Knowledge in action in weaving

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Analysing crafting knowledge must involve both mapping cultural meanings on craft and looking for bodily competences when artisans handle tools and materials. This two-fold approach has been used in research done in, and together with, the textile craft cooperative, Vävkompaniet (the Weaving company), in the Swedish town of Borås. A reason the crafts persons took part in the project was that they wanted to reflect on their own tacit knowledge (Polanyi, 1983) and knowledge in action (Molander 1996). From an academic point of view the aim of the research was to analyse the weaving process in order to find empirical examples of important components of knowledge in action, as it has previously been discussed theoretically. The intent was to produce educational films for students, grounded in research. Four films on knowledge in action were produced during the project. This article is based on interpretations of interviews with hand weavers, and films of their work. A researcher and a weaving teacher observed the weavers, while a photographer filmed their body movements. Through interviews, conducted in a conversation-like way during the observations, a space for reflections on knowledge in action in weaving was created. Because of their material, rather than conceptual approach to craftwork, the weavers brought up the importance of material sketching by sample weaving. While work with dressing the looms and weaving continued, many empirical examples of aspects of knowledge in action were observed. The importance of routine, rhythm, bodily skills, senses, judgement and experience are discussed in the text.

Keywords: textile craft, weaving, tacit knowledge, knowledge in action, senses, visual ethnography

Crafting knowledge: about cultural meanings and bodily competences

Craft has been a debated concept for a long time. It has moved about in the borderland between art and design, and from time to time has been used as a counterpoint to both "design" and "fine arts" (Ihatsu, 1996, p. 22). At the end of the 90s when the arts historian, now professor, Sue Rowley emphasised the need for theoretical analysis of craft practices she described two standpoints towards craft which still seem to exist: craft as a conceptual art form versus craft as material expression. The first standpoint emphasises craft's potential to allow an individual idea (concept) to be easily expressed in opposition to the rectification of mass-produced design. The second stresses the skill to use the proper raw-material and technique to make useful products, and pinpoints that an important feature of craft is that you can see the work of the hand in the object, and meet the object with your tactile sense (Rowley, 1997).

The point of departure in our project is that this dualism is not fruitful because, according to anthropological research, it is fundamental that aspects of conceptuality and materiality are tied together in craft products. Objects have a social history and a cultural biography as well as a material form (Appadurai, 1986). Thus analysing crafting knowledge must involve both mapping cultural

meanings on craft and looking for bodily competences performed when artisans handle tools and materials while forming objects (hand operations, touch, rhythm etc). This two-fold approach has been used in ethnological research done in, and together with, the textile craft cooperative Vävkompaniet (in English: the Weaving company) in the Swedish town of Borås.

Borås is situated in an area with a rich textile cultural heritage, often presented as the region with most of the prevailing textile industry of Sweden. Additionally some textile craft production is still going on. Conducting research here, together with the seven members of Vävkompaniet, has made it possible to reach in-depth knowledge in action, as performed by weavers who, at least part-time, work professionally with textile craft. All of them weave, but some also make products using other textile techniques such as knitting, felting or embroidery. Based on the premise that research could illuminate elements of the work that had become routine, and practices that seemed obvious and natural, one reason for the crafts persons to take part in the project was that they wanted to reflect on their own knowledge in action (Molander 1996) and tacit knowledge (Polanyi, 1983).

From an academic point of view the aim of the research was to analyse the weaving process, to find empirical examples of important components of knowledge in action, as it had been previously discussed theoretically. Besides co-production of knowledge with the weavers, the intent was to produce educational material for design students grounded in research. Since bodily anchored experiences of performing craftwork can be better shown in moving pictures than described in written text and photos, the decision was made to produce educational films.

Method

This article is primarily based on participant observations, conversations and filming in the studios where three members of Vävkompaniet produce their goods, and on a filmed interview with a fourth member, conducted in the shop were the craft products are sold. Mostly participation meant asking questions about what the weavers did, but very occasionally it was participation in dressing a loom. Additionally, tape-recorded longer interviews with five of the members of the cooperative were used as data. This interview material clarifies the members' views on the concept of craft and gives insights into how they usually perform the process from (design) idea to a complete product for sale. Through their reflexive sharing of insights on weaving, members of Vävkompaniet have been co-producers of the results presented in this article.

Methodological inspiration came, to a great extent, from the anthropologist Sarah Pink's books about visual and sensory ethnography (Pink 2007, 2009). She defines ethnography as "a process of creating and representing knowledge (about society, culture and individuals) that is based on ethnographers' own experiences of reality that are as loyal as possible to the context, negotiations and intersubjectivities through which the knowledge was produced" (Pink, 2007, p. 22). Pink underlines that ethnographic research may include collaborative work, which is what our work, conducted closely together with the members of Vävkompaniet, can be described as. Visual ethnography with video filming helps invoke an understanding of how people actually perform their work, with different tools and in various social settings (Sperschneider 2007, p.274). This is relevant for our research. But it is also important that, according to Pink (2007, p.22), ethnographic texts do not only account for observable things; instead, interpretations of immaterial and sensory qualities of human experience and knowledge are included in ethnographic descriptions.

The research was also guided by consumer researcher Russel Belk's emphasis on the visual, which according to him may help us achieve a different type of knowledge [from what we would gain from speech or written text] "…especially conductive to the goal of non-positivist research to capture the unique human texture of our informants, phenomena and sites" (Belk, 1998, p.311-312). Our research

can be seen as phenomenological in the sense that the conversations and interviews were aimed at understanding weaving experiences from the interviewed persons' own perspectives (Kvale & Brinkmann 2009: 26-27). But inspired by the sociologist Joanne Entwistle we are also convinced that to understand knowing involved in a practice like weaving, a combination of phenomenological perspectives and insights into representations and discourses of craft and of the body circulating in society today, is needed (compare Entwistle 2000:39 who writes about dress as situated practice).

