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REET AUS

TRASH / TO TREND

USING UPCYCLING IN FASHION DESIGN

ESTONIAN
ACADEMY OF ARTS

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TRASH TO TREND –
USING UPCYCLING IN FASHION DESIGN

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USING UPCYCLING IN FASHION DESIGN

DOCTORAL THESIS

Supervisor Harri Moora, PhD

ESTONIAN ACADEMY OF ARTS

Tallinn 2011

I hereby confirm that I have written this doctoral thesis independently. The sources of any work or ideas of other authors, as well as any literature or other sources that have been used for the purposes of writing this thesis, have been referenced.

Reet Aus

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Using Upcycling in Fashion Design

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c.

Content

A.

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F.

Foreword

I defended my Master's thesis in Fashion Design at the Estonian Academy of Arts in 2002. But my six previous years of study had shown me that the functioning of the traditional fashion industry is not compatible with my view as a designer of how a garment should be manufactured.

During my Master's studies, three co-authors (Anu Lensment, Marit Ahven, and Eve Hanson) and I created the brand Hula. We followed the rules governing the fashion industry, which should have led to a successful, international youth brand. To do so, we familiarised ourselves thoroughly with the functioning mechanisms of the fashion and textile industries, including the origins of fabric, the most commonly used materials, and the places where garments are manufactured. We ran market surveys, did price comparisons, examined marketing strategies, and so on. In sum, we studied the behind-the-scenes world of the fashion industry with help from international specialists.

But the more information we gathered, the more difficult it became for me to remain motivated by the fashion industry's norms. I found myself increasingly feeling the need to do things completely differently, often the opposite of the standard practice. The reason for this was that I had begun to see how wasteful and environmentally damaging the activities of the existing fashion industry could be. The signals were too loud and clear to be ignored.

This made me realise that creating something does not have to mean destroying the environment and people in the process and that creation does not have to be only based on profitability. The contrast between the locally acting communities and the global fashion industry was surprisingly large. And yet, local action does not preclude the application of global ideas – it is the already global mass production cycle that precludes attention given to local communities and the environment. The saying "think global, act local" became very important to me.

With this knowledge, I began to test different sustainable techniques that were based on the concept of remaining local (redesign, upcycling, plant-

based dyes, etc.) but which, in theory, could be sold to a global market. I wanted to understand if and how it would be possible to influence the existing fashion industry and whether these techniques could also be applied to mass production.

The theatre proved to be an ideal place for my technological experiments and, thus, my theatre costume design became the testing ground for different sustainable techniques. Some of the materials used came from re-used sources outside the theatre (i.e., the New Use Centre, old people's homes, industrial material waste). Other material came from the same theatre's written-off costumes from previous performances. It is a very exciting assignment to create something new from something existing. The experiment also gave me the interesting experience of seeing how a costume budget could be minimised. In the process, I designed the costumes for several theatre pieces with a costume budget of zero and yet found that, in doing so, I didn't have to relinquish my creative freedom at all.

I also had experiences working with theatres where it proved impossible to apply my methods because they are more labor-intensive than usual and require a much higher level of cooperation with the designer by all contributors to a performance. As a result, I had to turn down several opportunities because I had decided not to base my work on new fabrics purchased from the store.

I returned to fashion design in 2006. Based on my theatre experience, I started to design garments with the whole life cycle in mind and with the aim of using my role as designer to influence the cycle's course. My goal was to analyse every phase of the life cycle of a garment in order to understand how it can be manufactured with minimal environmental impact.

Whereas in theatre the principles of environmental sustainability and locality are easier to apply, in the fashion industry this is much more difficult. The first obstacles already became apparent in the choice of material. Since I was focusing on a sustainable fashion approach, upcycling – or bringing textile waste back into the production cycle – was a very new concept at this point. I found that material which was suitable for theatre costumes or one-off pieces was not suitable for mass production. And thus I tested different options in my 2006–2011 collections in order to find an appropriate material and technique that would enable me to use textile waste in mass production. At the same time, I also started cooperating with different garment manufacturers to familiarise myself with the possibilities of different production methods.

