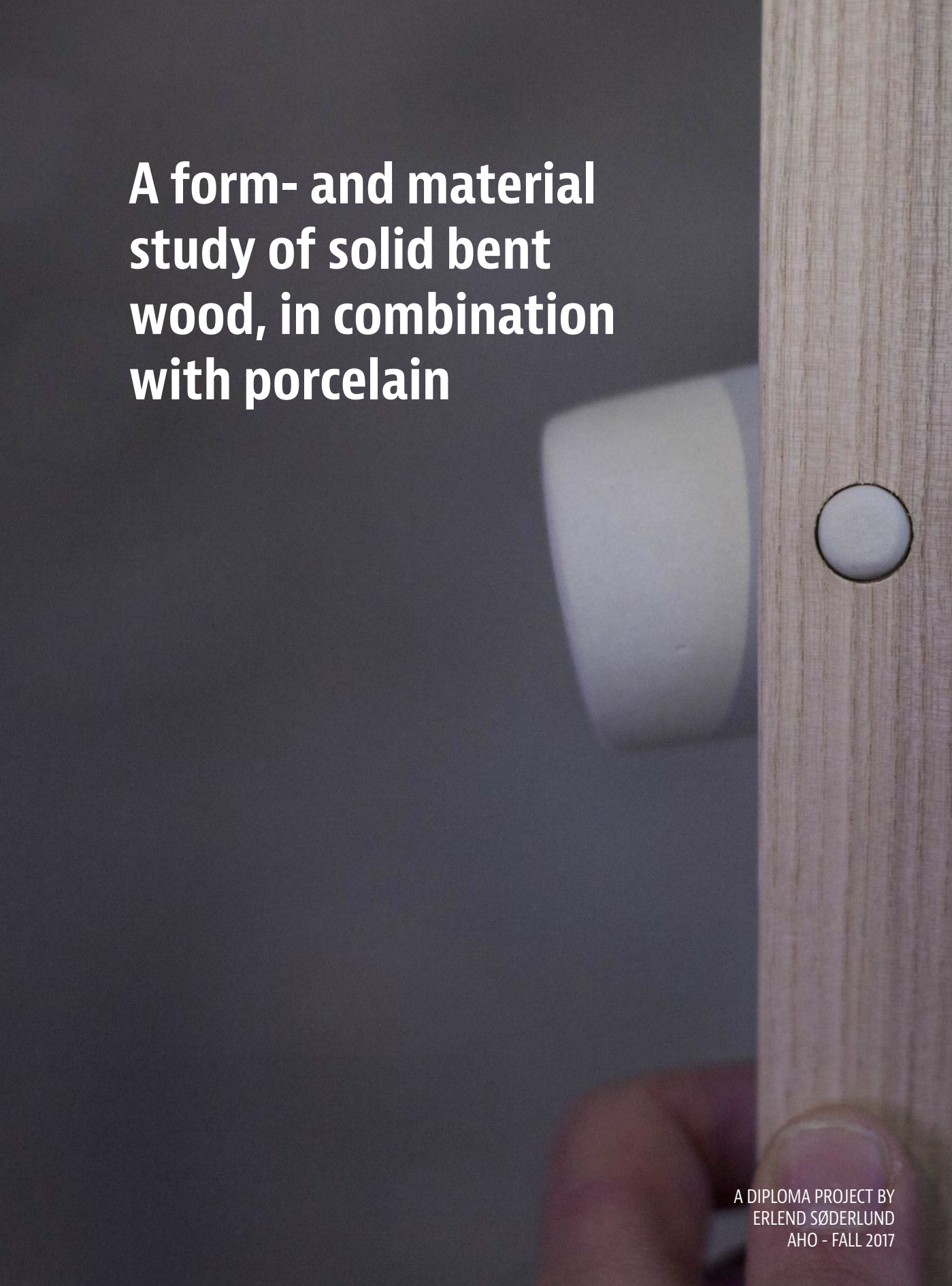
A form- and material study of solid bent wood, in combination with porcelain



A DIPLOMA PROJECT BY
ERLEND SØDERLUND
AHO - FALL 2017

A DIPLOMA PROJECT
BY ERLEND SØDERLUND

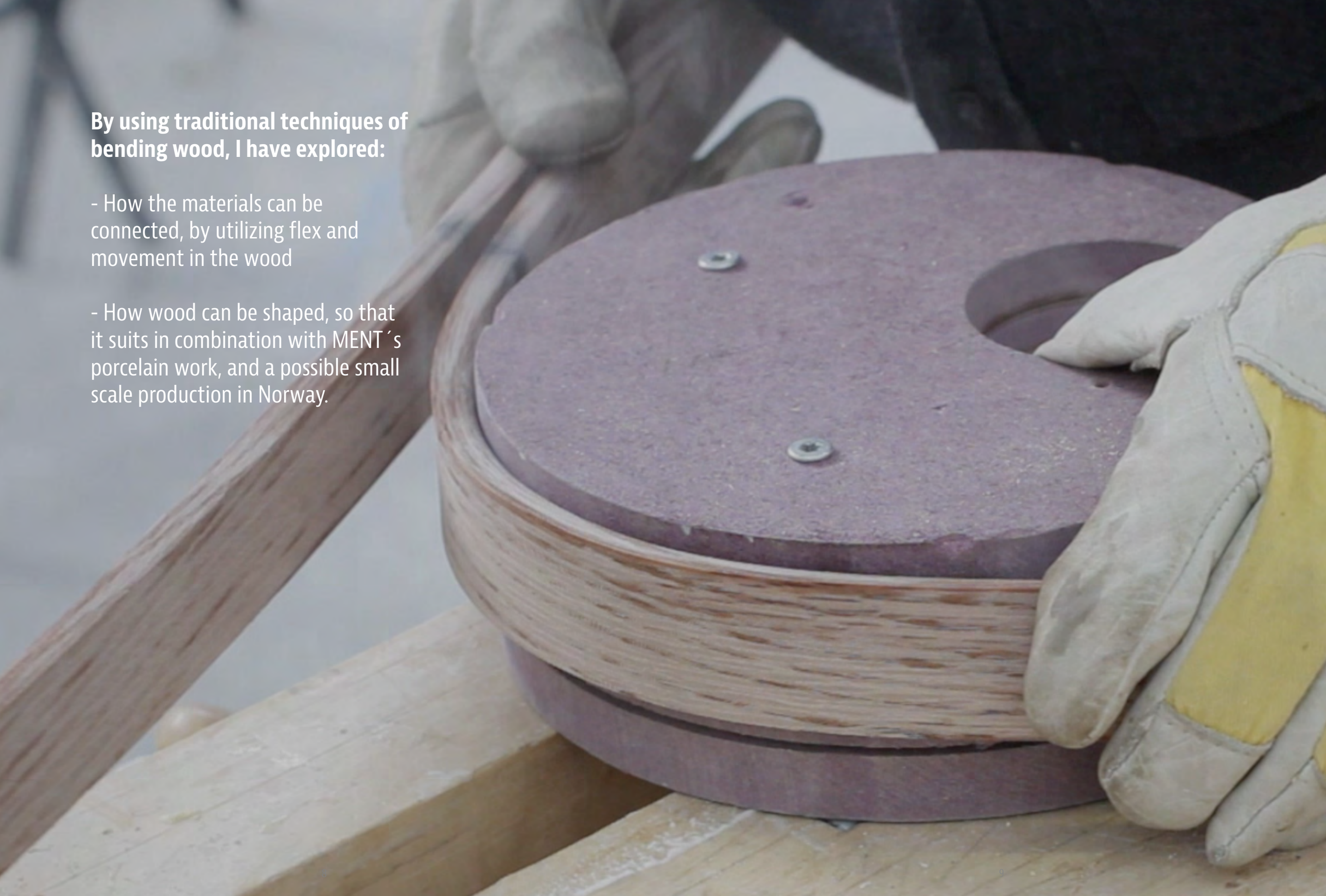
SUPERVISED BY
STEIN ROKSETH

THE OSLO SCHOOL OF
ARCHITECTURE AND DESIGN

FALL 2017

An experimental
project with a practical
approach.

The project is in collaboration with MENT, who design and produce interior products of porcelain



By using traditional techniques of bending wood, I have explored:

- How the materials can be connected, by utilizing flex and movement in the wood

- How wood can be shaped, so that it suits in combination with MENT´s porcelain work, and a possible small scale production in Norway.

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BACKGROUND AND MOTIVATION

As a designer, I would like to do both design and production of products. Wood is a material with qualities that can be utilized to develop functional products, and a renewable resource we have a lot of in Norway. It is also a material that is possible to process without expensive tools.

I find the area between design and craft interesting. I see potential in combining qualities from craft and design into a production of handcrafted quality products.

Last semester, I did a project where I worked with sveiping, a traditional Scandinavian technique where strips of solid wood are bent around a form, often used to make boxes for storage. This project made me interested in the techniques.

"Some type of wood bending has existed at last since the invention of the bow and arrow."
(Benson 2008, s4.)

Example of traditional use of solid bent wood

BENDING OF SOLID WOOD

I see potential in traditional techniques of bending wood, where you use steam or boiling water to make the wood flexible enough to bend.

With these techniques, you work together with the material. You follow the grain structure of the wood, and utilize the qualities of the material. You can make strong and lightweight structures, with very little material waste and without the use of glue or other chemicals.

"Steaming allows an efficient and cost-effective use of material, and results in little waste"

(Schleining 2002, s14)

HOW IT WORKS

By heating the wood with steam or boiling water, lignin (natural glue within the material) are melted, and the fibers softened. This makes it possible to bend the wood without breaking it. When the wood dries, it takes the bent shape.

Most hardwoods can be bent with success. Ash, oak and beech are typical species that are good for bending.

Grain direction needs to be parallel to the edge of the plank to be bent (grain run-out and knots will be weak points, and cause the plank to break).

A rule of thumb, is that the wood should be steamed or boiled for one hour per inch of thickness.

The wood are often bent around a form.

If you want to bend a thick dimension over a small radius, a compression strap will help to give good results.

Making of skis of solid wood. http://i.vimeocdn.com/video/510684818_1280x720.jpg

NORWEGIAN TRADITIONS

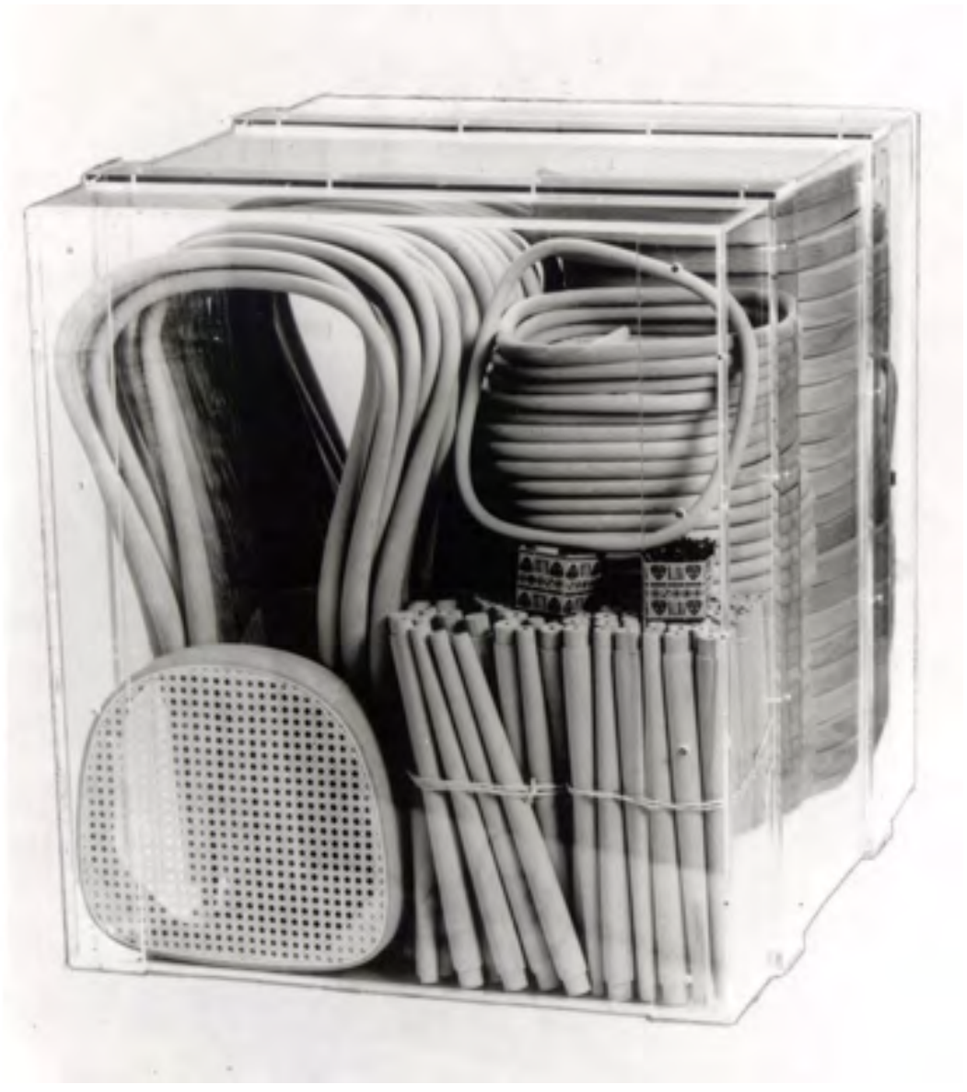
In Norway, we have a long tradition of working with these techniques. Skis, boats, tools and boxes for storage are objects we have a long tradition of making. Today, the techniques are mainly used in hobby projects. Mass production in low-cost countries has made our craftsmanship expensive in comparison.