In this article, analysis of the longer interviews made by the researcher mostly answer to this quest to contextualise personal experiences. After transcription, the parts of the interviews regarding the meaning of the concepts 'sloyd', 'craft' and 'art craft', were analysed for the first section of this paper regarding the cultural meanings of craft. The remainder of the fieldwork was accomplished by a team consisting of the researcher, a university teacher of weaving, and a photographer/media producer. A senior lecturer at the school was the project manager and discussion partner throughout the whole process. While the practitioners produced their products we (the weaving teacher and the researcher) observed their work, simultaneously asking questions about what they were doing, while the photographer filmed their body movements. All the different tasks involved in dressing the loom and starting to weave were filmed at the three sites where the work was done. Additionally, two occasions when the fabric was cut off from the loom were filmed. If a task consisted of the same hand movements over and over again for a long time, the camera was shut off after a while, until the next task began.

We interpreted the material, first individually and then together. Firstly, all of the filmed raw material was looked through. Parallel to this process of surveying the gathered material, previous works on "tacit knowledge" and "knowledge in action" were read. Independently we wrote down what was shown in the filmed material and categorised it with single words or short phrases. Both of us also noted parts where the weavers nicely explained what they were doing or where their body and hand movements were performed in especially interesting ways or were very clearly shown. Figures telling where the films' interesting sequences started and ended were noted. Then we compared our notes and it became obvious that to a great extent we found the same sequences valuable to continue analysing as examples of phenomena that the literature brought up. The few sequences that just one of us found interesting were discussed but we decided to leave them out, since the sections both of us had chosen comprised extensive material which provided enough data for our purpose. In relation to the time for which the project was funded, the quality of analysis would not have been better if we had tried to go through even more material. At this point, we started to sort the content of the filmed material under headlines that emerged from both the literature and from the film-material itself. Sight, tactility, work with the whole body, choice of material, feelings, rhythm, and balance are some examples of such detailed headlines that we had both noted.

A second step of thorough watching followed. Now we watched together, in order to compare our interpretations of what we saw. We also discussed how the content could be part of a comprehensible story about knowledge in action, and started grouping the detailed headlines together under broader categories. After discussions, where the project manager was also involved, it was decided that eventually some of these bigger categories should be the titles of the four films we were to produce, which varied in length between 30 and 50 minutes: 1. The shop and the design process; 2. Routine, communities of practice and personal knowledge; 3. Skills, judgment and senses; and 4. Experience and problem-solving. The research stage of the project – the analysis of filmed material as data – can be seen as finished at this point of the film-making process. The media producer edited the films, with the project manager as a discussion partner, based on our notes on what sequences of raw material should be used to synchronise with each part of the spoken text that the researcher had written. Simultaneously, we worked with a paper that was the first version of this article.

Knowledge in action rather than tacit knowledge

All knowledge has a tacit implicit side; there are hidden competences which contribute to what we know and what we can do. But to what extent can these competences be described in words? In previous research there are different opinions: Are parts of practical knowledge always impossible to put into words? Or can hidden competences, which are not at all mentioned in one context, cease to be wordless and instead be given suitable words in other situations? (Rolf, 1991). In our project the starting point was that many things which occur wordlessly could be raised through our conversations with the artisans about their work.

The philosopher Michael Polanyi changed the word knowledge to knowing, since he wanted to underline that knowledge is dynamic, always moving and personal; it only exists in the form of knowing persons (Molander, 1996, p. 35 and 41). According to Molander this also means that it is always bound to the context in which it is put to use. In other words, knowledge in action is situated (used in specific situations) and performed in a personal way. Actually, knowledge in action can be considered as reflected personal experience, which can be used for new actions, in different contexts (presentation by Bengt Molander at NIH in Oslo 2010-12-15).

But if sensory perceptions included in forming such practical knowledge in action are to be mediated to other people, they are inseparable from the cultural sensory experience categories we use to give them meaning. Thus what has been called "tacit knowledge" is not just personal and not totally wordless but also connected to broader discourses and situated practices (compare Pink 2009, p.35). It can be reflected on, and tentatively be given words, to a greater extent the more the practitioner concentrates her or his attention on bodily sensations (Schön, 1983). Questions and words, uttered in a language which fits the events of the practice, can make the practitioners sharpen their attention and direct it at critical points in the practice they accomplish (presentation by Bengt Molander at NIH in Oslo 2010-12-15). By interviewing in a conversation-like way during observations, we and the interviewees together created a space for such reflections, where cultural meaning categories regarding craft work and descriptions of crafting practices were put forward and discussed. An important aspect of the dialogues was that we were both familiar with weaving; we shared professional language with the weavers.

Doing craftwork – a hermeneutic circle with reflection-in-action or reflection distant from acting?

Knowledge in action can be described as a hermeneutic circle; a movement back and forth between parts and the whole (Molander, 1996, p.114-115). Molander (1996, p.14-17 and 115) refers to what Thomas Tempte (1982) has written about "the practical intellect" and claims that there is extensive knowing involved when artisans let their ideas about the complete product direct the on-going craftwork. In the design process the idea about the whole makes you decide to work upon a part of the object, and when you have changed a detail, the whole also looks different, which makes another turn to altering some part necessary. This oscillating movement goes on and on while the object is formed. It is a process of working with the materials and tools which is full of reflection.