I started using patchwork techniques. This worked well because it allowed me to use the smallest pieces of textile waste and non-worn parts of old garments. Having tried to combine different material, sewn new fabric from old textiles, cut and ripped up old clothes, I finally understood that these materials are great for one-off pieces. But if they were to be used in mass production the price of the garment would become too high and it would be difficult to sell. I presented my first collection of upcycled garments (2008) at the Fashion Weeks in London, Paris, Riga, and Berlin to get feedback. Emotionally, the collection was very well received – the media raved and people admired the work. But retailers would not buy it because the high volume of work involved made the price of each piece too high and they thought that the consumer would not be ready to pay so much for clothing made from reused materials. In addition, the relatively small pieces of fabric which needed to be sewn together to form the patchwork, the need for a lining, and the resulting weight of the fabric constrained the design of each garment to relatively simple models.

I did not want to compromise on using upcycled textiles, so I started to search for a suitable raw material and operative production model. I also started to look around at what was happening in Estonian garment production. What garment waste is produced and where does it go? I found the Masi Company in Valga, Estonia, and started a cooperative project with them that is ongoing. They send their textile remains to Tallinn, and I use them to design new garments. This find brought me a new collection using only industrial textile remains. Masi Company supplied me with larger pieces of waste which allowed me to move away from traditional patchwork techniques to produce more complex, tailored designs. The larger pieces also reduced the weight of the final garment and the need for a lining which made for a lighter garment which was more acceptable to the wearer.

And yet, this collection still didn't resolve all the problems that I had been working on. So I continued experimenting and searching. I ran a life cycle assessment on the S/S 2011 collection to find out the strengths and weaknesses of a localised, upcycled garment and what I should still change in the production cycle.

As I developed the idea of using industrial textile waste in fashion design, I saw a need to gather information about sources of textile waste in Estonia and elsewhere in one place. This became the impetus for creating a textile waste mapping web tool (http://www.reuse.ee/) that would help make suitable waste material available to a larger number of designers.

My main goal, after the practical experience I had gained, was to construct a design model that would make it possible to use different types of waste without needing a separate garment to be designed for each category. Finding a use for industrial textile waste was just one part of the solution. In my recent work and research, I have been most interested in the question of how to decrease the amount of discarded clothing (since this accounts for the largest share of textile waste sent to landfills). This would mean approaching consumers and changing their consumption habits. How can people be influenced to upcycle their own used clothes? I discovered the DIY, or do-it-yourself, phenomenon. I had previously considered this an unimportant, dilettante movement, but now I started to understand its full potential. When I gauged the years of practical experience and information that I had gathered and worked through, I saw that I could use all of it in one model. This was the beginning of the Trash to Trend platform (http://www.trashtotrend.com/), which when fully realised would encompass waste mapping data, discussion forum, case studies of upcycled products, background information on environmental issues, an explanation of the life cycle of a garment, and an opportunity for every consumer to find the right upcycled product. It also gives designers and companies the opportunity to act locally, reduce waste, collect information about different textile wastes, and to use this information in serial production and one-off sewing projects, as well as for DIY methods.

The Trash to Trend platform is intended to be global, with other regions generating their own local waste data. The goal for the whole process, of course, is to redirect textile remains back into production. And, in the long-term, to make information about how garments are manufactured public and available to everyone.

1.

Introduction

1.1 Contextualising the Research

The way we are producing clothes today is environmentally damaging. The textile and fashion industries consume huge quantities of resources, such as water and energy, use toxic chemicals, rely heavily on transportation which uses additional resources, produces a large amount of waste, and are implicated in human rights violations in developing countries (McDonough and Braungart 2002).

Fashion trends are created, promoted, and discarded. Over the past two decades, the rhythm of fashion has accelerated towards what is known as "fast fashion". This is a concept dominated by consumption, fast changing trends, and low quality, leading consumers buy more clothes because they are affordable but discard these after only one season (Fletcher 2008). Due to this, fast fashion contributes significant volumes to an ever-growing level of waste generated by the broader fashion industry. On top of that it seems as if the fast fashion concept has created a consumer need that does not account for the real social and environmental impact of manufacturing a garment. Most consumers of fast fashion do not know where the products they buy come from, how they were produced and distributed, nor that by discarding their clothing so quickly that they are increasing the rate of textile waste.

