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The Architecture of Threads
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Matilda Dominique
Master thesis, Textile in the Expanded Field

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Konstfack June 2014
ABSTRACT

Most people might not reflect upon textiles as anything more than the soft material in our clothes. As a crafts practitioner, I gain knowledge of woven materials that go beyond that. The knowledge of weaving and materials is developing the ideas that form the concept of this project. From the tacit knowledge, derived from years of practically working with textile materials, an intellectual understanding of materials and the worlds they construct is growing.

In this project, I decipher my own ideas of the woven structure in order to invite others to experience the universe within textiles. I look at the weave as a structure, built up by small particles in forms of threads. If seeing the weave from a distance, each repeated pattern can in turn be perceived as the smallest element. By seeing woven materials from more than one perspective, I believe that the understanding of the construction itself can develop. As this understanding grows, so does the ability to judge the quality of the material. In this line of thought, the tools used to reflect upon what materials are, how they are made and what they signify, becomes greater.

To visualise the knowledge I have of the textile structures I make, I work with a waffle weave structure, together with a dyeing technique called Ikat. I also draw connections between the woven structure and that of a map – as a tool that humans use to understand their surroundings.

The use of perspectives and scale is another tool that is used to widen our perception of the world around us. In order to create an experience of the universe within textiles and to invite others into that world, I draw parallels between the miniature scale of the woven material and larger, architectural structures.

The final outcome of this project is a textile installation, consisting of three weavings that together form a larger construction. The construction is open for people to enter and experience. Inside the construction a smaller woven piece is presented as a map over the woven world. This weaving initially contains the same information as the large structure, but on a much smaller scale.
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INTRODUCTION: The Architecture of Threads

It begins with one thread. As the yarns intersect, a woven universe takes form; one that gives the material its visual, tactile and functional uniqueness.

In the process of weaving, my entire body is in close encounter with the material. I see each thread as individual particles that, in collaboration with many of the same, hold up the architecture of the weave. My eyes grasp each intersecting horizontal and vertical thread as they slowly build up the structure. Simultaneously, my hands perceive information of fibre and construction qualities. By following the threads, the way in which their colour changes and the structures they build up on a more intimate level, I'm invited to a deeper understanding of the underlying constitution of the weave.

The Architecture of Threads develops a specific way to understand woven structure. By exploring the process of weaving, my intention in this work is to decipher my own ideas of the woven structure and to invite others to experience the universe within textiles. Through the course of the work I aim to visualise, problematise and contextualise my understanding of the significance of a woven construction, on a practical as well as intellectual level.

The structure of the weave

Ultimately, any woven material consists of two elements – the warp and the weft\(^1\) - that pass over and under each other as the weaving is made. In the process of constructing the material, this simplicity is what I see. Simultaneously I learn that a woven structure has the potential to contain complex qualities. Both aspects triggers my mind to think that the threads in the weave can represent something more than technical details. Most people might not reflect upon textiles as anything more than the soft material in our clothes. As a practitioner, I gain knowledge of woven materials that go beyond that.

As I weave, the structure of the weave appears to me as a society of threads, where the fibres come together in a network, shaping the environment around them. As each thread, a fragment of a larger context, intersects its perpendicular collaborates I begin to see a woven universe take form. The idea of the threads being the small particles that build up a larger context, is the essential concept behind this project.

Once the weave has come off the loom and is presented from a distance, my eyes perceive a repetitive pattern rather than individual threads. I read the system as it imitates itself, and here I understand each repeat as the smallest particle. The change of perspective feeds my mind with information about what the textile consists of. The two angles helps me to better understand them both.

Throughout the practice of weaving, I have discovered a particular weave structure that not only gives me the ability to produce three-dimensional textiles, but that also illustrates the idea I have of the weave as a network of intersecting threads that together form a woven community. The waffle weave binding, sometimes called honeycomb, is a binding in which the threads form a three-dimensional material, cleverly engineered to hold itself up. Through this technique, together with the use of the Ikat dyeing technique, I aim to explore and visualise the knowledge I have of the textile structures I make.

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1 The warp is the fixed vertical threads that are fastened on the loom (the weaving equipment). The weft is the horizontal threads that intersect with the warp to make a weave.
Through the course of the project the aim is thus to visualise the idea of the threads as individuals within a complex woven world. Furthermore, I have the intention to invite others into that world.

**Material knowledge**

Despite the fact that textiles are everywhere in most people's lives, not many of us recognise what they really are. I experience a general lack of awareness concerning materials, perhaps because they are so close to us at every moment of day and night. Woven structures are constantly close to our skin – in the clothes that we wear, the bed where we sleep and even on the train as we travel. Still, most people never reflect upon what these materials consist of, or how they get to the shape they are in. This lack of awareness can be linked to important discussions concerning material values and sustainability issues.

By seeing woven materials from more than one perspective, an understanding of the construction itself can begin to build up. As this understanding grows, so does the ability to judge the quality of the material. Ultimately, the tools used to reflect upon what materials are, how they are made and what they signify, becomes greater.

**Contents of the essay**

In this essay I take the reader on a journey through the process of my textile practice. The knowledge of weaving and materials have in turn developed the ideas that make out the concept of the project. From the tacit knowledge, derived from years of practically working with textile materials, an intellectual understanding of materials and the worlds they construct is developing.

In the first part of the text, my background as a textile practitioner is introduced together with how the concept of this particular project has evolved into it's current state. One paragraph in this part is also devoted to an introduction of why the knowledge of materials is of importance.

