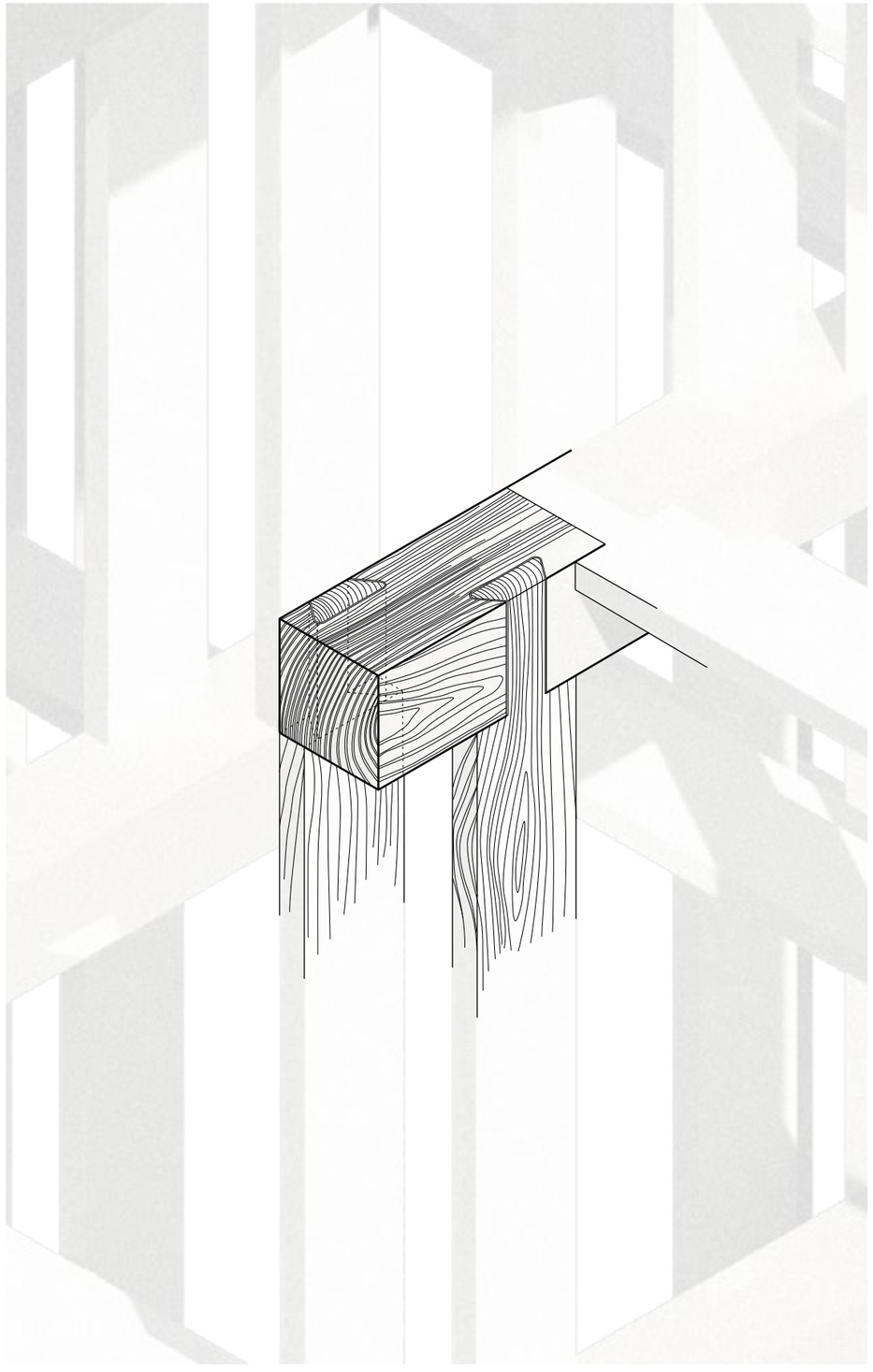
The small scale structure is creating a roof that behaves like a truss. It appears dense and the light is filtered through the structure but in some directions, as showin the corner of the wall, it becomes almost completely transparent.



(S) MODEL IN SCALE 1:1

Measurements 280 x 280 x 440 mm

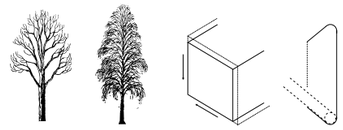
This model is similar to the first model of the endless joinery. But this scale is a little bit easier to work with and far less piece. Though it still is perceived as messy and asa surface in distance. The assembling of the structure will be done in layers with robotic help. Just like I did this one but more digital, one piece in every corner will stabilize the next layer and then the other pieces can be added faster with no need to wait for the glue to dry. The model is done in spruce wood just like the proposal.



Axonometric detail in scale 1:4

MEDIUM

CNC Milled Joint



Wood specifications

Connecting piece in ash, due to even tangiel and radiel shrinkage. Smaller elements in birch due to even quality and smooth appearance.