In modern-day developed countries, including Estonia, old clothes and textile industry leftovers mainly end up as waste in landfills. With the quantities of production having increased, the volumes of textile waste have increased rapidly too (Moora 2008). Production leftovers have become a significant problem for the textile and fashion industries in terms of growing waste management costs and image. Today, we can observe a growing consciousness inside the fashion industry about the ecological issues, and attempts to change design and production processes have surfaced. Many independent designers have emerged and started supplying to eco and sustainable fash-

ion markets. Sustainable and eco clothing is becoming more popular within fashion markets. Several companies are trying to create their products in more eco friendly ways to meet the demands of the environmentally conscious consumer. Nonetheless, sustainable fashion still only has a very small share (less than 0.5%) of the global fashion market (Mintel Oxygen 2009).

One area of the industry still lacking in terms of sustainability is mass production segment. More environmentally conscious mass producers and larger fashion chains primarily focus on ecological materials and social issues. Hence, a number of organisations have been established that aim to promote issues such as fair working conditions, health problems, a move from using conventional cotton to organic cotton, and more. These organisations include Fair Trade, PAN UK, Made-By, Clean Clothes Campaign.

However, the textile waste being generated by the fashion textiles industry remains outside the scope of these efforts. And practical solutions for bringing waste back into the production process are not being widely pursued. The reason for this gap might be owed to the fact that upcycling clothing waste is expensive and more complicated to incorporate into mass production. It is more time consuming to use textile waste in production – to collect material, analyse waste, and process it to a point where it is ready for production. Difficulties arise also because textile waste is non-standardised and material flow is irregular. In addition, there is no overview – including in Estonia – of where waste is being produced so that it can be sought out by those who would like to upcycle it. All this makes production with upcycled textiles more expensive and complicated than using new materials. Therefore, with fast fashion aiming towards mass consumption via the lowest prices, it embodies a system which necessarily produces large quantities of waste.

Sustainable fashion – especially design methods focused on textile waste, concepts of redesign, recycling, and upcycling – remains a field largely made up of independent fashion designers and academic studies. For this reason, the use of textile waste is mostly applied to one-off pieces and small-scale fashion production.

These efforts have been important for the sake of increasing consumer awareness. But they have not been sufficient to reduce the environmental impact of the fashion textiles industry more widely. Therefore the topic of textile waste in fashion design needs more research and practical experimentation to develop a market-fit production model which uses textile waste within the same system that causes it.

1.2 The Aims of the Thesis

Understanding that the wastefulness of clothing consumption and how current trends in the fashion industry inhibit our sustainability, in both environmental and social terms, made me look deeper into the garment design process. This understanding has been the basis for my own fashion and theatre costume design practice during the last six years as well as my research on the reinsertion of textile waste into fashion design.

The primary aims of this thesis are two-fold: to consider how to bring textile waste back to the production cycle in fashion design; and to understand and test, using different upcycling approaches and techniques, how to put this method into practice for (i) mass produced garments and (ii) one-off pieces.

In addition, I aimed to create an overview of existing and emerging textile waste suitable for upcycling available in Estonia and, through this, to promote the wider use of upcycling in fashion design, both in Estonia and globally.

Finally, based on academic research and the experiences gained from practical experimentation, I aim to present a design model that employs the upcycling method to create a fashion product with minimal environmental impact.

This thesis focuses on the principle of using textile waste in order to lower the environmental impact of fashion design. It does not go into detail on the social problems related to the fashion industry in this work, wider issues of textile or other waste, or upcycling in other industries, but rather gives an overview of the problems existing in the fashion textile industry in order to understand their extent and connection to environmental impact.

The practical work described in the present thesis is based on applying an upcycling method to the fashion design process because upcycled fashion design allows for the use of pre-existing material and, preferably, locally collected waste. I take a global approach to the problems related to the development of the fashion textile industry, but the analysis and practical examples in the work are based on the situation in Estonia. Despite this, the conclusions and proposed design model are generally applicable to other developed countries as well.

1.3 Methodology

The approach of inquiry that was adopted in this research project, largely intuitively at the outset, falls within the confines of practice-led research as it has been defined by authors such as Steven Scrivener (e.g., Scrivener 2000, 2002, 2006) and Michael Biggs (e.g., Biggs 2003, 2004, 2006), who have been pivotal in advancing the discipline of practice-led research in the recent decade.