Old Norwegian solid bentwood “Hegd” (https://digitaltmuseum.no/021025594422/hegd?aq=topic%3A%22Hegd%22&i=2)

"Chair No.14 cleared the way for Thonet to become a global enterprise, and numerous successful bentwood designs followed. Thonet's production peaked in 1912: that year, two million units were produced and sold worldwide."

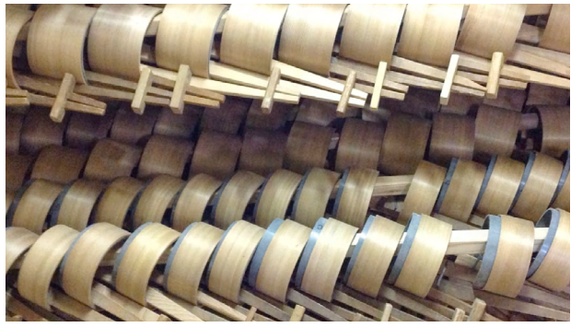
("THONET: Information". 2016)

http://www.3dfurniture.net/media/wysiwyg/2a35_Caixa_Thonet_214_640px.jpg



RATIONAL PRODUCTION

Michael Thonet´s production of steam bent furniture, and how they in Japan still produce bento boxes, serves as examples of how it´s possible to work rational with the techniques as well.



Bento box production in Japan
https://i.pinimg.com/736x/3f/c3/72/3fc372df97b27b-c397fed79e04534f3b--natural-materials-the-natural.jpg

THE MATERIAL COMBINATION

Barmen and Brekke´s work is a good example of the aesthetically qualities you can get by combining ceramics and wood.

https://barmenbrekke.wordpress.com/portfolio/make/#jp-carousel-784

"Almost any shape is possible to cast in porcelain, but more complicated shapes, like ones with overhang in several directions, are more complicated to make."

- Sidsel Hemma /MENT

PORCELAIN

Porcelain is a ceramic material, which are classified as inorganic non-metallic materials. Ceramics exhibit great stiffness, high resistance to corrosion, excellent wear resistance and low density. The major problem with ceramics is that they are brittle, have a low tensile strength and are relatively difficult to process.

You need draft angels to get the porcelain out of the mold, after the casting is done. This gives limitations to what kind of shape that can be casted. But the molds can be split into several parts. This makes it possible to cast more complex shapes, as long as you have draft angels in the direction the mold (or part of the mold) will be disassembled from the porcelain.

Porcelain offers lots of possibilities in what kind of shapes that is possible to make. But that less complicated shapes (with overhang in one or few directions), are easier to make.

In a small scale production, it´s important to keep the process as fast and easy as possible. It´s therefore better to design shapes without overhang in too many directions.

Image from MENTs production, Fåberg

THE PROCESS OF CASTING

Casting of porcelain takes place in gypsum molds. The molds are filled with liquid porcelain. The gypsum draws moisture out of the liquid porcelain, and the porcelain starts to dry. First in the outer area, that is in contact with the gypsum. If you want a solid piece, you let the porcelain dry completely out, before you separate the porcelain from the gypsum mold. If you want a hollow shape, you separates the porcelain from the gypsum mold before all the porcelain have dried out. You then pour out the porcelain that is still liquid. How long the porcelain stays in the mold, controls how thick walls the hollow porcelain gets.

The porcelain part do now need to be fired (at around 1300 degrees Celsius.) During this process, there is a lot of shrinkage (around 10%). If you want to glaze the part (to make it completely waterproof), it needs to be fired a second time, after the glaze is added.

Properties and qualities of the materials

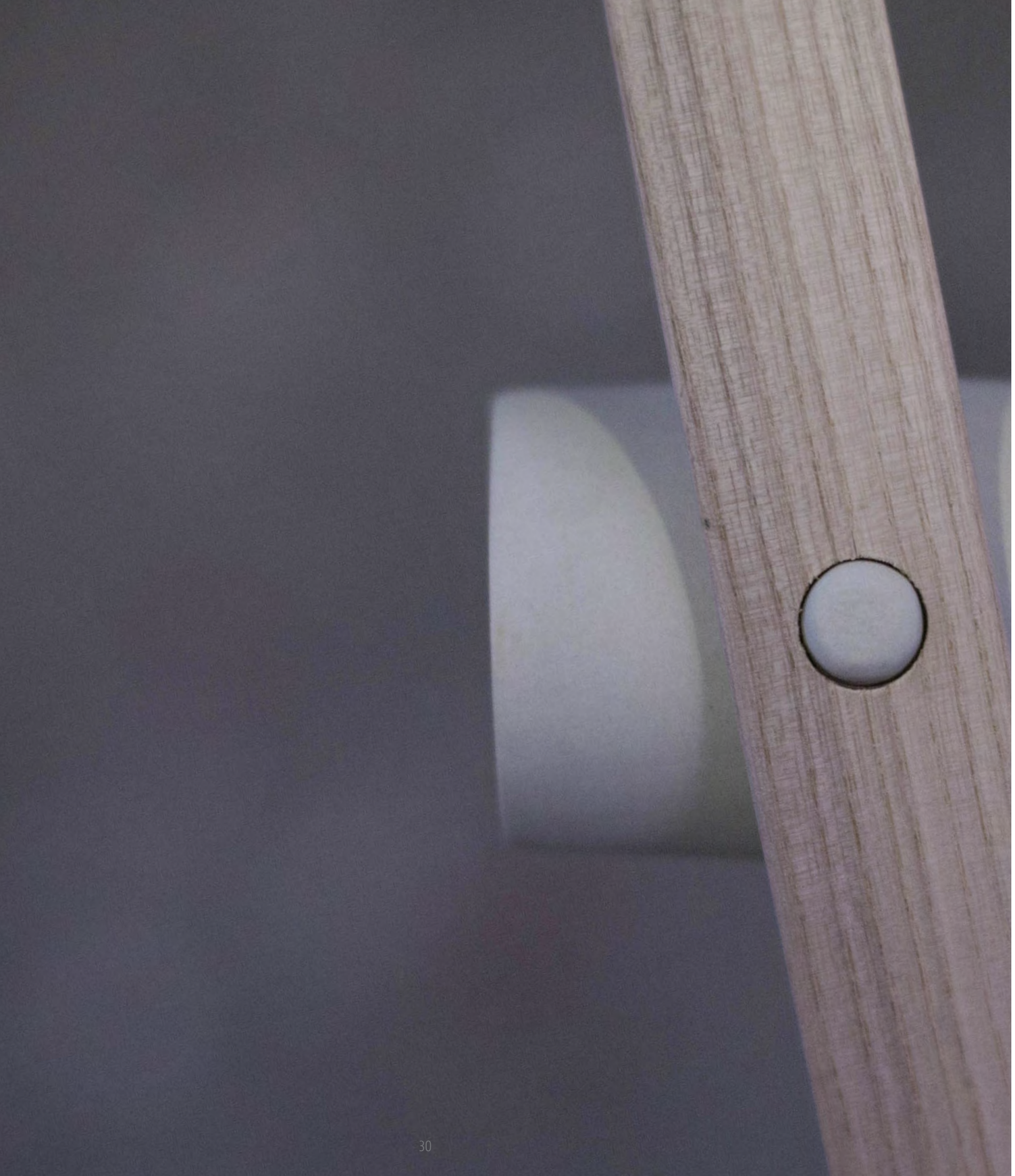
PORCELAIN

- Inorganic
- Form stable
- Hard
- Brittle
- High thermal conductivity
- High-temperature resistant
- Sound- reflective
- Food- safe
- Does not give taste
- Isotropic
- Air tight
- Water tight
- Low density
- High compressive load strength
- Low tensile load strength
- Translucent

WOOD

- Organic
- Movement with changes of moisture content
- Soft
- Though
- Low thermal conductivity
- Low-temperature resistant
- Sound absorbing
- Food- safe
- Might give taste
- Anisotropic
- Breathing
- Absorbs water
- Low density (if dry)
- Strength/weight ratio: as good as steel (depending on specie, grain direction etc.)
- Opaque

I find it interesting that the materials have many properties and qualities that is in contrast to each other. This might give opportunities to develop products with a wide range of functions.



PART ONE:
CONNECTING THE MATERIALS

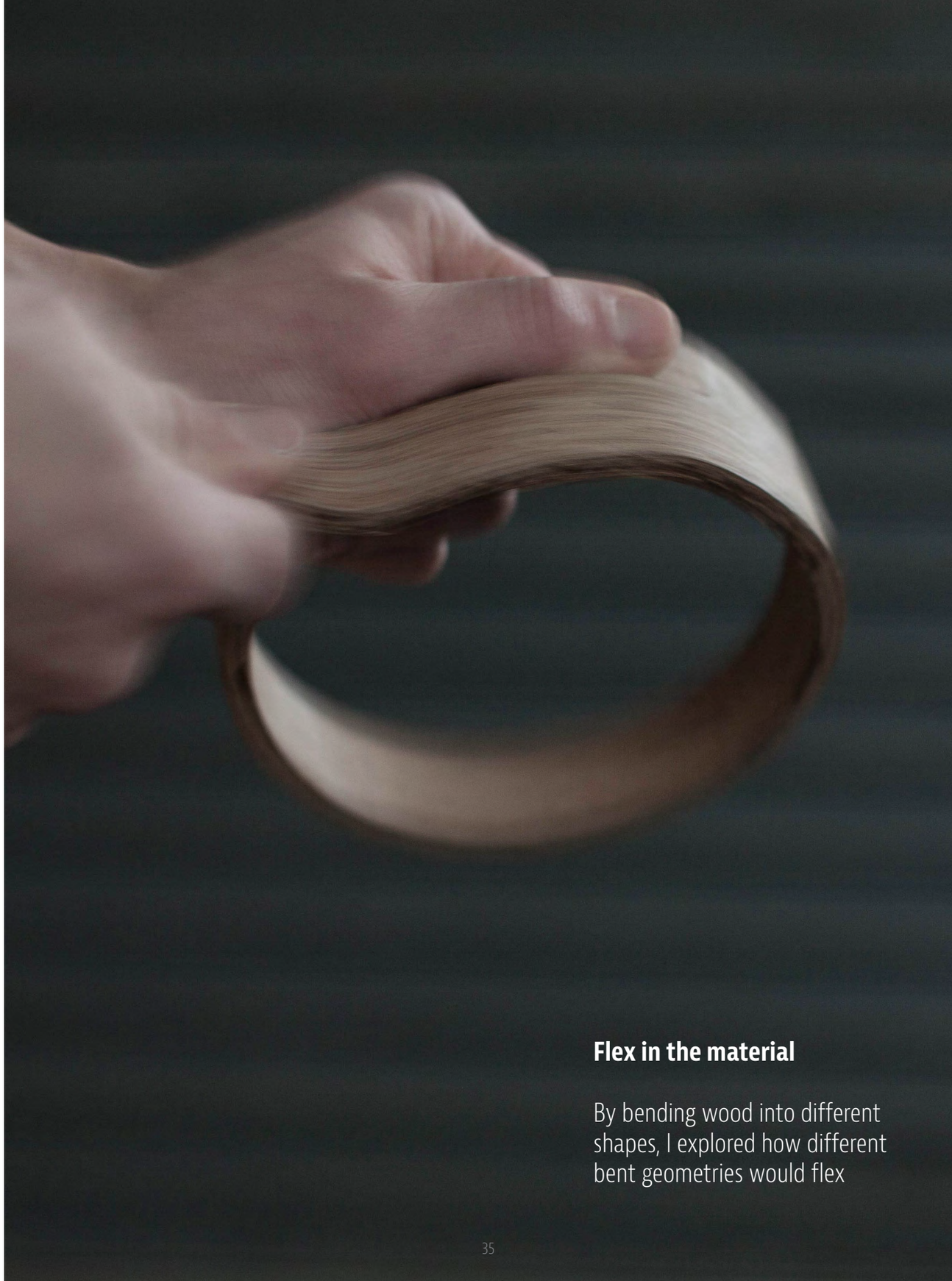
Why is this interesting and relevant?

