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Craft Qualities Translated From Traditional Crafts to Smart Textile Services

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ABSTRACT

In this article we suggest craft and craftsmanship as an inspiration to design more sustainable smart textile services. We look into the opportunities that interactive properties and services bring into the textile and garment life cycle. We use traditional crafts as a source of inspiration for the design and as a reference to analyse emerged smart textile examples with craft experts. We demonstrate the process in the form of a dialogue between the smart textile as material, the designer-researcher and the community of craft experts. The Research through Design activities result in three iterations of the smart textile proposal, suggesting Augmented Reality as an extra layer on the textile material, and a set of design guidelines as craft qualities. We demonstrate two versions of craft qualities found and evaluated in the Muhu skirt as a traditional folk garment, as well as 'QR-coded Embroidery', 'Bedtime Stories' and 'Textales' as smart textile examples. The story of defining, evaluating and reflecting on the act of designing as the generator of knowledge illustrates how the community becomes part of the Research through Design process.

KEY WORDS

Craft qualities, craftsmanship, design, sustainability, smart textile services

**INTRODUCTION:
FROM TRADITIONAL CRAFTS TO SMART TEXTILE SERVICES**

According to William Mark Adams (2006, p. 13), sustainability is ‘the path that allows humanity as a whole to maintain and extend quality of life through diversity of life’. Richard Lumsden (2003, p. 4) suggests (based on Carol Boyle) that sustainability is achieved ‘when an activity can be continued or sustained indefinitely without damage to the fundamental global system of the environment and the human social condition’. In this paper we suggest looking into traditional crafts as a sustainable practice and, with reference to Richard Sennett (2008), into craftsmanship as a sustainable attitude and way of creating new products and services—and apply the qualities found in traditional crafts to smart textile examples.

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is a peer-reviewed research journal supported by an International Editorial Advisory Group. The journal is listed in: the Australian ERA 2012 Journal List (Excellence in Research for Australia); the Danish Bibliometric Research Index; and the Norwegian register of approved scientific journals, series and publishers.

In order to understand how to guide the developing smart textile services towards sustainable craft values, we compared examples from the Creative Industries Scientific Program (CRISP), Smart Textile Services (STS) project to a traditional folk garment—the Muhu skirt (Figure 1). Further, we asked experts from craft practice and research to point out values they found similar between the folk costume and the proposed smart textile examples. Based on the gained insights, we proposed a first version of craft qualities, through the redesign of the smart textile proposal, which we took back to some of the same craft experts to evaluate.

The Muhu skirt is a traditional folkloric woollen skirt, 67 cm in length and measuring 252 cm at the hem. Meant for young maidens on a small island in Estonia, it has gone through many changes in the comparatively recent past—including going from single colour to stripes, and from reddish brown to reddish and orange. The plain stripes are accompanied by patterned stripes; the hem is decorated with a crochet lace. Since the 1930s, a lemon yellow skirt with a flower-embroidered border has been iconic to the island. (for these details see Puppert, 2011).



Figure 1 /
Muhu skirt worn by Ots. Photo from Ots' private collection.

The Muhu folkloric skirt served as an inspiration for the 'QR-coded Embroidery' project on conceptual and visual levels. 'QR-coded Embroidery' is a pillow that has a folk-inspired Quick Response (QR) code embroidered on it, which refers to a fairy tale related to the origin of the folk-inspired embroidery. The prototype was made by Kristi Kuusk using an embroidery machine and a basic HTML website.

Over the course of the project, the prototype was further developed in collaboration with industrial partners into an Augmented Reality (AR) fairy tale on textile with woven imagery, titled 'Bedtime Stories'—which detects images woven to the textile and relates AR elements, which can be seen through a tablet or smartphone, to the material.

HOW COULD CRAFT QUALITIES INSPIRE SMART TEXTILE SERVICES?

The environmental and societal concerns arising from conventional textile and garment production are covered widely in literature. Julian Allwood, Søren Ellebaek Laursen, Cecilia Malvido de Rodriguez and Nancy Bocken (2006) define the main environmental problems and propose a perfect sustainable consumer. Reet Aus (2011) deals with issues arising from production waste and shows an example for upcycling it. Kate Fletcher (2008) brings examples from different sustainable fashion directions. The development of smart textile products, which lie at the intersection of fashion and technology, raises additional sustainability challenges for the traditional garment and electronics industries. Andreas Köhler (2013) covers ecological issues specifically concerning smart textiles in his Ph.D. thesis. Textiles and technology, both innovation and fashion-driven industries, have their share in the overall consumption pace and the concerns involved. However, the interactive and dynamic properties of smart textiles that allow new kinds of services to emerge within the apparel field could potentially direct the industry towards becoming more sustainable. Certainly, there is an opportunity in smart textiles for achieving a slow and circular life cycle of the textile product.

Crafts with their involved traditions and rituals evolved over centuries—even sewing needles are believed to have been around for thirty thousand years. In our research team we translate the cultural values of these craft qualities into developing smart textile services—our aim being to regain some of the long-lived principles such as quality, individualised approach (tailoring) and value for handwork that was neglected when moving towards efficiency and standardisation. Smart textiles allow new values and ways of using garments to emerge in the textile industry. With their dynamic properties and collaborative approach (Bhömer, Tomico, Kleinsmann, Kuusk., & Wensveen, 2012) they call for a radical change in the garment industry. For a radical change, paradigms need to change rather than the materials we use, the way garments have been made, or how many times we use one cradle-to-grave item. As Donella Meadows suggests: 'There's nothing physical or expensive or even slow about paradigm change. In a single individual, it can happen in a millisecond. All it takes is a click in the mind, a new way of seeing.' (Meadows, 1997, p. 11). Therefore, it is important to consider the new dimensions the properties of smart materials open up. By looking into traditional values of textiles and crafts in general and into finding the qualities they share with smart textile examples, we hope—through a collaborative approach and craft value system—to propose an alternative to more conventional textile and garment production.

Nithikul Nimkulrat (2012b, p. 7) points out the great depth of crafting and its qualities: ‘Through the skilled hands of a craft practitioner, not only form is given but also meaning is embedded.’ Sennett is very clear in saying that crafts and everything related to them are much more than old techniques. He talks about material-engagement as part of the craftsmanship approach as ‘basic human impulse, the desire to do a job well for its own sake.’ (Sennett, 2008, p. 9) According to Nimkulrat (2012b), craft also involves direct experience, personal vision and mastery of a medium, and thus is a form of practice applicable to any design or art processes and activities. She refers to them as the objects or outputs of experience. Yuri Na (2012, p. 15) defines craft as a ‘creative activity by humans whose aim is the aesthetic functional object, realised from its whole life cycle as finished object, practice of making process, and services.’ She also separates contemporary craft that focuses on the ‘presentism’ of craft and contemporary living (last ten years) and traditional craft that belongs to the past.