This research tradition started to develop in the 1970s and 1980s, mostly in the UK but also in Finland which has fostered a strong tradition of artistic research. In Estonia, practice-led research does not yet have a very strong grounding. Most eminent among artist-researchers applying this framework of inquiry is Kärt Summatavet, who adopted the conceptual framework while working on her PhD in the University of Art and Design in Helsinki (e.g., Summatavet 2005, 2006).

To put it very simply, "practice-led research is research in which professional creative practices of art and design play an instrumental role in the research conduct" (Mäkelä and Routarinne 2006: 12). Yet it is emphasised that creative practice is not research in itself but rather a vehicle for an exploration that contributes to knowledge and understanding: "creative practice as such is not necessarily research, but creative practice that meets certain criteria can be regarded as research. The requirements are that there have to be explicit research questions, specific methods for answering those questions and a specific context in which the research is carried out" (Ibid. 15). Steven Scrivener (2006: 175) also points out that "although some of the process [of creative practice] may occur intuitively or tacitly, much of the process must be conscious, planned, thought out, informed by contextual understanding and cognition in all its dimensions".

What distinguishes practice-led research from other more traditional frameworks of conducting research is its emphasis on practice and artistic and/or design artefact as the driving force within the research. While in established fields of research experiments are usually carried out in order to test a certain assumption, i.e., to solve a problem or to answer a question, then in the field of practice-led research "making is conceived to be the driving force behind the research and in certain modes of practice also the creator of ideas" (Mäkelä and Routarinne 2006: 22). The issues, concerns, and interests of the research are explored and manifested through the production of artefacts and they serve not as a means to an end but "as an object of experience,

the creative product itself is as important as any knowledge embodied in it" (Ibid. 23) and in this way they also facilitate the constructive, solution-focused thinking of the artist or designer.

The inquiry within the practice-led research can arise either from practice or research intent. The pivotal role of practice does not free the study from the requirement of rigour nor from the intention to add knowledge and understanding. Michael Biggs has suggested that a persuasive connection between the question and the answer proves the suitability of the method (Biggs 2004, 12 – 13, via Mäkelä and Routarinne 2006).

Steven Scrivener has provided a more detailed account of the criteria for practice-led research in a number of his papers in order to institutionalise artistic research in the British academic landscape.

According to him, the underlying norms for a creative production research project should be as follows:

1. Artefacts are produced;
2. Artefacts are of high quality and original in a cultural, social, political, or (and) aesthetic, etc., context;
3. Artefacts are a response to issues, concerns, and interests;
4. Artefacts manifests these issues, concerns, and interests;
5. These issues, concerns and interests reflect cultural, social, political, or (and) aesthetic, etc., preoccupations;
6. Artefacts generate apprehension;
7. Artefacts are central to the process of apprehension;
8. The creative-production process is self-conscious, reasoned, and reflective

(Scrivener 2006, with a reference to Scrivener and Chapman 2004).

To achieve those goals of my PhD research I have adopted different methods, not only of artistic research through series of practical experiments but also interviews, waste data collection, questionnaires, and life cycle assessment.

The most important part of the practice-led research consisted of a series of theatre designs and fashion collections that are both experiments along the way towards a suitable design and production model as well as artistic work in its own right. These experiments have been informed by previous experiments, as well as by information gathered from free-form interviews with practitioners and researchers and work with the literary resources – another

important part of the research process.

I also adopted a life cycle assessment method to calculate the environmental impact of one of the items in the Reet Aus Upcycled S/S 2011 collection to get feedback for my design decisions and to further enhance the design of the item as well as the entire Trash to Trend design and production model. LCA is a systems-based methodology to assess potential environmental impact throughout all the stages of a product's life from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling (ISO 14040, 2006).

Yet another important part of the research process is also the textile waste mapping project that was later used as an input for the textile waste mapping platform in the web. Questionnaires and interviews were used to gather initial data. This project was pivotal for the further implementation of upcycling also in serial production: until then, the data about the sites (either of production or storage), amount, quality, or type of textile waste was nonexistent.