Different views regarding reflection have been put forward in previous research on knowledge in action: Does an embodied reflection that instantly manifests itself as a bodily action exist? Reflection-in-action according to Schön (1983) – for instance a hand movement you just do, without thinking of it, when you try to fix something which is on its way to going wrong? Or should that rather be called intuition, while reflection just gets space to evolve when you are not fully busy acting (Molander 1996, p.143)? Andersson Gustafsson (2002:167) writes that pausing, silence and slowness is needed for reflection. Molander is also among those who emphasise that reflection is when you take

a step back to think about yourself and what you do. That kind of reflection demands calmness and patience not to act instantly (ibid p.144). By distancing from acting, and by putting words to knowledge in action, it is possible both to communicate knowledge and to be self-critical regarding your own knowing. In that way the weaknesses of what you already know may be obvious and there will also be a way to widen your knowing by learning from others. Language, culture and social interplay are pre-conditions for reflection if seen in that way. When the hand weavers were observed, and when we watched the filmed material afterwards, we had not made any choice between these different ways of conceptualising reflection; we had both of them in mind.

Routine and good judgment – important features in an expert's knowing

It's said that you need 10,000 hours of training to be a skilled crafts person (Frayling, 2011, p.15). During that time bodily skills and capacities to use the senses to gain knowledge are developed and one way this knowing manifests is as routine. A concept that can be used to talk about how routine is established in craft work is muscle memory, or as the archaeologist Apel (2006) denotes it with a concept from neuropsychology: procedural memory (savoir-faire). Since this form of memory is connected to body movements it can merely arise from practical experience and extensive repetition. An expert can use muscle memory to build up bodily routine, which mostly makes the work go faster and smoother. But routine can also be important when obstacles occur since it can form a well-known background which unexpected incidents in the work-process can stand out against. Molander has discussed that points where attention ought to be directed become obvious with routine as a background (Molander, 1996, p.256).

Routine is of course not the only important thing in craft work. According to Molander, bodily skills, feelings and judgment are basic prerequisites for a qualified involvement with craft (1996). Judgment when it comes to making different choices in the craft process is also fostered by training. According to Göranzon (1990, p.74) good judgment is learned from experiences in different situations and the conclusions drawn from these. Molander also underlines the importance of dialogue. According to him, judgment is developed both through conversations between artisans and by the wordless conversation with the material. The raw material answers by changing when the artisan works upon it with tools (Molander 2006, p.21). The craft person's reflections on the answers from the material contribute to developing judgment.

According to the philosopher Herbert Dreyfus, the artisan develops from novice to expert (while knowledge turns into personal knowing). The novice must have rules for how to perform a task, and a teacher who mediates basic knowledge. Then, the more a person works with craft, the greater their ability to recognise opportunities that can be acted upon. The expert has experienced lots of different situations. Thus he or she can act spontaneously and unconsciously (Dreyfus & Dreyfus 2000). Dreyfus claims that the expert acts beyond or outside the rules, while Polanyi suggests that experts apply rules in a more qualified way. He or she knows that rules are not general, but that you have to find suitable rules to follow, depending on what context you are in (Rolf 1991).

Between novice and expert there are other stages, such as advanced beginner, competent and skilled. Molander mostly brings up the last stage – the expert – and is critical towards Dreyfus' view. He claims it focuses too much on bodily aspects of knowing: an expert, according to Dreyfus, just reacts unconsciously and does not engage in thinking and problem-solving. According to Molander, instead attentive action and reflections are woven together while knowledge in action develops (Molander, 1996, p.46-47).

Dreyfus' division of different stages has also been criticised for being too schematic and unrealistic. We agree with Molander that attention is very important and we also find the general critique relevant;

all crafts people do not pass through all the stages in an exact order. However, we believe that Dreyfus' model says something overall about a craft person's treatment of parts and wholeness, and also about some important competences that are developed and practiced as time goes by.

Meanings on the concept craft

Craft a debated concept

Previous Swedish/Nordic research on craft has been conducted partly within the frame of sloyd-research (slöjdforskning), predominantly occupied with knowledge qualities and learning of sloyd in schools (Johansson, 2005, Johansson & Porko-Hudd, 2007, Gulliksen & Johansson, 2009), and partly within artistic research on (art) craft (Astfalk & Jönsson, 2005, Bondesson & Holmgren, 2007, Konstnärlig forskning Yearbook from Vetenskapsrådet, 2006, Zetterlund, 2006). The latter has recently become a more vital research area, since higher artistic textile education in Sweden, according to governmental decisions, must now rest on a scientific foundation. This literature describes art craft with emphasis on artistic expression. The testing of materials and expressions described in these texts seems to draw on theories and/or experimental practices, combined with a critical reflexive approach learned by the art crafts people during university education. We felt that the (more or less) conceptual or artistically expressive craft raised in this literature, is in different league than the craft practiced by the members of Vävkompaniet. The craft produced by the members of Vävkompaniet is absolutely not uncritical or unreflective, but is on the whole less spectacular and less conceptual than that described in the literature on artistic craft. Thus none of the two types of research totally captures the work conducted in Vävkompaniet. Because of that, we wanted to know how the weavers themselves looked upon their work.