The following section introduce the practical process of my work. Together with a description of the work, including the necessary trial and errors, I connect the practice to ideas that arise from the work of the hands. When working with a woven material, my mind simultaneously reflects upon how the threads seem to have a life of their own, as they collaborate to keep the woven structure intact. The bonding of the threads also resembles the grid of a map – and the comparison of the two widens the idea of the weave as a tool of how we perceive the world.

In the third part of the essay the theory of the grid is introduced, to further relate the system of the weave to that of a map. The 1977 film *Powers of Ten* is in this chapter used to expand on the concept of the weave as a tool for understanding. I compare the film, that moves the viewer outside the every day perceptions of our world, to that of the weave, which in turn can be used to transcend our minds outside conventional ideas of textile materials. I look at the weave as a structure, built up by small particles in forms of threads, and within the weave that is forming each repeated pattern instead can be seen as the smallest element. The use of perspectives and scale becomes vital in this section, as one additional tool for humans to understand their surroundings.

As much as I see the weave as a tool for widening the ideas we have of what a textile is, the intention to invite others into the woven universe is just as important. In part four I return to my practice. As previous parts concern methods of how to visualise the ideas of the concept, together with theories supporting these ideas, section four deciphers how to invite others into the woven world. In order to create a space that is open to experience universe of threads, I draw parallels between the miniature scale of the woven material and larger, architectural structures. This section
concerns the final construction of the work.

Throughout the essay, I switch between writing about my practical/technical process and the thought process that develops through the work. This includes reflections upon the theories used and the context I'm placing the work within. There is also a fair amount of technical terms throughout the text. I acknowledge that many people outside the weaving field may not be accustomed with these which is why I use footnotes with an explanation whenever the terms are introduced.

I am well aware that the questions the project is set around, may just as well be answered with other methods. Waffle weave is only one weave structure amongst many that would be possible to work with in this project, and the possibility to include other mediums, such as film, to attempt to visualise tacit knowledge has certainly crossed my mind. I do however believe that in order for me to study my own process and knowledge, it is crucial to delve into where that knowledge derives from. Weaving is the medium that I have been studying for a number of years, and the waffle weave technique has been at the centre of my attention for the last two. In the task of inviting other people into the universe within textiles, the presence of the material itself is crucial, and to execute the project with another medium, such as film, would risk the ability for people to physically engage with the material. In this particular project, I therefore see no point in including additional mediums when the focal point is the woven structure itself.

Last but not least, the result of the project is discussed, together with reflections on the physical outcome and the experiences gained from exhibiting the work at the Konstfack Spring Exhibition 2014. This part also includes reflections upon how I look upon the development of my future practice as a textile designer and craftsperson.
1. BACKGROUND

In my textile practice, I constantly return to threads. I have a fascination and love for them. When weaving, or studying a textile that someone else has made, I get absorbed by the threads' ability to move from individual particles to complex configurations, as the threads engage in and constitute a predetermined construction. These two elements: the threads and the construction, are, to quote the famous Bauhaus weaver and designer Anni Albers, 'the very essentials of a woven structure.' The fascination for and the potential of this simplicity keeps me curious.

Why materials matter

Making cloth is an activity that people have been engaged in for at least 30,000 years. During the most part, humans have been making things from materials found in the near environment. Wool and hair from sheep, dogs or goats, as well as fibre from native plants have all been used as raw materials to make textiles. The knowledge of making textiles is part of the way we know, construct and connect to the world around us – and this knowledge has, until recently, lived on from generation to generation.

Since the end of the 19th century, when machines were introduced and revolutionised the way we made things, awareness about and closeness to materials and their history has moved further away from our daily lives – physically as well as mentally. The work of the hand in local communities, has exchanged with the work of machines, and workshops have been moved to the factory floors. At first still within reasonable distances to the users of the made goods. Later, in order to meet the demands of quantity and pricing, production moves to places across the globe, which in turn makes people more distanced to the processes of making. The things we possess merely become something that we find in shops.

In order to deepen our understanding of the material world, there is a lot to be gained from interacting with materials from more than one perspective. As a practitioner I have the privilege to connect with textile materials both from the close-up construction of the material, as well as understanding the patterns from a distance. The two perspectives are equally important as an understanding of the material world is built up.

Mark Miodownik, Professor of Materials and Society at UCL, talks about the importance of how humans interact with materials. Besides being able to understand our surroundings through seeing and thinking, we can deepen our understanding of the world through tactile interactions with the materials that build it. By touching a material, and noticing its inner qualities, we understand far more about it than if we only look at it.

Material knowledge not only has the potential to help us better understand the world outside ourselves. Along with a deeper understanding of materials comes a sensitivity to their qualities and in turn a more sophisticated ability to value that quality.

5 Ibid p. 60
Talking threads

My fascination for threads and woven structures has slowly developed through several years of practising weaving. I have always felt a strong attraction to the medium, and not the least to the ability of constructing a material that weaving opens up for - with one set of simple elements.

A few previous projects have been useful as I have developed what is important and interesting in my practice. In 2013, I began to write letters between two threads that were shaping the weave I was then in the process of making. In the letters, the two intersecting threads share their thoughts and experiences from life, in a both serious and humorous manner.

March 20th 2013

Dear Warp thread #27,

How are you holding up? I passed you today in the loom during construction. I’m sorry I didn’t have the time to stop and say hello, the weaver seemed to be in a bit of a hurry. It was nice to see you again though; I think the last time was when we were in that warehouse in the south of Sweden. By the way, do you know where we are located now? I seem to have lost track of time and space since my last transportation. Would you be free for lunch sometime soon? I’d love to hear what you’ve been up to.