Joints

Digital version of a dovetail joint. Sizes and shape determined by mill diameter. No additions. The connection piece will shrink and secure the joints.

The process

Robot milled with a turntable to access from all sides and manual assembling.

MEDIUM

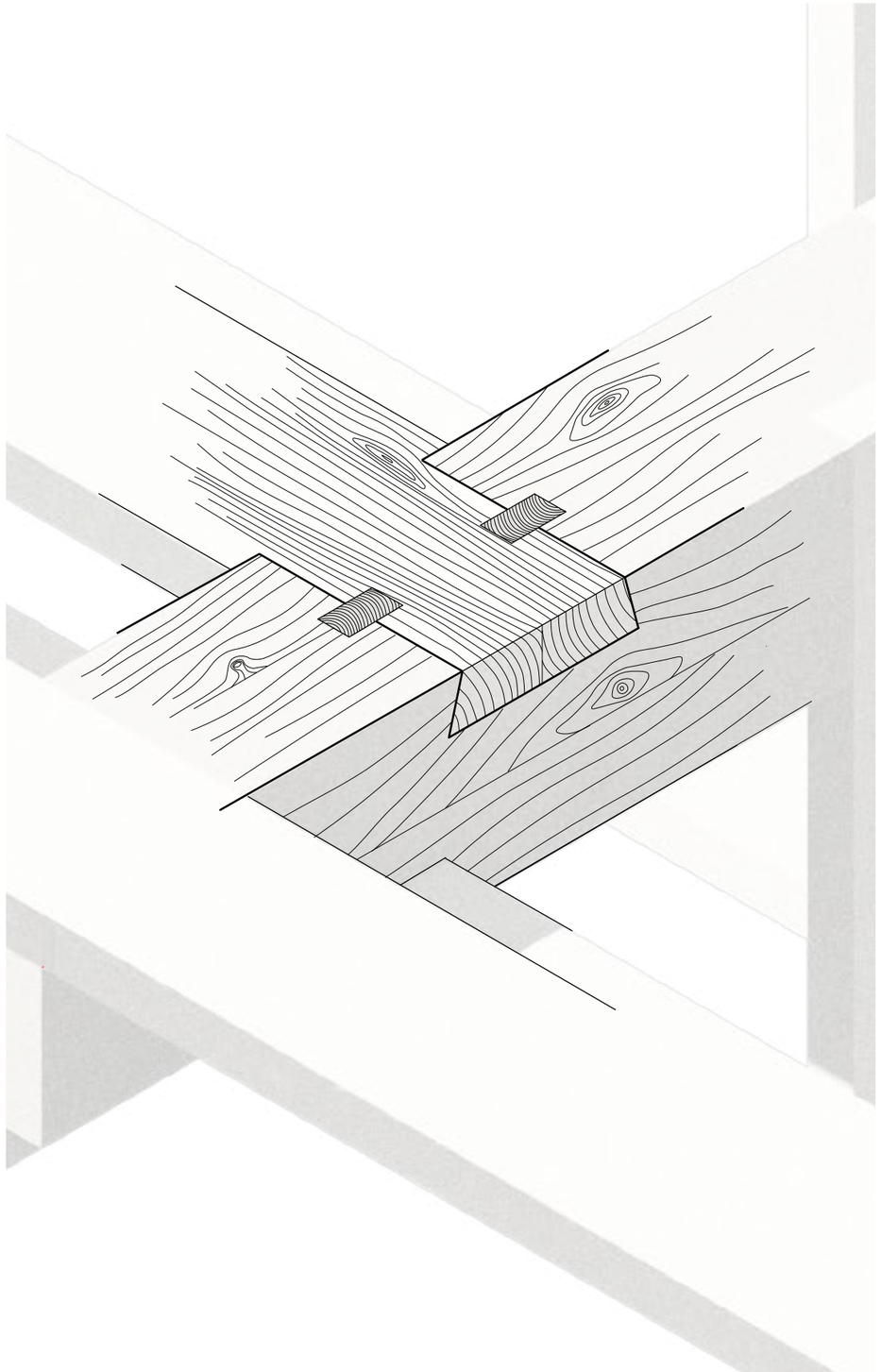
Drying Space

The structure of the dryings space is creating storage for the wood. The rigid grid divides the space and provides air for the drying. The appearance is messier than the small scale or the large scale since its still transparent but with many visible components.

(M) MODEL IN SCALE 1:1

Measurements 80 x 80 x 320 mm

As the size goes up the impression of the structure becomes messier but as you get close you can clearly destiguice the shape of the detail and you can read the geometry, but more of the structure and not as much of the individual joint. The model is done in ash and birch wood just like the proposal.