From our starting point it follows that there is no point in dividing artefacts into things for use (i.e. craft) and decorative things (i.e. art), since for the user artefacts can change meaning, from being things for use to being exposed as decorative art (Glassie, 1989 referred in Nordström, 1996). It is possible to judge different aspects of a crafted product positively, depending on whether the work is seen as conceptual art or craftwork (Rowley, 1997). The fact that different views of the concept craft exist, side by side, must not be seen as a problem; instead it can be enriching. It can lead craftwork in different directions at the same time and strengthen the position of craft in society. But since our project was about knowledge in action we considered that standpoints regarding craft as material expression, versus craft as conceptual art, may imply different focuses when it comes to what kind of "crafting knowledge" is emphasised: Skills in using the proper raw materials and techniques to make useful products? Or skills to materialise ideas and values in creative ways? We wanted to make clear whether the craft we studied was produced from any of these standpoints and, if so, discuss with the weavers how that might influence their views on what knowing that is most important. Therefore we asked the practitioners in Vävkompaniet how they defined the concepts craft (hantverk), art craft (konsthantverk) and to some extent sloyd (slöjd) and art (konst) (English wording from Ihatsu, 1996).

Art craft, craft or sloyd?

One of the weavers said that a cooperative with a shop, like Vävkompaniet, is very important for the type of craft workers she belongs to: "Here is a forum for us who are not well-known craft people… or art crafts people, but want to get our stuff out and hope for someone to like it." (Interview nr 6). Even though the members sometimes show their products at exhibitions, for instance in their own exhibition-room, the main display of their products doesn't take place in (art) galleries but on shelves or the display window of the small shop they own together.

"What is Vävkompaniet? What do we have [in the shop]? (…) Members may think differently about what they are doing," said one of the members when asked about the concepts craft and sloyd. She continued: " I feel that probably I think of what I am doing as art craft, more than sloyd because sloyd is more when you repeat something. (…) Like fabrication of a fork. Yes, something like this. You do it on and on again", she said and pointed at a wooden tool for fork-hooking (gaffelvirkning in Swedish). Actually none of the members called their own products sloyd. This woman exclaimed: "I do nothing of the kind! I mean I don't fabricate things that look the same all the time. Instead they are more art craft somehow," she said about her own products (Interview nr 4). She seemed to find the border between art craft and art more complicated (and maybe meaningless?) to define than the difference between sloyd and art craft, but she underlined even more that art comprises unique products: "I think there's only one item. If you make an art object, then, in a way, there is only that one. Because you just produce it once, like a painting. Yes, then it's art." "Thus, the concept of art you describe is more unique?" the researcher asked, to get this clearer and she answered: "Precisely. And art craft, I think, can be both. It can be one individual decorative thing, but it can also be an object for use." She also claimed that design is important when it comes to what shall be defined as art craft. It must not be the same design [model] all the time, but a unique form, so that if it is an object for use it has its own expression. Regarding textile work she said that art craft can, for instance, be about using a combination of colours that you have never tested before when weaving; "…you do not sit there and repeat" (Interview nr 4).

Another woman in the cooperative also calls her work art craft nowadays and she related a turning point in her life, when the seed to seeing her products as art craft was planted. It happened when she visited the big city nearby, to buy clothes. When she tried on some garments one shop assistant said that she needed a shawl around her neck to complete the outfit, and she went away to fetch one. But in the meantime this woman instead picked up her own shawl: "And then I spun my shawl around me and both the shop assistants said it was the most beautiful they had seen in a long time." She thought it was "insane" that someone who didn't know her said that something she had done was beautiful, and that the owner even wanted to discuss if such shawls could be sold in the clothing shop. "And then it struck me, oops, can something I fabricate interest others!?" That experience altered her view of the things she produced: "Then it was not just home fabricated handicraft, instead it was art craft!" she stated (Interview nr 1). Eventually this insight that her production could be labelled art craft led her to become a member of Vävkompaniet.

Yet another member said it is difficult to label what she is doing; she doesn't call it sloyd but on the other hand, unlike the women mentioned above, she hesitates to call what she is doing art craft: "I would like to say craft. There's so many different opinions, but I think art craft actually is an exceptional product, a unique product" (Interview nr 5). By pointing at a tablecloth and saying that she can set up the weft in a loom and make ten of the same kind, ten that look all the same, she emphasises that she is not doing art craft. She describes herself as someone occupied with textiles and a member in a group of crafts peoples, not art crafts people.

So the concepts are floating. Textile products become art craft when they are seen as goods, which can be labelled that way, based on how they are fabricated and how they look. The transformation of the products from (handi)craft to art craft is emphasised as their producer enters the manifold arena of art craft, or rather when the producer is allowed to enter this arena, since a person has to be elected a member of Vävkompaniet.

The design process in Vävkompaniet – a material approach

How the practitioners in Vävkompaniet carry through the process from idea to product seems to a great extent connected to how they view their position in the craft field (as not "well-known" crafts-persons) and how they have learnt to work during their education. It is noticeable that the members of Vävkompaniet describe a more material and sensitive, rather than conceptual, approach to craftwork. This can be interpreted, firstly, from interviewees' answers about their choices of different materials as a base for their production.

When one woman is asked to talk about what she has produced over the years, she answers by mentioning the textile materials she has been working with, in periods: "I have been weaving woollen fabric, and then also with paper-yarn and then with metal threads in it." She further explains that she means warps made of paper-yarn and wefts from copper thread, which makes a woven material that she can shape in three dimensional structures (for instance by folding). She came up with that idea because of the pure desire to experiment: "It was precisely this with the materials. Just have to mix them and see what happens!" (Interview nr 6). Another woman, who works with nuno-felting (felting wool onto silk or cotton fabric) expresses the same desire to experiment without having any hypotheses about what the outcome will be: "I just enjoy doing it. (…) I enjoy mixing colours and observing what happens and so on" (Interview nr 1).

