

LOOM

A MASTER PROJECT BY IDA GUDRUNSDOTTER
2016



LUND UNIVERSITY

LOOM

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ABSTRACT

This project addresses the problems the traditional loom has in our modern society resulting in a product that provides a new and modernized way of looking at the loom. A lighter, easier and more intuitive version that one could use even without having previous experience with weaving.

Most of us have encountered a loom in our lives, but very few have a relationship to it. As weaving is one of the oldest crafts we have, I felt an urge to change this relationship.

The loom hasn't changed much since the 16th century. There are a lot of variants on the market but most of them are built on the same principle and construction. When the loom was developed, the society and living arrangements looked much different from how we live now. Space, time and level of experience needed when weaving wasn't as important factors when the original looms were designed. Therefore, it does not always fit in to our modern lifestyle.

Through Interviews, testing and study visits. I found that the size of the loom depends on the heddle system, the system that controls the threads, making them go up and down. The most essential part of the project have been to create a new kind of heddle that makes it easier to weave and at the same time allows for a simple and smaller construction that anyone could have at home.

The result of this MA-project is a new way of looking at the loom. The new loom exists in the borderland between furniture and tool. A product anyone could have at home regardless of what experience in weaving or which living arrangements one has. It is foldable and easy to move when not in use. The user can at any time change the type of weave without having to change the threads which is not possible on today's looms, making this product versatile and yet simple.

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INTRODUCTION

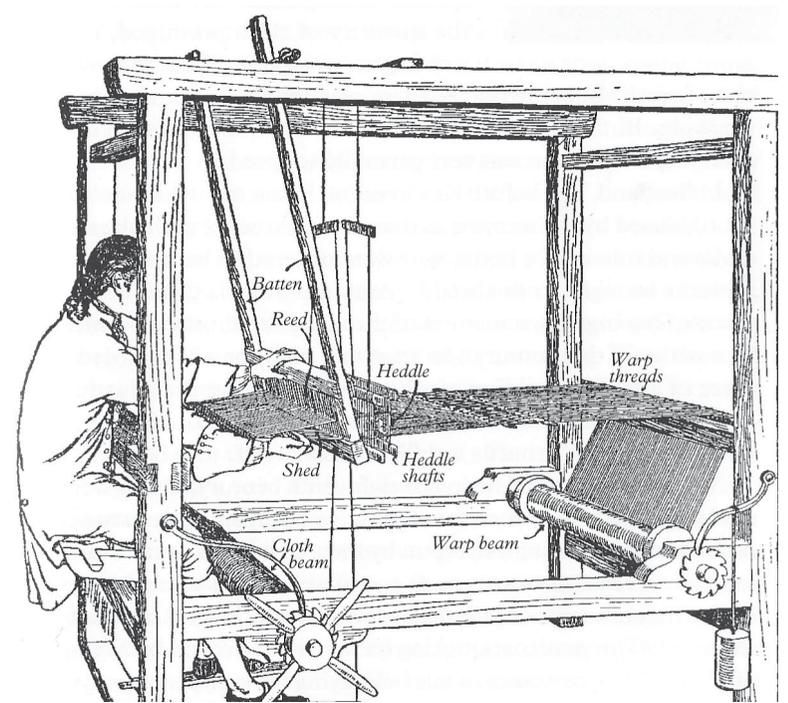
HOW IT STARTED

My project started with me looking at textile waste. Every year we throw away 8 kilo per person. That's equivalent to 2-3 percent of the greenhouse gases that every Swedish person emits every year. As I read more about this I started to think of weaving, as it is a way of up-cycling old fabric, with the possibility to give it a new value. While doing more research in weaving; watching You-tube tutorials, looking at art projects and reading about the possibilities of weaving, one thing was always present; the Loom. As a tool for making fabric the loom is quite spectacular; depending on its complexity, and the knowledge of the user, one could make amazing creations. I noticed when I continued my research, there are not as much interest in weaving as it is in other arts and crafts. Especially amongst the younger generation. So my question was:

/ Why is weaving not as common as knitting or crochet? /

WHY THE LOOM?

Weaving is one of the oldest crafts we have and the loom is one of the few unique tools that can turn something old into something new and also give it more value. For example the rag-rug, where you take old, used textiles and turn them into something more valuable. Unlike other craft tools such as the sewing machine or crochet hook, the loom does not have an obvious place in our modern lifestyle. One reason for this is that when society has evolved and adapted to the life we live today, the loom has been frozen in time. I see a great will to create amongst people I can also see the need for innovation in this market.



PROBLEM DEFINITION

When the loom was developed our society looked a bit different from today. There was no problem to fit a loom in a house; space was not really a part of the equation when designing it. It was supposed to be sturdy and stable so that it would hold to produce the fabric that where needed for many generations to come. Today we have more criteria for what a loom needs to be. The way we are living today in cities with limited space, the loom has no place. Although, as I'm going to show in this report, there is a demand for weaving from today's new crafter. It is just that the looms that are available today don't really meet up to them. People want to be able to weave and then put the loom away when it's not used. They may even want to transport it to each other and using a community platform to weave together and share experiences.

To summarize, the loom is wanted but outdated and really needs to be re-invented to fulfill the new needs and demands of the users.

BRIEF 1.0

Investigate if there is a need for a new kind of loom and for what market.

TOO BIG AND

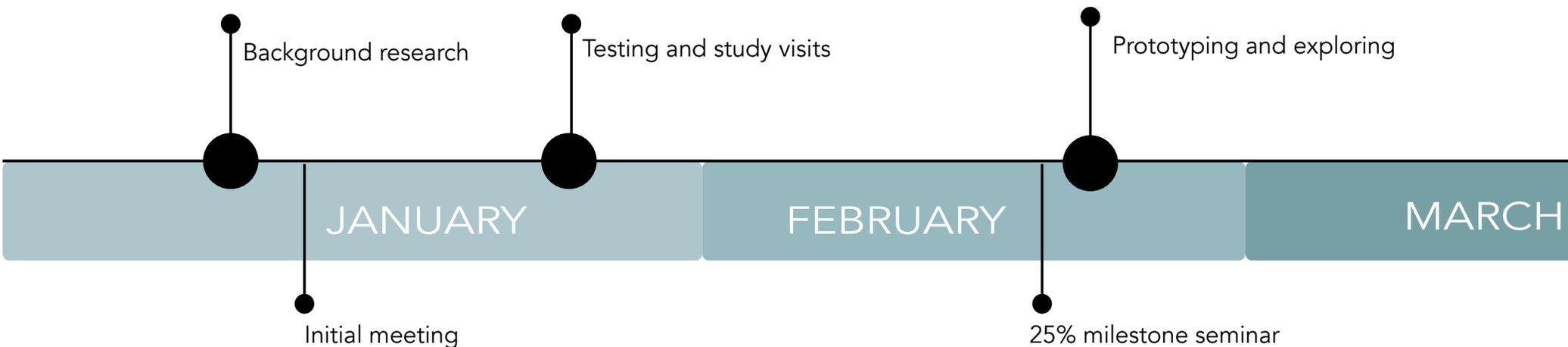


COMPLICATED?

TIME MANAGEMENT

I started quite early by doing some basic research around the background of weaving, both historical, cultural and technical. At that point I already had an understanding of the different techniques and tools that are used in weaving. I wanted to start testing and conducting interviews and study visits early in the project so that I would have a lot of time for prototyping and working on aesthetics later.

+ Milestones set by me

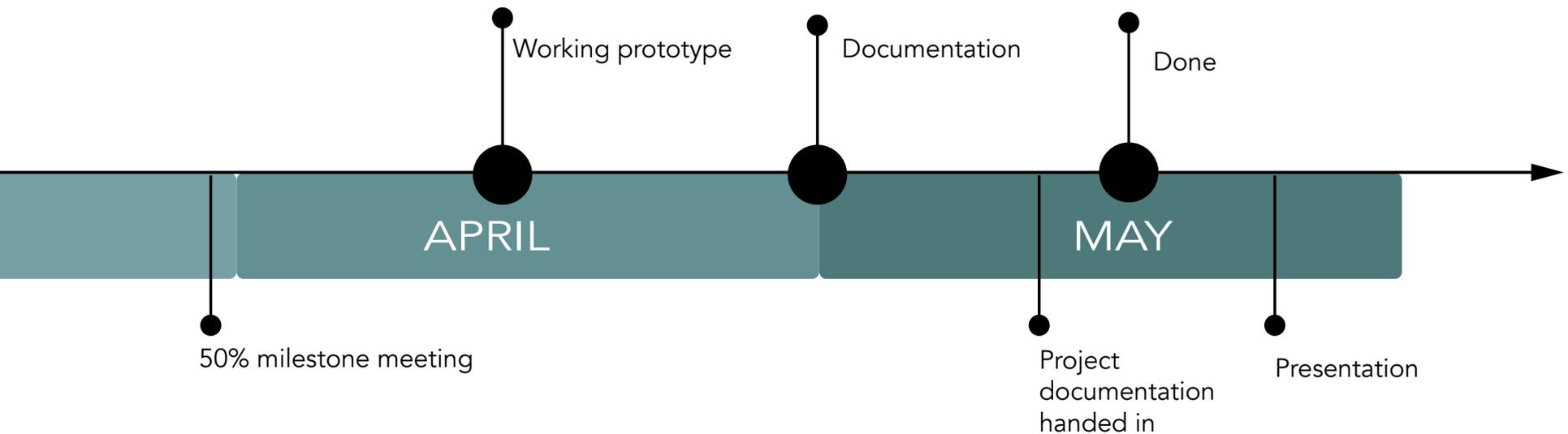


+ Milestones set by my supervisor

PERSONAL AIMS

My personal aim with this project was to design a product where I got to explore and go over the design several times so that a version 1.0, 2.0, 3.0. Could be produced and analysed. I wanted to be able to go into details and really have a thorough process.

My goal was to have a working prototype/product that have been well designed down to the details, so that on the 50% milestone meeting I could present a working prototype, and from the feedback I got, start to build a final version.





KEY QUESTIONS WHEN DESIGNING A NEW LOOM :

- **What is already existing?**
- **What do people want to weave?**
- **Why do people want to weave?**
- **What is the absolute basic functions that I need to incorporate into the loom?**
- **Size - How do I decide? What parameters?**
- **Do I constrain myself for an analogue solution or should I look at some digital solutions as well?**
- **What kind of problems do I have to address?**
- **Special tools? Or should you be able to buy old parts and use them? Modularity?**
- **Who is my user?**

For the user group:

- **What do people experience to be difficult when it comes to weaving?**
- **Cost - How much are people willing to spend?**
- **Time - How much time are people willing to invest?**
- **Space - How much space do people have for it? Where would people have it?**

ANATOMY OF A STANDARD FLOOR LOOM

- 1 CASTLE (SV. *Ram.*) = Holds the harnesses and is usually part of the loom's supporting framework.
- 2 SEAT (SV: *Sits.*)
- 3 WARP BEAM (SV. *Varpbom.*) = A beam at the rear of the loom where the warp is wrapped.
- 4 WARP (SV. *Varp.*) = The lengthwise, parallel threads on which you weave. They are held in position and kept under tension by the beams.
- 5 TENSION BEAM (SV. *Sträckbom.*) = A beam to keep tension in the warp.
- 6 WARP ROD (SV. *Skälspröt.*) = Rods to keep the warp in place and to help separate.
- 7 HARNESS (SV. *Solvskaft.*) = Sometimes called a shaft. A frame which holds the heddles. The harnesses move up and down to create the shed. Most commonly, there are 2 or 4 harnesses on a loom.
- 8 HEDDLES (SV. *Solv.*) = Long wires or threads inside a harness. Each heddle holds an individual thread of the warp in place.
- 9 SHUTTLE (SV. *Skyttel.*) = Sticks which pass the weft threads across the warp threads.
- 10 SHED (SV. *Skäl.*) = An opening created by lifting warp threads in different combinations. The opening/shed is for the weft thread to go through.
- 11 WEFT (SV. *Vävgarn.*) = The crosswise threads which are moved in and out of the warp threads.
- 12 BREAST BEAM (SV. *Bröstbom.*) = Beam where the weave passes to be rolled up on the cloth beam.
- 13 REED HANGER (SV. *Upphångningsstag för slagbommen.*) = *Hangs the reed*
- 14 REED ADJUSTER (SV. *Justering för slagbommen.*) = *Adjusts the reed*
- 15 REED (SV. *Vävsked + slagbom.*) = A metal 'comb' type tool which has metal strips set equal distances apart. This tool determines how many threads per inch there will be in your warp. 8, 10, 12 and 15 are the most popular.
- 16 TREADLE (SV. *Trampor.*) = These raise the harnesses and are powered by the user's feet. The order in which the harnesses are raised determines the pattern of the woven fabric. Each treadle is tied (by the user) to each harness, or to multiple harnesses at once.
- 17 CLOTH BEAM (SV. *Tygbom.*) = A beam at the front of the loom where the woven fabric (i.e.the cloth) is wound.

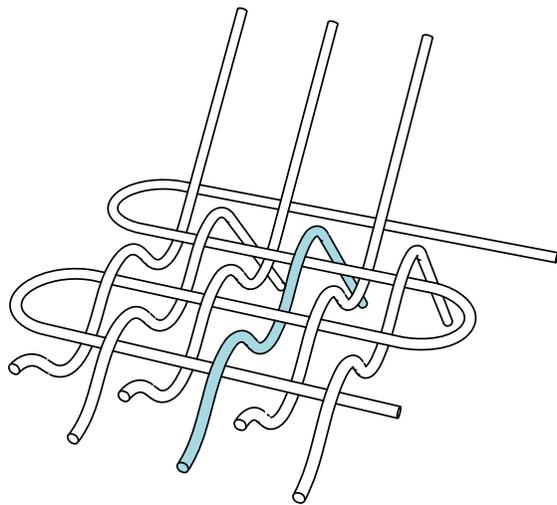
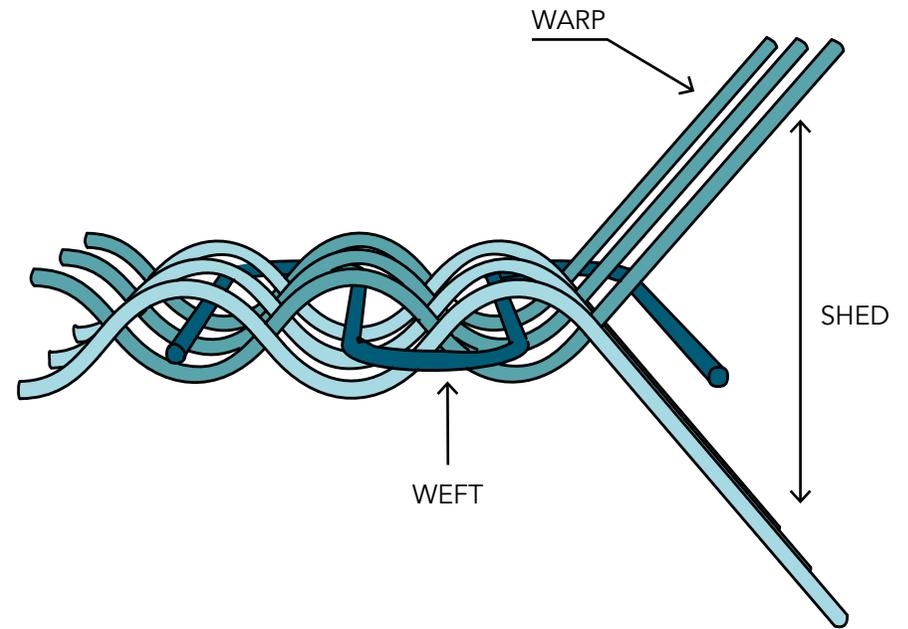
RESEARCH - PHASE 1

EXPLORING THE LOOM

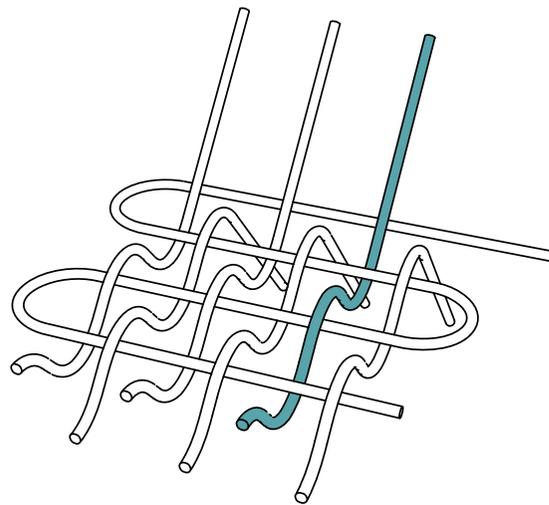
The first phase of my project was to understand the loom and what components that it is made of. And to understand the history of the loom and how the market looks today. This was essential in order to create a picture of what I'm going to focus on and so I don't have to re-invent the wheel all over again.