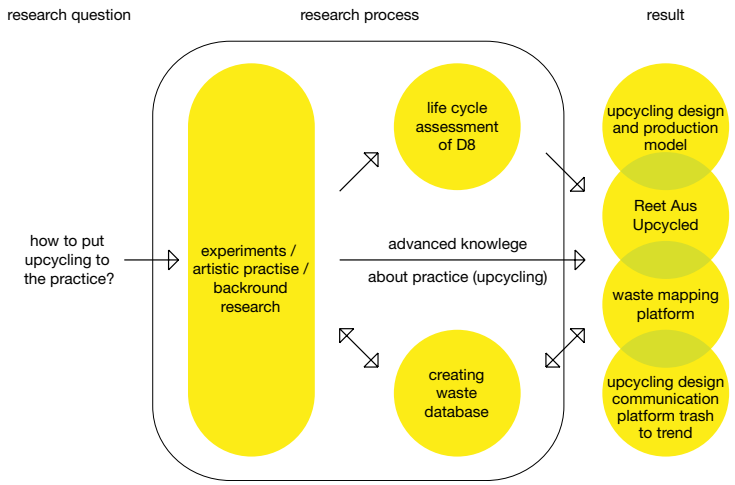


Figure 1. This drawing illustrates how the methodology of practice-led research is applied in this thesis.

The multiplicity of methods has enabled me to propose also a number of novel outputs that are partly independent and partly interconnected: a model of design and production called Trash to Trend, a series of fashion and theatre designs, fashion brand Reet Aus Upcycled that embodies the Trash to Trend design and production model, a web platform Trash to Trend to disseminate

knowledge and data gathered during this research, as well as the proposed design and production model, and a waste mapping platform Reuse that will continue to develop also after the completion of this thesis (see the drawing illustrating the adoption of practice-led research in this dissertation).

1.4 Structure

Literature Review and Interviews

Chapters 2 and 3 give a theoretical background for the themes presented in my doctoral thesis – using textile waste in upcycling as a method for sustainable fashion design.

Chapter 2 gives a short overview of the development of the fast fashion industry and its social and environmental impacts. Chapter 3 provides an overview of the concepts of sustainable design, incuding upcycling.

The theoretical part of the thesis is based on literature published in this field. The main authors I have relied upon are architect William McDonough and chemist Michael Braungart, theorist Jason F. McLennan, sustainable designer/writer/reader Kate Fletcher, theorist Stuart Walker, reader/designer/theorist Joan Farrer, writer/practitioner Sandy Black, theorists Paul Hawken, Amory Lovins, Hunter Lovins, and Ann Thorpe, and many other practitioners and theorist of sustainable design and fashion.

Since this is a very fast-growing and developing field, a large amount of the information was also gleaned from interviews with individuals who are tightly connected to the topic as well as from people with academic background, practietioners, and designers. The interviews highlighted in this thesis helped me form an overview of what is happening in the field of outsourcing, environmental science, cotton farming, and how the fashion upcycling field has been developing over recent years. Having direct information was essential to understanding the current situation.

Examples of notable interviewees include Duncan Wingham, Professor of Climate Physics at University College London; Eliza Anyangwe from Pesticide Action Network UK; Orsola de Castro, the creator and organizer of the world's first sustainable design platform Estethica, which is connected to London Fashion Week; Sashi Anand, who administers outsourcing in India for large, Western corporations through her New York based company; and

Alo Lepp, CEO of the Estonian garment manufacturer Marat. These interviews were recorded as part of the initial preparation for the documentary "Out of Fashion". This documentary is a project that I have been working on in parallel to my doctoral studies. Its aim is to portray the fashion textile industry's environmental impact through a visual medium. In total, the background research included five interviews. Additional interviews and shortened interviews are available on the website http://www.trashtotrend.com/.

Textile Waste Study

Chapter 4 gives an overview of the main types of textile waste that are suitable for fashion design. The successful implementation of sustainable fashion methods based on textile waste recovery, including upcycling, requires a thorough overview of the producers, types, and volumes of textile waste created. A lack of local information and limited access to the information that does exist accounts for some of the largest obstacles to realising an upcycling model based on recovering textile waste. In order to alleviate this situation, I conducted a detailed textile waste study in Estonia in 2011. The goal was to get an overview of the main sources (waste producers) and volumes of textile waste in Estonia and to create a network of textile waste producing companies and potential users in order to further cooperation between them.