Sincerely,
Weft

—

March 22nd 2013

Dear Weft,

I was so pleased to receive your letter. Thank you!

Oh, the stress. I don’t enjoy being stressed. Yes, the construction went pretty fast once you got involved. Before you joined in I had to get into a dye bath, well, parts of me anyway. It wasn’t enjoyable at all. Hot and stinky. It tangled me up. I’m glad that’s over. I do remember that warehouse; I didn’t really like it there. Dark, cold and so many fibres everywhere. Crowded. I don’t like crowds. They make me dizzy. I think we’re a bit further north now. I guess still in Sweden.

Sorry that this letter isn’t very cheerful. It would be lovely to see you over lunch. How about tomorrow?

All the best,
Warp thread #27

This project, Talking Threads, was much based on intuition. At the time, I was not entirely sure why the threads started to communicate with each other. Besides wanting to understand the threads and their backgrounds, I felt an urge to lift them up from their forgotten corner and make them more visible. The idea is related to how materials in general, but perhaps textile materials in particular, constantly are taken for granted.

Hence, the Talking Threads project aimed to shed light on the material, at the same time, my understanding of the weave went into a further direction. Through the act of weaving, an intellectual or philosophical kind of awareness started to take shape. As each thread, a fragment of a larger context, intersect with one another, I began to see a woven universe take form.

A collective deconstruction of a weave

In December 2013, the project 1330 Threads was installed in a public library in central Stockholm. The work was part of the group exhibition Going Public Making History, where seven textile students from Konstfack presented a piece of work in a chosen space outside of the conventional art- or design context. In relation to Talking Threads, this work was developed with much more
intention and direction. The goal was to make people experience the textile material in an unusual way, by being confronted with it from unconventional distance. During three days, a hand-woven structure was installed at the site and as people were visiting the library, I invited them to disassemble the weave. People were asked to pull out a thread of the crafted piece. The idea was to work with an interpretation of the analysis tool deconstruction and to build up a new understanding of the weave by taking it apart. Within philosophy, deconstruction means both to break down a certain view of the world and then to build another view back up. The word itself derives from the French word déconstruction, which in turn is a play on de-struere - to break down, and con-struere – to build up.

By inviting to a collective deconstruction of the weave, I challenged the visitors to physically interact with the structure, and thus forcing them to a close encounter with the material. In the action of pulling out threads from the weave, the woven structure was experienced in a new way.

The parallel between Talking Threads and 1330 Threads is my interest in sharing my own experience as it unfolds while I work. However, the intention is not to give a particular view or knowledge about weaving and threads, but rather to open up for other people to build their own understanding of what a textile material can be. As a textile practitioner, with a deep rooted knowledge of materials and techniques and their historical and cultural aspects, I want to create textile “worlds” open for others to step into. By inviting others into the universes of woven structures, the aim is to trigger their experience and perception of the significance of textile materials. The questions I would like to answer within the frames of this project is thus how to visualise my idea of the threads as individuals within a complex woven world, and further how to invite others into that world?

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2. PROCESS, PART ONE: The making of a material – construction of knowledge

In the following section I present the practical process of *The Architecture of Threads*. The material understanding as well as the idea of the threads as individuals, that in networks shape a complex woven world, have very much developed through the work that I do with my hands. All the knowledge and experience gained through hours and years of studying a material and a technique is, however, impossible to write down in words. No matter how detailed the instructions or technical notes that are being recorded along the way, there is no alternate route of earning the tacit knowledge that comes with practising a craft. I intend, however, to give as full of a picture possible, of my practical and mental process, through connecting the technical and practical exercises with thoughts and insights that arise in correspondence to the work of the hands. In part three of the essay, I connect theories to the ideas that forms this project, but prior to this, I believe it is crucial to understand the practice itself.

It is fair to say that what I intend to show in my work is in fact the process itself. When speaking of the process in this essay, I point at the relationship that expands between the work of the hand and the thoughts of the mind, rather than the actual steps of the making. This chapter includes practical experiments together with analyses of how these attempts lead the project forward.

**Tools of visualisation**

The process of weaving is not linear, nor is this project. To begin this section, I will however start at the initiation moment.

**Waffle weave, linen and the computerised dobby loom**

As I begin the project, I have a chosen framework within which I aim to visualise the ideas of the woven universe, and the material knowledge earned through weaving.

As stated in the introduction, the waffle weave structure is the technique I have been exploring for the last two years. The background for this particular exploration is my interest in and fascination of three dimensional structures, where the waffle weave enables me to construct this. I also find that the waffle weave proves to be a useful tool in the ambition of visualising the underlying ideas behind this work. The structure itself illustrates the complexity yet also the simplicity of the technical aspects of what a weave can be. When constructing a waffle weave structure, long floatations of threads are left in both the warp and weft - a result of the threads not binding together as often as, for example, in a plain weave. (Images 1 & 2) When the weave is taken off the loom and the threads are no longer stretched out, the material contracts and the surface of the textile rise.