DEFINITION

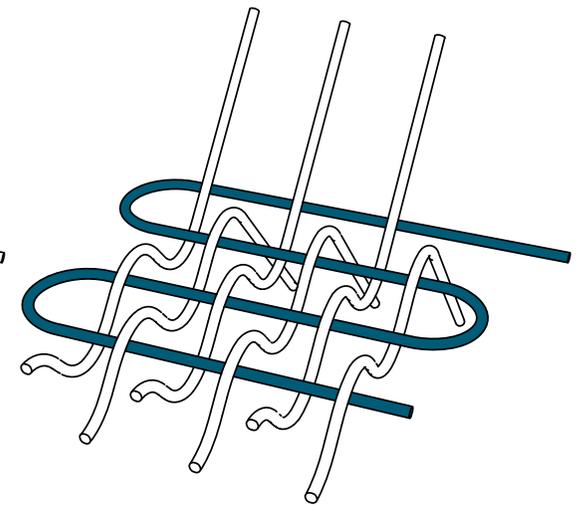
A weave consist of threads going in one direction (warp) and threads crossing the warp (weft). A loom is defined as having a mechanism that controls the separation of the warp, creating a shed so that the weft can pass through. This mechanism is most often referred to as a heddle. The heddle can be very advanced and control each thread separately or it can be as simple as a rod.



WARP



WARP



WEFT

THE WEAVE

The main function of the loom is to create a shed in which the weft threads can pass through. Depending on the order in which the warp and the weft is crossed, different types of weaves can be produced. The most common ones are the plain weave and the twill weave. These kinds of weaving techniques can produce a wide range of patterns.

PLAIN WEAVE:

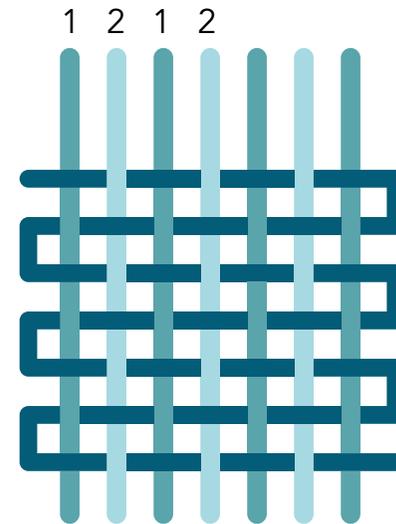
Plain weave is created by having the weft passing the warp, every other under and every other over. This is done by having a shed that lifts the warp-threads in a given order. If we call the warp-threads 1 and 2, then 1 goes down and 2 goes up and next turn they will do the opposite. In a standard floor loom a plain weave only requires two treadles (*the pedals that controls the shed*) but plain weave is also possible to do with a simple frame loom or similar.

TWILL WEAVE:

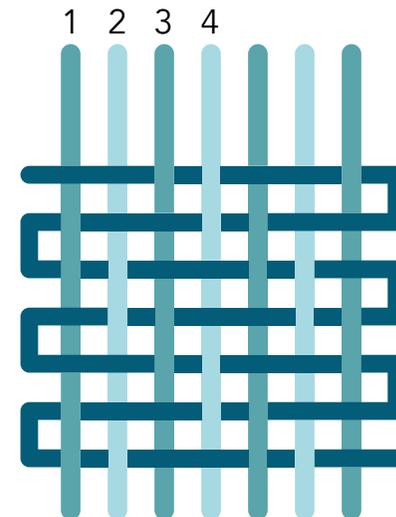
The twill weave is a bit more advanced than the plain weave but it follows the same principle. On a standard floor loom this type of weave requires four treadles. The twill weave gives a thicker fabric than the plain weave and it is most commonly used in jeans fabric. The twill weave creates diagonal lines in the fabric in the way it is constructed. Here the weft passes four different sets of threads, instead of the plain weaves two, we'll call them 1,2,3,4.

In the first turn, thread 1 and 2 goes down while 3 and 4 goes up, in the second turn, 1 and 4 goes up while 2 and 3 goes down. In the third turn, 1 and 2 goes up while 3 and 4 goes down and the final turn 1 and 4 goes down while 2 and 3 goes up and then it starts over.

This shows that the complexity of the weave increases in a linear curve depending on how many treadles you have to work with.



PLAIN WEAVE



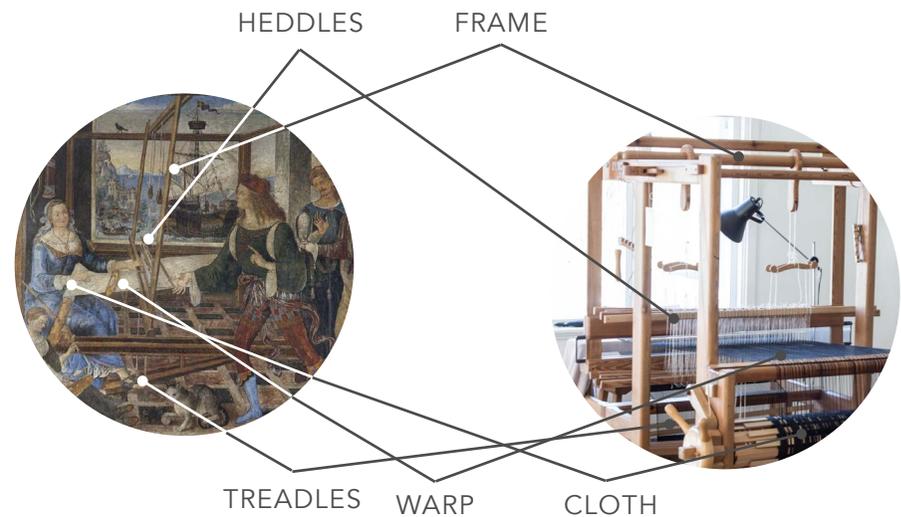
TWILL WEAVE

THE WEAVING HERITAGE

“What was originally a necessity became a way of showing who belonged to a particular social class, clan, ethnic group, village etc.” (*The techniques and art of weaving M. Brahic*).

Some claim that weaving is as old as 23.000 years old. Hemp, silk, wool and cotton are some of the materials that have been found in ancient textiles and we still use them today. From the 16th century and onwards looms became more complex. A loom could have up to 12 treadles (today we use up to 4) due to the demanding art of making damask weave (now produced in Jacquard looms). By the industrial revolution hand weaving declined due to automation and a greater need for industrially produced textiles. From being an occupation of status and pride, creating products by hand lost a lot of its worth. This lasted a bit into the 20th century. The hand weaving movement didn't get big again until the 1960-1970s. People at that time became more conscious about crafting and wanted to recover the old arts. When talking to weavers, they all agree that there is a new interest that hasn't been seen in several years, partly due to a consciousness around material and waste.

The loom has not developed much since the 16th century. It has become a bit smaller and has developed some new functions to ease parts of the weaving process as well as more ergonomic and faster to work on. Because the loom was developed such a long time ago and without having to deal with the issues we are faced with today such as shortage of space and time. Most of the looms today take up a large space, if not, they are very simple and can't do complex weaving. It is hard for the old classical looms to accommodate for the living situation of most young people, because of this, small and simple frame looms that don't require a special skill or place has emerged on the market. These small looms are mostly used to create tapestries and art but are not so suitable for doing fabrics for products such as blankets, curtains, or rugs.



Penelope with the Suitors
A fresco by Pintoricchio in
the 1500's

Floor loom at Glimåkra
loom museum.

INTEREST IN HAND WEAVING

1500



INDUSTRIAL REVOLUTION

1970



2010



MARKET

There is a wide range of looms on the market, each suited for a specific need, however most of them work by the same principle. The frame loom, the rigid heddle loom, the back-strap loom and the tapestry loom have a more simple construction. They don't have a mechanism that creates a shed, instead the user does this by hand. This limits these looms in efficiency but makes them easier to handle especially if you are new to weaving. The table loom, harness loom and floor loom are what you would refer to as classic looms. They are far more complex in their construction and require some experience to handle but when mastered they are a lot more time efficient to weave on.

SMALL LOOMS:

In the category of small looms there is a wide spread of complexity. As with all looms they are restricted by their size, meaning that they can only produce textiles that have the maximum width that of the loom. Resulting in them being used more as a tool for hobby activities than for real production.



SMALL LOOMS

PLUS AND MINUS

Easy to warp
Low threshold
takes little space
easy to move/take with you

Limits the size of the result
more time to weave
harder to make complex patterns
Some have a bad work angle

BIG LOOMS:

Most of the looms categorised as big looms have the same construction; a big and sturdy frame and a quite complex system for threading and weaving. With an exception for the tapestry loom, this loom is very simple in its construction. It has a frame where the warp is fastened but there are no beams to roll the warp upon, so the fabric is restricted to the size of the frame both in width and length. A tapestry loom is, as the name suggest, mostly used for tapestries, due to the lack of a complex heddle system. The classic loom, such as the floor loom comes in a lot of different variations, but they all have the same components. The most common ones have four heddle bars with which both plain and twill weave can be woven.

INDUSTRY LOOMS:

The Dobby and Jacquard looms are both industry looms. They are automated and produces big quantities of textiles. They work through punch cards that controls each thread separately making it possible to make very complex patterns. The system used in these kinds of looms is considered to be the first form of software.



BIG LOOMS

PLUS AND MINUS

- | | |
|-------------------------------|----------------------|
| Can make big textiles | Hard to warp |
| Easier to weave patters | High threshold |
| Faster to weave large amounts | Takes a lot of space |
| More ergonomic | Hard or not movable |

PROBLEMS

When searching online I came up with a lot of ads where people was giving away their old looms, partly because of lack of space but also because they inherited them from an old relative and did not know what to do with it. I also found that there where a lot of ads had been out for a long time even though they were for free.

To understand what the potential user group might want I reached out and did a short informal survey with questions regarding looms and weaving, to see what kind of interest there is in the craft as well as what problems people might have with it. (I got answers from 31 people). I could see that there was an interest in weaving but not with the kind of tools that are available today. A lot of people thought that there is too much preparation, and the weaving itself is so complex so that you have to put too much time in learning the basics before you can start to create something. When talking to crafters, I also found out that a lot of them would like to try weaving and would really be interested if there was a way to make it easier and more space efficient. When I asked what kind of products they would like to weave most answered rugs, blankets, fabrics and tapestries.

I took all the information from these discussions and went on to the next stage of my research phase.



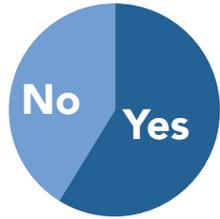
Vävstol bortskänkes

Säljes av: [REDACTED]

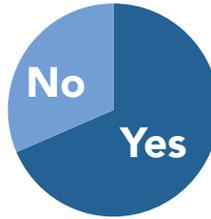
Vävstol bredd 150 cm bortskänkes mot nedmontering och bortförande. [REDACTED]
Finns i Västerås. [REDACTED]

Ad for a loom that is given away.

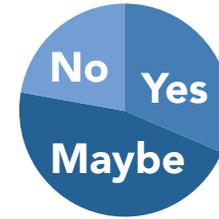
Have you tried weaving before?



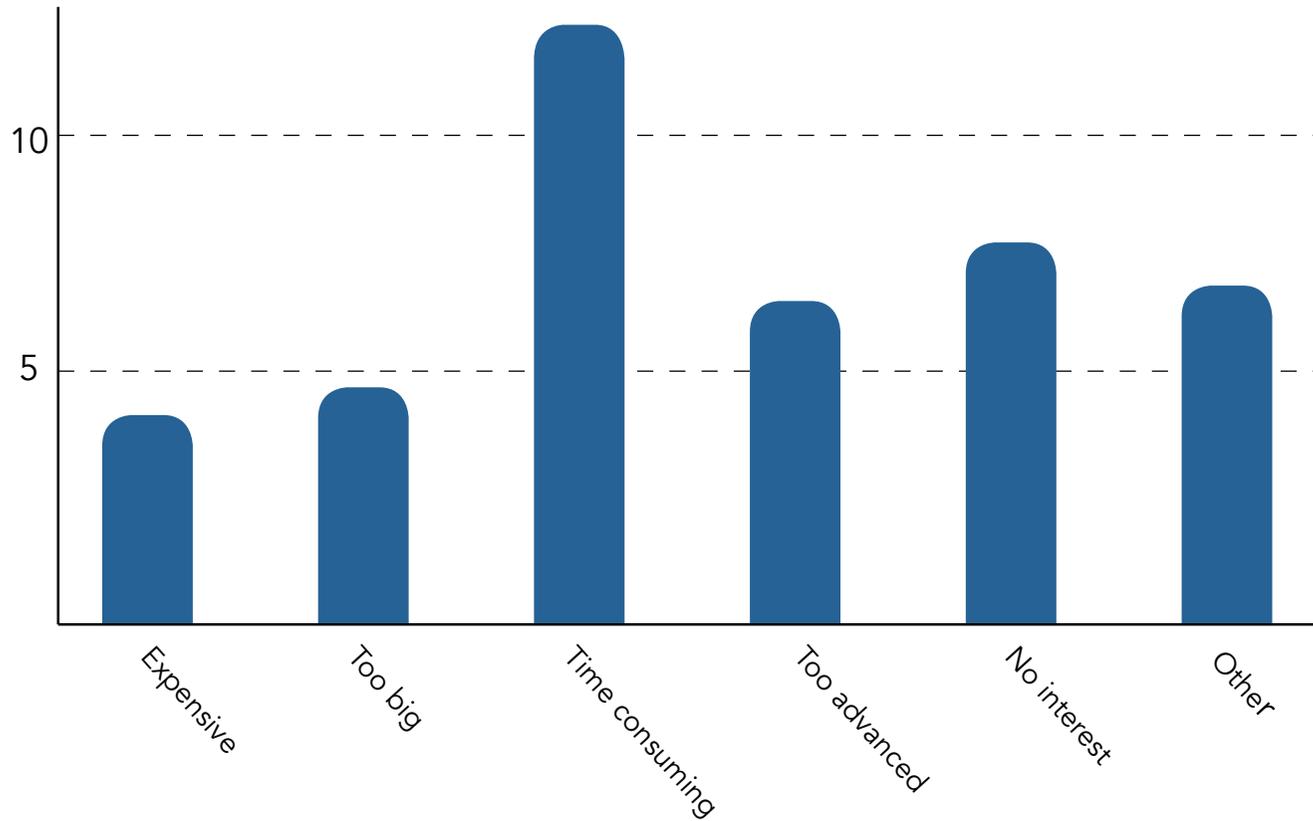
If you haven't would you like to?