Secondly, the members' stories about their appreciation of the textile cultural heritage convey a material approach to craftwork. One woman especially mentions the old habit of using outworn old textiles for new products. It seems that she views materials that have been used historically as carriers of the positive value of tradition. When she discusses other different textile materials she has used she mentions both bear-moss (björnmossa in Swedish) which she has used as weft in door-mats, hand-spun linen yarn "with splinter and straw in it" used for a table cloth, and old linen sheets, which she buys at auctions, cuts and then uses as fill for carpets. Another member sees her own work as part of a textile tradition of working with natural fibres: "Actually, I find it hard to cope with synthetic materials. Thus one thing I want is that natural materials shall not disappear. Instead they [natural fibres] must be available" (Interview nr 5).

Thirdly, the material-driven rather than conceptual way of working in craft can be interpreted from answers to the question regarding where the members get their inspiration. The textile material, rather than any idea about a message or value that shall be expressed, seems to be the common starting point. One woman, when she describes the basement room she works in, gives the impression that she is in the middle of her material. It is like a combination of a storage-room and a workshop where she has her stock of textile materials, tools and yarn on the shelves around her. She says it's rather messy but it's "awesome" to be in that room: "There's needles and there's buttons and knitting pins and sewing-machines. And that, I think – I believe – is inspiring! You feel: Oh, there's that. I have to use it for something. And that! It's like: what shall I produce from that? I think I want to see everything around me" (Interview nr 7).

The importance of sample weaving

When asked the question "What does your process look like when you produce something? Do you sketch?" one of the women says: "I both do and don't. Sometimes. But otherwise I just see the material: Oh, I want to do something from this! Now, for instance, I have lots of silk fabrics at home, in different green shades. Thus I am thinking of using them for a bag" (Interview nr 6). Since this material and sensitive, rather than conceptual, starting point is common among the members of Vävkompaniet, they sample weave more often than they sketch with paper and pencil. Sample weaving can be seen as material sketching (directly with the yarn) and experimenting in the loom. The aesthetic expression is tried out and technical problems can be solved through sample weaving.

When the research team followed the hand weavers' creative processes, we gained insight into what it means that knowledge in action can be described as a hermeneutic circle; a movement back and forth between parts and the whole (Molander, 1996, p.114-115). When we met Maria Stawåsen, one of the members of Vävkompaniet, we understood especially how important a clear conception of the whole is (or at least can be) in the design process. But we also got to know that the idea about which product she wanted to make – the idea equivalent with the whole – didn't show up until different parts were put into the same "intellectual melting pot". Conversations with friends about home decoration, a yarn with special characteristics, which she already had at home, and an old note book with structural drafts for different patterns one day melted together into an idea about the product: a panel curtain made in a weave pattern taken from the old note book but woven in modern paper yarn.

The idea about the panel curtain led her way through the sample weaving process. The parts she tested all related to the conception of the whole. She wanted to reach a quality of fabric which was stiff enough to be a panel and transparent enough to filter light from a window in a beautiful way. She wanted the paper yarn to lay flat and some very small interspaces, which could let light through, should occur between the yarns. Thus she experimented with several reeds which gave the weave different density. Since she is an experienced weaver, and already had knowledge about what denting can mean to a fabric's looks, she was not content until she had found a quality that didn't look as if the fabric was striped when it was held up to the light.

For another weaver we visited, Anna- Karin Lindfors, who also conducted the design process through sample weaving, the idea about a scarf was the whole and she worked a lot with the parts, denting and beating in to find a suitable soft and lithe quality of fabric. Maria and Anna-Karin also used sample weaving to test the finishing of their weaves. Maria experimented with glue instead of stitches for the hem of the panel curtain, and Anna-Karin tested different ways to make fringes. During sample weaving, the hand weavers do not just decide the aesthetic expression of the weave but actually they also practice the knowing/knowledge in action, which is needed to fabricate it. Up-scaling may mean that some additional handgrips or body movements are needed, but most of the body-motions are performed already when the sample is produced, thus also the possible ways of using the body are tested while sample weaving.

In the creative process knowledge from one domain can be used to develop something new within another area. Ann-Jeanette Rosberg-Kroon uses knowledge from her previous occupation as a goldsmith and weaves pieces of jewellry. The design has changed as her knowledge in action regarding weaving with metal threads has grown; she used to do flat weaves but now she makes forms with volume. When she talks about her creation process we get an example of another approach to design, where a pre-conception of the whole product is not as important as a reference point for working on the parts, as it is for other members of Vävkompaniet. It's not a clear idea of the complete product that leads Ann-Jeanette's work forward. Instead, a great part of the expression of each necklace or bracelet first appears when materials other than those of the basic weave are added, after the weave has been cut off from the loom. Each product is a bricolage of silver, pearls, stones, feathers and maybe other decorative elements. This way of shaping products, where decoration and colour is added at the end of the design process, makes the products unique and changeable, even after they have been sold in the shop. A stone or a pearl can be exchanged. If, for instance, a customer has worn a necklace at a party once, it can easily be re-made for another occasion where she will meet the same people. The goods are personalised and the customer can be co-creator in the design process. These are surplus values which this kind of design approach can contribute to.

Bodily skills, judgment and experience

Routine

As mentioned earlier, routine is an important aspect of knowledge in action. We interpreted secure and rapid, repeated body, hand and finger movements, performed when the hand weavers dressed their looms, as signs of routine; for instance, when they were threading, sleying and tying on. Also, the actual weaving – treadling, shooting and beating in – was often a matter of routine for the experienced weavers of Vävkompaniet. However, we noticed that tasks performed with routine were problematic to talk about. It is not easy to tell what you do when your movements follow accustomed patterns for action; when you don't think about what you are doing because you have done it the same way many, many times. But when we watched the filmed material afterwards we found practices that, if investigated, might lead to more insights into the meanings embedded into routine.