Following this project, me and MENT wants to combine materials and develop products together. I will work with bending of solid wood, and MENT with porcelain. The process of figuring out how the materials can be connected, is often time consuming and challanging.

In this part of my diploma, I therefore want to explore how the materials can be connected. The goal is to find principles we can use in product development later.

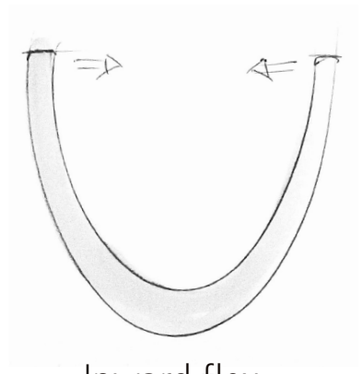
FRAMING:
FLEX AND MOVEMENT IN THE WOOD

This is my hypothesis of how the materials can be connected: by utilizing flex and movement in the wood. I´m curious if this can work, and want to explore it.

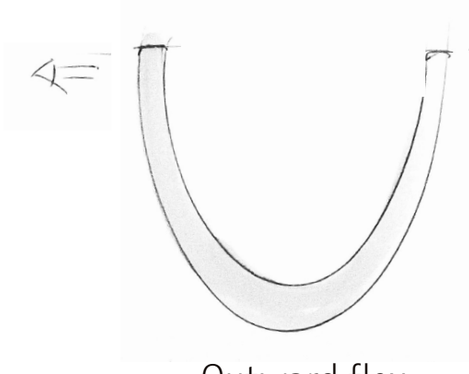


Flex in the material

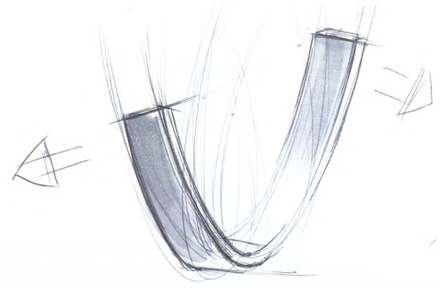
By bending wood into different shapes, I explored how different bent geometries would flex



Inward flex



Outward flex



Sideways flex

Example of how one of the geometries did flex. In the analysis on page 44-57, you will find how all the geometries did flex

Movement in the material

Since I´m working with solid wood (a living material), I know that it will start to move, if exposed to moisture.

This is important to take into account, if the final piece will be used in environments with changing levels of humidity.

By soaking the bent geometries in water, I found how the different geometries would move, if exposed to moisture: back to it´s initial state (a bent curve will straighten out).

Movement of an U bend, when exposed to moisture

One hour later

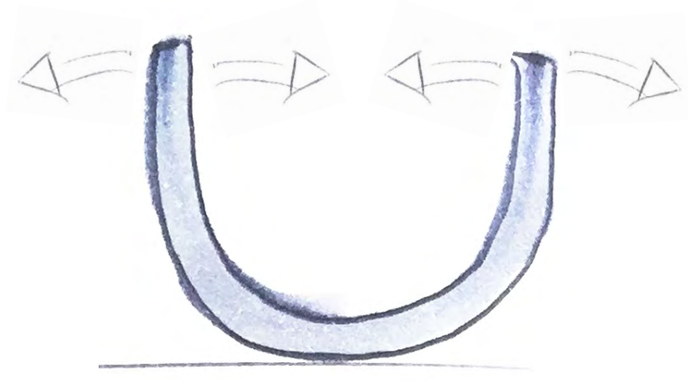
An U bend soaked in water, to study the movement when exposed to moisture

Summary of findings, flex and movement

With insights from the practical experimentation, I conclude with:

- It is flex that works in the same direction as the wood want´s to move when exposed to moisture, that should be utilized to make a connection to another material.

This is to be sure the connection will not detach, if used in a product that will be used in water, or in an environment with changing levels of humidity in the air.



This U bend can flex in several directions, but will only move in one direction if exposed to moisture: outwards (in the direction it came from).

Which means: The forces working outwards, is the forces that should be utilized to make a connection that will not detach, even if exposed to moisture.

ANALYZING AND EVALUATING

By analyzing the different bends, I could compare and evaluate them. In the analysis, I rated the bent geometries after the following criteria:

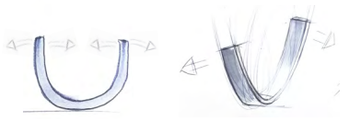
- How controllable flex they had
- If they had an appropriate amount of flex

Criteria that will be important to make good connections between the materials.

EVALUATION:

FLEX AND MOVEMENT

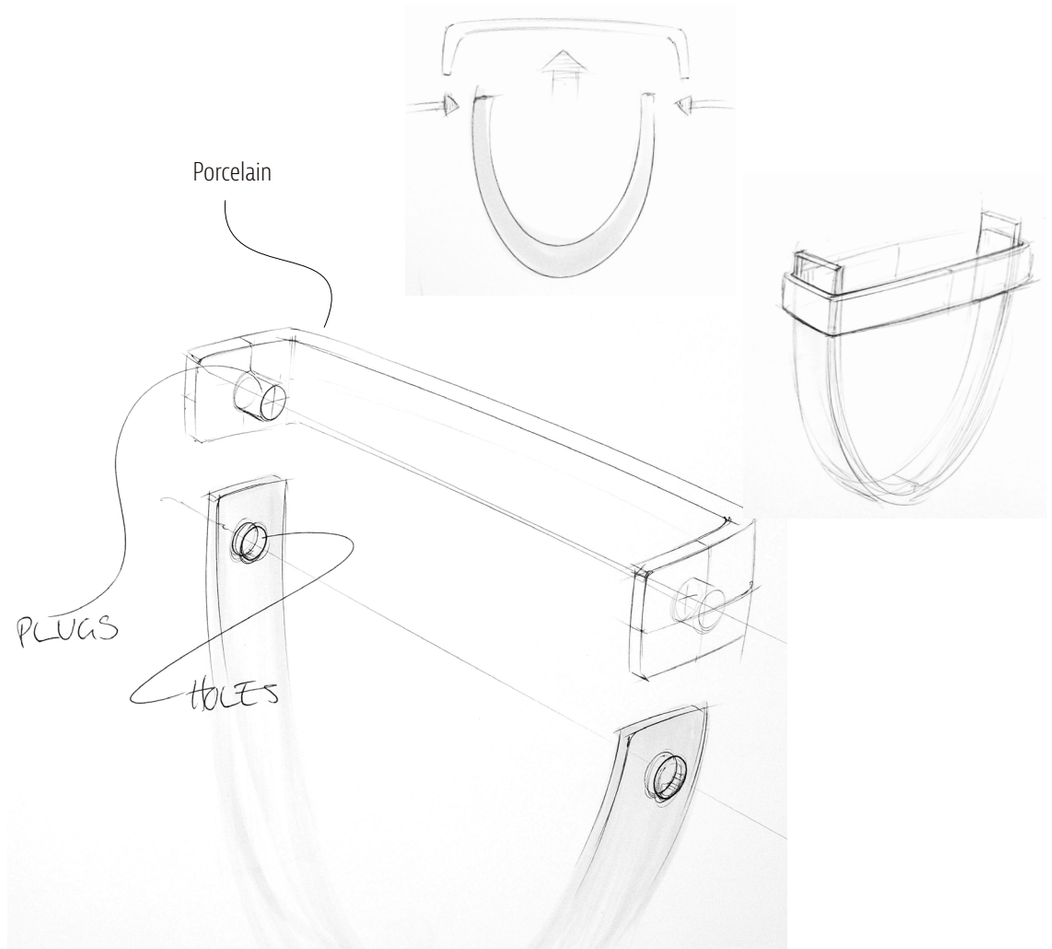
/U bend



Amount of flex:	○ ○ ○ ○ ○ ● ○
Directions of flex:	Inwards and outwards (opposite to each other), but also sideways to some extent.
The woods movement when exposed to moisture:	Outwards. And because of this, the forces working this way should be the forces to be utilized in a connection.
Potential to utilize flex and movement to make a connection:	○ ○ ○ ○ ○ ○ ●
Comment:	I see potential in this geometry. Distinct directions of the flex, and an appropriate amount of it.

POSSIBLE

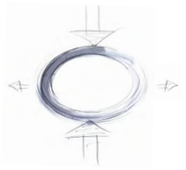
CONNECTION PRINCIPLES



EVALUATION:

FLEX AND MOVEMENT

/Circle bend



Amount of flex: ○ ● ○ ○ ○ ○ ○

Directions of flex: Due to very little flex, it´s only possible to make it shape by squeezing two sides together towards each other. It does then slightly form an oval.

The woods movement when exposed to moisture: Since the ends are connected to a circle, the geometry wants to get back to form a circle. And because of this, it should be possible to utilize both the inwards and outwards working forces for a connection.

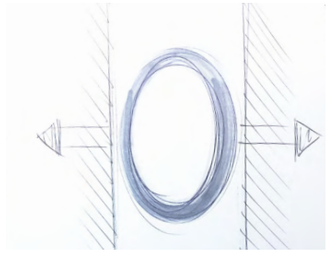
Potential to utilize flex and movement to make a connection: ○ ○ ○ ● ○ ○ ○

Comment: I see potential in this geometry, but I would like to make a sample with thicker wood to hopefully gain flex

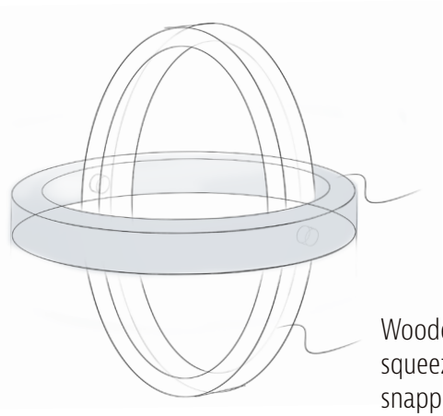
POSSIBLE

CONNECTION PRINCIPLES

Squeeze to flex



Forces working outwards



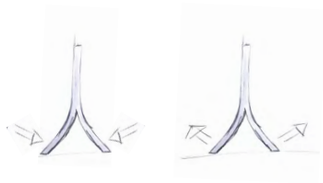
Porcelain part - with inward facing plugs?

Wooden part squeezed and snapped into porcelain part

EVALUATION:

FLEX AND MOVEMENT

/End split



Amount of flex: ○ ○ ○ ○ ● ○ ○

Directions of flex: Mostly in two opposite directions, but also sideways to some extent.

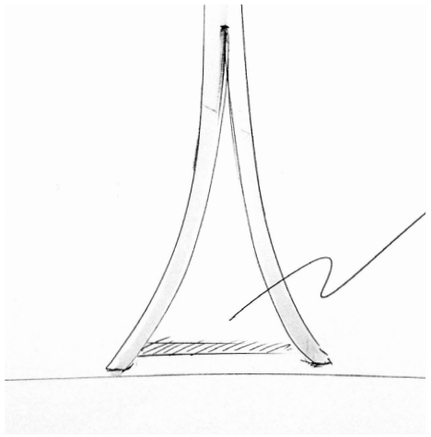
The woods movement when exposed to moisture: Inwards. And because of this, the forces working this way should be the forces to be utilized in a connection.

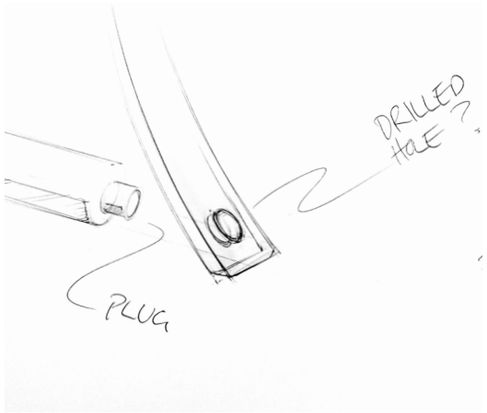
Potential to utilize flex and movement to make a connection: ○ ○ ○ ○ ● ○ ○

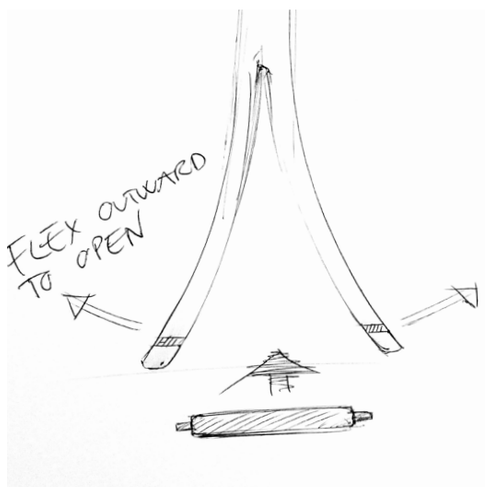
Comment: I do see potential in this geometry, but due to the grain direction in the piece (parallel to the split) the split might trig a crack that will continue the split in solid part of the wood (if roughly handled). And the grain direction needs to go in this direction to be able to make the bends. But it might also not be a problem. It needs to be tested.

