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PROTOTYPING SCALES OF KNITWEAR DESIGN FOR SUSTAINABILITY

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ABSTRACT

This paper explores how the physical presence of prototypes substantiates research at various scales of design. Working with sustainable change challenges us to stand in the open and act towards a future that we do not know the full picture of. Here I propose to turn our attention to the traditional design method of prototyping to unfold how to influence various scales of design.

The paper begins outlining the scope of the experimental and practice-based research within knitwear design, and discuss prototyping as a means to investigate the role of the designer in an industry in search of sustainable development. The presented design experiments show, how applying the knitted prototypes contributed to a research program which both holds the details, and at the same time makes it possible to assess the broader perspective of design practice when making changes of the existing fashion system.

INTRODUCTION

Working with sustainable change in fashion challenges us to stand in the open and act towards a future that we do not know the full picture of – and most importantly, we have a possibility to contribute to the transition. This

paper discusses prototyping as a means to investigate the role of the designer in an industry in search of sustainable development. Here I propose to turn our attention to the traditional design method of prototyping to unfold how to influence product design and design practice.

The insights presented in this paper builds on research from my experimental and practice-based PhD Design of Knitted Jumpers for Longevity about the designer's role in contributing to sustainable development within the shift of paradigm that the fashion industry faces (Fletcher & Tham, 2019). This study started with an interest in understanding how the textile designer can bring professional competency into play and make for changes of the existing fashion system. Throughout the PhD, the importance of the prototypes that I made and used in design experiments stood out. This paper explores how the physical presence of prototypes substantiate research at various scales of knitwear design.

BACKGROUND

The research presented here, is based on industrial knitwear manufacturing applying newer digital machinery and computer software, as these newer technological developments makes it possible to produce knitwear on-demand while customising each knitted garment. I have used the technology as a framework to explore what potentials this gives. As a business model, on-demand production can minimise deadstock of garments which most often end up for incineration (Klepp et al., 2015).

From a design perspective, I explore and unfold the influences it has on the design of knitted jumpers as well as designing them. Applying an approach of on-demand manufacturing gives the designer a chance to flip the design process and engage with user while also challenge professional skill sets alongside technology and strategies for sustainable change. The newer

development in knitwear technology makes it possible to adjust personal demands of size and aesthetics which are factors that may determine whether garments are being used or not (Laitala et al., 2015; Niinimäki, 2011). Issues with size and fit are one of the most common reasons for garments to be disposed of (Laitala et al., 2015). Especially for women, since standard sizing used in ready-to-wear clothing is not adapted to the various female body shapes (Laitala et al., 2011). Employing user involvement at the stage of production allows for the designer to also open the design process for aesthetic choices of the individual garment. This way of engaging with users and take their perspective into account, at the same time, acknowledge the need for a wider diversity in the fashion industry (Fletcher & Tham, 2019; Tham, 2016), where the use phase is seen as central in the transition to more sustainable behaviour wearing and caring for clothes (Fletcher, 2012; Laitala et al., 2015; Niinimäki, 2011).

Customisation at industrial scale is still a newer initiative within fashion. In this study I have combined the concept of customisation with elements of theories and design strategies to test and challenge these in practice. I therefore set out to explore how this effect the role of the designer and the designer's own process (Ravnløkke, 2019).

RESEARCH APPROACH

To fully understand the implications in an open and user involving design process, I used my own design practice and engagement in the research by applying an empirical approach with involvement of participants. In doing so, I prototyped a construction of scenarios and artefacts that allowed me to investigate how one design strategy and change of methodology affects other parts and processes. The research is therefore undertaken as a programmatic exploration (Brandt et al., 2011) where various experiments support the assumptions about the research (Redström, 2017).

The knitted prototypes that have been developed and used as a part of this research are manufactured on a digital flat bed knitting machine in the workshop at Design School Kolding.

PROTOTYPING THE PROGRAM

To describe the field I operate in, as well as the relationship between the various experiments, I lean towards Redström's (2017) spectrum of, what he calls, *a design space* (see figure 1).