Sennett links innovation to one’s personal identity talking about craft as a more advanced level of technique, such that the ‘technique will be intimately linked to expression’ (Sennett, 2008, p. 149). Similarly, Shaowen Bardzell, Daniela K. Rosner and Jeffrey Bardzell (2012) argue that craft is not a dead skill from the past to be preserved, but rather that craft participates in everyday life and evolves over time. There needs to be a certain relationship between the craftsperson and the community in order for the work to develop and stand out.

Merzali Celikoglu (2013), Mili Tharakan (2011) and Fang-Wu Tung (2012) stress the importance of linking the skilled use of community resources to community aesthetic sensibilities. Craft is directly linked to a specific community and place. ‘Pre-industrial artisans were skilled craftspeople who used locally available materials to create products and generate income’ (Tung, 2012, p.71). Craft is also highly cultural and carries an important role in documenting tradition. Handicraft has been used as information storage, telling stories about the village and histories of the community. As Celikoglu states:

Cultural traditions are a continuation of the past, as well as a projection into the future, actually being elements of the continuity of a society’s history. At this point, craft products can be taken as one of the transmitting elements of culture and tradition. Craftsmanship and so, craft products are material beings in the intersection of culture, tradition and society since historical production techniques and rituals generate them. (Celikoglu, 2013, p.36)

Certainly, craft objects are believed to have emotional value for the user in a meaningful way. They carry a story and an identity (Tharakan, 2011).

The developing smart textiles area is not part of an industrial system at the moment, and can therefore afford to look into different approaches, such as crafting. Some projects have focused on crafts and done interesting work in bringing textiles and technology closer through craft techniques. Tharakan (in Tharakan, Okude & Cheok, 2011) explores how Indian textile crafts would shape the future of interactive textiles and technology. Michelle Baggerman (in Baggerman, Kuusk, Arets, Raijmakers & Tomico, 2013)

looks into the social aspects of crafts in the context of smart textile services. Several designers within the smart textile field have focused on crafts and done interesting work in bringing textiles and technology closer through craft techniques to express conceptual ideas. Maartje Dijkstra (2015), for example, brings together material explorations in delicate shapes and powerful sculptural fashion items. Anja Hertenberger (2014) and Meg Grant (2015) created delicate Lace Sensor Dresses that bring together

pressure sensors made out of lace, and speakers covered with embroidery. Melissa Coleman (2009) also brings together craftsmanship and artistic expression in her work, such as the Holy Dress, a garment that punishes its wearer through an electric shock when a lie is told, and Media Vintage, a series of interactive electronic textiles that contain memories. The area should claim its right for a playful exploration phase, to understand what is meaningful to the user, before becoming part of mass production cycles.

Inspired by Estonian folkloric skirts, the first author of this article designs ‘QR-coded Embroidery’ (Figure 2)—that is, pillows with folk-inspired QR codes embroidered on them. When the code is scanned with a smartphone QR code scanning application, it directs the user to a video of a fairy tale. The fairytale originates from the same region as the patterns and colours used as an inspiration in the embroidery design. The QR code embroidered on top of a textile can be scanned with any freely available QR scanning software. The application needs an Internet connection to open the resulting website with the video in the smartphone browser. The website can be updated constantly; therefore, it can show different fairy tales at different times of the day, months of the year etc.



Figure 2 /
‘QR-coded Embroidery’ pillow that connects fairy tale to its origin’s colours through a QR code. Photo: Arttu Karvonen, PR fashion room, model: Kertu

‘Bedtime Stories’ is the next design iteration of the ‘QR-coded Embroidery’. We brought the craft-inspired prototype to the industry partners and developed it further together. Here, the skills and tools of the designer-researcher extended to those of the collaborators. The concept offers an alternative way to translate fairy-tale knowledge into people’s personal experiences and pass that wisdom through generations while building up family stories together. ‘Bedtime Stories’ consists of a set of bed sheets that have images woven into the fabric. The images are recognized by a custom-made software that displays 3D characters from a fairy tale through an iPad onto the textile. This allows parents to create personal stories with their children during going to bed rituals. In the example—the story of Little Red Riding Hood—three characters communicate the story: the wolf, the grandmother and the flower.



Figure 3 /
‘QR-coded Embroidery’ pillow that connects fairy tale to its origin’s colours through a QR code. Photo: Arttu Karvonen, PR fashion room, model: Kertu

METHODS AND PROCESS TO DERIVE CRAFT QUALITIES

To identify craft qualities that could be related to smart textiles, we first asked craft experts to compare three examples—the original Muhu folk skirt, the smart textile examples ‘QR-coded Embroidery’ and ‘Bedtime Stories’. The craft experts pointed out values relating to crafts that were present in all three items. The first semi-structured interviews with craft experts re-defined the designer-researcher’s understanding of the craft qualities. That change in the understanding is described in the next section of this paper. Following the multiple interpretations principle of interpretive field research of Michael Myers and Heinz Klein (2011) the re-defined understanding was again confronted with experts of the crafts field. The same group of people with in-depth

understanding of crafts was invited to share their knowledge reflecting about the new smart textile design. In the second round of interviews we asked the craft experts to comment on the craft qualities and the designer-researcher’s re-defined understanding of them. The way the designer-researcher saw the craft qualities in the traditional Muhu skirt, and in smart textile re-design ‘Textales’ was presented to the experts to validate and enrich the understanding of the craft qualities. The craft experts were asked to point out how they saw each craft quality present in traditional crafts, e.g. the Muhu skirt, and in the smart textile service concept ‘Textales’. We also asked them to comment on the craft qualities in general, if they noticed anything they found should have been different.

All interviews lasted around one hour and were kept relatively open to enable the participants to give their opinions at ease. For data capture, all interviews were recorded in field notes and audio recording.