The textile waste database I have produced is based on local textile and garment industry enterprises and the result of a previous waste study. Interviews with Estonia's biggest textile companies (Qualitex, Wendre, Baltika, Marat, Ilves Extra AS, and Coats Eesti AS) were conducted in order to map out the amount and type of textile waste produced in Estonia. The representatives of these six garment manufacturers were interviewed over a two-month period with the help of volunteers. The results are provided in Addendum 7 and http://www.reuse.ee/. The aim of this web-based database is to expand it to other countries so that this database may cover a larger area.

Case Studies

Chapter 5 gives a case-by-case overview of my experiments in upcycled fahion and theatre design during 2006–2011. The thesis highlights twelve case studies that illustrate the most important parts of my own creative work

as well as the practical side of upcycling as a sustainable fashion design method.

The aim of these practical experiments is to show how upcycling can be used in mass production. The case studies focus on designing and testing technologies through which to implement an upcycling method. Each case study begins with a specific problem encountered when implementing upcycling in fashion design or theatre design and looks at it practically. The chapter describes my case studies in these two important fields – fashion and theatre. I found that it is much easier to implement upcycling and to apply a local approach in theatre costume design. In fashion design, the challenge is posed when mass production is desired.

I tested the different opportunities afforded by upcycling experimenting with different inputs: pre-consumer waste, post-consumer waste, and production waste. Examples include used clothing, cast-off police and army uniforms, industrial remains, old domestic textiles, old hotel sheets, unsold retail collections, and defective products.

In addition, the results of the life cycle assessment of a typical upcycled fashion product is presented in this part of the thesis. LCA is a methodological framework that can be used to assess or estimate the environmental impact of the life of a product from production to disposal.

Upcycling Design Model

In Chapter 6, I present my main research outcome in the form of a design model for upcycling that can be applied both to a variety of production methods. The Trash to Trend design model implements the principles and practices described in the research section of the thesis, including a waste data mapping exercise and upcycling techniques tested in a range of production contexts – from one-off pieces to mass production.

To implement the model in practice, I created the web-based platform Trash to Trend (http://www.trashtotrend.com/), which acts to mediate and pool information from users, and in doing so brings together producers of waste, designers, and clients. To involve the client in the process of making a product, it is important to show how a product is produced and to make the production chain more transparent – thereby influencing their future choices. The functioning of the Trash to Trend model is illustrated by the collection Reet Aus Upcycled from March 2011.

Fast fashion consumer in New York 2010. Photo by Marianne Kõrver-Tüür

2.

Fast Fashion and its Impact

This chapter gives a short overview of the development of the fashion industry and its social and environmental impact.

It is unknown exactly when people started to wear clothing, but anthropologists estimate it to have been between 50,000 and 100,000 years ago (Kittler et al. 2003). DNA researchers Kittler, Kayser, and Stoneking use the emergence of the human lice species to estimate that humans started wearing clothes about 72,000 years ago. The first sewing needles, indicating that garments were being produced, are up to 40,000 years old (Ibid.).

These estimates suggest that, for the majority of our long history of production, people have been able to manufacture garments without wasting non-renewable resources or substantially polluting the environment. At first, clothing was made by people themselves or by those with more skills, and later by professional tailors. Individual items of clothing were repaired, mended, or tailored to fit other family members, or recycled within the household and put to use again as rags or quilts.

At the end of the 18th century, the industrial revolution brought the inventions of the steam engine and the power loom. These completely changed the process of clothing manufacturing. The original and personal production model, wherein durable garments were made by hand and passed down from generation to generation, was replaced by an anonymous, industrial giant and a mass production model which often eliminated the need for a designer altogether.

Industrialisation grew rapidly in the beginning of the 20th century, providing the means for increased production of all consumer goods, including clothing. With industrialisation – and the scope to produce increased numbers of goods at lower prices thereby making them available to a larger portion of the population – came mass consumerism, which became an integral part of

the economy. Economic growth came to depend on increased consumption achieved via the continued marketing of new products and the disposal of old ones, discarded simply because changing stylistic norms promoted their obsolescence.