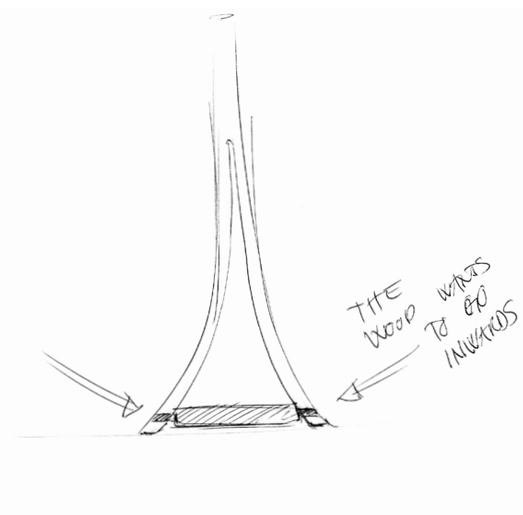
POSSIBLE

CONNECTION PRINCIPLES







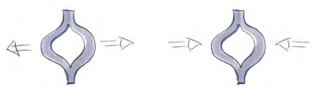


EVALUATION:

FLEX AND MOVEMENT

/Middle split

Amount of flex: ○ ○ ○ ● ○ ○ ○



Directions of flex: Two opposite directions. Inwards and outwards from the middle.

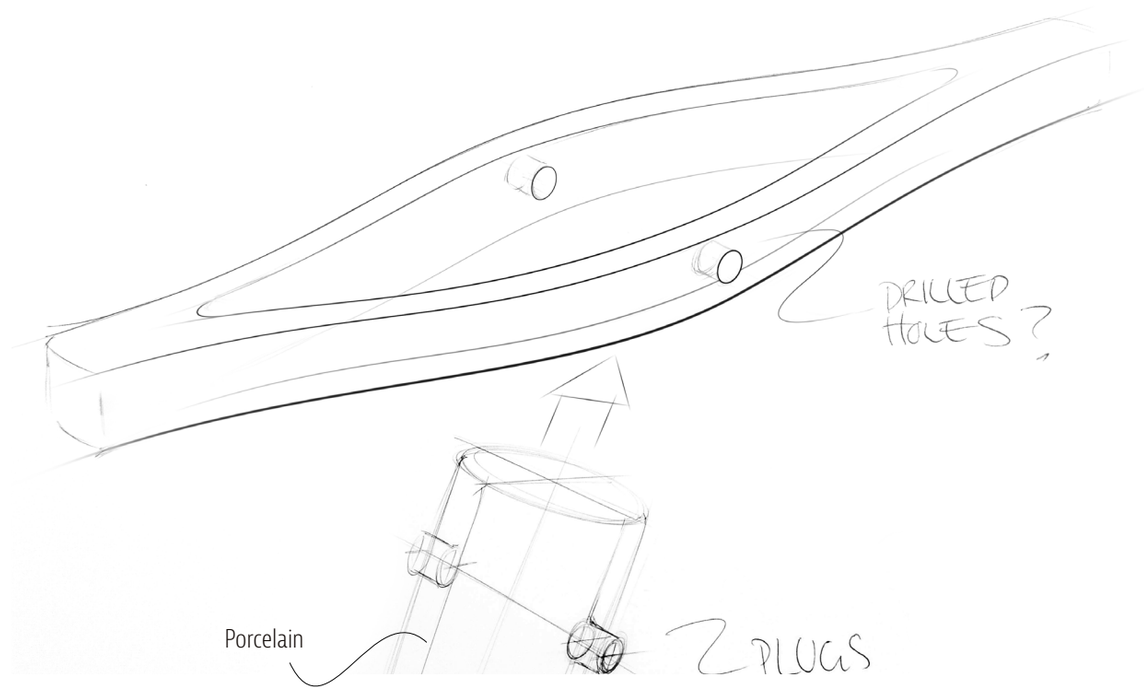
The woods movement when exposed to moisture: Inwards. And because of this, the forces working in this direction should be the forces to be utilized in a connection.

Potential to utilize flex and movement to make a connection: ○ ○ ○ ○ ○ ○ ●

Comment: I see potential in this geometry. The flex is controllable, and the embracing shape could make a secure connection to a geometry of porcelain in the middle of the wooden piece.

POSSIBLE

CONNECTION PRINCIPLES



EVALUATION:

FLEX AND MOVEMENT

/Twist

Amount of flex: ● ○ ○ ○ ○ ○ ○

Directions of flex: No flex

The woods movement when exposed to moisture:

Potential to utilize flex and movement to make a connection: ● ○ ○ ○ ○ ○ ○

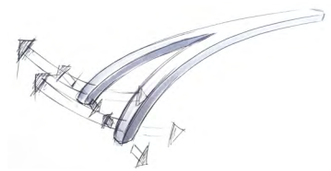
Comment: No flex

EVALUATION:

FLEX AND MOVEMENT

/Bend + end split

Amount of flex: ○ ○ ○ ○ ○ ○ ●



Directions of flex: In all directions. Little controllable.

The woods movement when exposed to moisture: Inwards for the split, and outwards for the bend

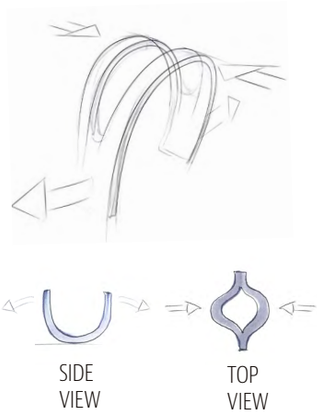
Potential to utilize flex and movement to make a connection: ● ○ ○ ○ ○ ○ ○

Comment: I do not see much potential to utilize the flex and movement in this geometry. Due to bends in several directions, it will also be forces working in several directions (if flexed or exposed to moisture). This makes it hard to control in which directions the different forces does work.

EVALUATION:

FLEX AND MOVEMENT

/U-bend +
middle split



Amount of flex:	○ ○ ○ ● ○ ○ ○
Directions of flex:	Outwards and inwards (opposite to each other) for both the U-bend and the middle split. And to some extent sideways for the U-bend.
The woods movement when exposed to moisture:	Outwards for the U-bend. Inwards for the Middle split.
Potential to utilize flex and movement to make a connection:	○ ○ ● ○ ○ ○ ○
Comment:	It could be possible. It is forces working in several direction (if flexed or exposed to moisture), but they seems to be quite predictable.

Bent geometry:

Potential to utilize flex and movement to make a connection:

○ ○ ○ ○ ○ ○ ●

○ ○ ○ ● ○ ○ ○

○ ○ ○ ○ ● ○ ○

○ ○ ○ ○ ○ ○ ●

● ○ ○ ○ ○ ○ ○

● ○ ○ ○ ○ ○ ○

○ ○ ● ○ ○ ○ ○

I chose to go further with the geometries that got medium to high score in the analysis: geometries that had most controllable flex, and an appropriate amount if it.

The analysis gave an overview over the geometries and was helpful to evaluate- and compare them.

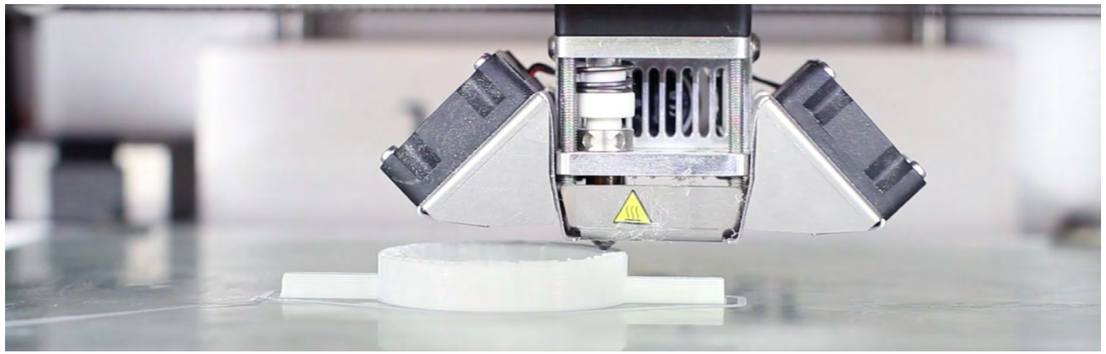
Geometries I chose to go further with

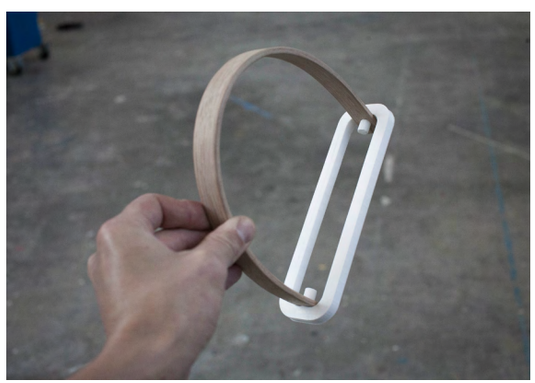
CONNECTION PRINCIPLES

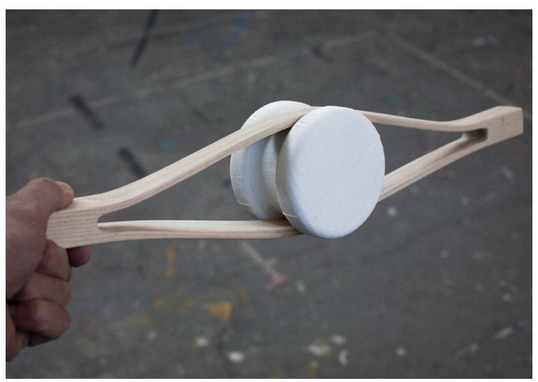
By printing geometries in plastic, I could fast and easy test connection principles with the chosen bent geometries.

Principles that might be used to connect bentwood and porcelain later.

Principles of how
geometries might be
connected







ANALYZING AND EVALUATING

To compare and evaluate the connected geometries, I ran them through a new analysis, where they got rated after the criteria of:

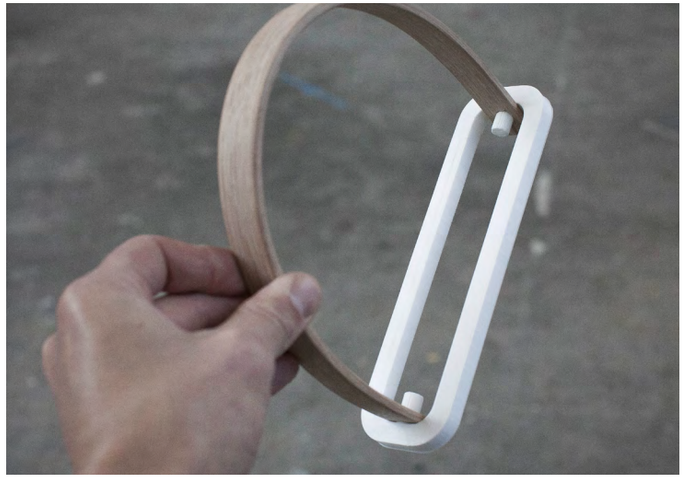
- How strong and secure the connection was.

An important criteria for a connection to work well.

EVALUATION:

CONNECTION

/U-bend



Does the connection feel secure?

○ ○ ○ ○ ○ ○ ●

Assembling of the geometries:

A lot of flex in the wooden part made it easy to assemble.

Comment:

I see potential in this principle to make a connection with porcelain. With this dimension in the wooden part, it´s easy to disassemble and assemble the parts.

It should be possible to adjust how hard the flex is by changing the dimension of the wood. Bigger dimension could make a connection that´s impossible to disconnect without breaking the parts.

EVALUATION:

CONNECTION

/Circle

Does the connection feel secure?

NOT RATED

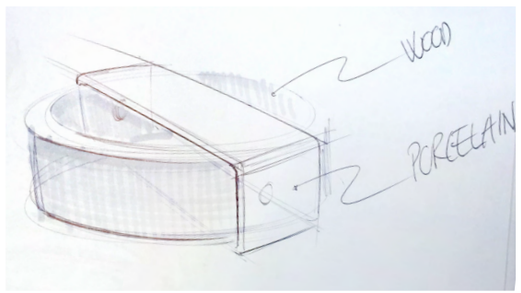
Assembling of the geometries:

It was as much flex in the plastic part than in the wood. This made this sample worthless, since the point is to test out how it could work with porcelain (which does not flex at all.)

Comment:

Needs to be tested with porcelain, but it seems like the dimension of the wood is too big to generate appropriate amount of flex. I want to try the connection principle with thinner wood.