THE FIRST VERSION OF CRAFT QUALITIES AS A REDEFINED UNDERSTANDING OF THE DESIGNER-RESEARCHER

The first version of craft qualities (Kuusk, Wensveen, & Tomico, 2014) was found as a result of the first round of interviews with the craft experts. In the first interviews the craft experts reviewed the traditional Muhu skirt along with two smart textile projects, ‘QR-coded Embroidery’ and ‘Bedtime Stories’. The smart textile objects were presented to the experts who were asked to point out similar aspects between all of the three. What emerged was a set of qualities encountered within the traditional crafts and the smart textile services projects ‘QR-coded Embroidery’ and ‘Bedtime Stories’, identified by the members of the project and interviewed craft experts. The first version of craft qualities was drafted up based on the interviews. Craft qualities inspire smart textile services to be designed from a sustainable starting point. They allow the services to emerge from the need and meaning in the society, carrying traditional values.

The experts were chosen based on their knowledge and different kind of expertise on (Estonian) craft and approached through shared contacts. Mirje Sims is the chairman of the board of the Haapsalu Handicraft Association in Estonia. Her main interest lies in Haapsalu scarf preservation and innovation. Katrin Kabun is a wool and knit expert devoted to promote traditional wool. Tuulia Lampinen works mainly with weaving in Finland. Marit Ahven is the Fashion Design lecturer at the Estonian Academy of Arts and HULA project manager. Her interest is mainly in sustainable fashion. Nithikul Nimkulrat is a lecturer in Textiles Craft, textiles, practice-led research and is an experiential knowledge artist and crafts researcher.

The experts were involved by the means of informal conversations, semi-structured interviews and e-mail exchange. As Celikoglu (2013) points out, based on Allan Feldman (1999) and Sarah Pink (2007): conversation as a cooperative venture has a direction allowing new understanding, the transmission of knowledge through an informal conversation also provides the potential transfer of tacit knowledge. In order to be able to find new directions the conversations and interviews for our research had an open format. During the meetings we introduced the prototypes and the rationale behind them to the experts. Afterwards they were asked to point out craft characteristics in each example: Muhu skirt, ‘QR-coded Embroidery’ and ‘Bedtime Stories,’ and find overlapping values in them.

As a result, nine craft qualities were identified—each serving as an inspiration for the re-design of the smart textile service proposal ‘Bedtime Stories’ into ‘Textales Dream Bear edition’ and ‘Textales Sunny Sunday edition’ that will be explained in the next section. Each craft quality will be explained first from the traditional craft perspective, and then through how it appears in the ‘Bedtime Stories’ project. Through this narrative, we present the re-defined understanding of the designer-researcher. The nine identified qualities were:

- Embedded meaning
- Material as a medium
- Hidden stories
- Heritage and tradition
- Touch and feel
- Societal responsibility
- Family connection
- Open source community
- Evolution in time

These craft qualities are described for the sake of clarity mainly based on traditional crafts (exemplified by the Muhu skirt) and the ‘Bedtime Stories’ project, and not ‘QR-coded Embroidery’, despite it being an equally important example in the process of identifying the qualities.

Embedded meaning in traditional craft originates from the community’s ability to store ‘coded’ information on the folk garments. It requires a key of knowledge to be accessed (Summatavet, 2005). The quality is about local people adapting currently valuable meaning to the universal symbols and using those unique and personal representatives to tell a story of that time in their community. In the first industrial design experiment, ‘Bedtime Stories’, the digital static 3D characters are revealed once the defined image has been recognized by the tablet on the duvet cover. The extra layer can only be seen through the tablet device in the specific application.

Material as a medium in traditional crafts represents the material properties and knowledge inherent from the environment and the maker or craftsperson. For example, the Muhu skirt’s orange-yellow colour originates from the sea mines that were washed up at the local port in 1930, where Muhu women got the necessary yellow tone for the yellow skirt yarns (Puppart, 2011, p. 159). It stands for the craft’s character to be the mirror of the current time, always renewing. Also in ‘Bedtime Stories’ the embedded fairy-tale, being digital content, could potentially change over time. The textile is enriched with an additional digital layer and the stories are communicated through the interaction of textiles and technology.

Hidden stories in traditional crafts act in the way of traditional costumes used to carry public and personal stories. The stories are embedded into the weave of the fabric, but their meaning and ‘code’ changes over time. Muhu embroidery has always been connected to the times, conditions and people of the time, and developed together with the island and its stories (Kabur, Pink, & Meriste, 2010, p. 295). In ‘Bedtime Stories’ the fairy-tales that are hidden in the duvet cover are the essence and the main value of the project.

Heritage and tradition in traditional crafts stand for the rigid custom of passing crafting skills on to the next generations in the family and community. For instance, as Kärt Summatavet (2005, p. 69) notes: ‘It was thought to be her mother’s fault when a girl could not manage handicraft’. It was also customary to fully use textile pieces, since the material was extremely time consuming to make. In ‘Bedtime Stories’ the intangible values that are embedded into the technology in the project create the connection with the heritage. Traditional relevant story-telling carries human values along family by family. The stories shared in a new way give a modern view of the community to the traditional story.

Touch and feel in traditional crafts builds on the way many craft items invite touching. It’s almost that they are expected to feel differently than they look. Depending on the thickness and material of the thread, a woven textile varies from smooth to rough. A printed image can be easily distinguished from one embroidered or woven by hand. ‘When one touches an object, the touch searches for a connection between the object touched and the consciousness of the person who touches it’ (Nimkulrat, 2012a). In ‘Bedtime Stories’ touch is an essential property achieved by the use of high quality woven textile. Touch of the textile remains to be the leading trigger for the digital interaction.

Societal responsibility in traditional crafts celebrates the distinguishable style of each craftsperson, that made it possible for a craft object to be traced, where the material came from, who designed and made it. The item’s making process formed a story with its embedded meaning in the specific community (Kabur et al., 2010). The material scarcity and local lifestyles allowed nothing else than local and high quality materials and production. In ‘Bedtime Stories’ the production steps from creating the textile onwards have been closely followed by the project partners involved in producing the sample. Local and high quality materials and production methods have been used.

Family connection in traditional crafts represents the shared time and stories that were part of many crafting activities. For example, the tradition of gathering all women of the family when making the traditional mittens and other textile items for the wedding ceremony and dowry. As important as the craft objects themselves were, there was also an underlying agenda to share stories and experiences of the two uniting families. Group con-

nection through crafting has also been used in therapy (Corkhill, 2014). In ‘Bedtime Stories’ the family connection is envisioned to grow through the time and stories shared on the duvet cover. It is realized by providing together time and story inspiration for the family through the combination of the textile and tablet application.