We were told that routine allows the weavers to find peace in the work. Anna-Karin Lindfors spoke of a state when "the autopilot" managed the work. It was her word for what happened during the occasions when she made movements with her body, but didn't direct her awareness and her thoughts towards them, because it wasn't necessary. The movements functioned anyway since the body´s muscle memory had registered exactly how they ought to be performed in order to be efficient. And they were repeated in the same way over and over again (compare Andersson Gustafsson 2002, p.167). Then it was possible for her to direct awareness toward other things instead. She mentioned that she could listen to radio or music while weaving. When we looked at Anna-Karin's tie-up (of the pedals) we saw how embodied routines certainly contributed to making the work flow easily. First she tied the pedal-cords into all of the lamms. Not until all the cords were fastened in the lamms she continued tying them to the pedals in one succession. In that way she created a rather long period when she could repeat the same hand and finger movements several times; a period when the muscle memory could work, when she didn't need to think of how a new task should be performed.

When Maria used the bobbin winder to make quills we got an example which can be related to the theories that routine can form a well-known background against which unexpected incidents in the work-process can stand out (Molander, 1996, p. 256). Since she was in a room where she didn't usually weave, the tools were placed differently than she was used to and she could not follow her normal routine. At first Maria didn't think of the fact that the operations had become different. But when the quill got entangled, her body started processing the significant features of the situation. She had to rewind some yarn from the quill and start winding once again. Then her muscle memory told her that something was wrong. Thus she tried to establish her normal routine in the new setting by using another handgrip the second time. And when she suddenly remembered the finger grip, which was part of her normal routine, she also noticed that the positions of the tools, in relation to her body and to each other, was different and had to be changed. She nodded at the umbrella swift and loudly said: "I don't think I used to have that one placed there." Thus the absence of routine – which she felt with her body – was the background against which things to pay attention to were discernible this time. After she rearranged the tools, the bobbin winding went very well.

Among the members of Vävkompaniet we did not just notice routine in body movements and grips. They also have routines around which order they do the different tasks in, while dressing the loom. Titti Jonsson, one of the members of Vävkompaniet, told us that when she started teaching weaving courses she had to write down every step in the process and pin the paper to the wall, so that both she and her students could see it. Still sometimes she has to pause a little and think about what is the next thing to do, but she certainly does not need a written list to look at. Nowadays her knowledge about all the steps has been internalised and embodied. Mostly the work just continues rapidly. Among the weavers we further noticed routines for continuing from one task to another. Thus even the critical points, where one task was replaced by another quickly, passed by when we were watching. For instance, Titti routinely places the front stick and the warp in a certain way on the reed when she

brings the warp to the loom. Through different preparations Titti has come up with a routine for dressing the loom where as little as possible can go wrong. Material aids like strings and straps, which she had added to the loom, and where she for instance could hang the reed, contribute to uphold her routine.

Dressing the loom in a secure way also included routines for constantly checking that everything, up to the moment when control took place, was properly done, for instance that every thread actually had been put through a dent in the reed. Titti, for instance, picked up the right number of heddles on each shaft before she started threading and she also had a system for threading one group of ends at a time, before she controlled them all. Other members had different systems for how and when such controls were made, but all of them had controls as routine practices during their work.

Personal, embodied knowledge, learned in communities of practice

Knowing persons have internalised knowledge by using it in different situations, by performing movements in personal ways (when it comes to pliability, intensity, rhythm and so on) and by investing feelings into the process where knowing is shaped. An example of personal knowing was that the length of the chains of movement differed depending on which person we observed. The members followed different routines, especially when threading and sleying the reed. These tasks can be done separately or as a continuous series of movements, covering both actions. One method was to do all the threading first, tie groups of threads together to knots, then untie knot by knot when sleying. But others did it in another way. They tied the reed up below the heddles and each thread was drawn through one heddle and one dent in a continuous movement.

The differences in procedure may stem from the fact that members started to form their routines when they were participants in different communities of practice (Wenger, 1998). Knowledge has grown during occasions where a group of people have met to commit themselves to hand weaving and collective learning processes have occurred. Participants have demonstrated to each other how to do practical work and they have reflected on actions together. There have been exchanges, for instance between teachers and pupils, people on the same course, or weavers who have been working in the same studios. All members emphasise that different courses they have attended have been very important communities of practice. Titti and Maria especially underline that being a weaving teacher has contributed significantly in building up their personal knowing.

During the project we have sometimes seen that despite the fact that members of Vävkompaniet and the researchers have learnt weaving in different communities of practice, a common understanding of weaving as a process exists. This could, for instance, be observed in a situation when Ulla, the weaving teacher, for the first time helped Maria from Vävkompaniet to dress a loom. When they needed to fix a broken thread together while beaming the warp, they instantly started working from different positions, without discussing what they had to do. Ulla stood behind the loom and put the end of the broken thread in between the cross sticks and then pulled the thread forwards. At the same time Maria, who was standing in front of the loom, put a new thread through the reed. Their body movements seemed automatically coordinated at the moment when the thread was passed over from Maria to Ulla. Their knowledge in action was clearly embodied, so no words were necessary. This was an example of wordless reflection-in-action. But on other occasions the cooperation led to reflections which were expressed in conversation. Thus we see no need to choose between the standpoints regarding reflection. Our empirical research has shown examples both of reflection-in-action and reflection through stepping back and conversations. One example of stepping back was given by Maria, who said that if major problems occurred she always “slept on it”, and the next day usually had a solution.