An important aspect of the attribute of the structure is the interplay between the construction and the fibre quality. In order for the weave to gain it's desirable qualities, the choice of material is vital. I am restricting my work in this project to one fibre type: linen. As a strong, stiff fibre, linen works in a satisfying manner to help the construction of the waffle weave to hold up the structure. I have in previous experiments also been trying out other kinds of fibre types together with the waffle weave, such as cotton and wool. All these fibres have their individual properties, and I acknowledge the importance of understanding how these properties affect the outcome of the structure. For example,

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10 Bonding points are where the threads in the weave intersect. In a plain weave, these points occur on a close interval. In the waffle weave structure, there is a further distance between the bonding points, which makes the threads “float” above or under each other. See image.
weaving a large waffle weave structure with a fine cotton thread can indeed result in a rather sturdy construction – i.e. the threads manages to hold themselves up unless the floats in the structure are too long. When weaving with wool on the other hand, the structure acquires more of a soft character and the fabric as a whole becomes smoother and more flexible than both cotton and linen. All three fibres of natural origin perform in their independent ways, all which I can appreciate depending on the context. In this project I work purely with linen – an aesthetic as much as a functional choice. The main reason for this is thus it's properties in terms of how the structure is kept rather solid. The fibre together with the weave structure creates a material that maintains its three-dimensional shapes, even as the fibre and structure is scaled up.

The loom I am using to weave also has it's own restrictions. In this project I work on a computerized dobby loom\(^{11}\), and this is for two reasons. Not only does it give me the ability to quickly move between different repeat sizes, but it also enables me to explore and alter the construction of the waffle weave binding at the moment of weaving. The main limitation of the loom I work on is that the maximum fabric width that is possible to produce is 50 centimetres.

There are also some additional components that affect the appearance and performance of the woven structure. Amongst these are the density of the weave\(^{12}\), as well as whether the same fibre and quality of yarn is used in both directions. The number of repeats allowed in the width and length of the warp is also crucial – an aspect that I find particularly fascinating. As each repeat co-exist with one another to support the structure, it is not possible to weave only one large waffle if the three-dimensional effect is to occur. Each repeat within the weave works as a building block which needs the reproduction of itself in order to move into it's intended three-dimensional structure – similar to how the threads, on a smaller scale, form their network in collaboration with each other.

As soon as one of these components are modified, in particular the quality of the yarn and density of the threads – the appearance of the structure changes.

**Scale and perspectives**

As stated earlier, the idea of interacting with woven structures from more than one perspective - to gain a deeper understanding of the weave - is vital in this project. To visualise a sense of perspective, within the weavings, I work with scale.

Throughout the process I have several thoughts on how to use the waffle weave structure and scale. I begin to draw out, both physically and mentally, how the weave could, within itself, include a sense of perspective. Within the same woven piece, I plan to include both the smallest structure together with a much larger. In the initial sketches I draw out a total of seven different sizes of the waffle weave repeat, ranging from the smallest structure possible to the largest. (Images 3 & 4) These sketches also prove to be useful in the ongoing work of developing the concept around the project.

Besides using the repeat size as a method to scale up and down the structure, there is the possibility to work with yarns in various sizes. To get started, I choose (on a rather random note) three different yarn types\(^{13}\), each thicker than the next.

The testing and sampling of ideas, materials and variations of the waffle weave technique proves to be crucial for the work to develop. As an example, once the initial sketch of seven different repeat

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11 The computerized dobby loom is connected to a computer software, in which the designing of the structure can be made. Still, the loom is hand-operated in the rest of the weaving process.
12 How tight or loose the weave is packed
13 Linen 16/1, 16/2 and 8/5
sizes is tested in the loom, it turns out to be a miscalculation. The number of repeats possible to produce within one and the same woven piece is not seven but three\textsuperscript{14}. However, this error didn't stop the project from evolving, but rather brought it forward.

As the idea of including a sense of perspective into the weavings develop, I begin to experiment with alternative ways of doing so. Instead of altering the size of the waffle weave structure, I can alter the structure itself, in order to make it appear as if it grows and shrinks. (Image 5)

The computer loom gives me the possibility to draw out different structures in the computer software, and test those exact structures in the weave at the same time. There is thus a direct connection between thought, computer and loom. This opens up for a good understanding of how the structure work together with the threads as I instantly see the idea take form in the weave.

I spend quite a large number of weeks making samples: with different alterations of the weave structure as well as different yarn thickness in combination with the structures I explore. The three yarns initially chosen, are tested and evaluated. These tests brings me to experiment with both coarser and finer yarns. (Image 6) The idea is to see how much it is possible to scale up the weave structure, and still keep the desired three-dimensional shape. Also, the difference in size, between the finest and thickest yarn, need to effectively communicate a sense of perspective.

When scaling up the yarn, the linen fibre proves again to be the right choice of material. At this stage, I make one sample with a coarse linen yarn, which is conventionally used when weaving rugs\textsuperscript{15}, and another sample with a cotton rope. Both yarns have about the same coarseness, and the same repeat size is used. Once the sample made in cotton is taken off the loom, a much more “messy” structure appears. (Images 7 & 8) The soft fibre can not manage to hold the structure up in the same way as linen. It seems as if the more I scale up in yarn and repeat size, the more the material illustrate the architectural properties of the weave within itself.

At this point, I can probably move further and scale up the structure even more. However, because of what I want to achieve in this particular project, I decide to stop at this size. The size I have reached with the largest linen yarn, very well has the ability to visualise the internal structure of the weave.

Just as important as scaling up the structure, is the relationship between the small and the large yarn. If the sense of perspective is to occur effectively, the difference between the fine and the coarse yarn need to be noticeable. This leads me to test much finer yarns than the initial qualities chosen. A thread normally used for lace-making\textsuperscript{16} makes a convincing opposite of the rug-type yarn.

Within the samples I have made so far, I can see the potential to visualise the thoughts of the threads as individual particles, as they together build up their own context. Furthermore, with the difference in scale together with the alterations of the weave structure, I now have a number of components to use as tools when designing the experience of inviting others into the world of weavings.