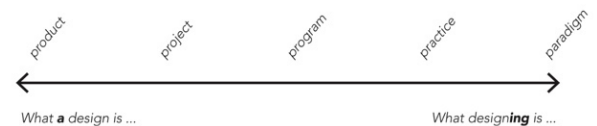


Figure 1: The illustration shows Redström's spectrum "a design space" (a reproduction of Redström, 2017, p. 39).

The space within this spectrum sketches the field of design that concerns the singular product as well as the matter of designing. Both perspectives are highly relevant when working with this complex set up of overlapping strategies of design for sustainability.

Here I use the spectrum to illustrate and bring forward the different scales of engaging with knitwear and design practice. The illustration shows the construction of the prototyped research program consisting of customised knitted jumpers, a design concept for user involvement, involvement of insights from the use phase, and an open design process (see figure 2).

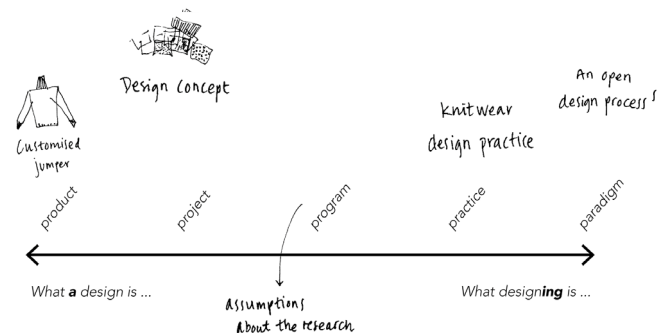


Figure 2: Prototyping scales of knitwear design. Application of Redström's (2017) spectrum *a design space*.

In this paper, I discuss the different prototypes and ways of prototyping scenarios used to build the program, as they have been essential to challenge, study and understand how the textile designer through professional competency can influence changes of the existing fashion system.

As it is with the typical design process, the process of my research experimentation is not linear (Sanders & Stappers, 2008) neither if it appears so when listing the different elements. However, I discuss this research from the assessment and insights of the elements included in its "design space": knitwear design practice, a design concept for customisation, personalised jumpers, and an open design process. Before going into the design experiments and the different applied prototypes, I will explain the assumptions about the research program, as this describes the elements of theories and design strategies which are tested and challenged in practice.

USER INVOLVEMENT

Involvement of insights from the use phase is a part of the program. It implies a study of users' practice in relation to knitwear and how these insights are used as inspiration for the design process of developing a concept of knitted jumpers for customisation.

The idea is hereby to design for the user's experience of the garments (Niinimäki, 2011). As "making a garment last is very different to making a long-lasting garment" (Fletcher, 2012), it is for sure possible to extend the durability of garments through resistant materials and the construction of them, but if the garment is only used a few times, and then replaced with new ones, its lifespan is not very long. It can therefore be argued that the difference between durability and longevity is associated with the use of clothing (Laitala et al., 2018).

By incorporating knowledge about the use phase, the designer has the opportunity to, consciously, work to increase satisfaction with clothing and prolong garments' lifetime (Niinimäki, 2011). From a perspective of sustainability, it is an advantage to, not only postpone the stage of disposal, but at the same time increase the use activity of clothing (Laitala et al., 2015). In other words, it is important to distinguish between clothes that are in active use and clothes that are passively stored. I am interested in how we as designers can support sustainability in the use phase. Therefore, I find it relevant to study how fit, material qualities and aesthetic preferences influence how often knitwear is used.

KNITWEAR DESIGN PRACTICE

Other fields of design have for long employed user-centred approaches to differentiate on a certain marked or to develop products based on user experiences (Sanders & Stappers, 2008). This is not common practice in fashion design. Even though wearing clothes is a part of our daily life, most people are not used to put into words their experiences and considerations related to it (Ravnløkke, 2019). Therefore, involvement of use practice and experiences requires new methodologies to explore and unfold knitwear design at this scale.