Open source community in traditional crafts is based on their reputation of being open (within a certain community) and developing towards directions guided by the community of crafters. The patterns and techniques for handicrafts, for example, are shared and passed on within the family and community. They are also borrowed or adapted from other communities’ creations. They get applied to the current local context and relevant issues. For example, there were different modifications of the Muhu skirt in time: red, orange, and yellow, due to the available materials and skills of the specific time (Puppart, 2011). ‘Bedtime Stories’ has been seen as an open canvas for communication. By connecting digital content to the static textile canvas, it gains a property of carrying ever-changing information on its surface, therefore becoming a communication tool.

Evolution in time in traditional crafts is about their constant change. The standards, skills and also the ideas present in crafts depend on the community and the craftspeople working on them. The crafts gradually change due to the environment, material or mindset changes in the community and in the craftspeople. As noted previously, Bardzell, Rosner and Bardzell (2012) argue for craft not being seen as a dead skill from the past to be preserved, but rather that craft participates in everyday life and evolves over time. Likewise, the ‘Bedtime Stories’ project is changing and developing over time. At first the change is through the iterations, and later perhaps by the supporting community. The possibility of creating new data, characters and stories, and extending the application to different platforms, is a start to showing some possible directions. Evolution in time gives the potential for a service model to naturally occur because of the maintenance and development needed over the course of the project.

CRAFT QUALITIES FROM ‘BEDTIME STORIES’ TO ‘TEXTALES’

Based on the interviews with craft experts in the context of the Muhu skirt, ‘QR-coded Embroidery’ and ‘Bedtime Stories’ we collected the first set of craft qualities, as described in the previous section. The gained knowledge became essential in designing the next iteration of the project combining textiles with AR digital imagery appearing on the textile layer. Consequently, in this section it is explained how some of the specific requirements, which we defined for the redesign of ‘Bedtime Stories’ into ‘Textales Dream Bear edition’ and ‘Textales Sunny Sunday edition’ based on the first set of craft qualities.

The craft experts appreciated the surprise and hidden elements of the project. The symbol used had to remain secret to the human eye also in the next iteration. The duvet cover would need to look beautiful. The digital characters would need to act as an added layer, which would bring extra meaning and surprise effect. Folkloric craft items carrying personal and public stories suggested the AR content to contain well-known elements with the possibility to adapt them to the user’s personal preferences. Similarly to the stories of craft, the AR content needed to change in time. Craft reflecting the current view to the values in life suggested the AR content connected to the duvet should carry a traditional fairy tale with a modern twist. This way the traditional cultural heritage would be adapted to the modern context.

To focus on a certain physical location with shared values, we decided to arrange all steps of the development of the new iteration of ‘Bedtime Stories’ in Europe as close to the project team’s base (Eindhoven, Netherlands) as possible. That would

allow the project team to keep an overview of the different steps and parties involved in the process. The story would reflect issues and themes relevant in that particular context at the moment. Touch, as the craft experts pointed out, is an essential property of any craft material and item. We made sure that this quality would be embedded into the interaction with the duvet the AR element would trigger. For example, when ideas to implement some features to the touch screen came up, we neglected them in favour of referring to the essence of textile touch in the concept. As such, we kept textile as the main interaction interface for the stories and didn't design the tablet screen to capture touches.

Keeping in mind the family connection as a strong characteristic of crafts, we made sure the storytelling involved parents or siblings experiencing the story together with the children—hence avoiding the AR application becoming a game for children to play alone. Acknowledging the openness related to craft characteristics, our aim has been to support users in making their own stories and to change the existing ones as they please. Similarly to traditional craft communities, we'd like to see the next iteration of 'Bedtime Stories' grow together with a community. The new software and story developments should be open and sharable. Privacy has to be maintained, but it should be possible to share the stories with the extended family if wished.

Figure 4 /
"Textales Dream Bear" edition realised by: Kristi Kuusk (TU/e),
Unit040, Johan van den Acker Textielfabriek and Kerstin
Zabransky. Photo: Katrina Tang Photography, models: Linda Nete,
Airon, Taavi. The video of the "Textales Dream Bear" edition is available:
<https://vimeo.com/130356417>



In the "Textales Dream Bear" edition (Figure 3) the sleepy bear goes wandering around the forest. Kids can follow the story narrated by their parents and find out how the Dream Bear encounters among other adventures a star, fish, rabbits and an owl. The woven textile design is refined to each story element. The tablet or smartphone application, accompanying the duvet cover and the pillowcase, adds an extra layer to the tale by revealing magic characters. The owl, star and other 3D characters appear in augmented reality application with sound effects on the cloth after the textile has been scanned with the smart device.

The "Textales Dream Bear" edition allows parents to share stories with their children. The shared tales can be personal experiences subtly woven into the narrative, the original "Dream Bear" adventures or creative imaginations based on the randomly appearing characters of the story. To achieve each experience, the "Textales" application has a separate setting for the storyline behaviour: "Narrative On", "Narrative Off" and "Narrative Random".

Since not all the requirements arising from the craft qualities could be applied to the commercial-like "Textales Dream Bear" edition, we developed an alternative community-based version. In "Textales Sunny Sunday" edition (Figure 4) the open source and DIY aspects are explored. The canvas represents some meaningful locations for a group of friends at a certain time and the characterised 3D figures play a role in the community story. The digital content can be viewed through a smartphone or a tablet device using openly available augmented reality software. The 3D characters, photos, video and sounds appearing on the picnic cover can be edited, added or removed any time by anyone. The application used is able to detect images on the woven picnic cloth and project digital content in the augmented reality layer on top of the textile. There is a QR-code that needs to be scanned with the application before a certain content can be found on the surface. When detected, the character can be moved and resized on the screen.

Figure 5 /
"Textales Sunny Sunday" edition realised by: Kristi Kuusk (TU/e),
Johan van den Acker Textielfabriek, Gordon and Ioana Jack.
Photo: Gordon Jack, model: Carolina.



CRAFT QUALITIES IN TRADITIONAL CRAFTS AND THE 'TEXTALES' SMART TEXTILE EXAMPLE

We presented the first iteration of the craft qualities in the context of the re-design of 'Bedtime Stories' to the craft experts and asked them to point out details and elaborate on the qualities. Immediately below, we describe the gained insights gained about each craft quality in traditional crafts and in the "Textales Dream Bear" and "Textales Sunny Sunday" editions.