\textsuperscript{14} Ultimately, the component that limits the repeat size is the number of shafts on the loom. Each shaft represents a set of threads, and the amount of threads on each shaft equals the number of repeats possible to weave. With greater amount of shafts on the loom, the size of each repeat can thus be made larger, and the number of different sized repeats can increase. Most hand operated looms have between 4 and 16 shafts.

\textsuperscript{15} Rug linen yarn 4/6

\textsuperscript{16} Lace-making yarn 60/2
A dimension of colour

So far, all samples made up to this point are either in white or in black. The reason for not introducing colour at an earlier stage, is simply because the trials so far have more to do with the material and structure itself.

Colour is one more tool that I work with in order to enhance the weave structure and, with shades and subtle colour changes, create a depth in the material. This way, the dimension of colour becomes a challenge of the distinct grid of the waffle weave. This in turn challenges the eye, in the means of how the viewer reads the pattern.

By this, it becomes even more clear to me that the intention of this project is not to give a simple experience of what a weave is, but instead to introduce a complex world of threads, where each person who interacts with the material is given the choice to deepen their own relationship with - and understanding of - textiles.

To achieve this dimension of colour, I have experimented with the Ikat technique. By blocking out parts of the yarn, to prevent these from absorbing dye, the colour is added only to the yarn that is in contact with the dye stuff. Depending on how the method is used, through tying plastic strings around the yarn or simply not dipping the whole yarn bundle in the dye bath, there is a possibility to achieve different patterns. (Images 9 & 10)

Conventionally the technique requires full control and mathematical calculations for the pattern to match up, but because I'm not interested in working with the technique to create precise figures, I instead adopt the technique in a somewhat unrestrained manner. Rather than making precise calculations of which parts of the yarn to add colour to, I have through trial and error learned how to work with Ikat to produce surfaces of shades and subtle patterns. (Images 11, 12 & 13)

I am more interested in how the colour and colour changes in combination with the weave structure brings a new dimension to the material, rather than to gain strict sections of opaque colour. By working with an adaptation of the Ikat technique I have the possibility to create intricate colour changes, subtle shades and also let the colour, threads and weave structure collaborate in the construction. The interplay between the elements that build up the dimensions of structure is superior in importance to which colour(s) I apply in the dyeing process. Both colours used in this project are ingredients that I have been working with for longer than the period of this particular project. I find it both interesting and important for my work to deepen my relationship with the different elements that are embedded in the practice. This is also the case with the colours I work with. My intention is to learn how the orange and the grey interplay with one another and the woven structure depending on how I choose to dye the yarn as well as in which order I insert the weft yarns.

17 Traditional dyeing technique with roots in South America and Japan
3. THEORY

Through the practical work of weaving - where hands and mind collaborate to learn how threads and weave structures affect each other as the material constructs – a different kind of thought process simultaneously develops. In my case, an understanding of the threads and the structure - that goes beyond the technicalities of what a woven material is – is starting to develop. The philosophical aspects of the weave has thus grown out of both technical understanding and hands-on experience, and is continuously expanding as my experience of weaving grows. In this part of the essay I elaborate on my thoughts on the weave as a miniature scale of the universe and draw connections to another grid based tool which humans have used to learn about the world – the map. From this parallel I move further outside the every day perceptions of our world, and introduce the ideas of how different perspectives can enable people to re-constitute their awareness of materials. To start of this chapter I will shortly bring to surface a factual understanding of the woven structure.

Understanding the weave as understanding the world

A plain weave is the most basic of woven structures, with the weft thread crossing over and under every other warp thread. But even the most complex of woven designs retains this connection to the warps and wefts.\(^\text{18}\) In *The Textile Reader*, author and curator Catherine de Zegher describes the fundamental principle of weaving in a technical, straight forward manner:

> A woven fabric consists of two elements with different functions: the fixed vertical threads (warp) and the mobile horizontal threads (weft or woof), which intersect the fixed threads perpendicularly and pass above them. Determined by the loom (the frame of the warp), the textile can be infinite in length but not in width, where it is closed by a back and forth motion.\(^\text{19}\)

Anni Albers presents another approach to describe the sensation of understanding the components within a weave. Albers states that 'each thread seems charged with uninterpreted energy: the underlying units twine and intertwine with non-stop vitality, as if to say that they exist singly but also as part of something greater.'\(^\text{20}\) According to Albers, the essence of weaving is the interrelation between the warp and the weft and the subtle play between them in supporting, impeding, or modifying each other's characteristics.\(^\text{21}\) This interrelation between the horizontal and vertical yarns is the construction itself, the structure that gives the material it's visual, tactile and functional uniqueness. The function of the warp and the weft is thus to organize the information within its gridded space. In the article *Zeroes + Ones: Digital Women and New Technoculture*, author and philosopher Sadie Plant refers to this *grid* in describing how it is so apparent in the making of textiles:

> It is their micro-processes which underlie it all: the spindle and the wheel used in spinning yarn are the basis of all later axles, wheels, and rotations; the interlaced threads of the loom compose the most abstract processes of fabrication.\(^\text{22}\)

I am simultaneously intrigued by the thought of the actual structure of the weave to be a network of ordered elements within a strict grid, as I am interested in the idea of the weave as a metaphor for mapping the content of our understanding. In the book *Textiles – the whole story*, written by professor and artist Beverly Gordon, the author take notes of how 'textiles are our constant companions throughout our (life) journey.' Further, she states how this material 'helps us relate to the


\(^{21}\) Ibid. p 141

\(^{22}\) Plant, p 330
Earth, to other people, to ourselves, and to something even larger than ourselves.\textsuperscript{23} The woven construction – a pattern of organized threads – can so resemble how humans of all time have been organizing matter and information in order to gain a deeper understanding of their surroundings. In this line of thought, the woven structure may well be compared to the function of a map.