Studying user's practices of knitwear, I had set up a design experiment to do in-depth interviews with female participants. This study concerned women, as I wanted to obtain insights on their perspectives of possible issues related to size and fit, as this newer technology in knitwear makes it possible to meet users' need for personal fit. To guide the dialogue in a semi-structured way, I used knitted prototypes (Ravnløkke & Bang, 2016). At the same time, I used a combined version of a wardrobe method (Fletcher & Klepp, 2017) and the Repertory Grid interview technique (Fransella et al., 2004). I did this to create the framework for a dialogue

that embraces and exemplifies both everyday use (wardrobe method) and sensory experience (Repertory Grid) of knitwear. The intention was hereby to support the participants in expressing themselves about knitwear, based on quality, appearance, touch, shape, fit, details, usability, and function, and thereby put into words personal preferences and experiences, using knitwear.

The interviews took place in the participants own homes which made it possible to involve their wardrobe as well. I brought a variation of knitted prototypes in order to direct the conversation to their experiences with knitwear, and tacit knowledge associated with use. The prototypes comprised of a selection of knitted textile samples and knitwear which played a central role in the interview. Additionally, the participants' knitted wardrobe was also included to evoke both personal and social aspects of the use of clothing (Klepp & Bjerck, 2014). The materiality of the knitted prototypes and garments acted as a catalyst for articulation and dialogue, as well as creating a common basis for an in-depth conversation about the participants' experiences with the use of knitwear.

The Repertory Grid technique is based on ranking and assessment of convergence and contrasts (Fransella et al., 2004). It is therefore essential that the selection of the knitted prototypes represent various elements that can be used in bipolar constructions (Bang, 2013). The knitted textile samples and jumpers, that I brought for the interview, were therefore developed and selected from a scope of different types of constructions. For example, the opposition between a tight and a loose knitted textile, as well as the experience of a tight-fitting or loose-fitting jumper.

PROTOTYPING KNITTED TEXTILE SAMPLES

The textile samples make two triads, each consisting of three different knitted textile samples with the intention that these form the basis for the conversation about tactile and visual experience of structures, patterns and colours. In order to sharpen the focus on the tactile and visual properties of the textile samples, the samples are of a suitable size to be able to touch them with both hands – they measure 34x26 cm. The textile samples are made to give a great variety to allow for a detailed dialogue (see figure 3):

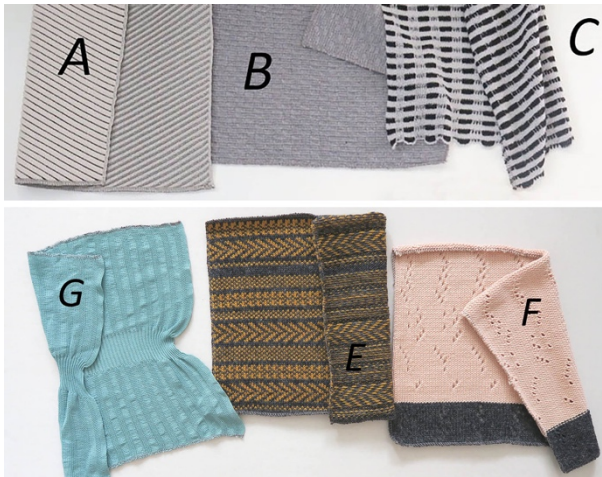


Figure 3: Overview of the knitted textile samples. The samples are folded so both sides are visible.

The triads are divided so that one consists of neutral shades of grey and black, while the other represents colours: such as turquoise, peach and ochre. These are carefully selected in order to have the participant describe their own preferences for colours. Therefore, I have deliberately chosen midtoned colours, and combinations of colours that can provoke to a greater or lesser extent, and thus produce a detailed dialogue.

PROTOTYPING KNITTED JUMPERS

The knitted jumpers were used in the dialogue to focus on shape, fit and details. The reason for choosing the jumper over other types of clothing, is to limit the experiment to one type of garment. In addition, a jumper is familiar to most people, and therefore easy to recognize and read.

The knitted jumpers were also divided into two triads, based on embracing a wide range of experiences with different types of garment (see figure 4):



Figure 4: Overview of the knitted jumpers.