CRAFT QUALITY: ‘EMBEDDED MEANING’

The experts pointed out the contrast between the two faces of ‘Embedded meaning’ in traditional crafts, one face being the non-changing traditional aspect, and the other the personal, unique way of planting meaning into crafts. Literature about ethnographic dress explains that the general look of a folkloric costume could say something about where it comes from based on the materials, shapes and colours widely used. Nonetheless, the patterns had to be unique and tell a story. Illustrating the beliefs, how craft objects were believed to protect, cleanse and empower people wearing them, Kabun pointed out the importance of the red tack thread on garments that was believed to protect the wearer.

The craft experts appreciated both the aspect of the image recognition (revealing digital characters when a certain defined image is scanned) and the content only being revealed through the tablet application as parallelling between the traditional crafts and ‘Textales’ application. The experts pointed out the value of the community in giving the application the meaning. As said by Ahven in our interview, if a person has read the Little Red Riding Hood tale, then the wolf carries a different meaning for him/her. The knowledge of the community gives the context to the understanding of the symbols—digital or not.

When Kirsi Niinimäki (2011) talks about the meaning of clothes and the ways of increasing it, she points out how this meaning could be embedded into craft items through the message that is communicated via the symbols, colours or other aesthetic features. Each person looking at a craft item, or any object at all, sees it from their own viewpoint and through their own lens of cultural and personal experiences. It is highly personal, and can have different meanings, depending on the time and personal/cultural context. For example, the swastika symbol, strongly associated with Nazi movements was used more than ten thousand years before as a powerful symbol in many places of the world. It signified well-being and good existence for Hindus, Buddhists,

Celts, Nordic tribes and many others (Black, 2014). Similarly, when a knitter places protective symbols into a mitten pattern, it is not obvious that the person wearing them would necessarily know about the meaning. Therefore, the ‘embedded meaning’ craft quality is about the ‘embedder’, the maker. It is about the craftsperson giving their own meaning to the item. It is about telling the story of the creator and how they become part of the craft object. Individual meaning that is formed by the community should always have a unique touch. Craftspeople working on Muhu Island one hundred years ago didn’t think much of craft pieces that looked the same. They saw the repetition of the same patterns as stealing all the magic from the patterns (Kabur et al., 2010, p. 6).

In the design example ‘Textales Dream Bear’ it is clear that the digital augmentation layer is ‘coded’. Using a tablet or smartphone device, which has the developed application running on it, is the only way to access the digital content. For a human’s eye the pattern seems to be a beautiful woven scenario of a bear’s adventures in the woods. It takes a computer with a certain skill set to detect all the defined areas on the textile and display augmented reality content connected to the specific locations. The development team makes the connections between the markers and the digital content. The user can work with the existing imagery and setting to adapt their own story and meaning to the suggested one. The family can play with adding physical items to the textile duvet and downloading new seasonal/popular/custom digital data provided by the developers of the application. The digital content becomes the service component that arises naturally from the specific craft qualities. It serves to allow the textile to change in time along with the users and their experiences.

The digital information is similarly ‘coded’ in the ‘Textales Sunny Sunday’ edition. It can only be accessed via a smart phone or tablet device with a specific application. However, the community makes the connections between the markers on the cloth and digital appearances. The users themselves have created the character and connected their photos or videos to the specific locations on the cloth. Therefore, at any moment in time users can add, change and remove digital content attached to the textile.

CRAFT QUALITY: ‘MATERIAL AS A MEDIUM’

When talking about material being a medium in traditional crafts, the craft experts recognised two types of environments giving impacts to the material: the natural and the man-made. Nimkulrat mentioned in her response how something that used to be derived from local environmental contamination (i.e. the yellow colour of the Muhu skirt) is nowadays achieved by chemical dyes in order to preserve the culture. In more general terms, the experts confirmed the material of craft to be a visual language. Further, they found craft to be telling the story of a certain place and time.

In the specific case of the Muhu skirt, they pointed out the importance of remembering that one hundred years ago the people actually lived in one certain island— the decorative skirt having been made in that exact location. People did not move or relocate too much without a serious reason.

The craft experts appreciated the notion of using textile for sharing popular and personal stories in ‘Textales’. They noted the stories on the duvet cover as originating/coming from the pattern itself. In that way, they saw ‘Textales’ as a visual language. Kabun valued most the idea of communicating and storing the personal stories of the parents. She envisioned the cloth to carry insights about the parent’s past activities and adventures. Ahven vividly pointed out the limitations of place and time. She noted that, even though we expect the garment to protect and keep us warm, as before, we cannot give to it the same meaning it used to have a hundred and more years ago. Ahven mentioned appreciating new functionalities that innovative textiles could open up for clothing. Talking about the project, she pointed out that ‘It’s about telling the story of a place and time. Today people are global and the stories are global.’ She saw how smart textiles could become the medium between people and the environment and appreciated the modern context of ‘Textales’ in terms of the material. She found that the new technology gave the main meaning and finishing to the textile in the ‘Textales’ project.

‘Material as a medium’ speaks to the user/viewer. In this case, the object already has embedded meaning and a story to tell. The user might find out the initial story of the craftsperson, but in any case it will be seen through the eyes of the user in their time and space in the context of their experiences. Caroline Hummels and Pierre Lévy (2013) talk about the meaning being between the human being and the world. Referring to the phenomenology of perception by Maurice Merleau-Ponty (1962), they explain how meaning is created in interaction because people perceive the world in terms of what they can do with it. Material, being exactly in between the person and the world around helps users to make sense of what they are experiencing.

Some of the meaning embedded in craft objects is invisible to the eye and only known by the beholders. Especially the magical aspects could be difficult to explain. For instance, according to Kärt Summatavet (2005, p. 82): ‘A silver ornament doesn’t merely protect, cleanse or heal, but the gift of the ornament is also a means of communication and a ritual sign’. A smart textile concept such as ‘Textales’ allows some of the magic hidden in crafts to become visible (e.g. symbols on the textile surface come to life through the AR). The characters carry meaning and communicate it to the modern user in a way that they would understand. Ancient symbols may not be familiar to us today, but we can read and connect to digital information and animations.

According to Tharakan (2011) craft objects represent elements of an individual’s identity. Talking about the material consciousness, Sennett (2008, p. 120) describes how the craftsperson in each individual depends on the curiosity about the material in hand. Therefore, considering the craftsperson side of the makers, they all have planted their individuality into the final designs of ‘Textales’.