The latitude and longitude of the map have similar functions as the warp and the weft in coordinating data within the record of the physical world. Furthermore, maps in various forms have been used as tools to assist humans in their attempt to understand the structures of the world. Hence, one of the main functions of the map is to organize space to make sense of the world. A similar attribute can be assigned the woven structures in this project.

When we use maps to direct ourselves in our physical and cultural surroundings, we 'transfer our eyes from the symbolic form of the gridded map to the actual environment charted by the grid, and thus we connect the image to the real.'\textsuperscript{24} In The Grid Book by Art Historian Hannah B Higgins, the author expands on this function of the map and discusses the idea of the map as being both a 'symbolic version of the world' at the same time as the map seem to 'relate directly to that world as a scaled model.'\textsuperscript{25} Higgins further lifts the importance of the relationship between the map grid and the real world, as the action of 'looking at and looking away from the map – expresses the uniquely comparative and interactive character of the map grid.'\textsuperscript{26}

\textbf{The use of perspectives}

This interrelation between the scale grid in which the matter outside the map is organised, and the matter itself, I believe is of great importance in the way we perceive the complex world in which we co-exist. A change of perspectives gives us tools to grasp the whole as more than just the sum of its parts.\textsuperscript{27}

In the documentary Powers of Ten, released in 1977 by Charles and Ray Eames, the different scales of which the information is given affects my perception of the universe. The film moves between images of our world, seen from distances as we usually perceive it, to information that is more difficult to grasp. During the 9 minutes of the film, the viewer is taken on a journey to the outer edges of the universe. As the film takes the viewer from Earth and into space where the sight of our own galaxy suddenly appears as a single glowing star, I get sucked into a new vision of understanding, where the change of perspectives is throwing my eyes and my mind between images I am used to perceive and information that I can barely grip. The film continues to move, back to earth and inwards the body of a person, to finally stop 'inside a proton of a carbon atom within a DNA molecule in a white blood cell.'\textsuperscript{28} Through this travel, both my mind and body are given an experience of the world outside my normal mode of recognition.

When watching this short film, I become aware of how small we really are, and how much there is that I hardly ever reflect upon, despite being surrounded by these fundamental matters like the Earth, space, the stars and my own body, every single moment. Similarly I can understand how most people hardly ever reflect upon the textile materials that humans around the globe likewise spend every second together with. It is almost as if the materials are too close to us for being noticed.

This brings me back to the underlying conceptual idea behind the project. The lack of material

\begin{footnotesize}
\begin{enumerate}
\item Gordon, p. 57
\item Ibid
\item Ibid
\item Concept coined by the Greek philosopher Aristotle (384 – 322 BCE)
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awareness may be looked upon as the missing link between the close-up perspective of a weave that a textile practitioner is familiar with and the way most other people view textiles from a distance – or don't take notice of at all. One could claim that this material devaluation in fact is what feeds the approach of *The Architecture of Threads* in the way that I wish to fill in that gap with material awareness.
4. PROCESS, PART TWO: A woven universe

As much as I see the weave as a tool for understanding the construction of the world, the intention to invite others into the woven universe is just as important. The first part of my process concerns a lot of experimenting, in order to both deepen my own understanding of what the weave resembles, but also, to design a material that manages to visualise the ideas that take form in my mind. This process has taken up more than half of the project in time, and is vital for the development of the continuous work. In this part of the text I return to my practice, to decipher how to invite others to experience the weave. In order to create this experience, I draw parallels between the miniature scale of the woven material and larger, architectural structures. This part concerns the final construction of the work.

Even though the process as described in this essay may seem to follow a linear route, I have been working – both practically and mentally – across different stages simultaneously. At the start of the project I had a quite distinct idea of how the final outcome would be designed, but during the course of the experiments and sampling, the idea is modified as the different tests are taking shape. A deeper understanding of how the waffle weave structure works together with the different yarns tested, along with a development of the conceptual idea of the weave itself has thus enabled the project to move forward. With this, I am at last at the point where I begin to design the final outcome of this project.

The weave as an architectural structure

At this point in the process, I have a few questions that need to be answered. The question of size is an important matter throughout the work, and I have continuously considered the importance of making the final piece of a size that would invite people into the structure itself. When I weave, I see a close resemblance between the woven structure and larger, architectural structures. This resemblance is even more apparent as the waffle weave is scaled up.

The connections to architectural structures relates back to how to integrate scale and perspective in the work. I want to create an opportunity for others to see the woven structure both on a close-up and from a distance. By give a possibility to experience the weave from different perspectives, I hope to open up for new thoughts on what a textile material is.

From the experiments with different scales within the weave itself, I move on to test different scales with the woven pieces. This step relates to the idea of the smallest particle and the entirety. With the weavings I present as the final outcome, it seems logic to create a structure in which each weave now is seen as the smallest particle.

Before I can decide on which of the woven samples to execute in the final piece, I need to plan the construction in which they will be part. This type of large construction that I have in mind, I have never made before. Moving from two-dimensional (as textiles are mostly seen as), to three-dimensional structures in the scale of architecture is a new world for me. It is easy to think that a woven textile is to be hung on the wall, like a curtain, or laid on the floor as a rug. The conventions that exist within the textile field, are also what first comes to my mind. The planning of the final piece moves through a couple of different stages. One of the starting points is to make a labyrinth of the weaves, in which people are more or less forced to come close to the material. (Images 14 & 15) Still, the woven pieces are hanging from the ceiling, safe within the conventions. I realise that I need to move outside those frames.