Would you like to be able to weave at home?



What is keeping you from trying?



RESEARCH - PHASE 2

FINDING AN OPPORTUNITY

From the research that had been done I had to find an opportunity for me to work with. By talking to people about their experience with looms and what they feel are the key elements in weaving. I also had to break down the elements of the loom to find what the essential parts are and how they could be modified and from that information decide what is possible and what is not.

GLIMÅKRA WEAVING MUSEUM

The Museum opened in 1995 and is curated by a non-profit organisation. They have except from a big collection of looms and literature, courses, lectures and exhibitions covering weaving and textile art.

I went to Glimåkra weaving museum to talk to its intendant Lillemor. She has a lifetime of experience in weaving and is also leading weaving courses during the summers at the museum. The museum has over 20 looms and most of them are actively used today. Their biggest loom is 210 cm wide, but it is so big that it takes up half of the room. *"We are thinking of getting rid of it, nobody uses it really. The most common width that is used here are 100-150 cm"*

One of the most important aspects of weaving according to Lillemor is the social aspect, *"This is where you come to socialise and relax together while doing crafts"*. Also to help each other with problems that might come up during the weaving. The weaving community is very strong and there are a lot of forums where you can get help from others that have more experience. Lillemor said that a weaving house is the only possibility for many to weave together because you can't take a loom with you and there is no room to have several looms at home, and the smaller looms can't produce the nice and big pieces that you want, like a rug or a plaid. She states that the complexity of the loom is not as important; *"We do damask and satin sometimes, but not often, and then it's the most experienced weavers that do it. The most common looms are the ones with four treadles, with a four treadle loom you can create most of the common patterns."*



ALICE BJÖRKMAN, WEAVING HOUSE

To get some more real life experience in weaving I visited Alice Björkman, She has a neighborhood weaving house in Lund. Together they have seven looms that are used frequently. Some are brought from their old homes and some are donated from people that just don't have the space anymore.

We went through the loom and how everything is connected and I got to try and weave a piece of a rag-rug from a warp that was already set up to weave in. To my surprise the actual weaving was not as smooth as I had thought, it was really hard to keep track of which order you had to step on the treadles. It was really easy to lose count of where you were if you lifted the foot from the treadles. There was also much more physical work than I was expecting. The beater was heavy and it took quite much force to beat the fabric as well as pushing down the treadles. Though it is a lot easier with a loom that creates a shed where you can slide through the weft. Overall it was an interesting experience and I got a lot of good information to consider in the following research.



INTERVIEW WITH STUDIO BRIEDITIS & EVANS

Studio Brieditis & Evans is a design studio that are focusing on the concept of re-use. In particular the re-using of textiles. Their project Re, rag rug has been very appreciated and exhibited worldwide. It's a project where they have created rugs, one per month for a year, each with its own technique, resulting in twelve unique and up-cycled rugs. The studio consists of Katarina Evans and Katarina Brieditis, both with a background in textiles.

I wanted to meet up with them because they have a very unique way of looking at textiles and the making of them as well as a first hand experience in how the textile industry works and the problems of being your own manufacturer.

We started the interview with talking about the textile industry and problems with being your own manufacturer. There is always a struggle between time and money. If something is crafted, the price it sells for usually can't reflect how much time is spent on it. If time consuming things like preparation etc. are lowered, it's also going to affect the profit of a product.

Being your own producer is however positive in so many ways, for example Evans and Brieditis argue for the environmental aspect of small scale production. The bigger the industry is the more trash is produced. With local production and especially when you recycle and even up-cycle old textiles as studio Brieditis & Evans do there are little or no waste.

They, as many others I have talked to, see that the interest for weaving is on its way up and there is a strong potential target-group for a new product on the market. The loom is versatile but you are constricted by the size and have boundaries of what's possible and what's not. Space is definitely one of the biggest challenges with the loom. Both that it is not that often you can have it in an apartment and also that it is, in contrast to knitting or sewing, very stationary.



USER GROUP INTERVIEWS

This group of craft-interested people meet up approximately one day a week to craft together, exchange experience and enjoy each others company. I got to sit with them to see what thoughts they had around weaving, if they would be interested in it and what features and aspects they find important with crafting. The group consist of Elin Anderson - 27 years old with a bachelor in industrial design, John Elf - 27 years old entrepreneur, Ebba Gröndal 26 years old engineering student, Hugo Barcelona 25 years old architectural student, Cajsa-Lisa Ivarsson 27 years old engineering student and Douglas Eurenus 24 years old student.

We talked a lot about working together, sharing a common interest, helping each other and inspiring each other into trying out new things. *"The social aspect of crafting together is very important"* said Ebba.

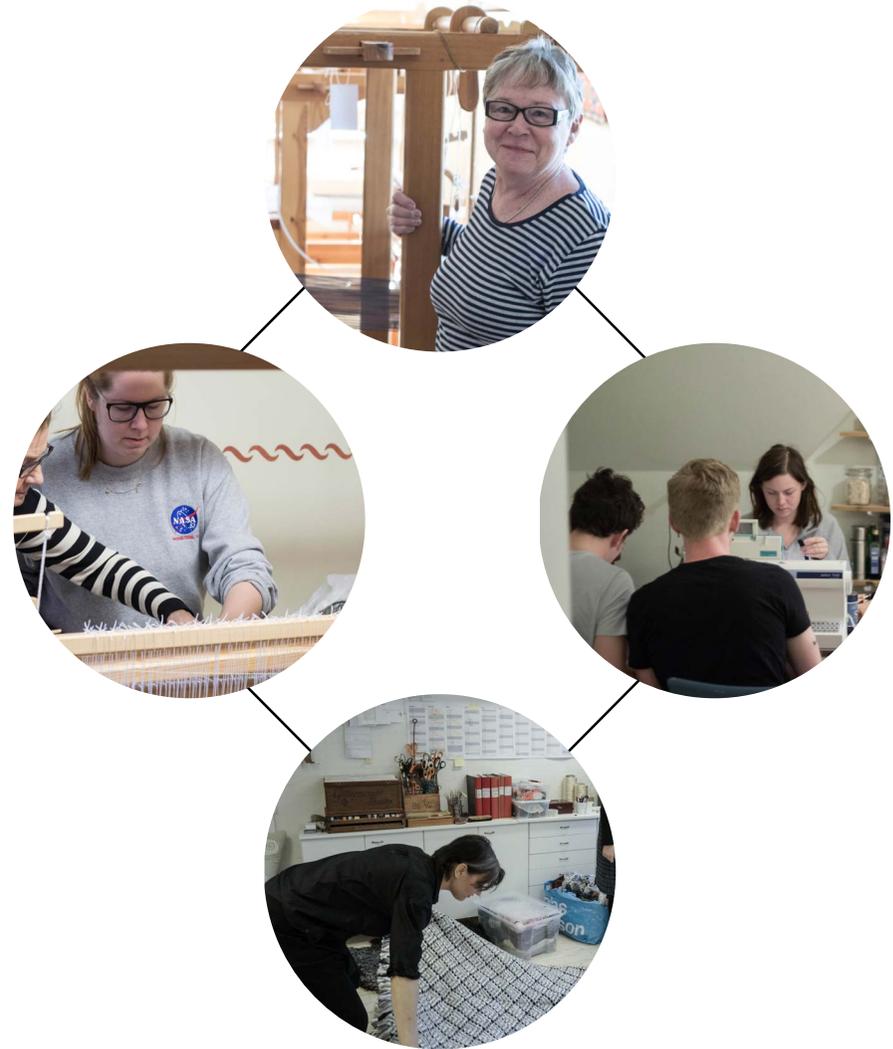
Most of them agree on that it would be fun trying to weave, 4 out of 6 said that they would like to weave at home, however most didn't know where to start and how to get into contact with someone who knew how to weave. *"I would like to try weaving, but I don't really know how or have the time to get to a weaving house and my apartment is way too small for a loom"* said Elin. Most agreed on that the most important qualities of a loom would be portability and to be able to store it when it's not used. Size was also agreed to be important, that it would be possible to have a loom even if you live in a small apartment. *"I would have it in a corner or on my study desk, but I would like it to feel like a furniture that matches everything else and not like the old ones that feels very folk art style"* said John.



CONCLUSIONS FROM INTERVIEWS

The key aspects I took away from my meetings are that the community is very important, weaving is a social activity and the need for being able to weave together is something that is important to accommodate. Another aspect that is important is that the loom should be easy to use but should still be able to create high quality results. With current looms it seems like you have to choose; Either you have a small sized loom that is easy to use but you are limited in the size of the product, or you have a big complex loom that can produce almost anything (but then there is a high threshold to being able to use it). Can I find the golden middle way? And what users am I targeting?

- **The social aspect and community is very important**
- **Have to balance easy learning with high quality result**
- **Must be easy to use and not have too much preparation time**
- **Possible to experiment and create your own expression**



INPUTS FROM INTERVIEWS

/ I WOULD LIKE TO BRING IT WITH ME /

/ THE SOCIAL ASPECT OF WEAVING IS IMPORTANT /

/ THE SMALL LOOMS WE USE MOSTLY FOR THE KIDS, YOU CAN'T WEAVE ANYTHING USEFUL ON THEM. /

/ RESTRICTED TO A LARGE SPACE OR A WEAVING HOUSE /

/ I WOULD WANT TO DO LARGE THINGS SUCH AS BLANKETS AND CARPETS /

/ MOST COMMON TO WEAVE ON A FOUR TREADLE FLOOR LOOM. MORE TREADLES IS ADVANCED TO USE IF YOU ARE A BEGINNER /

/ IT FEELS SO COMPLICATED TO USE /

/ THE COMMUNITY IS STRONG AND GIVES A LOT OF SUPPORT /

/ THE KEY IS TO FIND A GOLDEN MIDDLE WAY BETWEEN THE TIME SPENT ON PREPARATIONS AND THE WEAVING ITSELF /

/ FRAME LOOMS ARE EASIER TO USE BUT THEY TAKE MUCH MORE TIME TO WEAVE ON /

/ PROBLEM WITH NOT BEING ABLE TO PUT IT AWAY /

RELATION OF VALUES

To be able to see connections between the existing solutions on the market I had to sort them into different categories where each has a relevance for what qualities a loom possesses and what type of market it's for.

EFFICIENCY OF WEAVING:

The more complex a loom is the more efficient it is to weave on (to a certain point). For the weaving to be efficient, a shed must be created, lifting the warp in a desired order. To create a shed, a weaver uses the heddles. The rule is, the more complex pattern, the more layers of heddles (and treadles). On a rigid heddle loom, the heddles are set to a pattern and can't be re-arranged. If one would want to do a more complex pattern on a rigid heddle loom they have to pick the threads by hand to create the desired pattern. On a floor loom, the heddles are separated and connected to heddle beams that in their turn are maneuvered by the treadles. When pushing down a treadle a heddle beam will rise, creating a shed from the threads that are connected to that specific beam. Having heddles that can be arranged as one desires is the foundation for being effective in one's weaving.

REQUIRED SKILL LEVEL:

Mostly in weaving, it is not only the weaving itself that takes time and requires experience, but also the preparation. If anything is done wrong with the threading of a loom the whole weave will be affected. Threading the heddles is a work of precision and takes a lot of time. In most cases, the easier it is to thread a loom, the longer time or more inefficient it is to

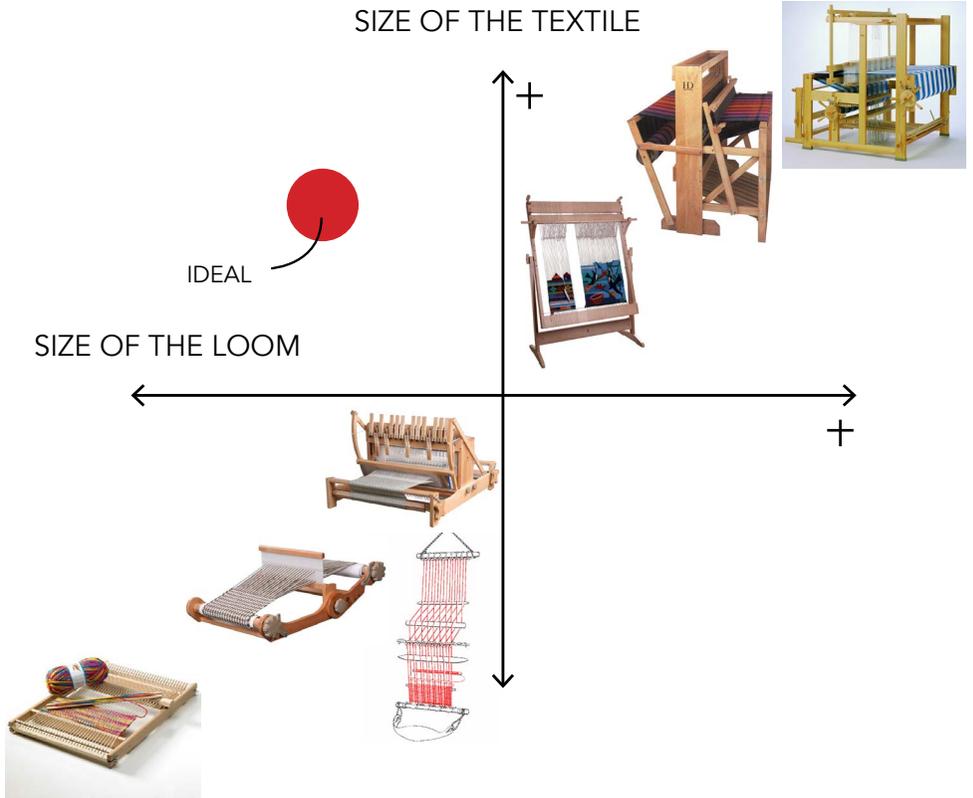
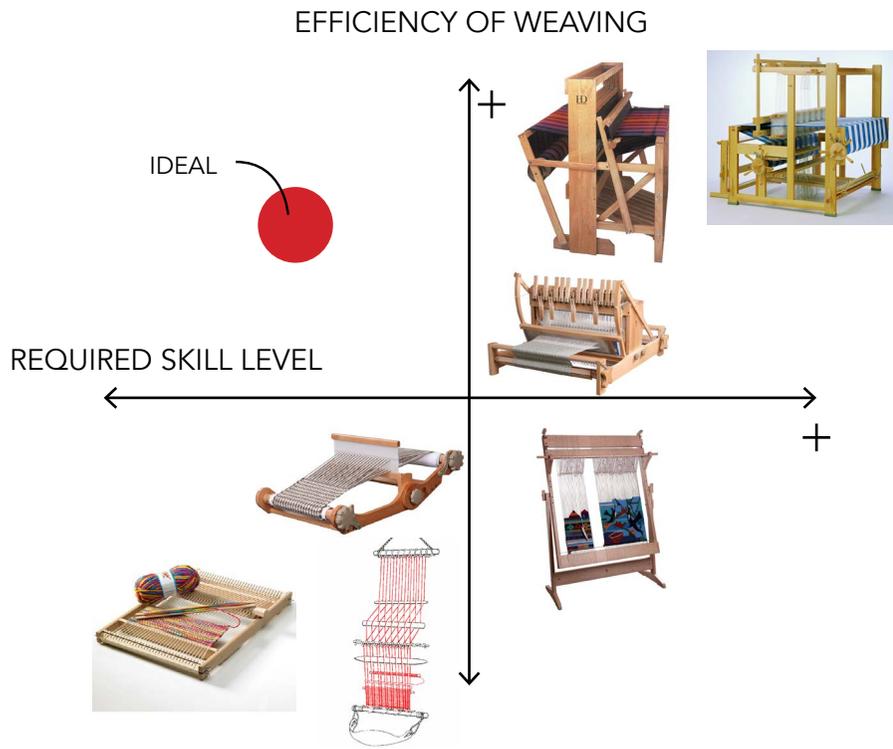
weave on it and vice versa.