POSSIBLE IMPROVEMENTS

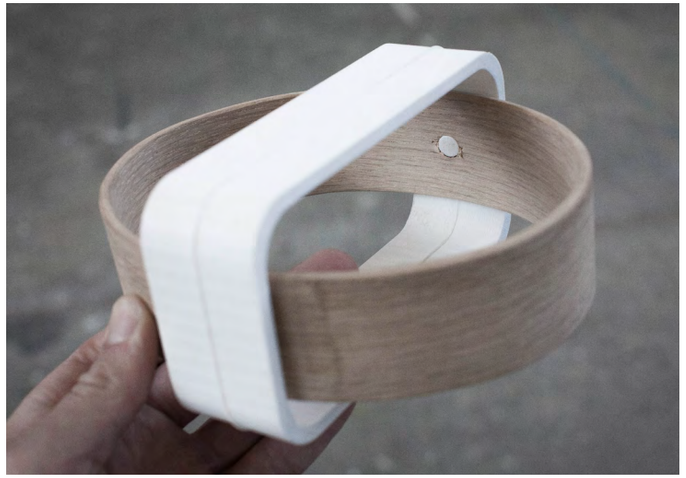


Thinner and wider wood
- Will it generate more flex?

EVALUATION:

CONNECTION

/Thin oval bend



Does the connection feel secure?

○ ○ ○ ○ ○ ○ ●

Assembling of the geometries:

The wooden geometry was just flexible enough to flex into the plastic part. Snaps really hard together.

Comment:

I see potential in this principle to make a connection with porcelain.

EVALUATION:

CONNECTION

/End split

Does the connection feel secure?

○ ○ ● ○ ○ ○ ○

Assembling of the geometries:

The wooden geometry was just flexible enough to flex into the plastic part. Snaps really hard together.

Comment:

Connection does work. But if roughly handled, the connection might pop, and the wood might continue the split with a crack in the solid part of the wooden geometry.

EVALUATION:

CONNECTION

/Middle split

Does the connection feel secure?

○ ○ ○ ○ ○ ○ ●

Assembling of the geometries:

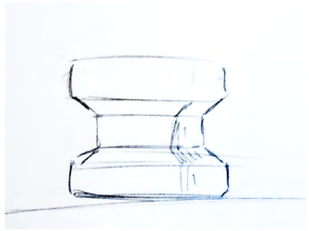
I had to re-steam the wood to make it flex enough to get the plastic plugs into the holes in the wood

Comment:

I see potential in this principle to make a connection with porcelain. You get a secure connection that´s not possible to disassemble without breaking the parts. By using round plugs, the connection could have a function as a hinge. And it might be possible to adjust how hard the flex is by changing the dimension of the wood (if this is desirable). Smaller dimension could make a connection where you can connect and disconnect the parts.

POSSIBLE IMPROVEMENTS

I see potential in making a version without plugs. The plugs might be difficult to cast, and not always desirable in a product.



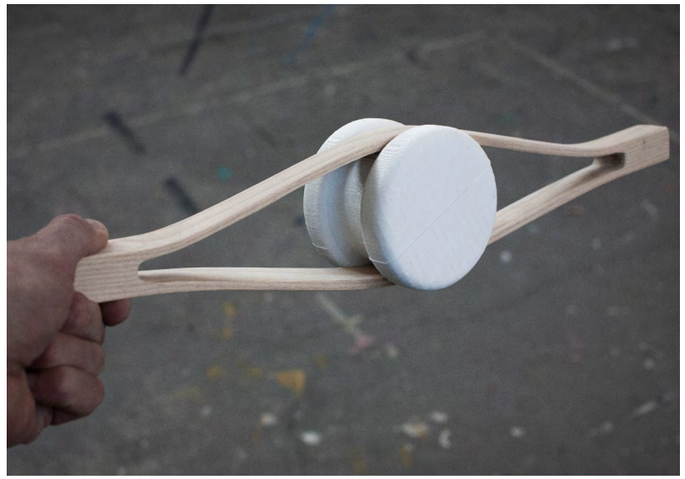
Possible shape of the geometry that could be connected to the wood

EVALUATION:

CONNECTION

/Middle split

- variant 2



Does the connection feel secure?

○ ○ ○ ○ ○ ○ ●

Assembling of the geometries:

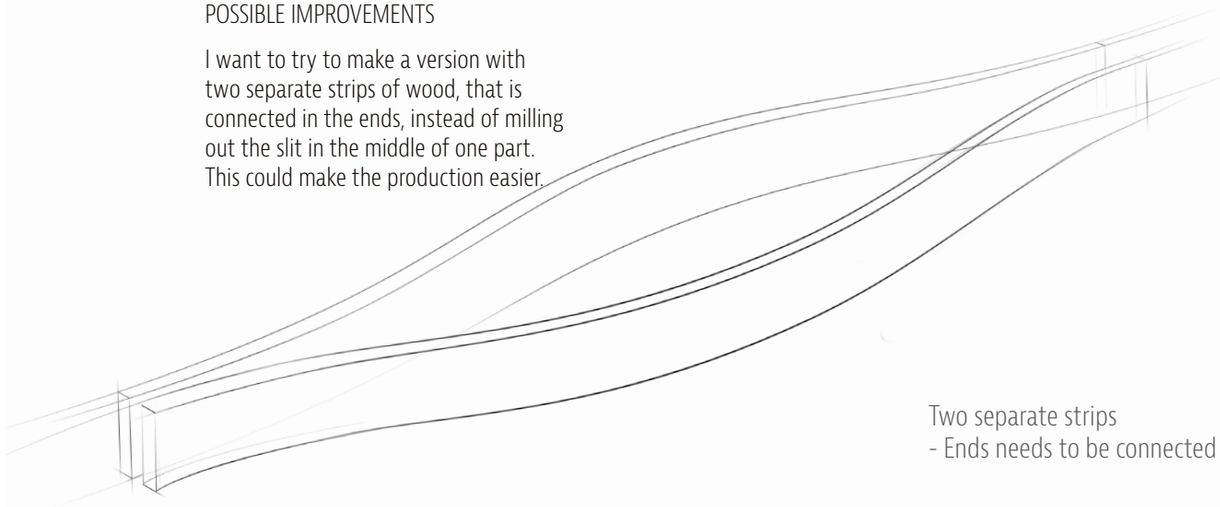
I had to re-steam the wood to make it flex enough to get the plastic part into the slit.

Comment:

The connection seems to work very well. Without the need of plugs in the porcelain, the production of the porcelain part could be easier.

POSSIBLE IMPROVEMENTS

I want to try to make a version with two separate strips of wood, that is connected in the ends, instead of milling out the slit in the middle of one part. This could make the production easier.



Two separate strips
- Ends needs to be connected

EVALUATION:

CONNECTION

/Middle split

- variant 3

Does the connection feel secure?

○ ○ ○ ○ ○ ○ ●

Assembling of the geometries:

Very easy. Due to the dimension of the wooden slits, they can flex a lot. You can either flex the wood around the inner geometry, or the ends of the wooden slits can be connected together after the inner geometry are in place.

Comment:

A connection that should be easy to make (both the porcelain and wooden part) and assemble.

The ends of the wood needs to be connected. This could be done in several ways: Glue, wooden plugs, metal bolts or screws or end-caps (like in this sample) are some possible ways this could be done.

Connection principle:	Potential to make a connection between wood and porcelain:
	○ ○ ○ ○ ○ ○ ●
	NOT RATED
	○ ○ ○ ○ ○ ○ ●
	○ ○ ● ○ ○ ○ ○
	○ ○ ○ ○ ○ ○ ●
	○ ○ ○ ○ ○ ○ ●
	○ ○ ○ ○ ○ ○ ●

I chose to go further with the principles that got medium to high score in the analysis: principles that had the strongest connection and felt most secure.

The analysis gave an overview over the connection principle and was helpful to evaluate- and compare them.

Connection principles I chose to go further with

By soaking the connection samples in water overnight, I could check if the movement in the wood would act as I thought.

The wooden part to the right had the same shape as the one to the left before soaked. The changes in shape shows the movement in the wood, when exposed to moisture. The part to the left is unchanged (due to the plastic geometry in the middle, that blocks the movement).

THE FINDINGS WAS:

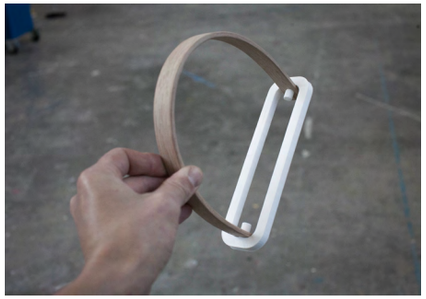
The wood want´s to move back to it´s initial state, in all the geometries (it is trying to straighten out).

None of the samples did detach. They are actually stronger now, since the wood tries to move in the direction of the plastic geometries.

TESTING CONNECTING PRINCIPLES WITH PORCELAIN

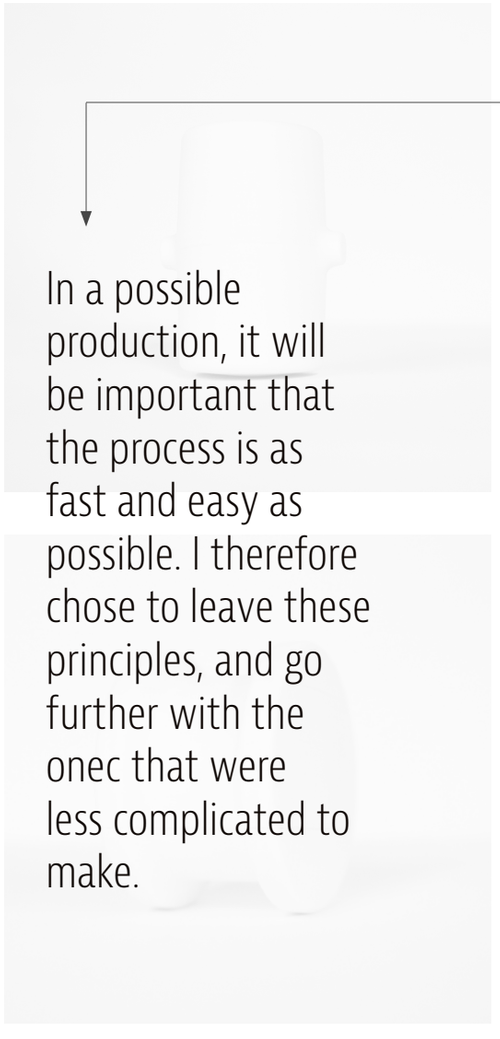
To find out how the chosen principles would work with the real materials: bentwood and porcelain, I wanted to test chosen principles with porcelain.

Chosen principles
to go further with



Geometries
that needs
to be casted
in porcelain,
to test the
principles with
the actual
materials

Chosen principles to go further with



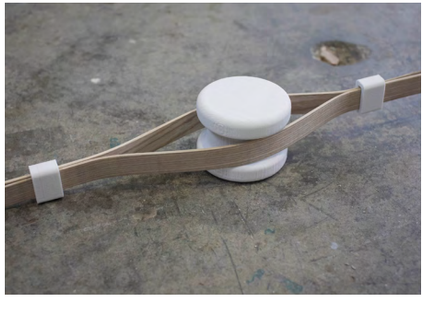
This geometry could not be casted in porcelain, due to the thin and fragile circular shape that connect the plugs.

In a possible production, it will be important that the process is as fast and easy as possible. I therefore chose to leave these principles, and go further with the onec that were less complicated to make.