Bodily skills and senses

Regarding bodily skills in weaving, based on our filmed material we firstly want to mention rhythm (repeated changes between stillness and movement). Skilled weavers rapidly find rhythm in many tasks while dressing the loom. Just like Anna-Karin had found a rhythm when she tied up the pedals, all the experienced weavers' of Vävkompaniet have adapted the rhythm of the work to their own preferred body rhythm. Someone makes rapid movements and rapid changes between modes, while another person works slower. It is not the task that decides the suitable rhythm but the person performing that task.

Otherwise much weaving skill is about the skillful work of the hands – both deftness with ones fingers (dexterousness) and sensitivity are important. For instance, lots of knots need to be tied while dressing a loom. We have seen the thumb grip – thumb against forefinger – being used many times and another important hand movement has been the use of the flat of the hand when weavers sense the strain of the warp several times during the work process, either with a bouncing or with a caressing movement over the threads. How to deal with different textile materials, without tearing the threads, is an important skill that has to do with the tactile sense. It's all about sensing what degree of stretching is suitable or possible when working with different fibres and qualities of yarn.

We used the expression muscle memory ourselves when talking about routine earlier in this article, but that concept is not enough to explain what craft work does to the body. Also sensuous perceptions must be drawn into the picture (for instance using Merleau Ponty's phenomenological approach, even though we have not had the opportunity in our project to develop this angle further). When Titti picked up fibres for weft in her weave it became very obvious that the tacit knowledge of the hand includes both muscle work/motor activity and sensing. Her muscles worked while the hand gripped a bundle of fibres, and the sense in the hand decided the amount of fibres she should take each time to get equally thick inlays. Also when it comes to parts of the body other than the hands, weaving involves a combination of motor activity and sensing. The important "foot work" Maria did when she wove with fragile paper yarn is an example of this. She could sense with her foot how far down she could tramp the pedal before the threads broke. The pedal, the lamms, the shaft bars, the heddles and all the cords between the different parts in the loom transmitted information to Maria's body about the extent of stretching the warp-threads were subjected to. The pedals and all the other parts of the loom they are connected with can be seen as a tool, which is an extension of the body (compare Polanyi, 1962, when he writes about the blind man's stick). It is about having a dialogue with the material, letting the material talk, through the tool (compare Molander, 2006, p.21).

In the same way, sensing is a part of beating in. It's very seldom a weaver beats in with all the muscle power they have. Instead, most often a regular level of how hard every beat should be has to be accomplished. Accuracy and precision in the work demands care in the craft persons physical control of the body, writes the art and design historian Christopher Frayling (2011). And the sense in the body is important when you decide whether you are sufficiently accurate. The sense of how hard the beater hits the weave is transmitted through the body and it makes weavers adjust their body posture and muscle strength to beat sufficiently hard to get the density of the weave required. And when it comes to what they want, weavers need to use their eyes. An expert can perform many handgrips without looking at what they do. But sometimes the sense and the sight co-operate – hand and eye help each other to control that things go right.

An occasion when this occurred was when Anna-Karin used her sight to check what happened when she sank a certain pedal and at the same time she held a hand, with fingers stretched out, on top of all the shafts, which made her feel which ones raised when she tramped. Another function of the eye is what is called having a sure eye (in Swedish ögonmått, which can be translated "measure by the eye").

For a weaver this can be about approximately deciding length, angles and density as well as amounts of material.

Five human senses are often mentioned: touch, sight, hearing, smell and taste. We have not seen the members of Vävkompaniet use taste and smell, but you smell when you burn fibres to test the material and in the shop customers have spoken about the specific smell from woollen yarn. Sometimes one might take yarn in the mouth to give it a little dampness, and then at least there comes a taste from the material. So these five senses could all be involved in textile craft work, but as just mentioned, we have mostly heard of touch and sight, and some comments have also been about hearing. A weaver with a keen ear interprets different sounds from the weave as a warning signal that something is about to go wrong.

Besides the five senses that are often mentioned, balance and pain were two additional sense impressions that the members of Vävkompaniet experienced while we observed their work. That the sense of balance influences weaving was obvious when the weavers talked about treadling. They use both hands for throwing the shuttle, but some of them just use one foot at the pedals since the other one has to be placed still, so that balance can be maintained. Additionally, pain from long weaving hours is mentioned by the members of Vävkompaniet. Furthermore, the kinaesthetic senses (Proske & Gandevia 2009) must be mentioned. This is the awareness about the movements and positions of different body parts; the kind of perceptions that contribute to coordination. A hand weaver for instance co-ordinates treadling and shooting. Thus the kinaesthetic senses are also important in weaving.

The sense impressions sometimes can be discerned from each other – you can observe for instance when sight is the most used sense in a certain situation. But when Maria was sample weaving we understood that the occasions when the sense impressions together give a sense of wholeness and total presence in the situation are equally, if not more, important for the development of knowing in weaving. This was a moment when she was engaged in what happened to the weave and at the same time she reflected on what she did; a reflection where sight and body seemed to be more active than denomination and thinking. Donald Schön (1983) writes about "the practical intellect" tied to action and performance. Maria's sample weaving gave us a good example of this. When a question was posed she was totally concentrating on what was going on in the weave, so at first she did not even hear the question from the interviewer. She needed full presence in the weave to understand how material, loom and body should all co-operate to give her the result she wanted. With a phenomenological wording she described the feeling as "being there" – being in the weave: "You are in it! I am here," she said and pointed at the threads in front of the loom.