In the ‘Textales Dream Bear’ edition, Kerstin Zabransky, the storyteller-illustrator invited to work on the project, contributed professionally with her detailed and holistic style of drawing and storytelling. But she also gave part of her identity to the project via the story she chose to share. Her passion for woods, animals and camping is clearly communicated both in the textile duvet design as well as in the digitally appearing characters. The augmented reality developers from Unit040 involved in the project contributed with their technical knowledge and buildup of the characters. They made sure the content envisioned by Zabransky would come together in a user-friendly application. The weaving partners involved in the process generously gave their textile knowledge and time to the project. Both ‘Dream Bear’ and ‘Sunny Sunday’ editions carry the identity of Johan van den Aker Textielfabriek in the way the design has been constructed into the fabric.

In the ‘Textales Sunny Sunday’ edition, the users themselves have added their personal touch. The picnic cover follows the drawing style of Ioana Iliescu-Jack. The makers brainstormed together and came up with the objects to show on the picnic sheet. The digital content was crafted bit by bit, added at different times. Gordon Jack’s 3D characters and scenes carry architectural references in the style and hint to his professional background. A 3D flower, also part of the ‘Sunny Sunday’ picnic sheet and modeled by Kristi Kuusk, carries memories from a day of making together. Certainly, the material is particularly expressive to the makers, who embed the meaning into it in the first place. It carries their identity. If the user becomes the maker, as happened in the ‘Textales Sunny Sunday’ edition, the lines blur and reveal more meaningful perspectives.

CRAFT QUALITY: ‘HIDDEN STORIES’

The craft experts saw the way that folk costumes were communicating ‘hidden stories’ as a code made up by the community. They pointed out people following a certain tradition of how the symbols were used. The experts also pointed out how important the role of the people’s imagination was in carrying and developing that story. Basically, the narrative was in the imagination of people, who interpreted certain symbols according to their knowledge about the meanings.

Ahven pointed out that the main difference with the more traditional craft is that in ‘Textales’ the imagination comes to the blanket. The stories can and would change in time only if people could manipulate them themselves. She appreciated the stories being virtually hidden and getting meaning only with the technology. She found the parallel between fairy-tales, where locality and nationality with the cultural aspects played an important role, and ‘Textales’, which is a story of the moment and time. She wondered further about the manners living with the people; with people mixing, also the manners and traditions mix. Ahven pointed out how important the storytelling aspect in ‘Textales’ is, and valued the craftsmanship needed to build up an interesting story.

The way that stories can be hidden into craft pieces and the process of making them is inspiring. They live mostly in the imagination of the craftsperson and the viewer or user. The stories might be anchored by symbols, colours, signs or smells, and yet mean something very unique to every viewer who experiences the craftwork depending on their background. ‘Illusion and transformation are twins of meaning making. Media forms that involve illusion and transformation can give aesthetic power to expressive statements about the human condition. We imagine worlds using media in order to make sense of the human condition.’ (Harrell, 2013, p. 337) The augmented reality stories hidden inside the textile bring that highly imaginative process into a different level. The imaginations become digital and move onto the textile canvas, as pointed out by the craft experts.

Even though the ‘Textales Dream Bear’ edition carries a relatively limited story, it can be told differently depending on the age of the child. Parent’s own experiences form the days passing to become part of their storytelling experience, and therefore highlight different aspects of the suggested narrative.

The meaning of the story carried in ‘Textales Sunny Sunday’ edition changes along with the changes in the group of friends. People go through individual and joint experiences, which change the way the symbols are seen. The ‘code’ of the project is made, carried and changed by the community itself. Traditions within the community can remain or exchange for new ones. Both the physical cloth and digital content allow that to happen. For example, a patch representing the new home of a friend who moved to another country could be placed on the textile and connected to the blog full of her adventures in the new place.

CRAFT QUALITY: ‘HERITAGE AND TRADITION’

Kabun mentioned how learning handicrafts was part of daily life in pre-industrial families. They practiced traditional crafts in the same way as learning how to cook or work with wood.

Telling an old story in ‘Textales’ through the new technology was compared by the craft experts to passing on knowledge and history through a different language. They pointed out the educative moment in parents sharing their old stories and passing on their values through such modern versions of fairy-tales. They appreciated the possibility to actually alter the traditional stories with softer and different versions better suiting the current understanding of the world. For example, violence in the fairy tales could be solved differently.

Reading books for children would be a tradition in many families—as would playing and reflecting about daily activities. The storytelling proposed by ‘Textales’ can be another way of interacting with children through tactile experience of the textile material and magical digital worlds. Based on feedback during exhibitions, fathers seemed to be more comfortable with technology and saw ‘Textales’ as an opportunity to bring the storytelling moment with the kids closer to them.

In ‘Textales Dream Bear’, the storytelling could become a tradition carried on as in the crafts. The ‘Dream Bear’ story can be told by passing on values with it. Perhaps the values can be experienced rather than heard of. The storyline can vary, but doesn’t have to, since the application allows different modes of storytelling. The same characters can be met during the adventure in the storyteller’s envisioned order that is by default in the application. They can also be met randomly, challenging the parent to come up with an interesting storyline on the spot. And, as a third option, the characters can appear in the order of markers appearing in the tablet camera. This allows the parent to craft a story based on their personal preference.

In the ‘Textales Sunny Sunday’ edition the emphasis is more on adding new inputs for the story. The action of adding new elements invites the person to reflect on how it fits to the existing canvas, how it related to the heritage. People have contributed with their stories and characters continuously; therefore, every new input can build on the existing content (as the heritage of the story) or take a different direction. The tradition needs to be changed from time to time to understand how changes are essential part of development. Different elements get more focus and attention in different times. Through the process of creating and remaking the canvas, the users learn from each other and develop a common knowledge.

CRAFT QUALITY: ‘TOUCH AND FEEL’

When talking about ‘Touch and feel’ the experts emphasised the property of knit being a softer structure than weave and the way that construction of the fabric influences the body. For an experienced person it is possible to recognise whether a certain textile is handmade or machine made. Kabun pointed out, however, that people one hundred years ago didn’t use to analyse what feels better, but just followed the tradition known to them. It was customary to wear linen in summer and wool in winter because this was how it had always been done. Higher quality linen was used in a shirt and lower quality in a skirt, and sometimes the materials were changed. There were long shirts with the upper part made of one material and the lower part made of another material to fit the desired feeling. Kihnu *kõrts* (skirts) were worn in all possible ways, nobody washed them. The stripes coloured with plants would not have survived the washes. New Kõrts were assembled from two worn out Kõrts. Even coats were changed inside out when materials got too used. The experts also appreciated the feeling and love that is put into the items when making them by hand. As Ahven pointed out in our interview: ‘It feels different than line production items. It has hidden human warmth feeling.’