"The geometry could be possible to cast, if the circular shape had a bigger surface. But it will be more complicated to cast, than the other shapes, since the plugs are one the inside of the shape"

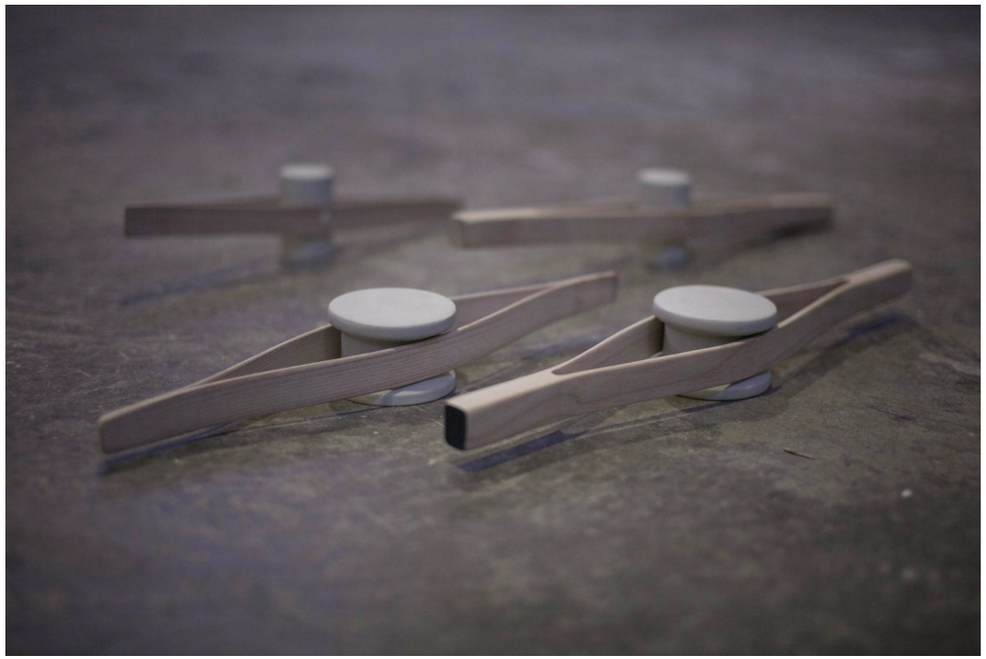
- Sidsel at MENT

Chosen principles
to go further with



Geometries
that will be
casted in
porcelain, to
test the chosen
principles with
the actual
materials

Image from the making of
the geometries in porcelain.
Done by MENT



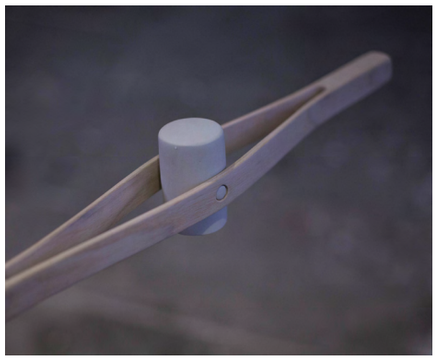
Porcelain and wood were assembled.

- The chosen connection principles did work with parts of porcelain and bentwood.

QUALITIES OF THE DIFFERENT GEOMETRIES

One part of solid wood
with milled slit

Porcelain part
with plugs



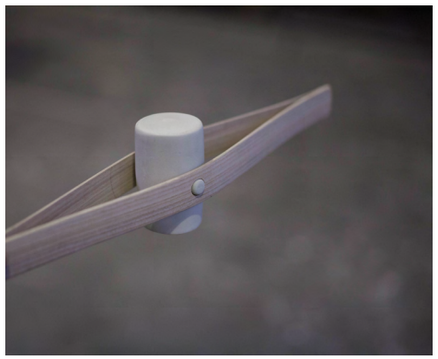
Porcelain part
without plugs

Qualities of using one part of solid wood:

- You get a final piece without any glue

- Easier to make a connection with little flex (desirable if you want a connection that should not be possible to disassemble).

Two thin strips of solid wood,
glued together in the ends



Qualities of using two strips of wood, glued together in the ends:

- Faster and easier to make
(milling of the slit in the middle of a solid piece takes longer time that gluing the ends of two strips)

- Easier to make connections with more flex (desirable if you want a connection that can be assembled and disassembled).

Qualities of using plugs in the porcelain:

- Gives opportunities to integrate the function of an hinge.

- Easier to make a tighter connection

Qualities of not having plugs in the porcelain:

- Easier to make both the porcelain- and the wooden part, without plugs and holes.

- Possible with a simpler form language

- Possible to integrate the function of a sliding rail

Thickness of the wood - An important factor

By adjusting the thickness of the wood, you can control a lot. Thinner wood gives more flex, and thicker wood gives less flex. Much flex makes it easy to assemble the two parts, and also to disconnect them. This can be both positive and negative. With thin wood, you can for instance make a connection where the user can connect and disconnect the parts. With thicker wood, you can make a connection that is very strong and impossible to disconnect without breaking the parts. This is possible by steaming the wooden part before assembling it with the porcelain. The steam makes the wood flex more than it ever can do in dry condition.

CONCLUSION

The key to successfully make a part of solid bent wood to lock into a geometry of a static material, like porcelain, is to:

- Utilize flex in the wood that works in the same direction as the wood wants to move if exposed to moisture. Which is the opposite direction of how the wood was bent (the material wants to straighten back to it´s initial shape, if exposed to moisture).

By doing this, you can get a connection that will not detach, even if it´s used in environments with different levels of humidity, or in water.

By adjusting the thickness of the wood, the flex will be stronger or weaker. If you take this into account, you can make connections that are very strong, and impossible to detach without breaking the parts, or you can make connections that you easily can mount and unmount, without breaking the parts.

The geometries does not need to look exactly like they do in the material samples. They shows principles, which can be adjusted to different shapes. The key is to lock the wood into a position where the bent part is set under tension. To do this, two points must be in contact with the static material.

The principles shown here, might not work in every situation when combining the materials. But they should be possible to use, and tweak to work, in several situations, and within products with different kind of shapes.

If you should use one solid part of wood, or two strips glued together, depends on the use:
- For a connection you can disassemble, two thin strips will be better
- For a connection that should not be possible to disassemble, using one solid part is better

The learning outcome of this process will be valuable when working further with developing products with the materials.

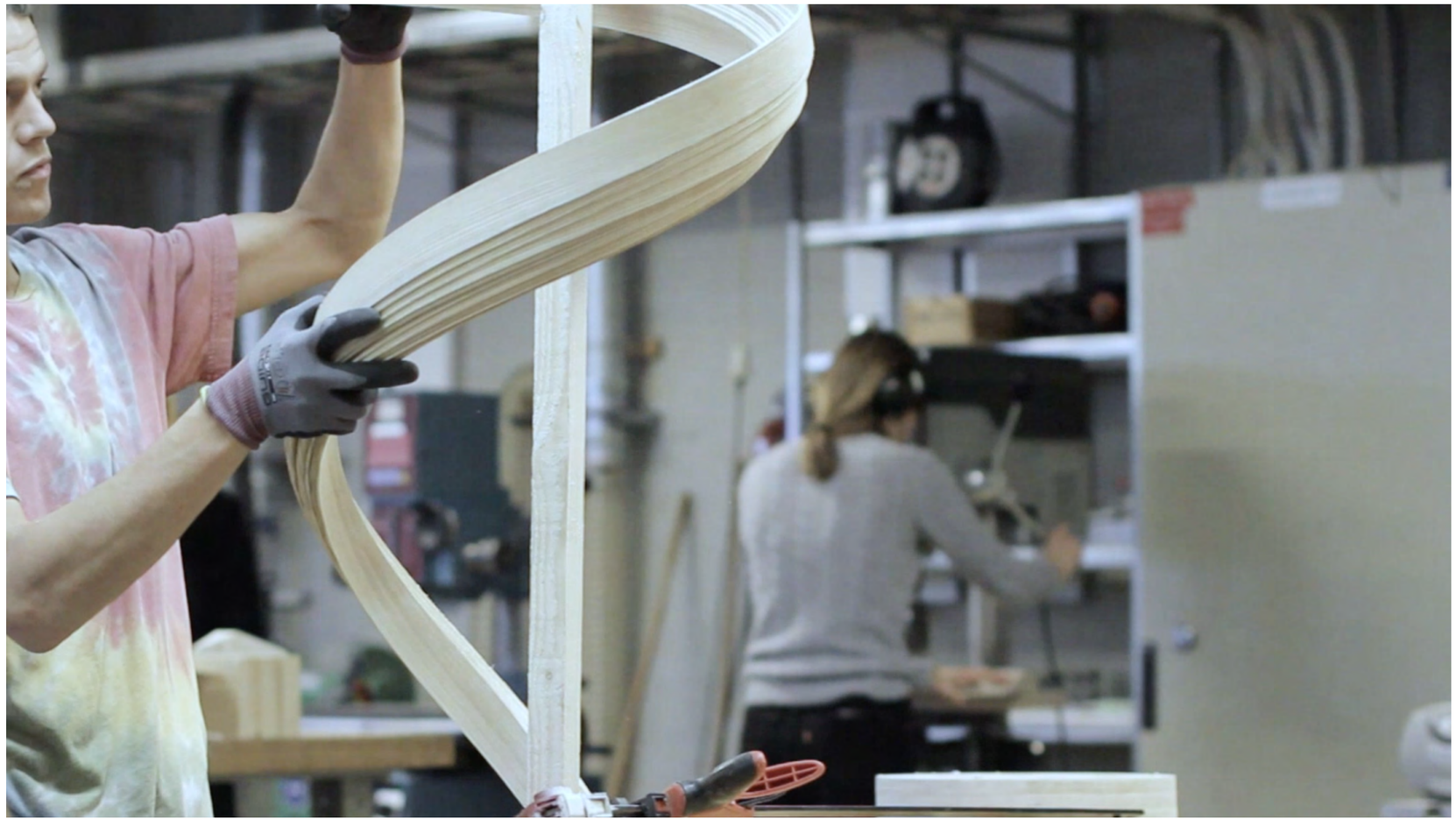
PART TWO:
SHAPING WOOD

Why is this interesting and relevant?

By using traditional techniques of bending wood, I wanted to explored how wood can be shaped, that suits a combination with MENT´s porcelain work and a possible small scale production in Norway.

MENT works with design and production of interior products of porcelain. They have a form language, where everything is asymmetrical or skew. They do have a production at Fåberg, here in Norway, where they utilizes qualities of craft. Every product gets its own unique character, even if they are made in a serial production.

By small scale production in Norway, I mean a production that will be suitable to do for one person in a normal wood workshop. It will be important that the production is as rational as possible, due to high labor costs in Norway, compared to low cost countries. The production should be possible to do without too much expensive machinery, and with as little material waste as possible.



Framing

In this part of the project, I chose to explore free-form bending of solid wood. There is mainly two ways to work with bending of solid wood: bending with a jig-setup or free-forming.

I chose to work with free-forming, since it´s fast to work with and gives opportunities to make more sculptural and unique pieces. Qualities that I find interesting and appropriate for a combination with porcelain in interior products. Also a technique that is suitable for a local small scale production, since it´s faster and requires less tools than bending thick dimensions of wood in a jig setup.

Exploring

By using a practical approach, I aimed to get hands on experience of the possibilities and limitations of the material.

Due to the limitations of the material (how it can be bent and twisted before breaking), I trusted a practical and experimental approach to be the most appropriate way of exploring how the material could be shaped.

By experimenting freely, without thinking about any result or possible use, I aimed to find ways of working with the material, that could generate sculptural shapes, possible to make in a rational way.

The main finding from the explorations is how it is possible to bend several thin strips of wood at ones, and the opportunities this gives to form different shapes and structures of the material

By controlling the ends of all the strips, you can shape and bend the strips together, and let them spread into different structures.

This makes it possible to make sculptural shapes fast and easy, since you do not need to shape every strip individually, which would be more time consuming and harder to do nice and evenly.

Several strips can be milled and bent from one plank, with parts of the plank left unchanged.

This makes it possible to make structures with both a rigid element (part of the plank left unchanged), and a sculptural element (the bent strips). Everything from one plank.

Strips can also be shaped, by squeezing their ends together. The wood then takes the shape it wants: often strong and sculptural ones.

This makes it fast and easy to make sculptural shapes, that all will have their own individual difference.

SHAPING WOOD:
SUMMARY OF FINDINGS

- Bending several strips at ones makes it possible to make sculptural shapes in a rational way.

- This principle can also be used with strips that´s milled in part of a plank. This makes it possible to make structures with both a rigid element (part of the plank left unchanged), and a sculptural element (the bent strips). Everything from one plank.