SIZE OF THE LOOM:

The width of a loom is in direct relation to the width of the produced fabric. However, the more complex a loom gets, the bigger construction is needed to support the mechanism. Smaller looms with simpler heddle solutions, such as the rigid heddle looms or using a shed-stick, makes the construction simple and therefore smaller. The problem with a shed stick or rigid heddles is that it also acts as the beater and for it to be manageable and not too heavy they are restricted to smaller sized looms.

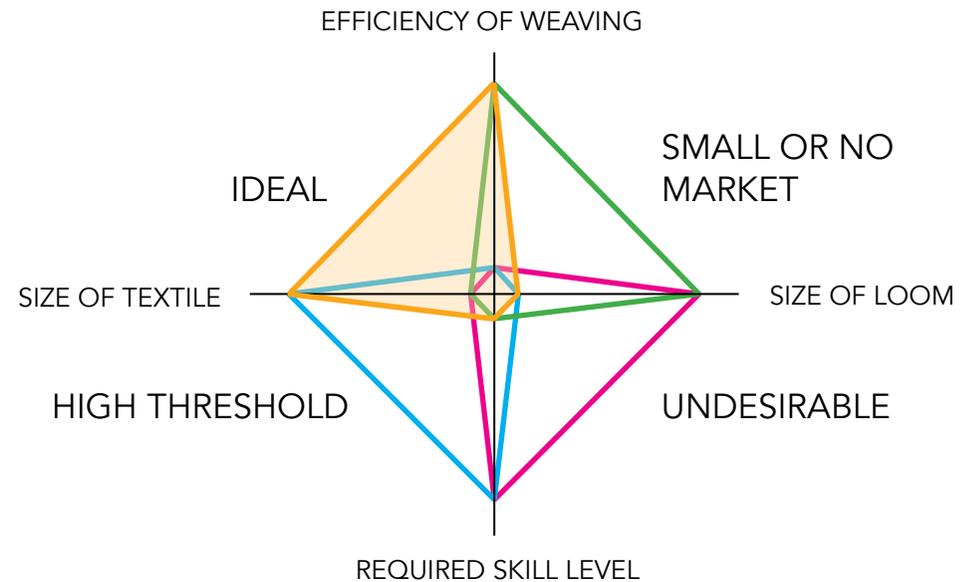
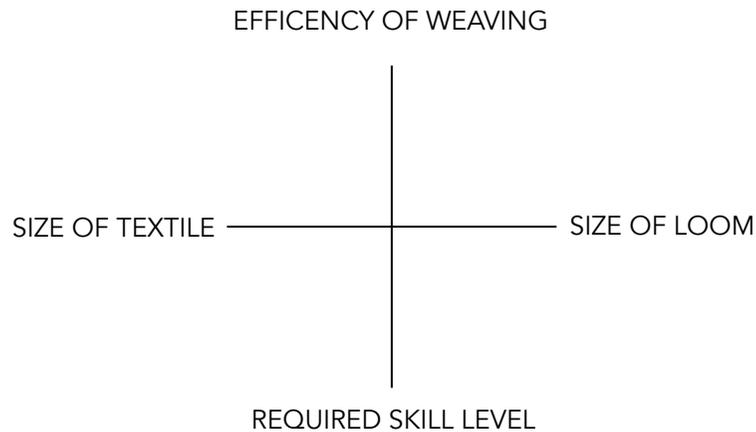
SIZE OF THE TEXTILE:

The textile can only be as wide as the loom allows. To create a fabric that has a width of one meter, the loom must be at least 120 cm wide. In looms that have a cloth and warp beam, the fabric can be as long as you like (almost) and it is possible to create several pieces in one warp.

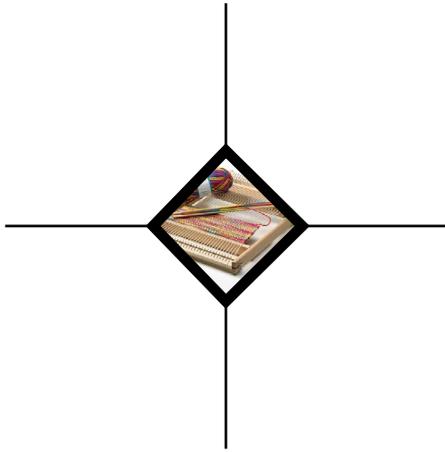


HOW CAN I USE THIS INFORMATION?

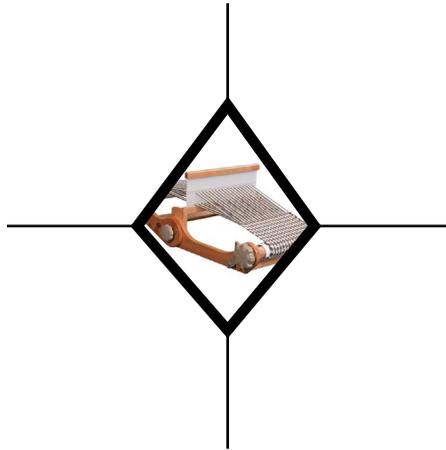
With most looms, as we can see on the diagrams on page 29, the vertical and horizontal values are interrelated. The size of the loom and the size of the textile has a linear relation, just as the required skill level and how efficient it is to weave on the loom. To get to an ideal state this balance must be disrupted. If I distribute the categories into four axes onto a spider diagram we can then see patterns of different desirabilities depending on which values a loom has. To have a loom that is easy to learn but at the same time efficient to weave on, and can create big textiles without being big in its construction, would be an ideal loom. However it would not be realistic to have a totally ideal state due to some parts that have to take up space and that there is still a threshold for learning how to weave.



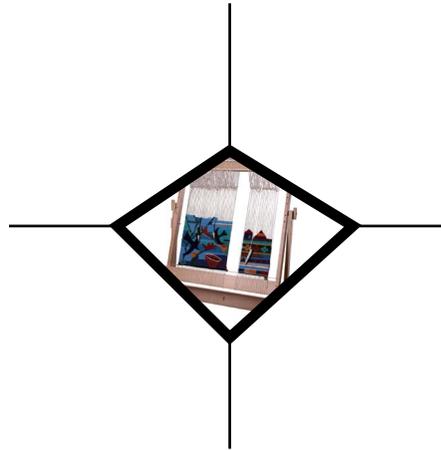
FRAME LOOM



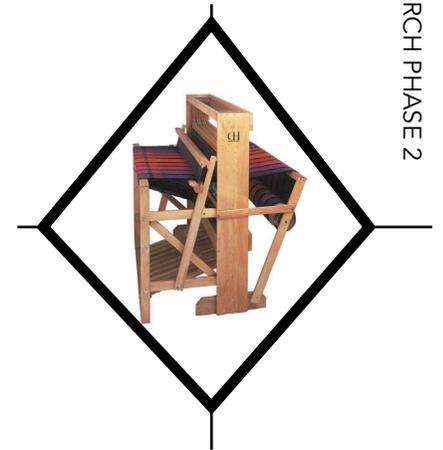
RIGID HEDDLE LOOM



TAPESTRY LOOM



HARNESS LOOM



BACKSTRAP LOOM

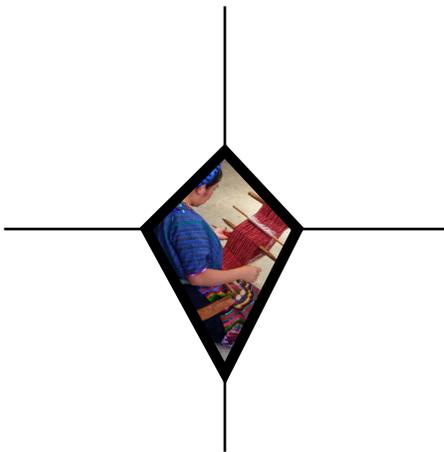
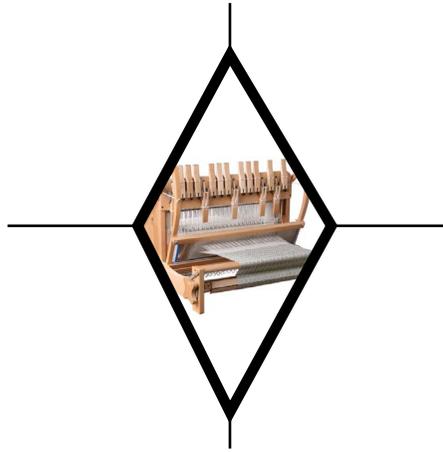