In ‘Textales’, the craft experts appreciated the bodily interaction in the fairy-tale, how it is in contact with the textile as opposed to the tablet screen. They suggested to develop the structure of the textile surface itself further. It was also pointed out that perhaps the touch could, instead of a separate quality, be part of the ‘Material as a medium’ quality.

As noted previously, Sennett (2008, p. 9) talks about material-engagement as part of the craftsmanship approach as ‘basic human impulse, the desire to do a job well for its own sake.’ Being in constant contact with the material allows the maker to personally relate to it. Nimkulrat (2009) refers to craft items as the objects or outputs of experience. It is even said that through the craft object or pattern the user, viewer or wearer can touch the craftsperson behind the creation of the item. It becomes a bridge between people and times. Through the use of traditional textile in combination with current technologies, perhaps a bridge could be created between craft values of the past and the possibilities and knowledge of today. Certainly, the idea of further developing the material surface triggers thoughts such as, what if the surface could change its shape according to what happens in the story?

Both ‘Textales’ redesigns invite to the user touch. People like to move their hands on the high quality woven textile. They also like to catch the digital content. The effects of disappearing and moving flowers and characters surprise them. Maybe there is a small hope of actually feeling a flower, a longing for some magic. In the ‘Textales Dream Bear’ edition the kids play with the digital characters by moving or manipulating the textile. By doing so, they understand how the characters are ‘attached’ to the fabric and move along, once it relocates. It almost appears as if they are touching both fabric and the fairy-tale at the same time.

When thinking along the lines of finding possibilities to develop the textile surface further, ‘Textales Sunny Sunday’ edition allows some try-outs. The concept allows different structures as patches (Figure 5) or objects or as attachments to be added to the canvas. They can always be connected to the old or new digital content. The very low-tech experiential way would allow the designer-researcher to find out possible interesting directions for that idea.



Figure 6 /
Patchwork blanket with structural patches on left. Photo: Berit Sander. Care label of ‘Textales Dream Bear’ edition on right. Photo: Kristi Kuusk



CRAFT QUALITY: ‘SOCIETAL RESPONSIBILITY’

The craft experts saw societal responsibility as an inevitable feature of the time of traditional crafts when everything was local and that was the only way to do things. Life was static in one place. The resources were scarce and had to be treated carefully.

The craft experts found it valuable that the ‘Textales’ project team had considered local production and high quality materials for the production of ‘Textales’ samples. They found it valuable to keep something consciously local, to think about an item’s afterlife, waste problems, and cradle-to-grave systems. Thinking through the whole life cycle of the product was pointed out. The experts also noted the importance of redefining the sense of “local” into a community (rather than geography) based notion.

Yuri Na (2012, p. 15) defines craft as a ‘creative activity by humans whose aim is the aesthetic functional object, realized from its whole life cycle as finished object, practice of making process, and services.’ Today it has become close to impossible for a designer to trace the origins of every component of what they design and produce. As a consequence, there is a lack of a whole picture and responsibility is distributed over the whole production line. However, through technology and trusted connections, a shared responsibility could be found.

In the ‘Textales Dream Bear’ edition, the style of the illustrator can be recognized and the weaving partner has chosen the textile materials carefully. For raising the general awareness, the items have extensive information on the labels (Figure 5) stating in very clear and simple language, how the items should be cared for:

We have made sure to produce Textales Dream Bear edition with least energy and toxic emissions possible. All workers involved had reasonable employment rights and conditions. We have used 100% cotton fibres and lots of creativity to bring the augmented reality storytelling to your home. Please make sure to use the product until the natural end of its life, and to pass it on, if you don’t find it useful anymore. Wash it only when necessary, at low temperatures and using eco-detergents. Please hang-dry Textales and avoid ironing where possible. Repair if needed and make sure to bring it to a textile-recycling unit in the end of its life. (Textales care label)

Since ‘Textales Sunny Sunday’ edition is a collaborative creation of several people, it allows creativity to step into the daily lives of more people. It inspires making rather than consuming. The process of making and sharing the project also created several moments of sharing insights about the larger issues the research project was dealing with. Therefore, in its own way, the project is raising awareness about the textile industry environmental and societal problems one person at a time.

CRAFT QUALITY: ‘FAMILY CONNECTION’

Kabun pointed out that pre-industrial families were closely connected due to the time specifics. People had no other choice than living very closely together in small spaces. According to her, there was always time in the evening to share stories with the family (i.e. ‘*videviku tunni pidamine*’, which in Estonian means ‘to have an hour for noticing the sunset’). For connecting families through the shared stories, the craft experts saw the textile in the ‘Textales’ concept as the interaction mediator. They valued the role of ‘Textales’ in the creation and valuing of family time. They saw the application as a trigger to bring that shared time forward and, as Ahven pointed out, being ‘a tool for communication, to create quality time in the family’.

Also due to people living in such close proximity, crafting together in the family while sharing stories of the day used to be common practice. The way that families are now scattered between different houses, towns, countries and continents limits the possible interaction. Allowing digital technology to merge with warm and soft textile in the context of family stories opens up new ways of supporting emotional connection within or between families. For example, in future developments the fairy-tale could be told to a child in Sweden via the tablet app by their grandparents in Peru.

In ‘Textales Dream Bear’ edition, playing with the stories and the textile creates the family together time. This allows the values and moments to be shared. As the future developments of the application could function over distance, the story sharing could be extended to family physically further away. Through that, the hour for sunset could be regained as a family time independent of the geographical locations of the people.

Working on a mutual goal naturally leads the people to share stories. People in the party might change, join, and leave. Crafting together, or at least the on same item, creates the shared family time in the ‘Textales Sunny Sunday’ edition (family in this case being seen as the chosen family—friends, group of colleagues or other party).

CRAFT QUALITY: ‘OPEN SOURCE COMMUNITY’

For the ‘open source community’, the experts pointed out the pace of change to be the difference. For the Muhu skirt to change from red to yellow, the pace of change was very slow, whereas changing digital characters in the tablet application of ‘Textales’ is a matter of minutes. This is true, however there is also a difference in the speed of change depending on whether the user is crafting a patch, modelling a 3D character, downloading a premade model or attaching a photo. The craft experts appreciated that the project involves a technical solution while remaining easy to use.