To represent different expressions, types and qualities of jumpers, they are selected based on the price ranges: low, medium and exclusive. In addition, the triads are

composed on the basis of the style of the jumper, the shape, and details.

As I wanted insights into the participants' experiences of quality and durability, jumper 7, 8, and 9 show signs of peeling, discoloration, holes/run stitches and shrinkage after washing. My aim was for the participants to include experiences with wear and tear, and also elaborate on these experiences in the review of their own wardrobe.

USE OF KNITTED PROTOTYPES

The participants examined the knitted prototypes and described their experience with the different textile samples and jumpers (see figure 5) – some dealing with haptic and visual perception, other focusing on the participants' experiences with fit, cut, decoration and other details, in order to gain an insight into the participant's personal preferences associated with use.



Figure 5: Participant study of the knitted prototypes.

The third part deals with the daily choices and use of knitwear. It allows the participants to tell about their own knitted garments, while the individual garments can be touched and seen close up. Going through the garments, the participants were asked to categorise their wardrobe into three piles of their favourites, those worn occasionally, and those that they rarely or never worn (see figure 6). At the same time as the division, the participants were asked to describe the different garments, and the reason for placing these in the respective piles. The participants' stories about the garments, and this hierarchy division, gave the participants the opportunity to elaborate on personal experiences.



Figure 6: Participant's categorisation of own knitted garments.

In the interplay between conversation, and the involvement of knitted prototypes, I could use my own senses to gain an empathic understanding of the participants' narrative. The physical representation of knitted textiles and jumpers, as well as the participants' own wardrobe, acted as a catalyst for the participants' experiences with knitwear. Furthermore, they enabled participants to tell about their use practices and elaborate on their own preferences. It was thus both the verbal description and the physical artifacts that provided insights and knowledge about use:

"I really use this one a lot. Even though it is a bit simple – maybe the simplest piece of clothing in my wardrobe: I think it's made of wool. Yes, it is. That was also why I bought it. Because it was simple and made of wool. It has kept really well. I like this at the bottom – that it goes up like this (pointing to hem with a roll detail). Then, there is a little detail. And then it has some sleeves that tighten a little (showing the area of the forearm)" (see figure 7)



Figure 7: Image of the knitted jumper described in the above example.

The example shows how the physical exemplar from the participant's wardrobe supported her in expressing why she like the garment, and yet also in telling about her more general knowledge of material quality and personal preferences of style.

In that way, the materiality of the prototypes was central to obtain insights of the use phase, which made it possible to study the users' preferences, what they like, and what works for them in daily use situations; keeping in mind active use and longevity.

A DESIGN CONCEPT FOR CUSTOMISATION

The empirical approach offered a detailed insight into use situations and use frequency. The first design experiment showed a coherency between aspects of satisfaction with garments and how often these were used. As a part of the research, I incorporated these insights into development of a theoretical business concept for design of knitted jumpers to be customised and produced on-demand at industrial scale.

The user insights were grouped and divided into categories of visual expression, style of the jumper, proportions and fit, and material tactility. These were further used to inform and create relevant parameters for customisation of aesthetic preferences and individual size (see table 1).

Table 1: Overview of how user insights have been transformed into development of the design concept.

	Design parameters for customisation	Textile means
Visual expression	Neutral and complex expressions (variation of colours, structures, patterns and details)	<ul style="list-style-type: none"> - Small-patterned structure - Combinations of colours and structures - Details of hemlines and details of colour
Style of jumper, proportions and fit	Variations of style and fit	<ul style="list-style-type: none"> - Manufacturing on the basis of individual body measures - Varieties of the style and the length of the jumper
Material tactility	Variations of thickness and surface	<ul style="list-style-type: none"> - Small-patterned structures - Use of single and double knitting technique

The user insights showed, for example, that tactility of the material and details are important means for the experience of using knitwear. To offer a range of different tactile experiences of the knitted textile, I employed a technique of small-patterned structures, and additionally, use single and double qualities: two variations of the knitted construction, which give a thinner or thicker fabric, respectively, knitting with one or two threads at the same time.