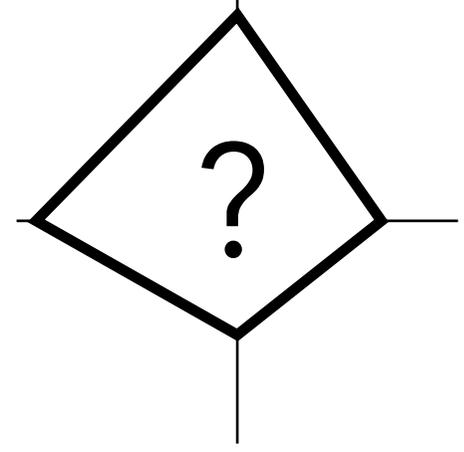
TABLE LOOM

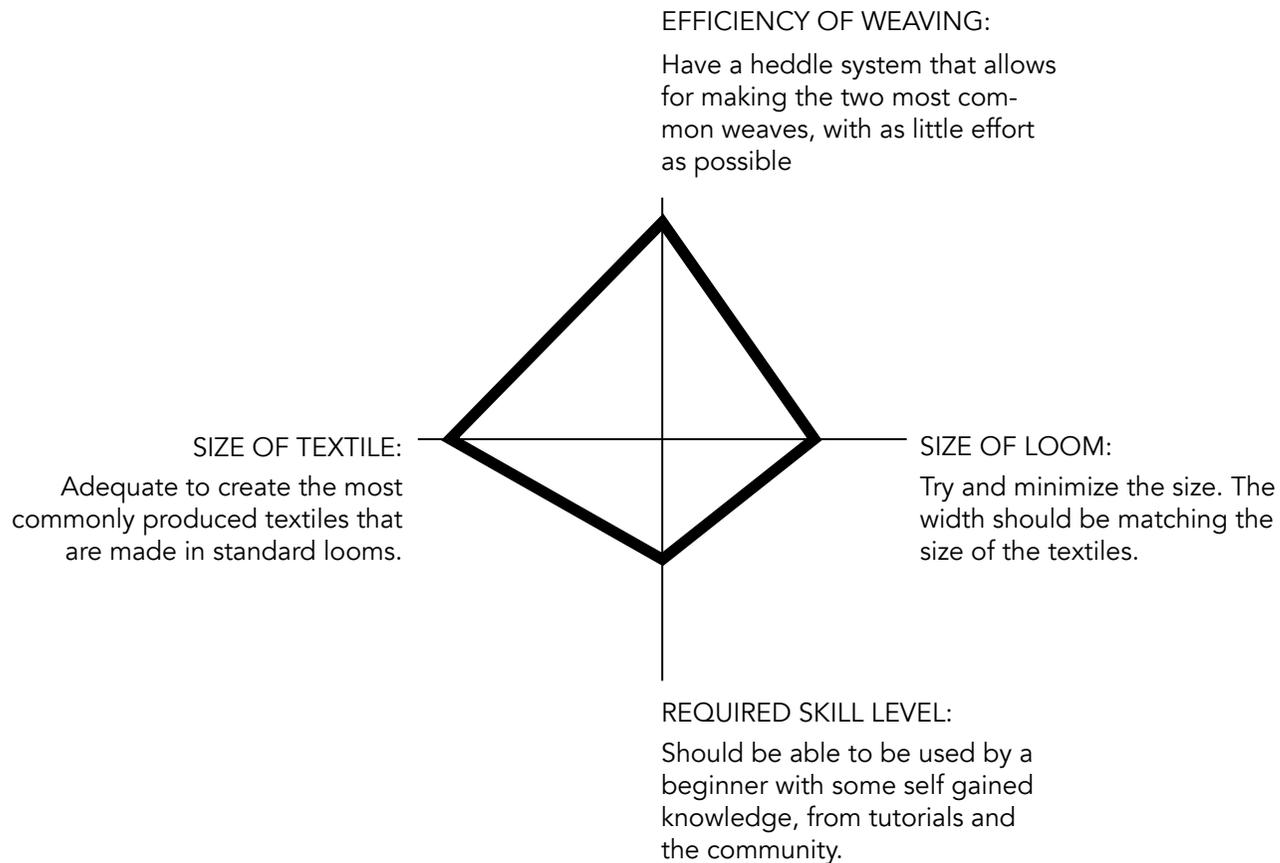


FLOOR LOOM



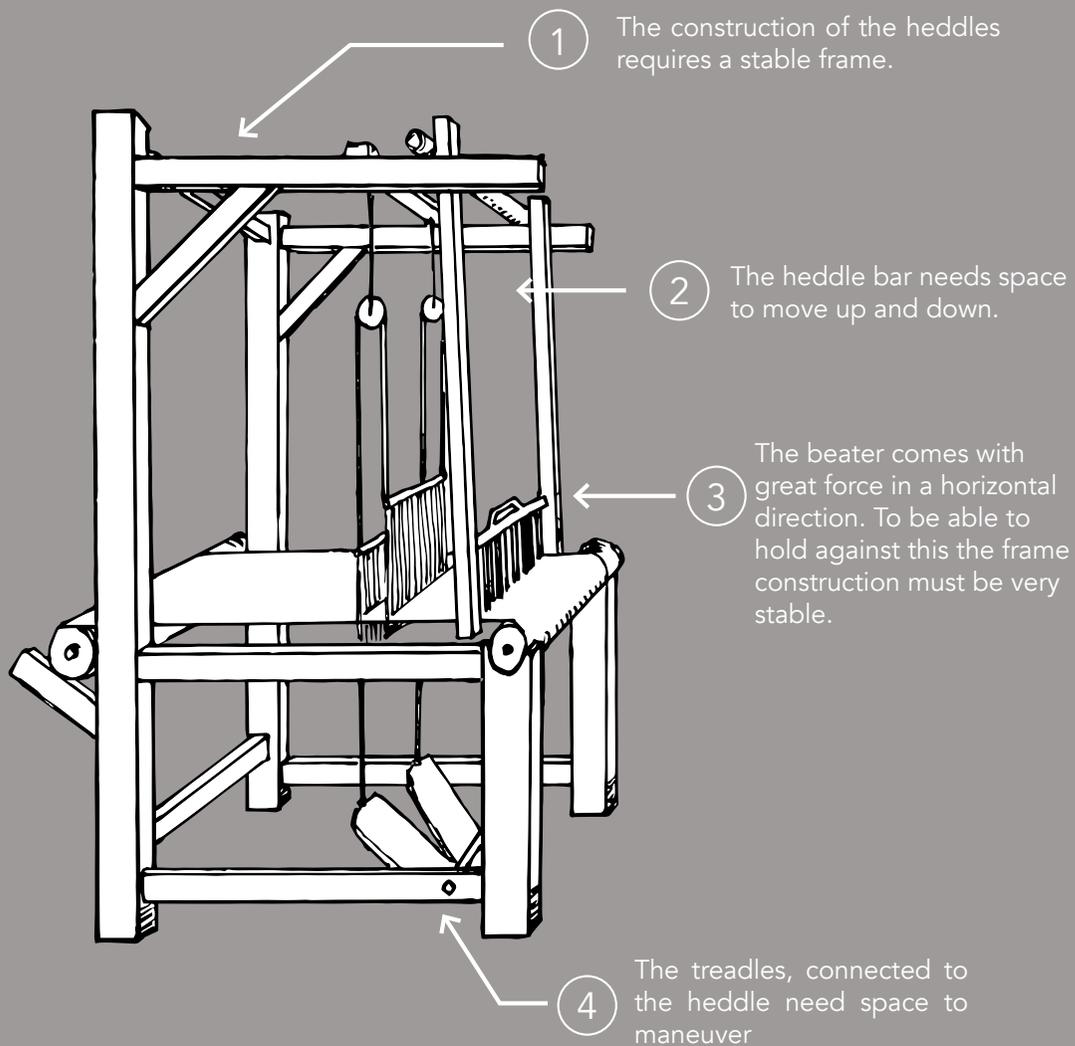
MY OPPERTUNITY



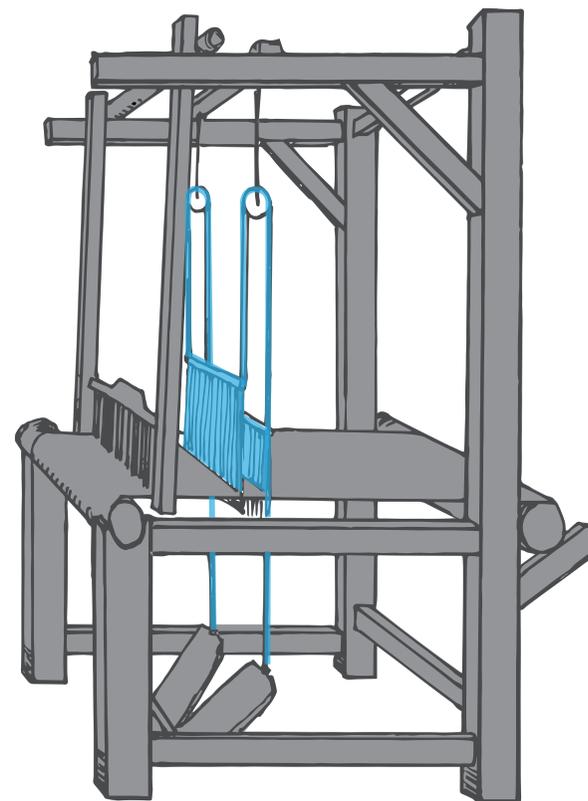


How can I minimize the size of the loom without compromising the size of the textile by creating a loom that has a high efficiency without having a high threshold?

WHAT MAKES THE LOOM SO BIG?



The heddles are the key in making a loom smaller, they are controlling the size of the loom in their construction. If I could create a different way of making a shed, maybe I could make the loom smaller.



EXISTING HEDDLES

The wire heddle is the most common existing heddle and are used for standard floor looms. Each thread in the warp is threaded through one loop of the wire. After that, depending on how many treadles the loom has, the weaver can control the wires by connecting them to the heddle beams in a order mapped out by the pattern that the weaver is going to use. There are some other solutions for heddle systems on the market. All of them are based on the principle of the rigid heddle. They have two positions for the warp threads, restricted to a set pattern of a plain weave. They are also designed so that the heddles act as a beater, which means that the user has to be able to lift the heddle and beat the weave with it over and over again. For these solutions to work on a bigger loom they would have to have a separate beater to not give the user any work injuries. There are ways to create more complex pattern with the rigid heddle loom, although you would

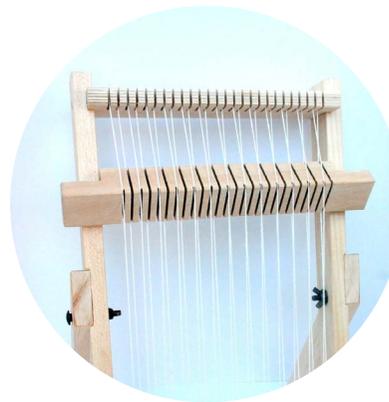
have to combine a couple of them, as using one would still be restricted to plain weave. You have to have four separate rigid heddle bars to do a twill weave and because the holes are set in a position, the weaver still becomes restricted to very few pattern alternatives. With four different heddle bars the rigid heddle becomes as much work to thread as the string heddles, not giving it any advantages. The rolling heddle bar works in the same way as with a rigid heddle, the only difference is that instead of moving the heddle up and down the weaver rolls it back and forth creating different sheds. This method is one of the easiest ways of making a shed but it is also very restricted to the two positions the rolling heddle can have.

Can make any type of weave

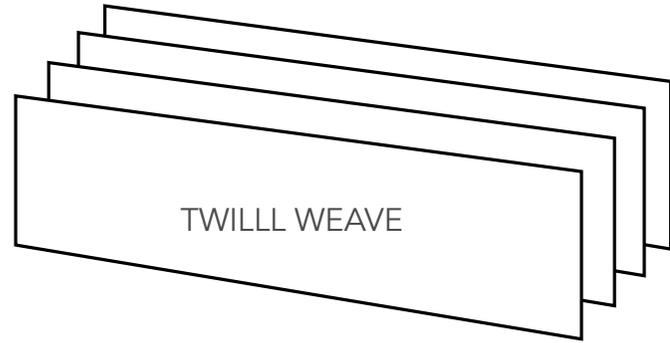
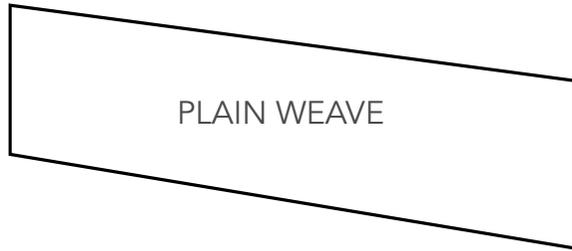


WIRE HEDDLE

Are designed for making plain weave



ROLLING HEDDLES



BRINKLEY HEDDLE



RIGID HEDDLE

CONCLUSIONS

AREAS TO FOCUS ON

The heddles control the size of the loom as well as the complexity and efficiency of the weaving. Simple heddles, such as rigid heddles, creates small and easy looms while advanced heddle systems, such as the ones on a floor loom, creates big and complex looms. There is no loom on the market that is small in size but that can still produce big textiles with the complexity of a four treadle loom.

Could I take the best parts from these two systems and make a new one? One that will facilitate the simplicity of the rigid heddles and the possibility of variations from the thread heddles? If I can come up with a way to make the heddles easier/smaller, the loom could keep its complexity but be scaled down in size.

HEDDLES/BEATER:

The heddles and the beater are kind of interrelated. They are both a essential part of the loom to keep the threads separated. On floor looms they are the biggest contributing factor to the looms size. To enable leverage for the beater and heddle, the construction of the loom must be big and robust. The beater is a quite easy construction but the heddles has a very advanced system that allows the warp to be lifted in patterns with each thread going through a separate hole in the heddles.

JOINTS:

The joints of a loom are the parts that are most affected by the forces produced during weaving. Some joints have to have moving parts and at the same time stand the great forces that can come with beating the fabric or keeping the warp tense. Their main function is to withstand the forces and keep everything stable and connected.

FRAME:

The frame has the function of both keeping all the parts in place and also keep the loom stable and counteract the forces that are in movement while weaving. In simple looms such as a frame loom, there are no advanced heddle or beater systems that require height or leverage, nor is there any strong forces affecting the frame making it possible to have a sleek and minimalistic construction.

BEAMS:

There are three types of beams normally on a loom, the first two being a warp and cloth beam which has basically the same function and construction; To roll up the finished cloth of the warp. These two beams must have a mechanism that allows them to roll, but also to lock. The beams are made so that you have free movement in only one direction while a locking mechanism that stops in the other, this allows the beams to stretch out the warp and keep it tense. The third beam is the breast beam. It is basically a mark for where you should start the weave and is an additional tool to stretch the warp to keep it tight. This beam does not move and is fastened to the frame.

FUNCTIONAL ANALYSIS

OVER ALL FUNCTIONS

Class	Function		Area	Value of importance *
HF	Create	Shed	Heddles	10
N	Make	Warp rise in desired order	Heddles	9
N	Enable	To press the weft tight	Beater	9
N	Prevent	Warp from loosing tension	Beams	9
N	Support	Weight of parts and forces	Frame	9
N	Be	Stable	Frame	9
N	Enable	Fabric to be rolled up	Beams	8
N	Be	Easy to thread	Heddles	8
N	Accommodate	Grip in moving parts	Beams	7
N	Be	Light weight	All	7
N	Be	Easy to mount/assemble	Joints	6
D	Emit	Simplicity	All	5
D	Allow	For changing of weave	Frame	5
D	Be	Portable	All	5
D	Be	Collapse	Joints	4
D	Facilitate	Warping feature	Frame	3

HEDDLE FUNCTIONS

Class	Function		Value of importance
HF	Create	Shed	10
N	Make	Warp rise in desired order	9
N	Enable	Diversity	8
N	Be	Easy to thread	8
D	Be	Intuitive to use	8
	Be	Light weight	7
	Have	Clear visual directions	7
	Have	Aesthetic values	5

HF - Head function: value of 10

N - Necessary: value of 9-6

D - Desirable: value 5 and under

*From interviews with expert weavers

IDEATION

CREATING SOLUTIONS

In order to create something simple, I chose to look back at the earliest looms and how they worked. To see what I could learn from them and what advantages they had. If I could take away all but the necessities and then add functions that are valid for the solution. Then, I could become more innovative when I don't compare with the solutions of today, but rather looking at the functions of the loom as something to be solved.

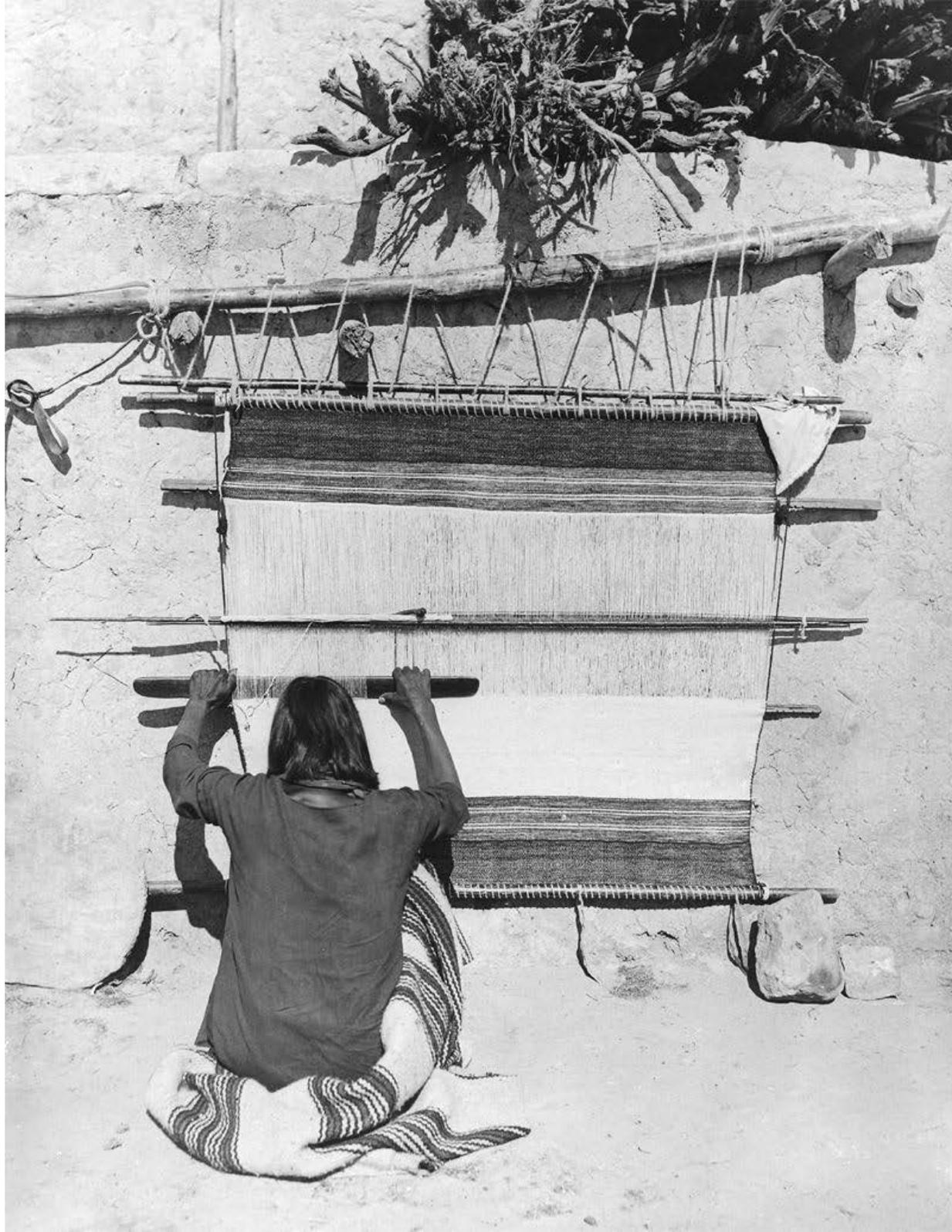
INSPIRATION

This was my inspiration picture, the fantastic Navajo loom. These looms have a very simple construction. They are not as efficient to weave on as the modern looms of today but could still create beautiful and complex patterns in the fabric. The loom uses gravity to keep tension in the warp and the construction makes it possible to do your own loom with material found anywhere in the nature such as sticks and stones. Because it's vertical, it doesn't take up as much space as a floor loom, if you would have it in a room for example. And it is possible to have it very wide without it being deeper.

Would it be possible to do a vertical loom that have the components of a floor loom? To be able to make the loom compact, I would have to create a new kind of heddle system, and if I can keep the system independent from the frame, so that it could fit any frame, then I will have more freedom to make a loom in any format.