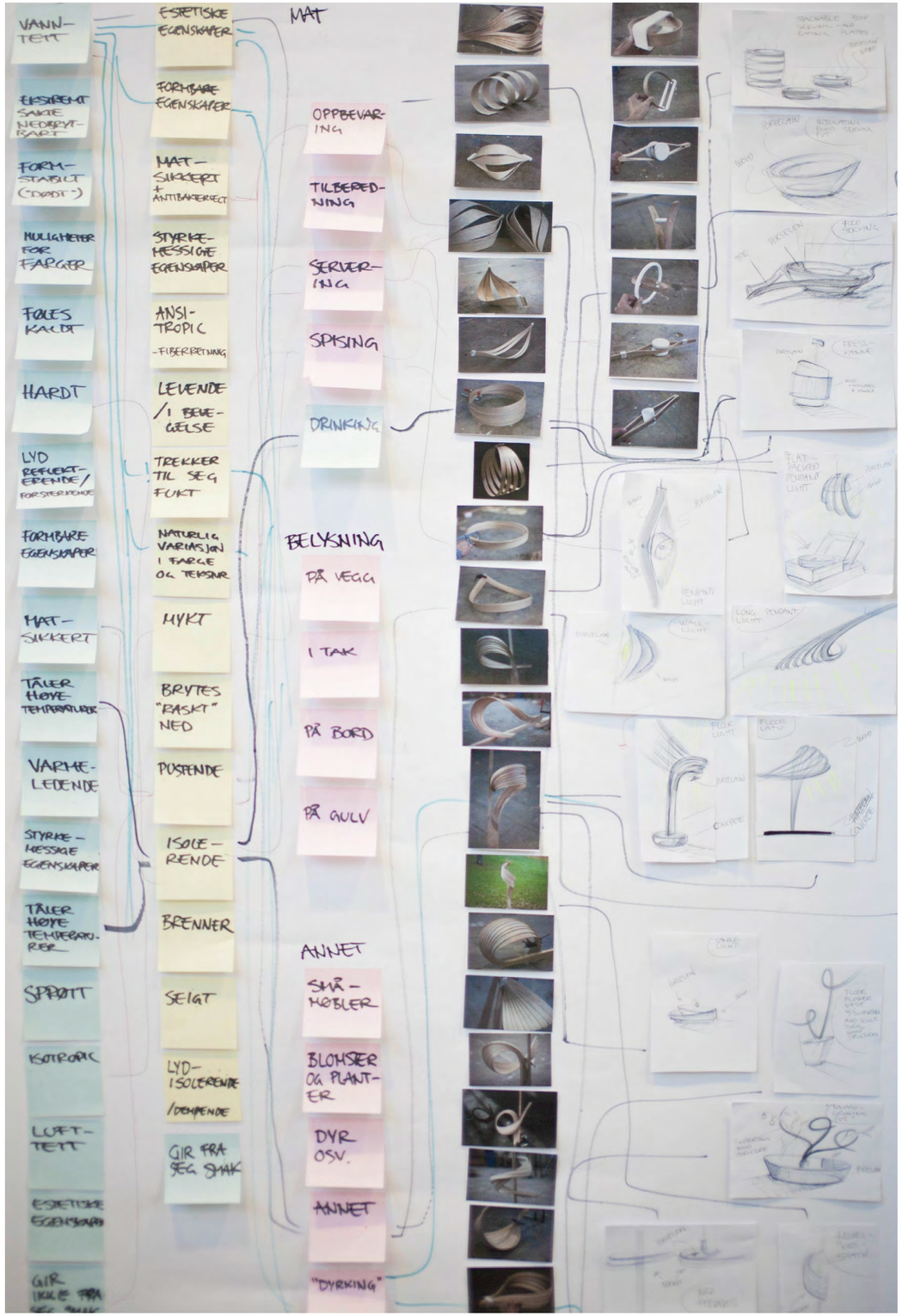
- Strips can also be shaped into sculptural shapes, by squeezing their ends together. The wood then takes the shape it wants: often strong and sculptural ones. This makes it fast and easy to make sculptural shapes, that all will have their own individual difference.

PART THREE:
EXEMPLIFICATION OF USE

Why is this interesting and relevant?

To explore the value of the material combination, and the findings from this project

To set the findings from the process in context, by uniting porcelain and bentwood into product concepts for interior products

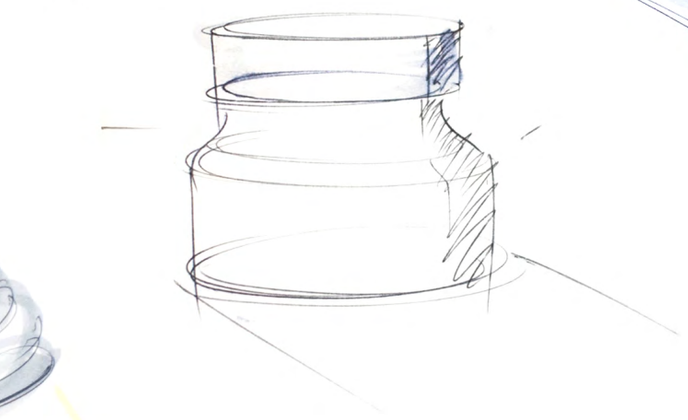


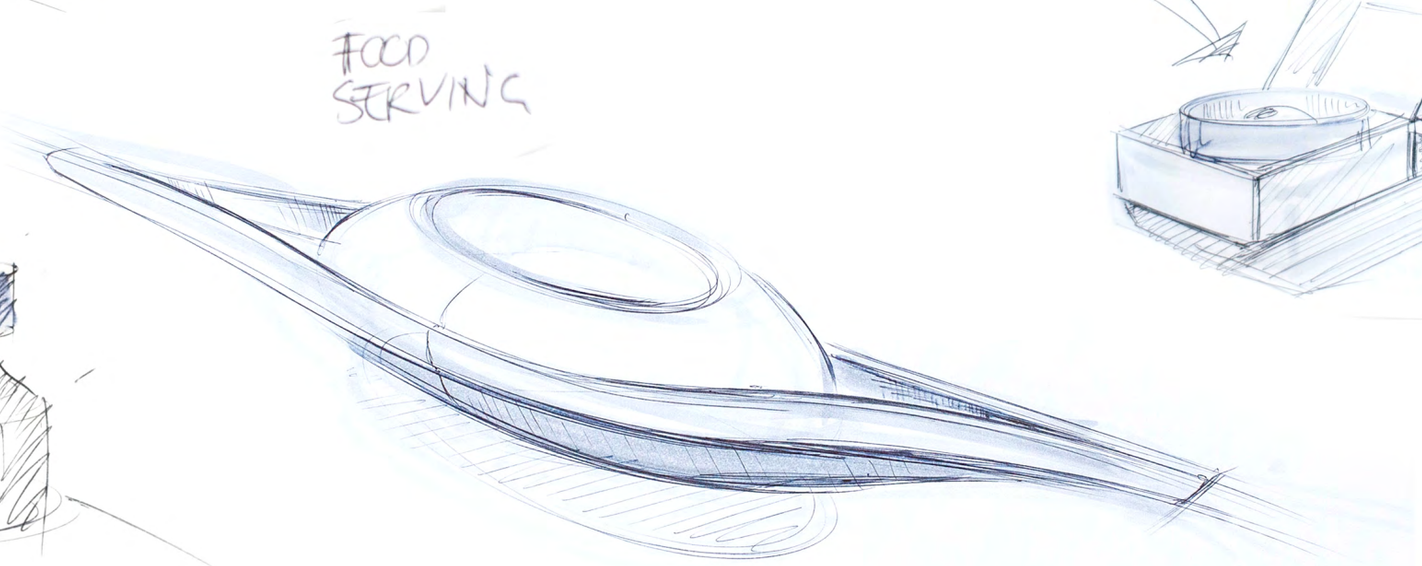
IDEA DEVELOPMENT BY THE METHOD OF FORCED RELATION

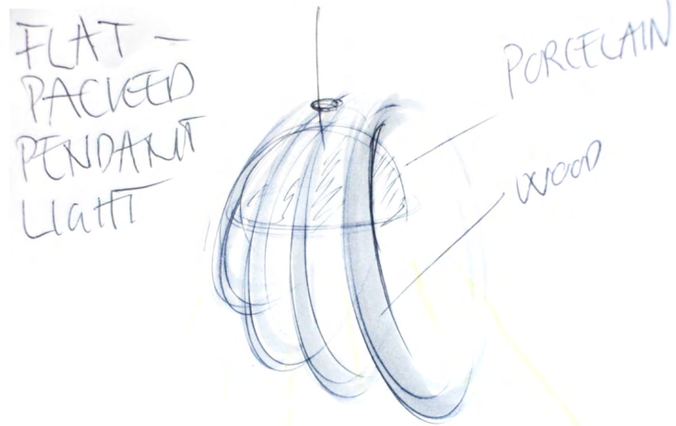
Ideas for how the findings could be used were developed by using the method of forced relation.

The method was helpful to develop ideas for interior products, where the material combination came to it´s right, and findings from the process could be integrated.

Properties and qualities of wood and porcelain were related with MENTs product categories, possible connection principles and shapes of bentwood.







The ideas we chose to develop further into concepts. We chose the ideas where the materials came most to it´s right, and that MENT found most potential in for their customers. In the following pages, the concepts are presented.

CONCEPT:
Sculptural pendant lamp

PORCELAIN

- DIRECTS AND REFLECTS THE LIGHT.
- PROTECTS THE WOOD FROM THE LIGHT SOURCE.

WOOD

SCULPTURAL SHADE

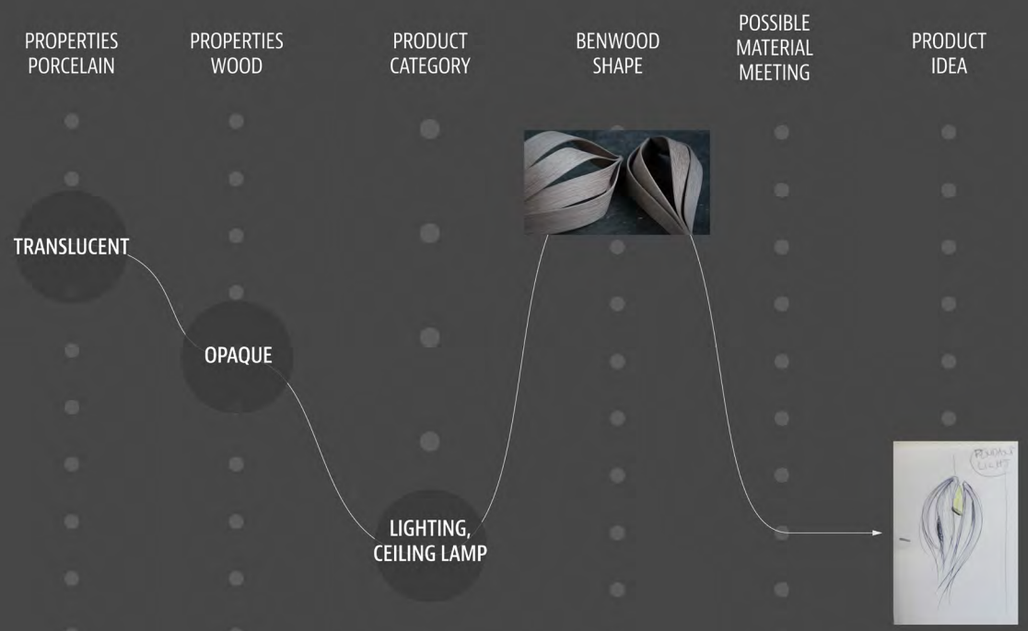


Illustration of where the idea came from by using the method of forced relation

CONCEPT:
Floor lamp

WOOD

SCULPTURAL SHADE

CONCRETE BASE

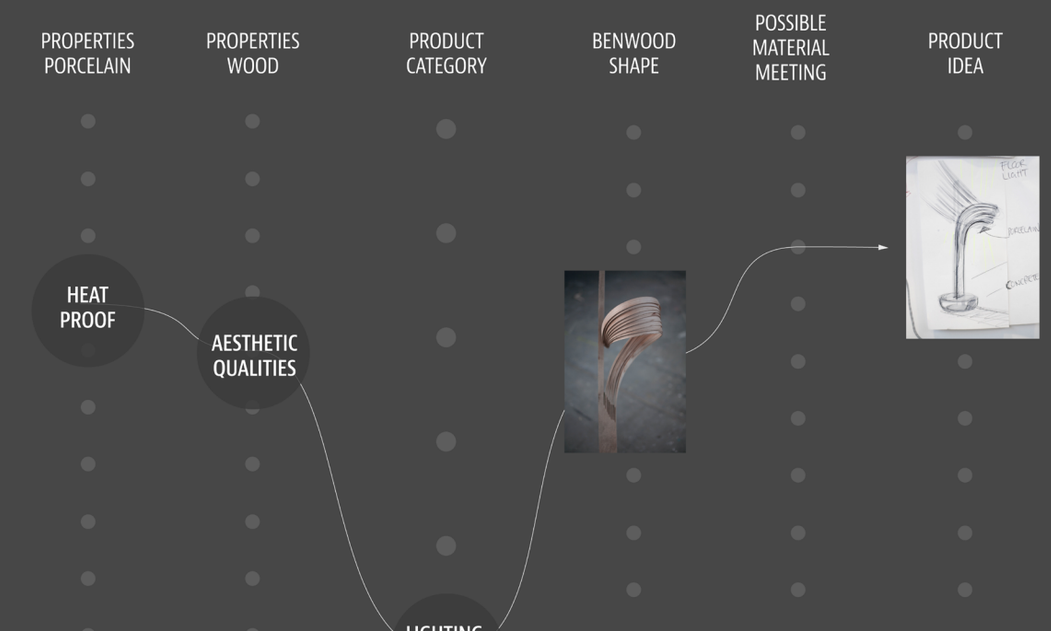
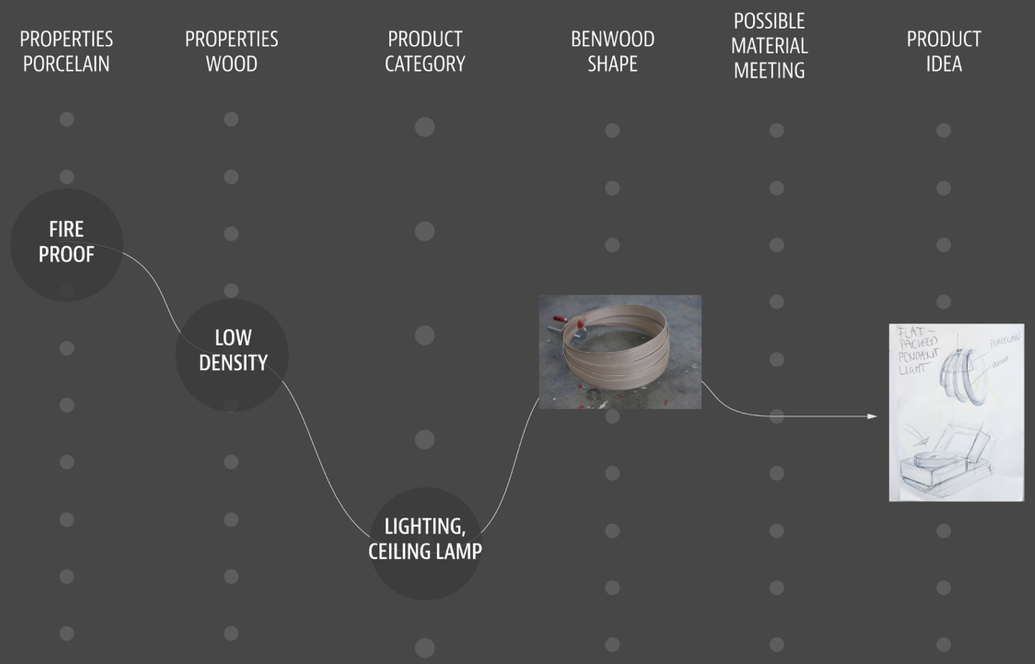