The Los Angeles-based design studio Synthesis was founded in 2011 by architect and designer
Alvin Huang. The work of Huang and his multidisciplinary team consist of a range of experimental architectural structures. I find, in some of their work, a relationship in the approach to conventional ideas of materials and the structures they form. In the project *InformedForm: Articulated Tensions*, the approach to the perception of space is something I can relate to the questions in my own project. One of the structures created within *InformedForm* 'explores the potential of altering the conceptions of rigid linear architectural compositions' and is furthermore stated to alter the perception of space and by that force people to interact with the space. With this, the aim is to open up for a questioning of typical architectural conventions. (Image 16)

Just as the architects of the Synthesis studio question the structures' relationships to walls, floors and beams – typically right-angled surfaces, I begin to question the linearity that hanging textiles often resembles. Together with influences from the work of Synthesis design studio and the concept developed through my project, I develop a structure that moves beyond horizontal and vertical lines. (Images 17 & 18 shows scale models and 1:1 tests of this development).

**Relationships between the space and the map**

Once I have an idea of how to shape the construction from the woven material, I can make the decisions that are necessary for production. As shown in the images, the final construction contains five individual weavings. This number is based partly on what I found necessary for the structure to become a space in which people can move freely and at the same time be close to the material. Other considerations I have to make is how much time I have to weave these pieces, but also how much material that fits in to the budget of this project.

As discussed earlier, the relationship between the different scales is just as important as enlarging up the structure. Here the idea of the weave as a map is useful.

To understand the woven world on a deeper note, I aim to design a weave which can be read as a map of the large construction. This map is woven with the finest yarn from the earlier experiments. I use the alterations of the weave structure together with the colour technique to make a small, three-dimensional landscape of threads.

The two elements of the final outcome, the five large weavings and the one woven map, are presented in relation to each other, where a connection can be made between the two. Ultimately, the woven map contains all the information of the structure that also exists in the large construction. Similarly, the five weavings that make up the large construction, may be read as magnifications of the woven map.

The final plan for the outcome, is thus to make one large construction that consists of five separate weavings, made with the thickest yarn. This construction ultimately becomes what I in this project call the woven universe. This space is made to invite people to experience the woven structure through more than one perspective. Within the space, a map over the woven world can be found – which initially contains all the information of the large structure, but in a much smaller scale.

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The exhibition

The only way to understand a material and how it works within a space is to let the two elements meet. All the planning and testing with other materials can give a hint of how the final outcome will work, but only once the actual woven structure moves into – and claims – the intended space there is a real chance to understand how the pieces and the space will interact with one another.

Before I begin to install the weavings in the exhibition space I test and examine the construction in terms of how to anchor the weavings to the ceiling, floor and walls. Also, prior to finishing all five large pieces, I take the opportunity to test how they act when stretched from one point to another. (Image 19 & 20) My thought has all along been to stretch them tight in order to keep the construction fixed.

A couple of things happen as I move into the exhibition space and begin to install the work. The space is not only inhabited by the installation I am planning to finalise. I have to take into consideration the exhibition as a whole, where my work is in dialogue with my fellow student's pieces. (Image 21) A test installation with a cotton fabric makes me realise that the space, as well as the project, most likely won't benefit from installing as many as five large weavings into the intended construction. Three pieces seem to do the job equally as well. (Image 22)

When the large weavings are introduced to the exhibition space, they naturally claim the space. They introduce themselves to the room with a self confidence that I wasn't counting on. This sensation that the weavings, just by hanging from the ceiling, seem to speak out for themselves makes me wonder whether the planned construction is going to benefit the pieces as I had intended. Furthermore I begin to understand to what extent the weavings themselves have a quality within them that invites people to come closer to the structure.

I do a test to stretch the weavings, across the space from one wall to another. What in my mind had seemed to be an exciting and unconventional way to exhibit a textile structure is now in the need of a rethink. As I experience the weaving as a stretched out object, the structure is forced into a state of abnormality. When the weave is still in the loom it is also stretched, but here the warp and the weft threads have about the same tension. As it instead stretched from one wall to another, only the warp threads are forced to stay in place. The horizontal weft ends are in a different state. (Image 23) I find the communication between the two elements to be lost. Furthermore, the angle, or direction of the stretched out weave tend to make the structure disappear from the gaze of the observer. It's floating above the head, and doesn't naturally meet the eyes of the viewer. These two observations results in a decision to rethink how to install the Architecture of Threads.

When I finalise the installation I do my best to keep my senses open to become aware of how the material and structure converse with one another. Simultaneously I bring back to memory the reason for breaking the conventionality of hanging textiles within a room. Both aspects are equally important and results in an installation where the structures claim their space without much force. I do in fact, despite all attempts to break free from conventions, let one of the three large weavings simply hang down from the ceiling. The piece is about four metres long, and the ceiling even higher. From a beam high above, the weaving is dropping down with all its embedded weight. Its loose warp ends touch the floor, as if making a statement. On either side of this centred piece, the remaining two large weavings are placed.

To create a sense of a world in which to become embraced by the woven structure, and at the same time challenge the linearity of the surrounding architecture, I let two weavings claim the space with unexpected angles. One, a shorter piece which measures one and a half metres long, is attached to the wall as well as the floor. The bottom part of the weave is moved out about half a metre from the wall. The other, about three metres long, is installed with a greater angle, and on top of that slightly
Neither of the two weavings has much tension or force in their positions, but rather follows an invisible diagonal without the constrains of the stretching.