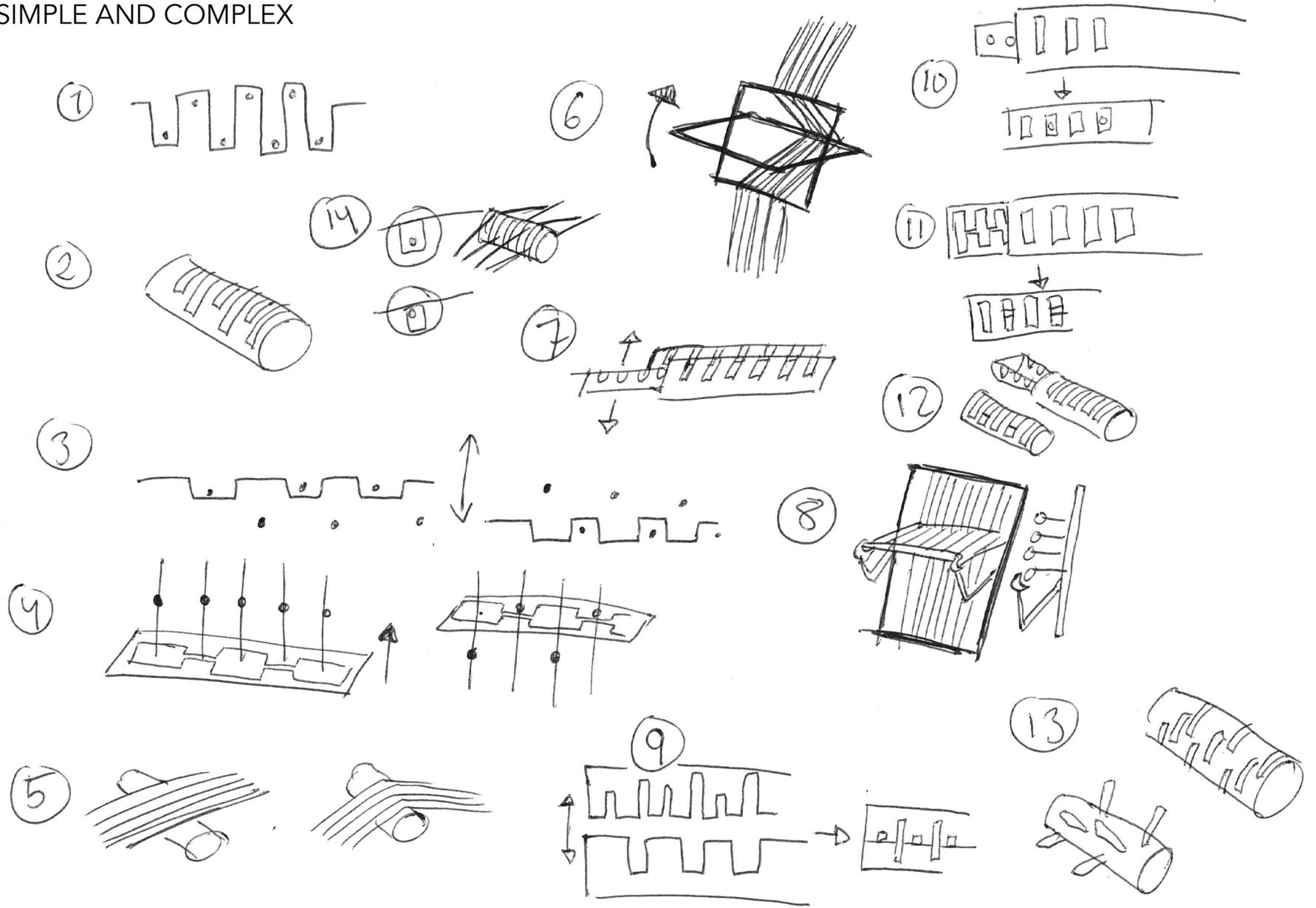
BRIEF 2.0

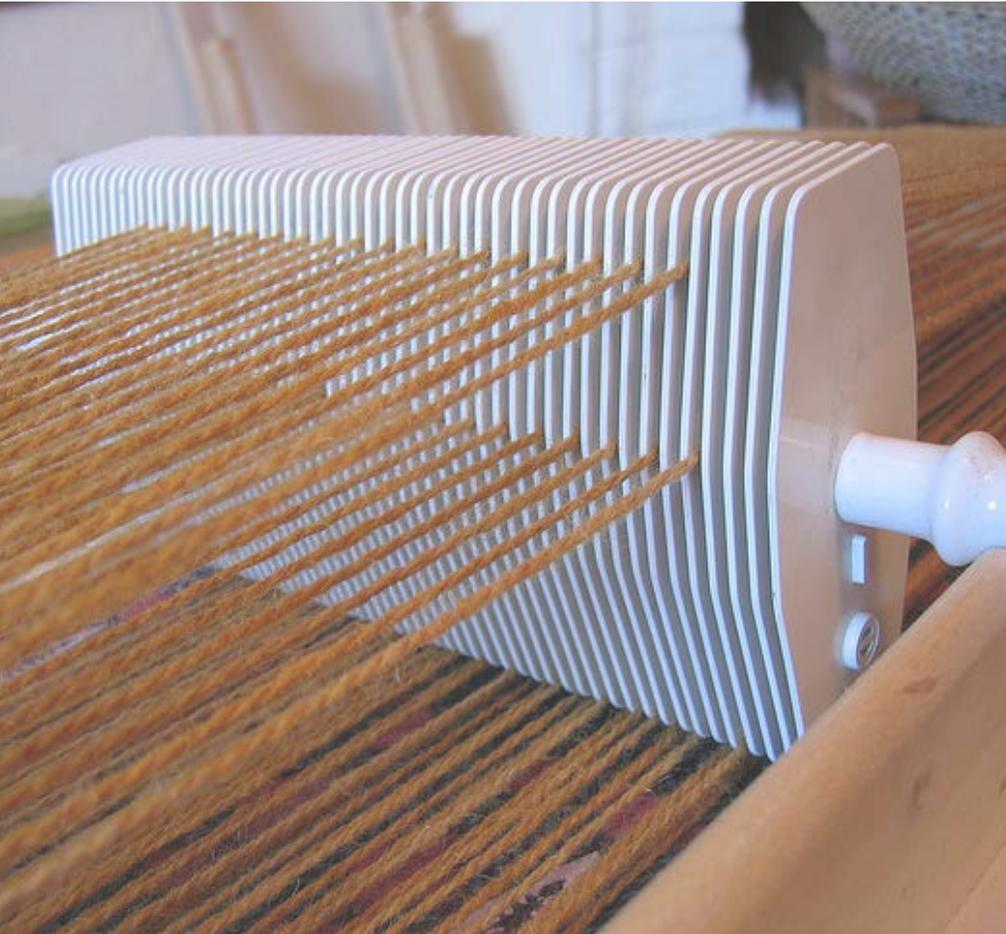
Create a new kind of heddle system to be able to minimize the size of the loom. Enabling people to have it in their apartment as well as bring it with them to others and/or having several in a small area.



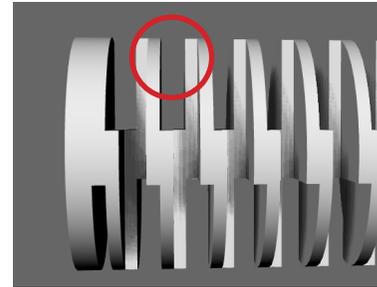
HEDDLE

SIMPLE AND COMPLEX



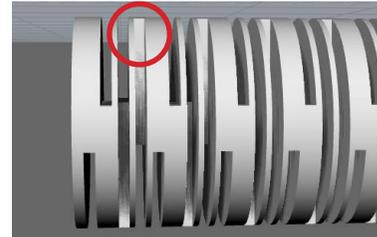


In my ideation I got inspired by the Brinkley heddle, shown in the picture above. I asked myself; what if it was possible to use that same technique, but instead of just having two positions, make it go all the way around and in that way make it possible to create more patterns.



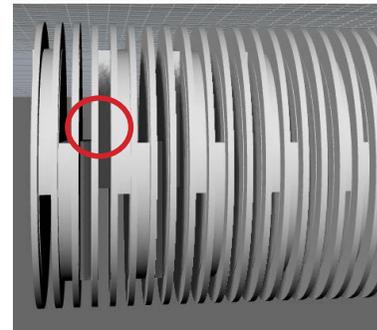
VERSION 1.0

No separation of the warp, risk for twisting and friction between warp threads.



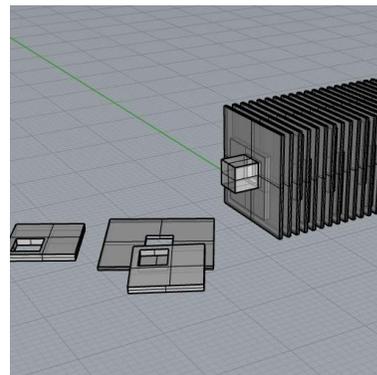
VERSION 2.0

Nothing to keep the warp in place when it is in the highest position, risk that it slides into another cut or twisting.



VERSION 3.0

Very complex to make in one piece, it could be too fragile at the long thin sections of the dividing part, if it breaks, you have to replace the whole rod.

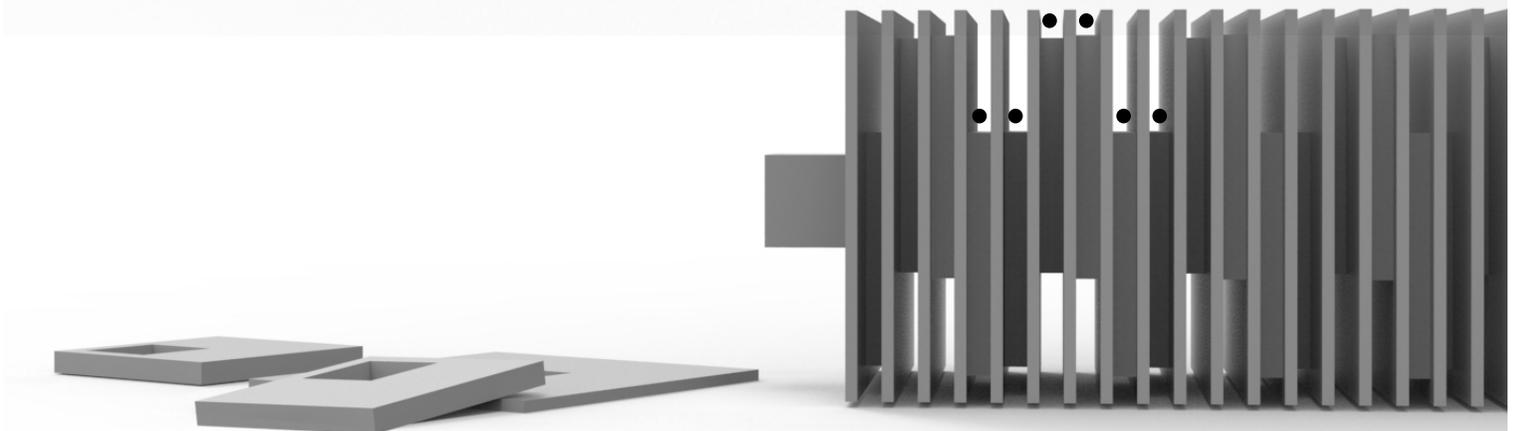
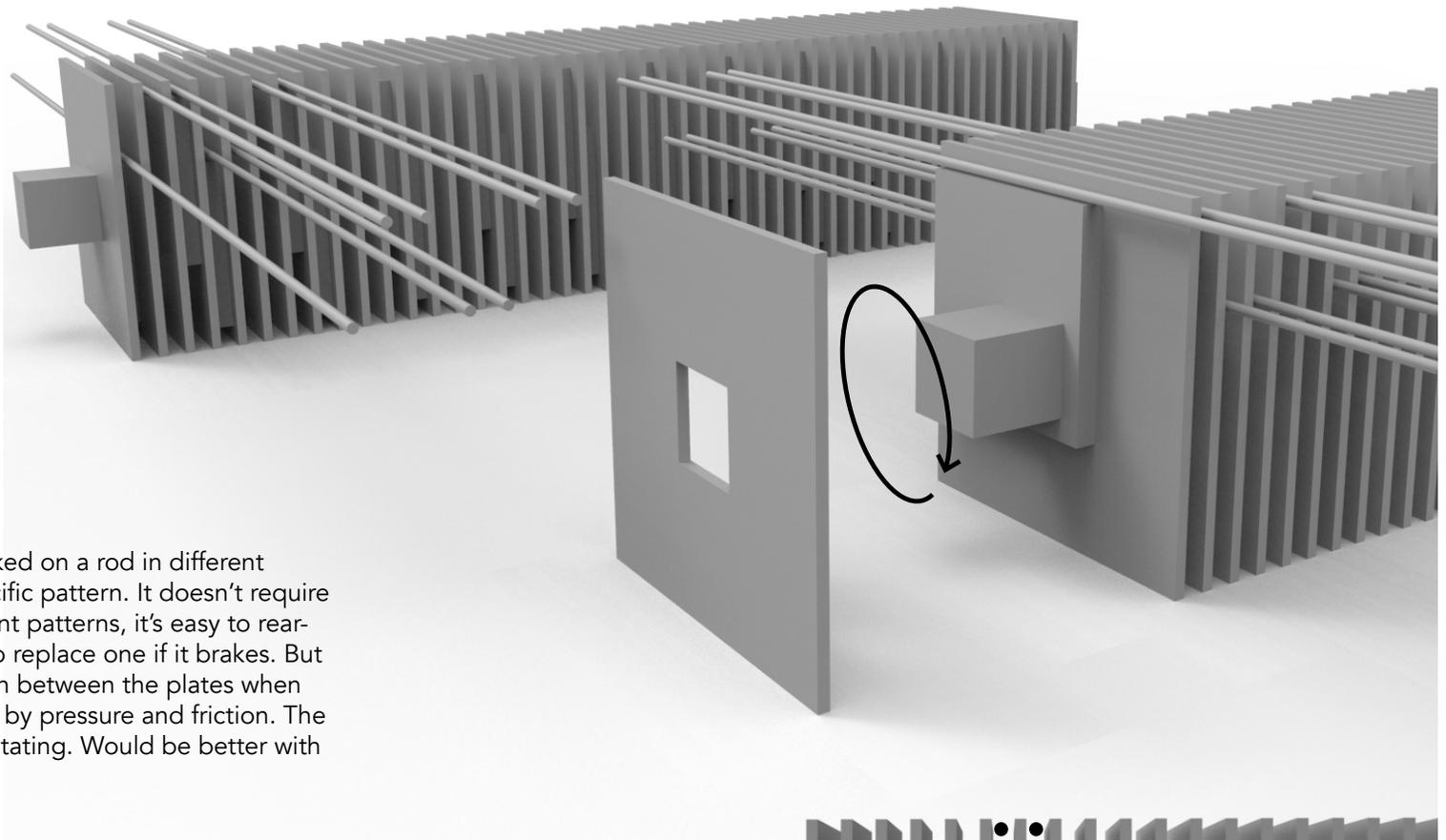