Illustration of where the idea came from by using the method of forced relation



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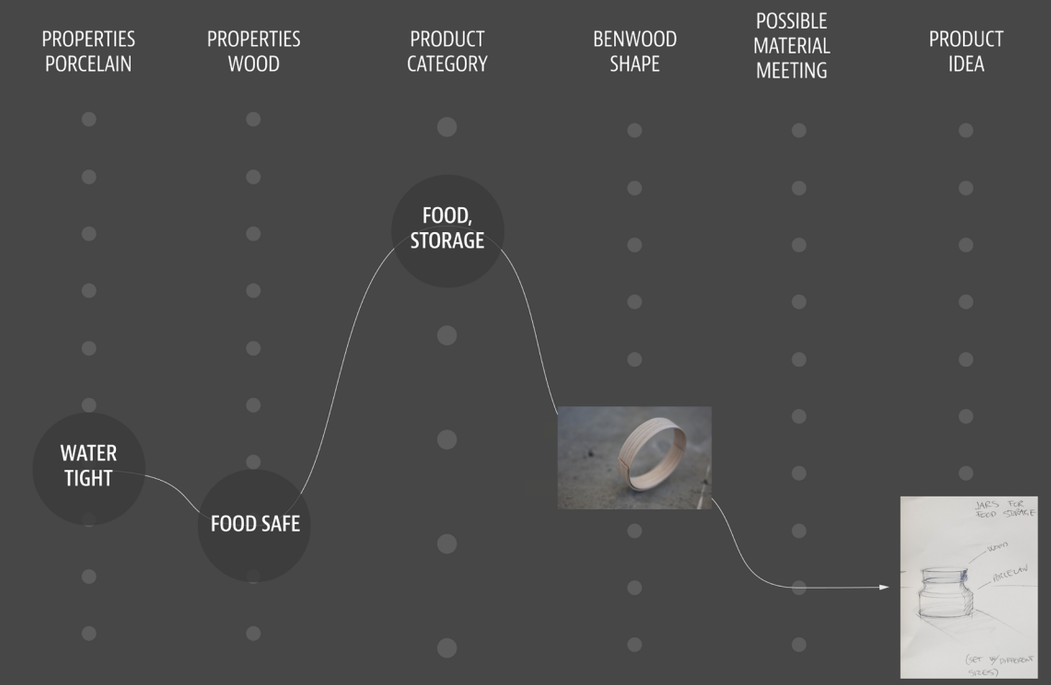

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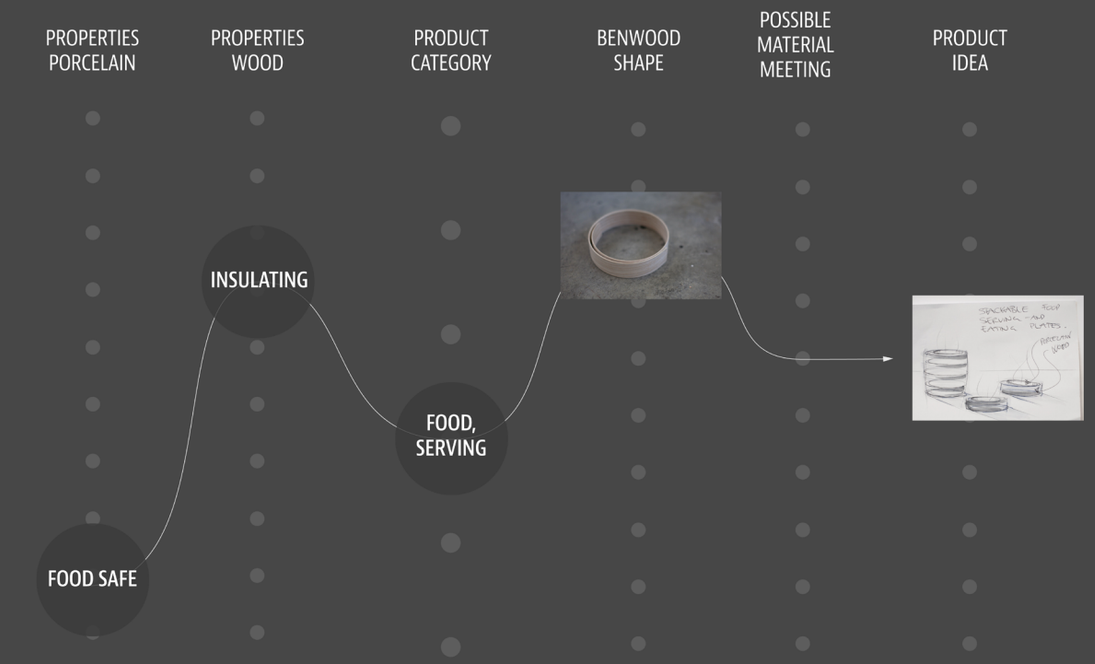

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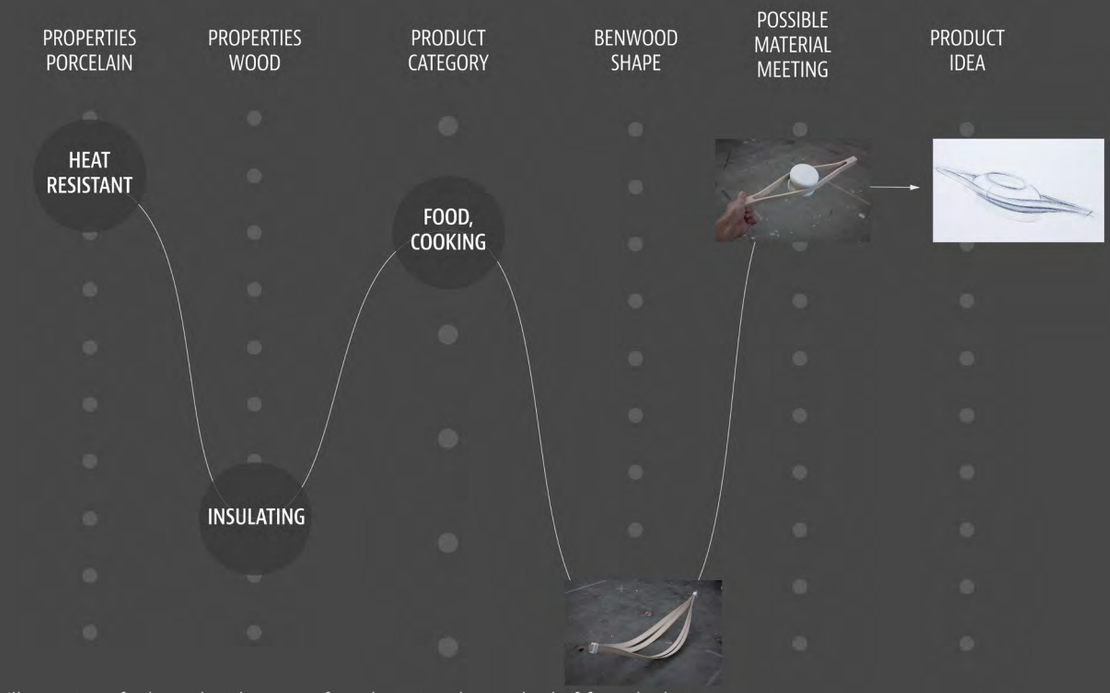

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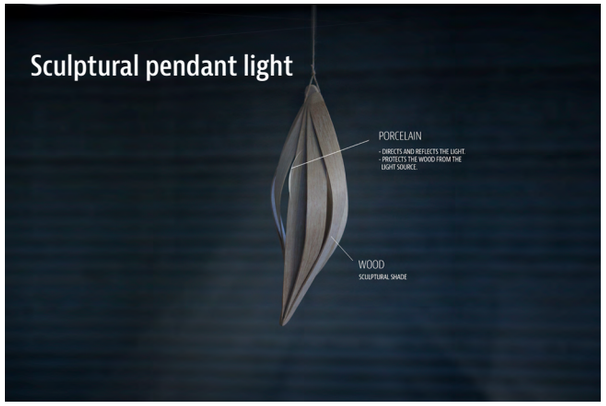

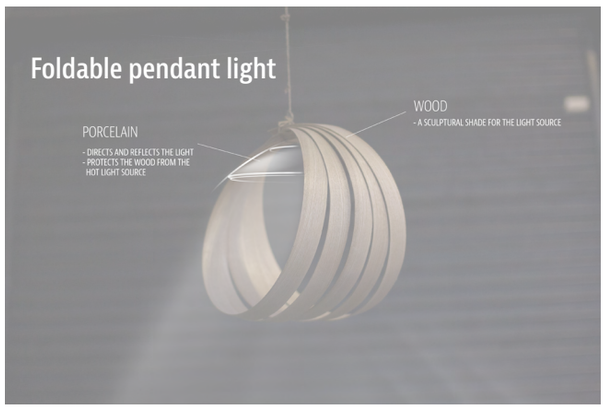

CHOICE OF CONCEPTS

In collaboration with MENT, we chose to take the following concepts further:

- Cooking and serving of food
- Sculptural pendant lamp

We see most potential in these concept to develop sculptural object with size. Factors that according to MENT are essential to develop products in the upper price range, to markets like hotels and restaurants.

We also do find the concept of floor lamp and foldable and flat pack pendant light interesting. Due to their level of complexity, we will not develop them further at this stage, but come back to them later.

CONCEPT MODEL
SCULPTURAL PENDANT LAMP

The porcelain directs and reflects the light, and to protect the wood from the light source

The wood works as a sculptural shade, and makes sculptural shadows.

CONCEPT MODEL
SCULPTURAL PENDANT LAMP

The porcelain directs and reflects the light, and to protect the wood from the light source

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CONCEPT MODEL:
Cooking and serving of food

The ceramic pot can be used to cook warm dishes in the oven.

The wooden structure can be used when serving from the pot. It makes it possible to handle the pot without burning your hands or the table.

CONCEPT MODEL:
Cooking and serving of food

The ceramic pot can be used to cook warm dishes in the oven.

The wooden structure can be used when serving from the pot. It makes it possible to handle the pot without burning your hands or the table.

THE CONCEPT MODELS

The models are not developed products, but concepts, meant as examples and inspiration of how the materials can be combined, used and shaped.

REFLECTIONS

By doing this practical and experimental project, I have gained a lot of hands on experience of how to bend solid wood. Experience I think will be useful in development of products of bentwood, in combination with porcelain.

By using the method of forced relation, the project also generated ideas for how the findings of the process could be used to develop products. Ideas that can be developed further after the end of this diploma.

THANKS TO

Thanks to MENT for a good collaboration.

Thanks to my supervisor Stein Rokseth, for guiding me through the project.

Thanks to the workshop at AHO, and especially Roald, Thomas Isak, Geir and Halvor for tutoring me in the workshop and giving me a nice space in “byggehallen”.

Thanks to Løvtrespesialisten and Emne 3 for giving me Norwegian ash wood for the project.

And thanks to Natalia Lucia Agudelo Alvarez and Steinar Killi for additional guidance in the project,

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APPENDIX
A SELECTION OF IMAGES
FROM THE PROCESS