Once these three large woven structures has found their position in the space, the small map-weaving is placed out. Originally this piece is woven with the dimensions of fifty by seventy centimetres, which is the same width as the large structures. (Image 26) However, when the small weaving is seen in relation to the large, they seem to take each other out. This observation leads to the small weaving being cut into four pieces. One of them is chosen to represent the map of the woven world. (Image 27)
CONCLUDING DISCUSSION

Through the course of this project, my attempt has been to visualise, problematise and contextualise my understanding of the significance of a woven construction, on a practical as well as intellectual level. To do the latter, I have tried to analyse how I see the weave, and by turning my eyes to maps and to use different perspectives, I have begun to decipher what weaving and woven structures mean to me. Besides digging deeper into my own understanding of the weave, I find that this work also has empowered me with new ways of speaking of textiles. It has both helped me to find the proper vocabulary and to strengthen my visual language. The visual language is naturally connected to the understanding of the woven structure on a practical level – both within my own practice and in the communication with people outside myself.

During the course of Konstfack Spring Exhibition, where *the Architecture of Threads* was presented to the public, I got the chance to, not only analyse the work for myself, but perhaps more interestingly to take part of other peoples' reflections regarding the work. During the course of the project, I have spent a lot of time thinking about how I want other people to perceive the weavings. One of my aims is to invite people other than myself into the complexity of the woven structure, where I see each thread as individuals that together with the next build up an entirety. By doing so I want to open up for an awareness of the wonderful and intriguing network of threads that makes up a textile material – also in a broader sense. To make people get curious about the material, it's construction and making. I look upon the pieces a bit like a conversation starter: once the senses begin to open up and notice the textile material in this particular work – connections can be made to other materials around us.

At the examination of this project a discussion arose about whether or not people do not already take notice and have great awareness about the material world. With such great amount of materials constantly surrounding us, isn't it inevitable that we also know very much about them? I don't doubt that many people have knowledge about materials, and I think a lot of people know more about materials than they may be aware of themselves. When we look at materials, touch them with our hands, a great amount of information goes into our system. At the same time, as the production of things moves further and further away from the consumers I believe that knowledge about that production (and the materials being produced) also drifts away. There is an interesting juxtaposition in this way of discussing that I find nourishing to my practice.

At the exhibition space people look really close, they even touch the work. Someone picks up the small weaving, feel it between their fingers, as if they need to use several senses in order to fully understand. As I watch visitors of the exhibition as they interact with the weavings in the installation, I take notice of how they handle the small piece. I see them draw their fingers across it, to try to understand its qualities. They compare it to the large weavings – and seem to understand the connection. In this perspective, the work that meets the public is managing to communicate and bring out a curiosity that matches the aims I presented earlier in this essay.

The way in which people approach the small weaving has triggered thoughts within me that connects to the discussion about whether humans need to use more senses than sight to deepen our understanding of the material world. As I watch people handle the piece I begin to wonder if our relationship with textile materials in general affects their actions. This fragile woven piece, that elegantly is placed on a podium in an exhibition is without much reflection picked up and touched upon. I draw parallels to how I myself would feel the material of a piece of clothing in a shop. There is a familiarity in the qualities of the material, that seem to give anyone the right to touch it. Within this I sense a curiosity that leads to attempts to understand this familiar – yet unfamiliar – material.
The large weavings are also examined closer. (Image 28) Many of the visitors express how they both understand and don't understand the structure. Its obviously complex, but the magnified weavings still tend to give away some sort of information about the construction. When talking to visitors the are most common question is how it is made. The magnification of the woven structure brings out qualities that seem to trigger people's curiosity to learn more about it.

Furthermore, one of the aims of this project was to visualise the sensation that I have when I weave. In the process of making the material my entire body is close to each thread, and I am able to watch them as they build up the woven universe. This is a sensation that I often loose once I take the piece off the loom. In this work, however, the enlarged weavings tend to communicate a similar experience as the entire body is forced to take in the hanging weavings in the installation. I find the scale of both material and structure as well as the size of the weavings and how they are installed to affect this experience.

Both the exhibition and the project as a whole has enriched me with new energy to continue my practice. This visualisation of my ideas of threads and weaving was my first attempt to let the material claim a space. It has been an important step to enlarge the structure and the material, and I feel encouraged and curious to stretch the boundaries even further. How much more can a waffle weave structure be enlarged before it collapses? What type of material is necessary then? And how will the size and material affect how people perceive the woven structure?

As a next step in my textile practice, I aim to continue a research based approach to the woven material and go deeper into the questions that have arisen along the path of the master degree project. I also find it ever as important to both share and extract knowledge with the world outside myself. One way is to let the material and structure move into public spaces, where meetings can be made possible between material and architecture, structure and senses.

In the following autumn I have been given the opportunity to follow a research team at the Institute of Building Structures and Structural Design in Stuttgart, Germany. It is a team of architects and structural engineers that use computational design to create advanced materials and architectural constructions. I look upon my own work as a low-tech version of computational design and architectural structures, and in the future I would like to do research in an expanded field of textile design. I find the boundaries between art, craft and science to be highly relevant when expanding a field such as the textile, and the similarities, as well as differences, between the fields intrigue me. How my time as an artistic research assistant at this particular institute will affect my future practice is impossible to say, but I am confident that it will nurture both the work of the craft and the intellect.
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