Since the late 1980s, high street fashion, led by global chains, has become ever more affordable and disposable. The sourcing of materials, the manufacture. and distribution of clothing have become the dirty secrets of the beautiful industry (Black 2008).

In 2000, consumers spent around US$1 trillion globally buying clothes. Around one third of sales were in Western Europe, one third in North America, and one quarter in Asia. In 2005–2006 clothing and textiles represented about 7% of world exports (Allwood et al. 2006). Inditex – which owns Zara, Bershka, Pull & Bear, Massimo Dutti, Stardivarius, Oysho, Zara Home, and Ulterqüe and is one of the world's largest fashion retailers – has grown dramatically in recent years, achieving consolidated turnover of 12,527 million euros in 2010, and net profit of 1,732 million euros (Inditex 2011). This revenue is generated by more than 5,000 stores in 78 countries worldwide.

2.1 Fast Fashion

In their book "Cradle to Cradle", W. McDonough and M. Braungart write: "Urban and industrial growth is often referred to as a cancer, a thing that grows for its own sake and not for the sake of the organism it inhabits." In the fashion textile industry, this type of thinking is represented by the concept of "fast fashion".

The concept of fast fashion has its roots in the 1990s. The movement was headed by brands like Zara and Mango. In 1988, the label Zara opened its first store outside of Spain, its country of origin. In 1992, Mango did the same. This completely new concept – built on fast production and variability in products – brought about a chain of changes in the world's fashion industry. Quality was no longer the first concern. The goal of fast fashion is to bring cheap copies of high-fashion trends to the consumer at maximum speed, affordable price, and as cost-effectively as possible (Fast Fashion 2010).

Fast fashion requires taking designs from the catwalk to the retail shelf in as little time as possible. As such, it provides both a means to quickly respond to the market and grounds for competitive differentiation among retailers:

the speed at which retailers can react to real-time sales information to get the best-selling lines into the stores before a particular fashion style or trend moves on (N. Tokatli, J. Econ. Geog 2008; Farrer and Finn 2008). Miuccia Prada and Jil Sander, writing in their article about fast fashion brands, note that: "constantly watching data on consumer behavior and trends, the firm's hundreds of designers produce thousands of prototypes a year. These are then widely discussed in house, with only 40% going on to be approved for a small sample. This test sample is then used to see where the level of demands is. If an item sells out fast it can be reproduced very quickly" (Miuccia Prada and Jil Sander 2009).

The fast fashion model is based neither on the consumer's natural needs nor the garment's design value, but rather on the emotional need to experience an ever-faster changing of trends. Whereas the traditional rhythm of the fashion industry focused on two yearly collections, the arrival of fast fashion chains blew this model out of the water. Thus, an increased frequency of purchases, a real reduction in price levels, and increased availability of low quality clothing has changed our relation to clothes and led to an increasing trend of throw-away or fast fashion (Birtwistle & Moore, 2007; Fletcher, 2008).

Today, the fashion textile industry must create and process goods more quickly and cost-effectively than ever before. The industry is dominated by consumption, fast changing trends, and low prices that make consumers buy more than they need. "If, traditionally, setup and switch-over times and costs have led to large batch manufacture of clothing with long lead times – fashion shows for summer clothing are held in the autumn to allow six months for manufacture – then now this pattern is rapidly changing, with customer demand for so called "fast fashion" where stores change the designs on show every few weeks, rather than twice per year" (Allwood et al. 2006). Inditex Group's 2009 Annual Report tells us: "The Group's distribution process is designed in such a way as to ensure the products on offer in the stores are continuously renewed. . . . worldwide, each store receives merchandise twice a week and each delivery includes new models".

In fast fashion, economic factors dictate the production process. Both the manufacturer and the consumer are focused on only one phase in the product life cycle – the sales transaction. A garment's value lies in its cheap price. Achieving this low price requires low priced inputs – including cheap raw materials, cheap labor, and fast production. The result of fast fashion is that the value of a product lies no longer in its quality, but rather its cheapness.

The textile industry is one of the industries with the longest and most compli-

cated industrial chains of the manufacturing industry. It involves actors from the agricultural, chemical fibre, textile, and apparel industries, retail and services sector, and waste treatment (European Commission; Defra 2011). Textile production not only has harmful environmental impacts during the production phase, but also during the consumption phase, where the means of caring for and disposing of clothes has a considerable negative environmental effect.