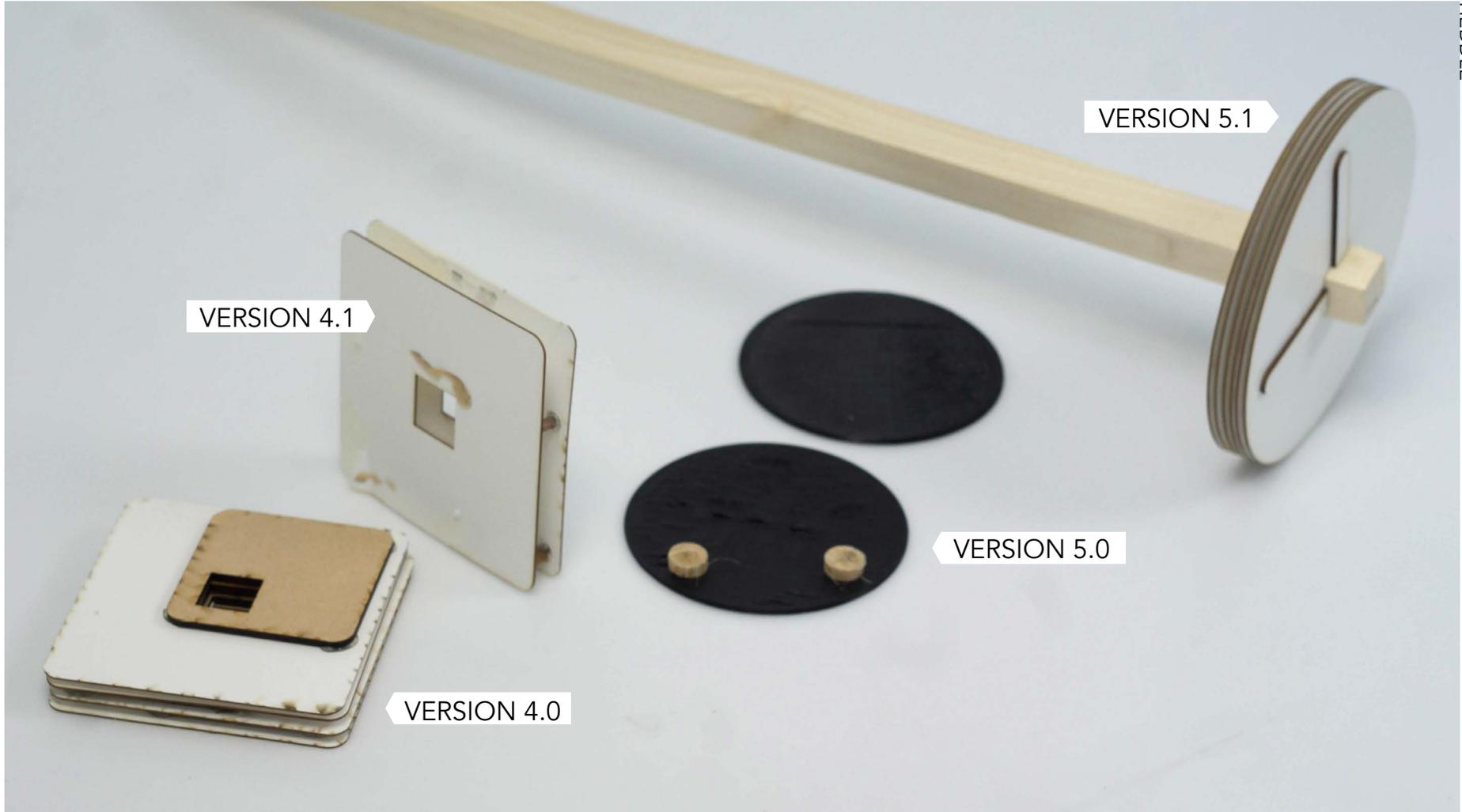
VERSION 4.0

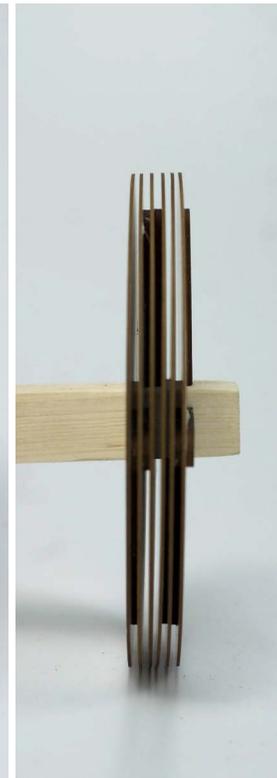
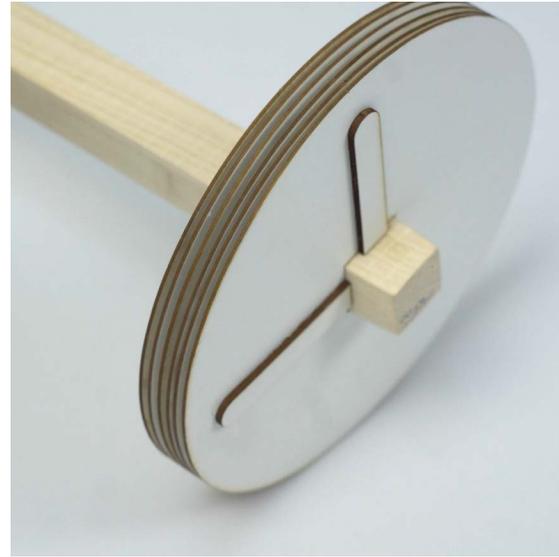
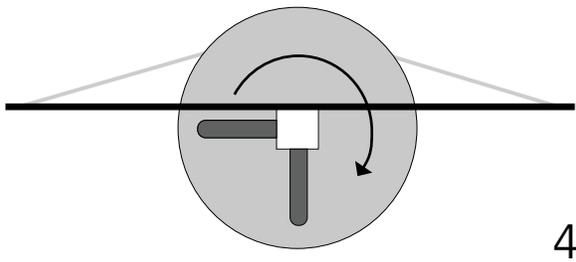
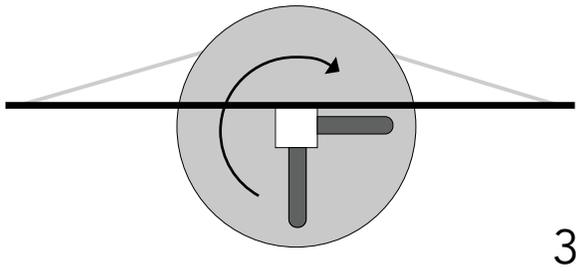
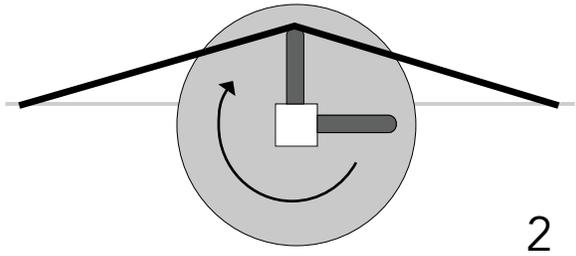
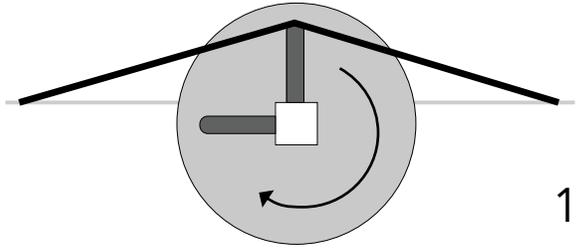
Thin plates are placed in between each thread plate so that the thread can't slide over to another groove. To create different sheds when the rod is rotated,

VERSION 4.0

Loose plates that are stacked on a rod in different directions to create a specific pattern. It doesn't require several heddles for different patterns, it's easy to rearrange the card and easy to replace one if it brakes. But the warp could get stuck in between the plates when they're only held together by pressure and friction. The shape is not optimal for rotating. Would be better with round shaped cards.