Axonometric detail in scale 1:8

LARGE

The Handcrafted One

Wood specifications

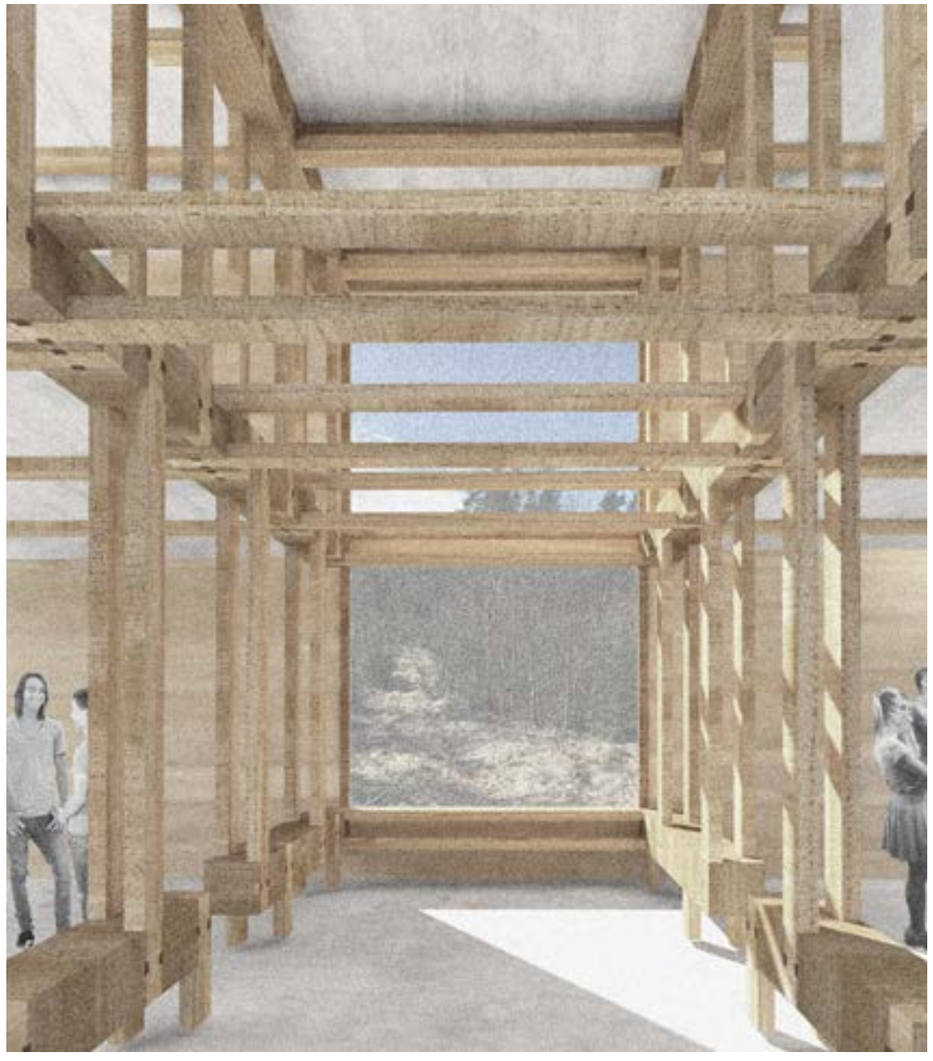
Norway Spruce due to usually straight fibers for larger dimensions. Oak used in smaller pieces that will secure the joint.

Joints

A dovetail joint. Larger dimensions enhances the geometry of the joint and hides the unevenness and flaws in the connections.

The Expression

The larger joints assimilates possibilities of different solutions of the individual craftsman, the same principle can be expressed in endless ways.



LARGE

Entrance Hall

With the increasing scale the visual impact of the joint itself is more enhanced and the scale of the wood is almost over proportioned. The element itself is determining the space and one section of the grid is almost as high as one floor.

(L) MODEL IN SCALE 1:1

Measurements 320 x 320 x 460mm

The increasing dimensions enables more flaws in the joint. The dimensions are bigger and the geometry of the joint is more readable which also enables more individual expression of the composition of the joint and of the craftsman. The model is made of spruce and oak oiled go give a warmer color.

CONCLUSION

This project started with an ambition to rise the question about craft and my personal opinion that it is an important feature in everything we surround ourselves with today. That our rapid consumerism is affecting our life and also the architecture we build today. During my exchange year this was a part of the discussion at the school and the topic was not as distant as I consider it to be at the university here. The architect was there (in The Netherlands and Belgium) considered a craftsman and architecture a craft much more. But during this semester my focus has moved to the expression of different craft in different scales and as methods. Which in a way expanded my view of craft and what I thought to discover. That craft is so different, and what I consider important is that a process is involved in the result, and the value of the time put into it is visualized. Its about respecting the process and the making, whenever it is in the beginning of the process with digital tools, or later, almost when the joint is being made and designed on site with the particular circumstances that provides. Its about acknowledging the process as a part of the decision and the result, and not expecting everything to be made in the same way or with the perfection of the machine.

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