The importance of judgment and experience

In our project we have listened carefully for stories about the hand weavers' development to the skilled experts we think they are today. Anna-Karin for instance told us that both her method for threading and her feelings for that task had developed. In the beginning she thought this work was very dull. But nowadays, when she uses heddles with open eyes and a hook to pull the threads through the heddles she has adapted this task to her own body rhythm. Through training she has developed speed, got a routine and now she can feel calm while threading. Without openness towards testing new tools and new equipment in the loom this development would not have been possible.

We have seen several examples of experts' good judgment, many of them have been about how to work with a certain textile material in the best way/with the best methods. Knowing the characteristics of different materials in a practical way is a very important competence for the weavers we observed. An example of this was when Anna-Karin decided to change her method of tying the threads to the

front stick. The threads of woollen yarn she used just slipped when she tried to make knots that should rest on the stick. Her judgment said that the weave would be uneven if she continued knotting in that way, so instead she choose another method where the threads are tied together to knots and a cord is drawn into each knot, and between the knots it is drawn around the front stick, to fasten the warp. This shows how important it is that more than one way to do different tasks is taught at weaving courses. Education must give the students a repertoire of possible ways to do things.

Besides using the best method for each material, other important judgments we saw the experienced hand weavers make were choices of suitable tools; tools that fitted both the material and each person's working method. For instance, the choices of shuttles were not random but adapted to the quality of the yarns and densities of the weaves. Also a little detail, like the choice of reed hook, could be carefully thought over. Anna-Karin for instance, who worked with so called heddles with open eyes, chose the combined threading and sleying hook (a very small reed hook), since she first used it to pull the ends through the heddle-eyes.

The experienced weaver can often answer the question: What does the way I work with this part mean for the whole? The answer to that question is especially important when you need to solve problems arising during the work. Understanding of how every single task influences the whole work process, and the characteristics of the final product, is needed to be able to choose which path to follow. The expert can see alternative solutions, adapted to different situations. As Donald Schön puts it: he can have a conversation with the situation (Schön, 1983). The experienced weaver can change things in the on-going process; flexibility is a sure way to security. For instance, Titti told us she had changed the pattern on a table cloth because she had actually used the wrong pedal for a while during weaving. We, who didn't know that this was a fault, just saw another rhythm in the pattern there.

Titti also gave an example that experience can lead to a new invention and thus to rationalisation. She has invented an aiding tool: with the help of a clothes-stand and small textile cushions filled with sand she has rationalised away the person who usually holds the warp during beaming. She draws the warp over the clothes stand, which is placed in front of the loom and, to stretch the threads and get resistance, she hooks on the weights (the sand-filled cushions) in the cords, which are tied around the warp to gather the threads. Nowadays she can work by herself any time she wants without depending on help. Another way to rationalise is to get rid of unnecessary processes in the work. Maria, for instance, doesn't knot threads together when she changes yarn while making a warp. She just fastens the thread she finishes with, by pulling it under the threads which are already stretched on the warping mill, and then she ties a loop in the beginning of the new thread and puts it onto the end stick on the warping mill. This saves time, especially when there are many changes of threads, like when Maria made her warp.

Some concluding words

For a small textile cooperative like Vävkompaniet the base of the production is the skilled craft work we have tried to enlighten here. The aim of the article has been to present empirical examples of important components of knowledge in action, as it has been previously described theoretically. Before we started analysing the members' weaving we had to understand what approach they had to craft work, since that influenced what knowledge and competences they emphasised. As we described in the first part of the article – which was based mostly on interviews – the production we have studied is called art craft or just craft by the weavers themselves. They make both series of objects and individual decorative objects, but mostly they think that their products simultaneously are objects for use, which distinguishes them from art objects. Connected to this the weavers describe a material and sensitive, rather than conceptual, approach to craft work, which tends to make sample weaving a more

important feature of the design process than sketching with pencil or artist's colours and brush. The skill to use sample weaving as a material sketching technique was developed by the weavers from their education and onwards. It involves having an idea about the whole (the finished product) and realising it by working through the parts (like the density of the warp or the intensity of the beating), while all the time doing a movement back and forth between evaluating the parts and the whole, when the judgment is made about what should be the next step in the design process. Thus sample weaving demonstrates that from the start of the weaving process, knowledge in action can be seen as a hermeneutic circle (Molander 1996). We also noticed that working with this oscillating movement between the whole and the parts is important as the work goes on. For instance, a loose thread in the warp is a small part which can influence the impression of the whole finished weave later. The competence to handle such small details with suitable tools and the right grips is profound in weaving.

In the second part of the paper – based on observations, conversations with the weavers, and filming – we have described several situations where the artisans have used bodily competences and senses while working with parts (small details) of dressing the loom and of weaving. We have also tried to show how the weavers use different ways of controlling that the small parts of the work they are doing are made in ways that guarantee the quality of the whole finished product. Empirical examples on aspects like routine, bodily skills, senses, judgment and experience, which have been discussed earlier in the theoretical literature, certainly have been possible to find. An important insight is that the knowledge that the artisans started to learn at different schools or in other communities of practice (Wenger, 1998) has been made their personal knowing (compare Polanyi, 1983) through their continuous work with weaving. Thus their judgment regarding, for instance, choice of tools involves knowing about what is suitable for the textile material they are working with and about what fits their own personal way of working. Hopefully our article and the films we produced in the project can inspire the reader/viewer both to direct attention to the small details of hand weaving and to think of weaving as a process that involves the whole person, and therefore is just so great to do!

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Lecture

Molander, B. 2010-12-15, at the Symposion Praktisk Kunnskap i idrettspedagogisk arbeid. Oslo: NIH Seksjon for kroppsöving og peadagogikk.

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