By today the textile art and development has taken great leaps. The details and complexities achievable by modern machines are impressive. However, it has closed down some of the openness and personalization possibilities for the end-user. It is a step further, out of our basic skill-range. Therefore, crafting fabrics is in a way limited to the closed group of textile designers and makers working professionally in the area. On the other hand, in the beginning of the twenty-first century, people are quite familiar with digital tools. Children start working with screens and programming languages and tools early, in their first years at school. They can easily navigate between digital content: create and modify 3D items, stories, develop applications. Therefore the possibilities to change the digital content appearing on the textile are wide, especially if the application could be considered an open source platform.

Only our team, as the original developers of the ‘Textales Dream Bear’ edition, can adapt and change the information embedded into the AR layer of the project. At the moment of developing the ‘Textales Dream Bear’ edition, the collaboration partners didn’t see it feasible to make the application into a platform, where users could add their own characters and stories. This limitation was the main trigger to start working on the ‘Textales Sunny Sunday’ edition in parallel to the ‘Textales Dream Bear’.

In the ‘Textales Sunny Sunday’ edition the objects can be added both physically and/or digitally by the end user. A patch or a shape, a stitch or a button, a photo or a print can be added at any point in time to the textile canvas. This physical add-on can become a marker in the ‘Textales Sunny Sunday’ edition, and easily connected to a new digital content as well. The digital

content can be also updated all the time with new 3D models, photos, videos, sounds etc.

CRAFT QUALITY: ‘EVOLUTION IN TIME’

The experts discussed how craft’s evolution in time takes two possible directions: either towards industrial technology (and therefore crafts getting more simplified) or towards complexity or style of the pattern (and therefore to develop the craft further). They pointed out the importance of having a distinction between craft, handmade and piecework, since all of them are made by hand; however, with a completely different focus and therefore meaning. They also noted that if the craft items get simplified, then the feeling they embed and carry gets degraded. Ethnographic patterns in another context (for example under a dictatorship) get a different meaning; therefore, the new generation always needs new symbols.

Beyond the notion of the ‘Textales Sunny Sunday’ edition being community based with possibilities for community-based software development and story sharing, the craft experts appreciated the skill of telling the story as the most essential property for the project.

In the ‘Textales Dream Bear’ edition the evolution in time is limited by the commercial input and the interest of someone to keep it developing. The application is closed and professionally developed by one of the partners of the project; the professional illustrator has completed the story. To bring changes and new aspects into the story and concept is up to the development team. The platforms it works on are limited to iOS and Android. However, further developments could lead towards an interesting service: new stories when children grow or just want to change them, new characters to existing stories to bring new insights or for special occasions, new actions for the existing characters, new adventures (side stories) into existing stories. The professional approach and dedication to the project allows it to be developed towards style and complexity while being an industrial process.

In the ‘Textales Sunny Sunday’ edition the evolution in time is one of the key elements. It uses only open source software and is therefore always open for modifications, add-ons and other type of suggestions that users can implement without approaching any specific developer. It has potential to be community based for both the new developments in software and stories that are shared. They will always catch up. Then both the content and the software would be in constant change and evolution in time—catching up with the modern ways of living, tools and contexts. In the open source model, the project could take several completely different directions and excel into applications that cannot be foreseen at the moment due to being limited by the current way of seeing the world.

IMPLICATIONS OF THE CRAFT QUALITIES TO THE SMART TEXTILE SERVICES AND FUTURE WORK

As smart textiles develop and become more and more mass-produced, designers have to consider their ecological, societal and environmental impact. Combining the trends-driven fashion mind-set with constantly renewing gadgets’ properties might be the worst-case scenario. However, introducing slow, circular and sustainable craft qualities to the developing field could change the way the garment industry functions as well as how people use their textile items. There is an opportunity in the first step of introducing a new kind of product-service to the market. It

is possible to catch the users’ attention and steer their thinking towards valuing the interaction and caring for their textiles. Giving an extra layer of meaning (back) to the textiles surrounding people (literally) everywhere, could be part of what people need for a paradigm shift—‘a click in the mind and a new way of seeing’ (Meadows, 1997, p. 11) textiles.

The dialogue between smart textile as material, the designer-researcher and the community of craft experts has resulted in two versions of craft qualities. The proposed craft qualities can be used as an inspiration when designing with smart textiles. They can be used to find different perspectives and angles to projects and services that designers are working with. They evoke intangible social values to gain importance while working with material and technology innovation driven areas, such as smart textiles.

Smart textiles with new interactive and dynamic properties previously not associated with textile items can direct the clothing industry towards a more sustainable valuing of craft-related intangible qualities. The digital properties allow services to appear, where not seen before to stimulate the business models to change. The clothing industry could change from fast product output towards longer lasting products with supporting services.

With the ‘Bedtime Stories’ and ‘Textales Dream Bear’ projects we did not aim to replace fairy tale books with AR bed linen. We explored what such a hybrid of a protective and comfortable textile cover with a fairy tale content could bring to the family connection. As pointed out by visitors during exhibitions, they saw the AR application as an opportunity to bring fathers closer to the storytelling and bed rituals with children.

While developing the projects, we tried to set an example of thinking through different aspects concerning the product’s life cycle. We kept the small production local and information about different steps open between the project partners. That allowed us to think of alternative life cycles, including service models for maintenance and disposal.

Caring for textile products can extend their natural lifetime. The novelty of smart textiles offers an opportunity to catch the attention of the users, to explain better how to care for the items. However, the care labels are not the only way that smart textiles could raise the awareness about the importance of the textile maintenance. Creative solutions could reward the users for washing the items in reasonable intervals, with the right amount of detergent and to keep using them for a longer time. For example, certain symbols or characters could appear only after the cloth has been without washing for a defined time; other elements after a wash with low temperatures or specific detergents. Perhaps a surprise element would only appear when the cloth has been in an active use in the family for a longer time.

Celebrating touch as an essential property of craft and materials, we began to wonder what else could be explored in the context of smart textiles. Could the material change its surface and shape it according to the content of the story? What if the digital characters could react to the shape change happening in the duvet? What if certain locations in the textile could soften or stiffen based on the development in the story? Textile surfaces could be combined with touch sensitive materials, such as conductive wool, threads or fabrics that would be able to send tactile input from the cloth back to the fairy tale and the other way around. These are considerations for future work.

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