The design concept was developed in a physical form, to be included in the second design experiments as a prototype of the business concept. In this way, the concept was an example and a test of how the textile designer can contribute to sustainable product development. The prototype of the design concept provided thus a practical and tangible experience with design strategies with a sustainable objective.

The design concept comprises of material artefacts representing the different choices which can be made when selecting a personal jumper. In second design experiment, the design concept was used to examine users' experience of being involved in the design process. It is used in connection with workshops, and is thus used to create a tangible scenario of what such a purchasing situation might look like (Koskinen et al., 2011; Stappers & Giaccardi, 2017). This makes it possible to observe the participants' experience, and interview them about their considerations, associated with the design choices they make.

Figure 8 shows examples of artefacts, including knitted prototypes, colour samples and working drawings of jumper style. Engaging with the design concept, the user will initially make design choices about the jumper itself: (1) style of jumper, (2) knit (material quality and stitch pattern) and (3) colour. Next, there is the option of choosing details: (4) sleeve detail, and (5) detail colour. The user can also choose to be surprised and the designer suggests a combination. Then the knitted jumper can be made. The relatively few options, provides 97,200 variations of jumpers, which is an extremely large collection giving wide range of options for customisation in relation to personal aesthetic preferences and fit.



Figure 8: Examples of the knitted prototypes, colour samples and working drawings of jumper style.

Overall, the second design experiment concluded that the 46 female participants, in the total of six workshops, selected their favourite knitted jumper from personal choices, which showed that the participants understood the design concept and that they wanted to get involved in the design process. The participants had the skills, the courage and the desire to make these design choices.

The more particular insight, exposed how the participants interacted with the design concept, and here I became aware of the importance of its physical artifacts.

The knitted prototypes were used as narratives, for how different choices would come to look. It thus became clear that the knitted prototypes, to a great extent, support the participants' selection process. Figure 9 shows how the surface of the knitted prototypes are explored by touch, and held against the body to consider choices. The prototypes were examined by stretching to assess elasticity and dimensional stability, and the colours were compared, by placing them next to each other. The participants interaction with the knitted prototypes, illuminated the *tacit knowledge* connected to use of garments: the experience of textiles and garments against body and skin.



Figure 9: Participant interaction with the knitted prototypes.

The participant described their choices of the jumper as it had already been produced for them. They revealed

considerations of how they would use the jumper and what other garments they would combine it with. Exemplified here by one of the participants in dialogue with another participant:

"Wow, this one would fit perfectly with the top you have – the one with pattern, and then with a pair of jeans. It will be smart. Or also with /... / It will be just your style"

Throughout the second design experiment, the prototypes showed not only as a tool to explore user involvement in designing knitwear and to establish a dialogue with users about this, the prototypes also turned out to become a reference point for the participants to discuss preferences and considerations with each other.

The tangible elements of the knitted prototypes show to be vital to support the participants' imagination. Which also emphasises the importance of the participants' imagination when engaging in the design process.

In addition to examining the user-involved design process, the second design experiment contributed with insights used in the subsequent design experiment, in which participants were given a personalised knitted jumper made based on their choice.

A PERSONALISED JUMPER

The aim of the third design experiment was to investigate how 3 participants use their personalised knitted jumper (see figure 10). In addition, I wanted to explore possible effects of the participants' involvement in the design process – could that, for example, give them satisfaction in the use phase? And how does the personalised knitted jumper live up to the individual participant's expectations, needs and aesthetic preferences? In that way, the knitted jumpers acted as prototypes for carrying out the research.



Figure 10: Personalised knitted jumpers chosen by the 3 participants.

A knitted jumper is used together with other clothes, thereby creating a so-called silhouette or an outfit.

Therefore, I was interested in gaining insight into how the participants would combine the personalised jumper with other garments in their existing wardrobe. The intention was to investigate how it would be included with the rest of the participant's wardrobe, and whether it would be used equally to other clothes.