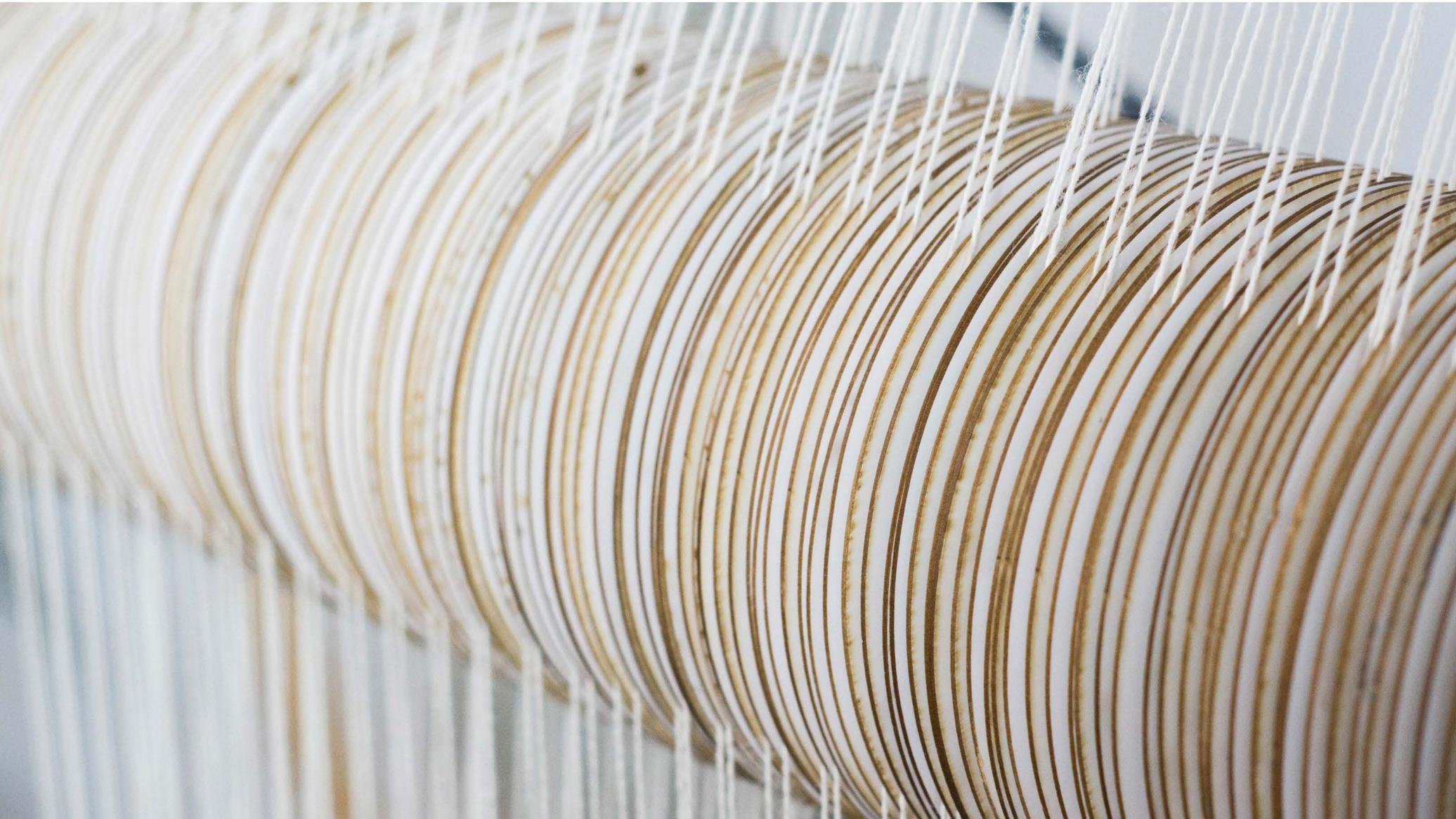




RESULT

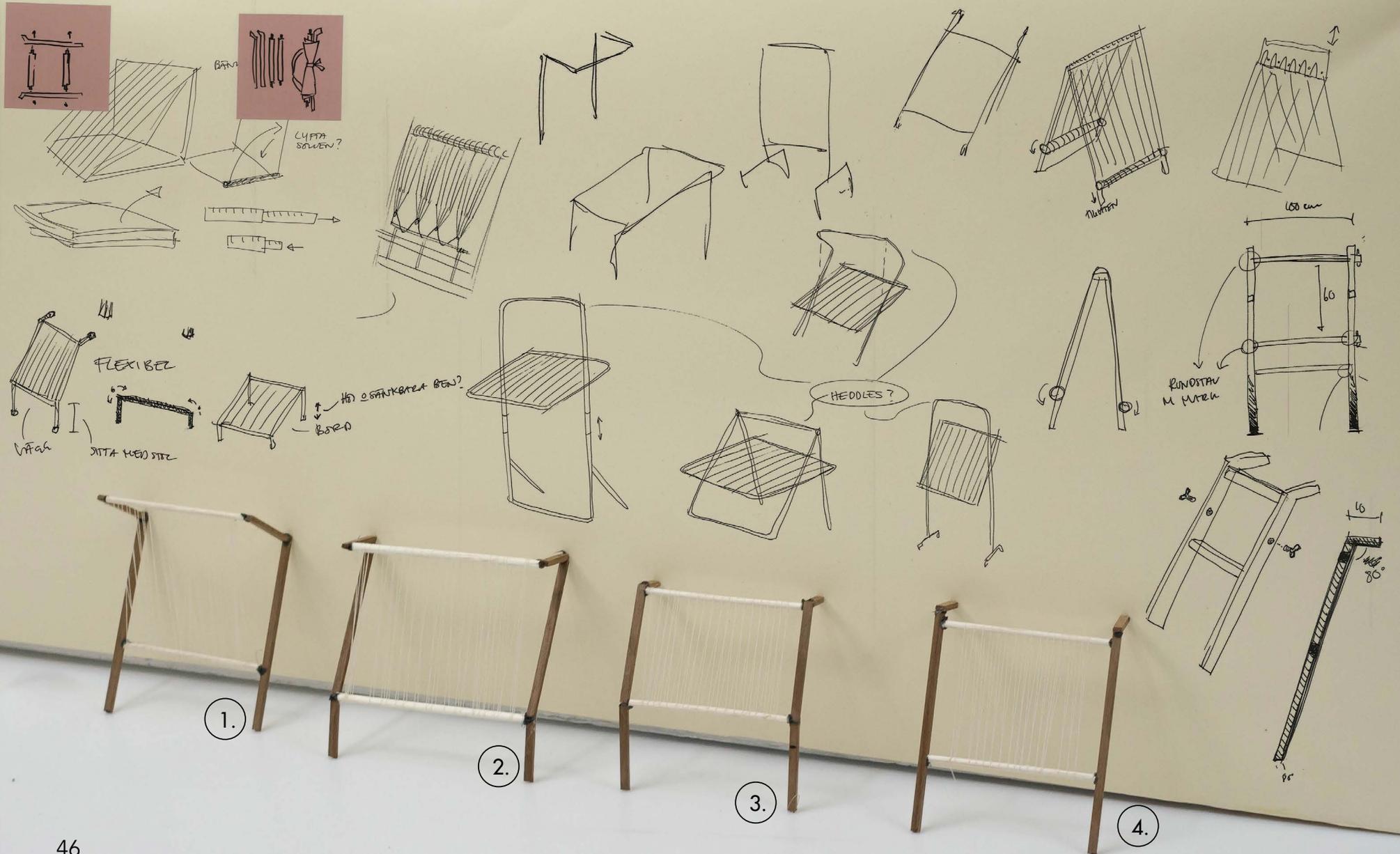
THE HEDDLE

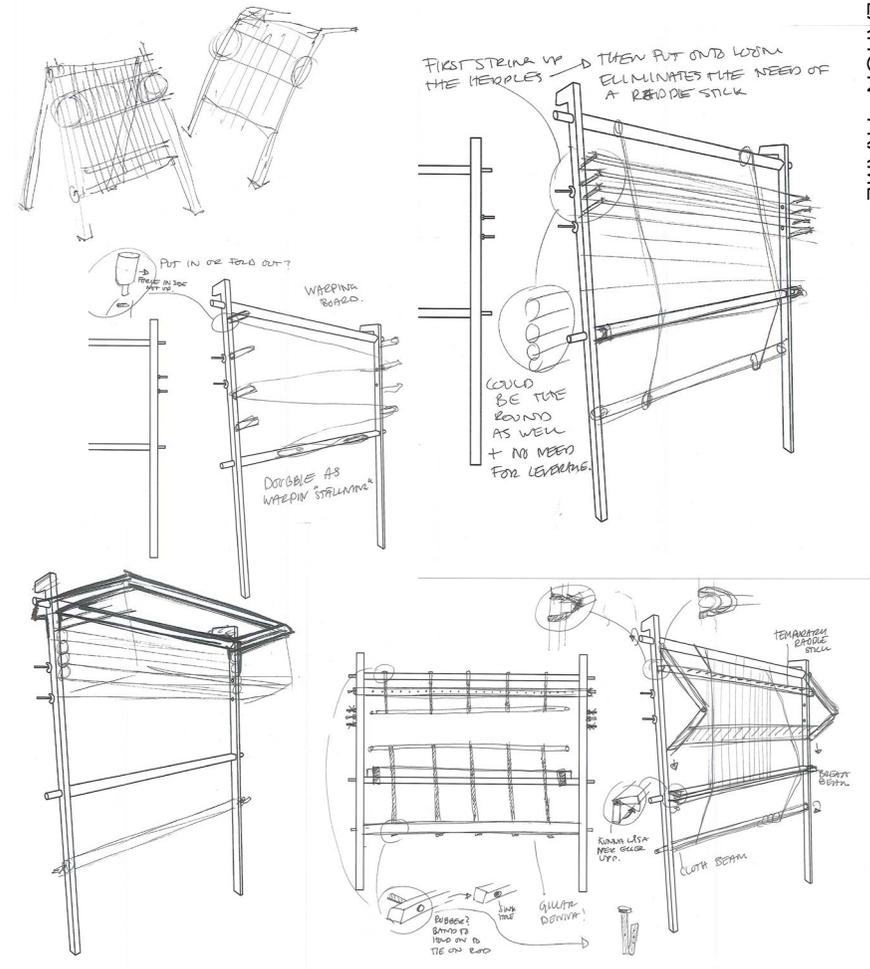
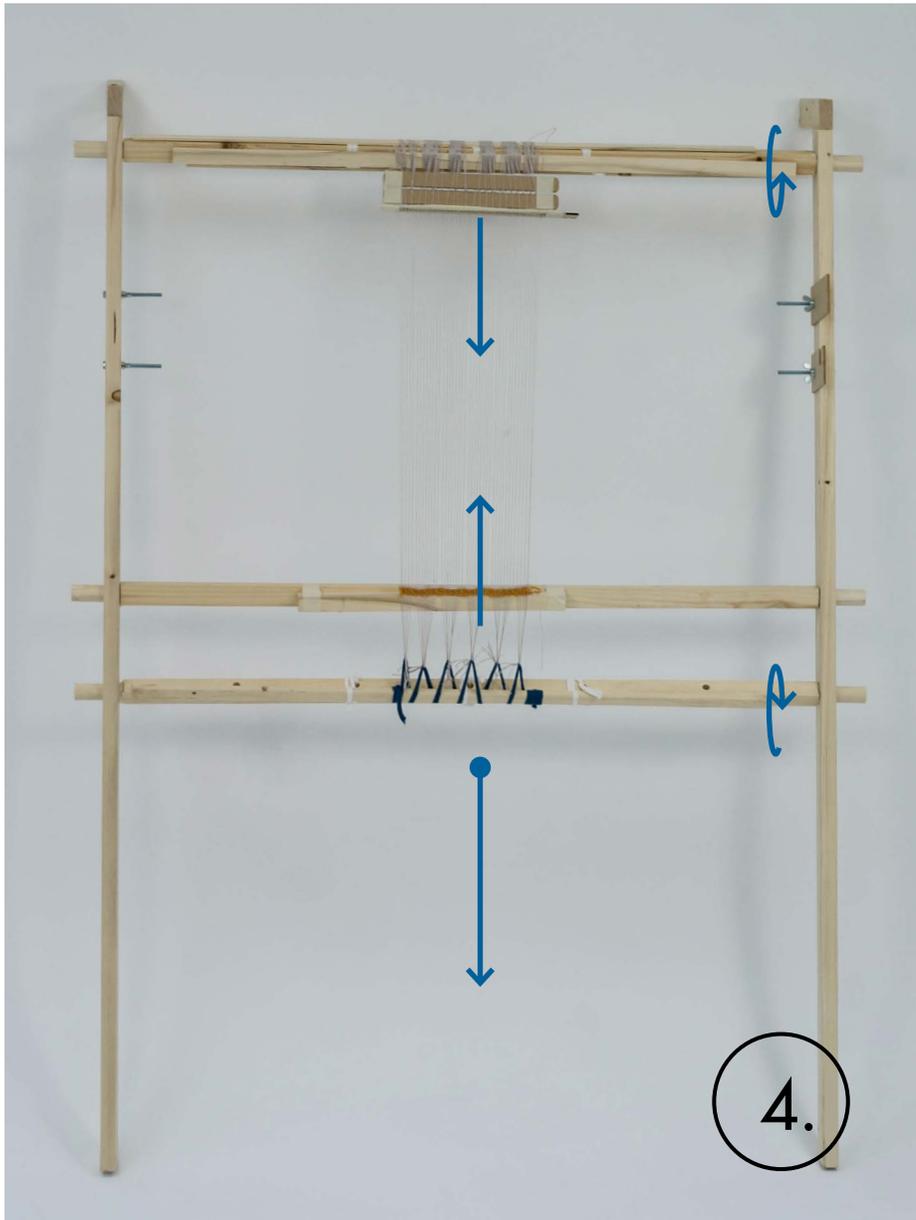
The result is a heddle that has the possibility to do the same complex pattern as a four treadle loom but with the simplicity of a rolling heddle. By eliminating the construction of the treadles this heddle is more compact and does not affect the construction of the frame in the same way. With this new heddle it is possible to create a frame that is much more compact and even have it standing.



FRAME

CREATING SOLUTIONS





This first version was too simple. It was missing some necessary functions such as being able to stand on its own, or having a proper way of stretching and loosening the warp. So I went back to the drawing board and created some new models that were able to stand alone, and maybe could accommodate more functions. After that I compared the different models I had made according to the criteria I got from my interviews to find the best match.



	9.	7.	8.	3.	4.	6.
Table	✓	✓	Maybe	Maybe	Maybe	Maybe
Against wall	Maybe	Maybe	✓	✓	✓	✗
Free standing	✓	✓	✓	✗	✗	✓
Space (-)	- 3	- 4	- 3	- 3	- 3-4	- 2
Flexibility	4	4	2	2	3	2
Stability	4	5	3	3	3	3
Total sum.	5	5	2	2	2-3	3
	+ Less space	+ more stability				

FINAL SHAPE

From testing out shapes with scale and full size models, I decided on working with this one. The frame is simple and can stand alone as well as, with some adjustments, lean against a wall or stand on a table. This was some of the requirements that the user group gave me. Another requirement I got was that it should feel like a furniture and not have the feeling of the classical looms, so that it fits in a modern home. Therefore I did a mood board to illustrate the feeling I was after with the design. From the "folk art" feeling to a modern and light expression.

When I had an idea of the style I wanted I started to sketch and create models of the parts that was needed to join and connect all the different pieces of the loom.



MOOD BOARD

From this



To this



TOP JOINT



LOCKING JOINT



BEATER JOINT



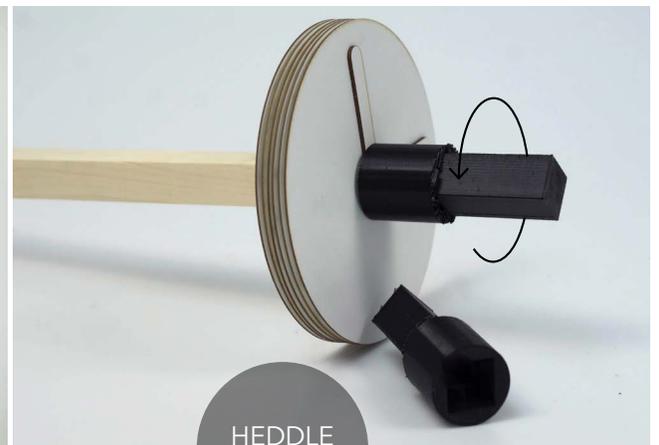
HOLDER FOR BEATER



CRANK



HEDDLE JOINT

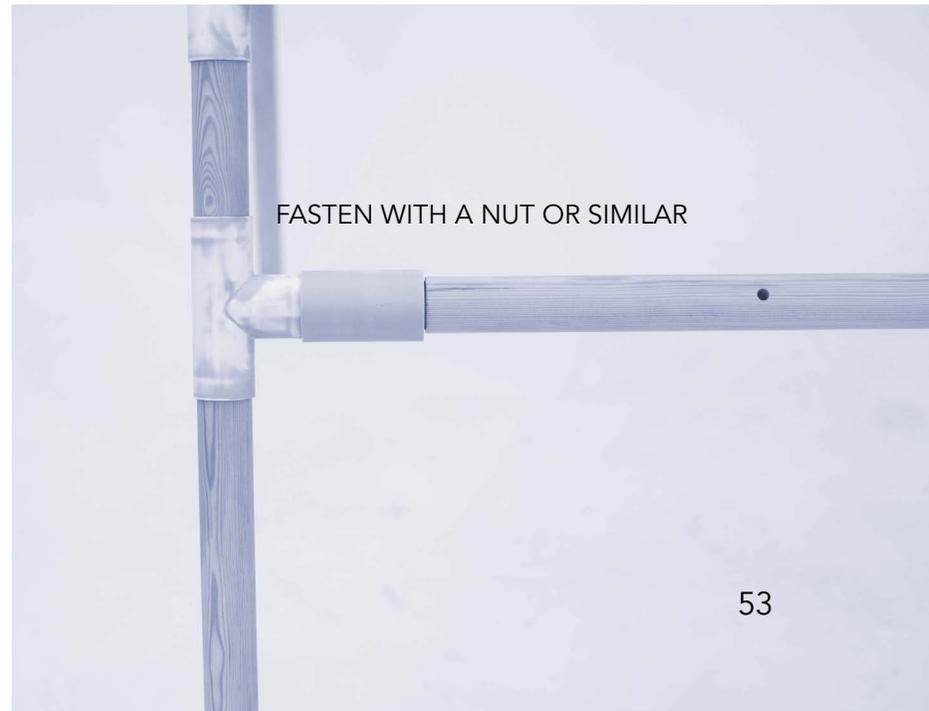




LONGER FEET TO BE MORE PROPORTIONAL



NARROWER ANGLE FOR SMALLER FLOOR AREA



FASTEN WITH A NUT OR SIMILAR

1



3



2



4



1. BEATER

The beater works through gravity. There is a string or wire attached to it and the user pulls it down for the beater to go up. when the user lets go, the beater fall and beat the fabric down.

2. FRAME

All parts that have some kind of interaction I chose to color, to make it easier for the user to understand the function of the loom. To keep the frame stable I had to add a cross at the back. When folding the loom this cross is detached and folded with the legs. The feet are changeable and can make the loom longer or shorter.

3. HANDLE

One of the big problems I encountered when reading through posts in different weaving forums, was that it is really hard to remember in what stage you where in if you left the loom for a while. So I marked the handle with 1,2,3 and 4 so that you always will know at what stage you where last when you resume the weaving.

4. LOCKING JOINT

The locking joint will hold the warp tight. When the user wants to loosen it they push the two locking pieces outwards and the beam will roll freely through a spring that is mounted inside the joint. As soon as you let it go the locking pieces, they will spring back and lock the beam again. The joint allows you to move the beam in one direction which means that you can easily tighten the warp without unlocking the beam.





END RESULT

THE LOOM

The result of this MA-project is a new way of looking at the loom. The new loom is something anyone could have at home regardless of living arrangements, and with little or no experience in weaving. This new type of loom is a mix between furniture and tool, since it has the aesthetic appearance of a furniture but is used as a tool. The loom is foldable and easy to move when not in use. The user can at any time change the type of weave without having to change the warp, which is not possible in today's looms. All in all, this product is versatile yet simple.

REFLECTIONS

Although I am pleased with the result, the main focus of the project has been the heddle. Because of this, most time in my project was focused on getting the heddle to work, and because of this, the design of the frame suffered. There is a lot I could do to make the frame more stable and to incorporate more functions so that weaving becomes even easier. I could also make it more portable and lighter, using other materials and folding techniques. The principle of the heddle works but it needs further investigations around what type of materials that would be best suited, and what type of production techniques should be used. I really see a lot of potential in a product like this. Especially the heddle system is a way of creating a shed that opens up so many new possibilities for how a loom could look like. But a very important aspect to be able to succeed in the market is that the product is accessible, easy to use and not too expensive. An alternative would be to sell the heddle as a product and do the rest as open-source. The consumer could then modify and hack the loom according to their needs and style. As I have seen through my research, the user group is very inventive and handy.

My master project has gotten a lot of attention from the press and the weaving community and most of it is good. The negative critique I've gotten is mostly concerned why you would need it when you have a weaving room or similar at home. It has so far been featured in the weaving magazine "Solvögat" as well as in "VÄV" magazine.



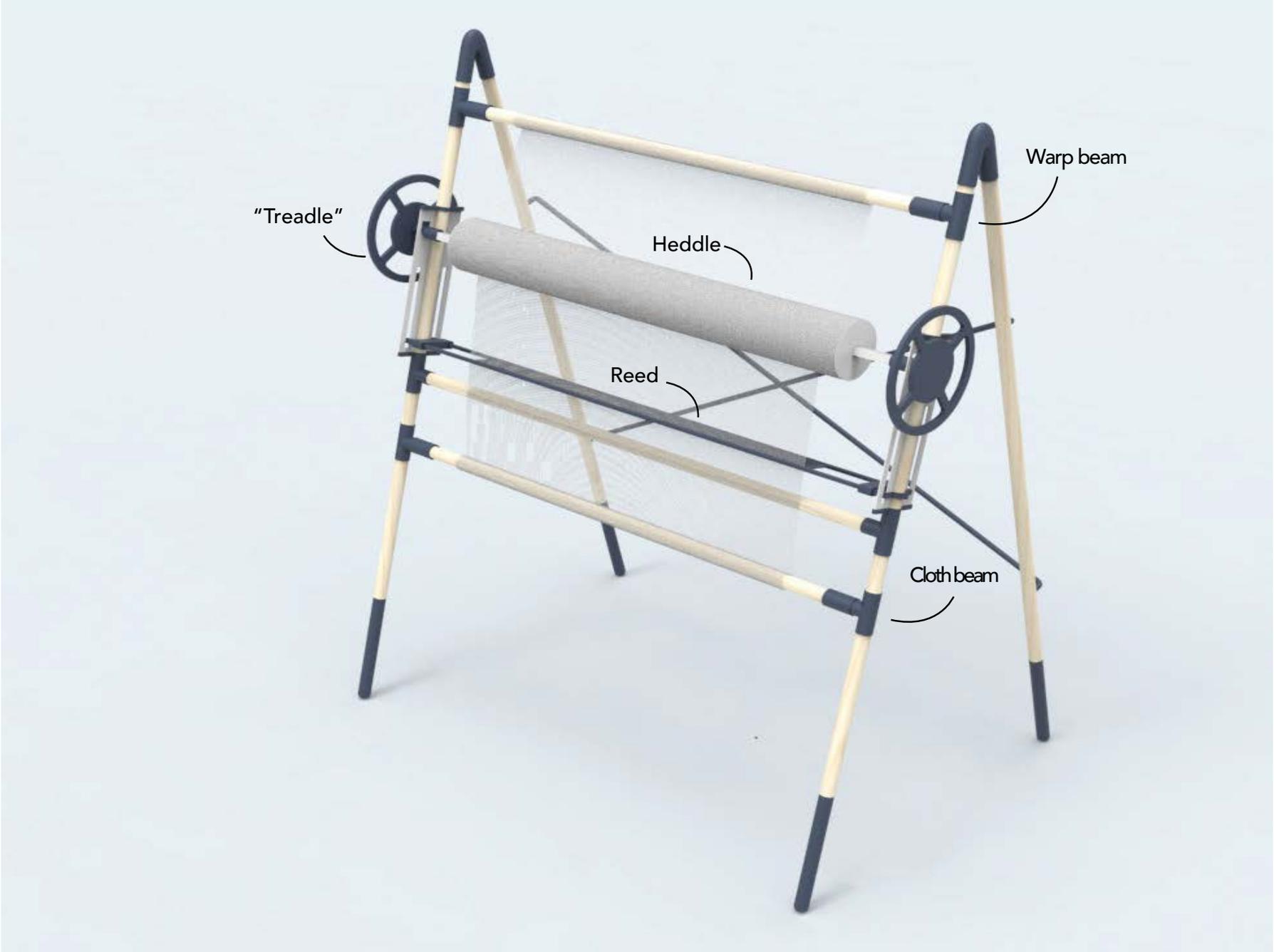


END RESULT









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<http://vavuppsattning.weebly.com>

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