In the third design experiment, I used a participatory wardrobe method, inspired by design probes, which allowed for the participants contributing in their own words and pictures describing their usage practices (Fletcher & Klepp, 2017). By applying the personalised knitted jumpers as design probes, I had the opportunity to follow the participants' way of using them, without even being present (Mattelmäki, 2006). I wanted the participants' experiences with the jumper to be as realistic as possible. Therefore, I left it up to the participants how they used their jumper, and made no demands on how often they should use it.

When handing over the personalised jumper, I encouraged the participants to take a picture of themselves when wearing it. I asked them to send the picture, via their cell phone. Possibly, with a brief description of the use of their jumper, and on what occasion.

The third design experiment lasted one year. During the time, I made individual semi-structured interviews with each participant based on their personalised jumper and their documentation – first interview after six months, and second, closing interview, after the entire year. The participants' self-documentation was used as a guide to the in-depth conversation about use of the personalised knitted jumper. I brought these pictures to evoke memories of how the jumper had been used in different situations, and in varying ways, as well as the participants' satisfaction with using it (see figure 11). Here I used the subdivision of the three piles: favourites, occasionally worn, and rarely or never worn.



Figure 11: Participant's self-documentation used to elaborate on use experiences with the personalised knitted jumper.

The participants adopted their knitted jumper, and they had each found their personal way of using the jumper, by styling it and integrating it with their other wardrobe. They showed how to add their own "design parameters", and even further adapt the jumper to their preferences and needs. Within the one year of the design

experiment, one of the participants often used a brooch to close her cardigan when she thought it's was too cold, to have it open. At the same time, she experienced how it, to her, gives a distinctive character that makes it more personal – as she could shape the cardigan around the body, by putting the brooch in (see figure 12).



Figure 12: Brooch as a closure of the cardigan. The participant show how she highlights her body figure by closing her cardigan by putting on a brooch

This was neither something I had planned, nor anticipated. The insight emphasises how using the knitted jumpers as prototypes provided detailed insights of specific use situations, as well as unfolding the participants' experiences with using a garment they had taken part in designing.

At another level, the prototypes contributed to more general insights of functional and aesthetic character. The third design experiment showed, for example, that the participants found joy and satisfaction, with the design choices of their jumper. They described how this in particular related to the colour choices, as the colour(s) of their jumper was easily matched with other garments from their wardrobe. In relation to colour, another insight was that neutral and classic colours; Not given are the ones that are used most frequently. Although neutral colours are typically considered to fit in many contexts, it is not a given that they are used more. Two of the knitted jumper prototypes are examples of alternative colours, and colour combinations being used frequently. This was due to the fact that it was easy for the participants to make combinations with other clothes, and therefore was used more often. One participant expressed it in this way:

“What I like about it (the jumper) is the colours: the combination of the pink colour and then the orange in the collar. It makes it a little more unique - so playful, somehow. And then clearly the pattern. It's such a combination of it all. /.../ And I think it (the jumper) fits in so many situations, both with a pair of nice pants, so for, not, to make them too pretty at work. Or when I attend something more important, or if I go for a bike ride, and just hang out.”

Gaining these types of insights are fruitful for the designer when working with design for customisation.

The example emphasises that the development of the colour scheme is important. It is a balance to create a wide scheme of colours that embrace the preferences of most users, while allowing all the colours to be used crisscross. Therefore, the colour scheme is developed to make all colours match; with the intention that users would not end up with a disharmonious combination of colours.

For the participants, it was not just the user-involved design process that was fun and different. They had also found joy and satisfaction with the use. At the beginning of the design experiment the participants were paying extra attention to their personalised knitted jumper, but over time it became more and more part of their other wardrobe. The knitted jumper prototypes succeeded in that way in providing in-depth and rich insights of the use phase.

AN OPEN DESIGN PROCESS

Looking back at the design experiments presented here, I see how the different knitted prototypes not only provided insights for the individual purpose. Making and using the knitted prototypes allowed me to explore various scales of design: Making the prototypes, I have studied design of knitwear up close by challenging the technology and unfolding the potential textile means to let these meet in strategies for sustainable product design. At the same time, prototyping the coherent set up of the design experiments gave me a personal experience of what significance it may have to open the design process for user involvement. By employing this approach of an open design process, I experienced how my role in knitwear design was expanded. Influenced by Redström's (2017) spectrum of a *design* space, the open design process I have explored here, has challenged the traditional understanding of “what designing knitwear is” not only from the perspective of the designer, but including users as well.

Prototyping the design concept gave an example of how the users were required to engage by making choices of the final design of their jumper before it was produced. Within the same scenario, the designer must take into account a user-involved design approach, as well as the way in which users are involved. In this context, the designer has a role as a stylist, which facilitates that users can engage in the design process.

My own design process of designing became extraordinary complex. For example, in relation to product development. Developing knitwear for customisation, the designer does not only develop one singular jumper at the time, but develops the parameters for users to be make choices in design. In that way, the designer has to think of the many possible outcomes from the given parameters; which requires for the design to adopt systemic thinking in product

development. I think the number of 97,200 variations of jumpers, which the design concept can provide, draws an image of the complexity the designer has to deal with in designing user-involving concepts like this one.

PROTOTYPING SCALES OF KNITWEAR DESIGN

Throughout the programmatic approach to this research, prototyping has provided a tangible exploration at the different scales of design presented in this paper. In relation to this, I will return to Redström's *a design space* (2017) which I have applied to illustrate in which way the knitted prototypes have generated knowledge to inform the different scales of knitwear design; On the spectrum of customised knitted jumper, design concept, knitwear design practice, and an open design process (see figure 12).

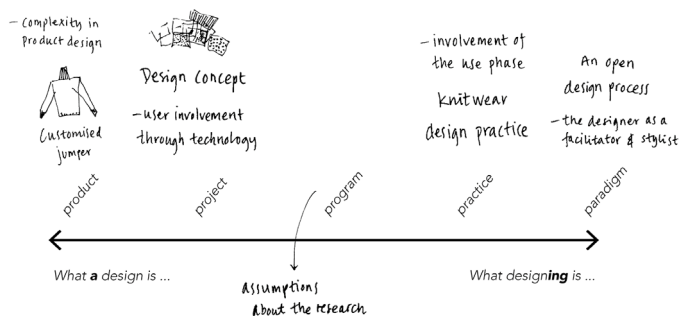


Figure 12: Prototyping scales of design. Application of Redström's (2017) spectrum *a design space*.

Applying the knitted prototypes contributed to a research program that holds the details, and at the same time makes it possible to assess the wider scope; Both equally essential to challenge, study, and come to an understanding of how textile designers can bring their professional competency into play and influence changes of the existing fashion system.

CONCLUDING REMARKS

To work with a complex topic as fashion and sustainability it is essential to think systemically and to address more aspects at the same time (Fletcher & Tham, 2019). I found that employing the different prototypes in this programmatic and experimental research set-up made it possible for me to take a systemic approach in which the detail of the different scales of engagement also generated knowledge as a whole.

To give an example of this, the physical appearance of the prototypes materialised a common reference point for discussion and knowledge generation. Moreover, the prototypes also helped to mature the conversations with the users. As use situations are a private affair, most often we are not used to speak of these with others. By bringing forward the physical exemplars of the

prototypes, the participants became more confident to share their narratives:

When I contacted the participants for the first design experiment, and asked if they wanted to be part of the project, they were unsure of what knowledge they would be able to contribute with to a research project. Use of the knitted prototypes and the questioning technique functioned as a “game” where the participants could experience that no answer was perceived correctly or incorrectly. At the same time, it made them familiar with what kind of knowledge they have – knowledge about use. I thus experienced that the prototypes helped to warm up the participants by giving them a vocabulary.

In that sense, prototyping and employment of the prototypes showed to be valuable in carrying out the research. What I find essential within this research, is the overall generated insights and examples which displays how design researchers can approach and challenge sustainable strategies in practice by using traditional skills of narrating futures by prototyping. Sometimes, these professional design engagements are forgotten compared to the enthusiasm for technological development and material innovation. This research demonstrates interplay between technological development in knitwear production and designing knitted jumpers which exemplifies how practice and disciplinary competencies can facilitate new directions that may change dominating practices into more sustainable ones.

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