In addition, these retail models produce a huge amount of textile waste. The fashion textile industry is now considered one of the most polluting and resource-intensive industries in the world, having social and environmental impacts throughout the value chain. It has been estimated that the average person in the UK sends 30kg of unwanted garments to landfills each year adding up to 2.35 tons of clothing which finds its way to UK landfill sites every year (Allwood et al. 2006).

Achieving greater efficiency and a faster speed of production requires producers to minimise costs, including reducing the role of the designer and the creative component. In fast fashion companies, this is illustrated by dramatically reduced costs of design, forecasting, and especially advertising - 0.3% of costs as opposed to 3–4% of rivals (Tokatli 2006).

Wages in the garment industry are typically low. This is not because of poor productivity, but rather because the structure of the industry creates intense competition between brands and retailers, governments, employers. and workers (LBL Report 2009). Wages are kept low through global competition that engages workers, factories and whole countries in a race to the bottom – a race where the winners are those that can produce as quickly, cheaply and flexibly as possible (Ibid.).

Beyond the cost of input, it is important to understand the wider factors which determine how a product's price is set. For example, in choosing to set a 4.95 euro price for a dress, the fast fashion label will have made a series of choices in order to bring the price of a product down so low. There is also a broader question to ask: what do these decisions, of which most consumers are completely oblivious, really entail?

To understand the situation in outsourcing business, I interviewed two CEO's – one based in Estonia (producing in Estonia) and another in the US (producing in India).

Interview 1:

In February 2011, I interviewed Alo Lepp, the CEO of the garment company Marat. For many years, Marat was an outsourced provider to international fast fashion labels including H&M, Esprit, and others. Alo Lepp admitted that these labels typically ordered lower-than-usual quality products. The interview also revealed that quality was not the determining factor in choosing where to outsource. Once the increasing price of cotton created a situation in which it became too expensive to produce in Estonia, Marat's clients started to look elsewhere for cheaper possibilities. Right now Marat is producing small quantities mostly for Scandinavian brands. See the full interview in Addendum 1 and short interview on http://www.trashtotrend.com/.

Interview 2:

I conducted an interview in December 2010 with Sashi Anand, the owner of Blue Plate Fashion, a company that coordinates garment production in India. The interview revealed that the previous year (2010) had been a difficult one for outsourcing-based enterprises, and thus the production price for garments had reached an all-time low. According to Anand, one of the primary reasons for this was a rise in cotton prices during the previous year. The rise in cotton prices has brought on a wave of bankruptcy in this market sector. Among other survival tactics, the company attempted to find alternative, cheaper production methods, which meant that their garment design became more and more simplified (simple product = quicker production = cheaper price). Anand talked about their working method – how they are working out a lot of designs and then different brands are coming to their office and will order from that selection. Put simply, the company sells the same design to different companies using different material and putting in a different label. This illustrates the overriding importance of the final selling price to the consumer of the product and the value of the label. See the full interview in Addendum 2 and short interview on http://www.trashtotrend.com/.

The global reach of fast fashion labels means that the average consumer has become uniform; local variety diminishes constantly. The same labels and merchandise are sold in Boston as in Tallinn. Speed and quantity do not beget quality, and thus the clothes sold by fast fashion labels barely last more than a few seasons.

In order to understand the repercussions of fast fashion as the prevailing model in the modern fashion industry, one must understand what is really behind a product's selling price. This includes the choices made to enable fast fashion chain stores to sell their products at such low prices and the side effects these decisions carry with them. More often than not, consumers are unaware of these wider impacts.

2.2 Social and Environmental Impact of Fashion Product

Today, fashion and textiles are global industries that have a huge effect on people's lives and health, as well as on our environment. In order to acknowledge and understand this effect, one must look at a fashion product from a life cycle perspective. In my practical work I chose to examine each stage of the life cycle of a garment in order to draw conclusions for my everyday work as a designer. I have focused on denim and jeans specifically because it is the material I use most in my collections.

Looking at a product's life cycle from the designer's point of view gives an important entry into fresh ways of considering the design process. Increasing the transparency of the production chain creates the possibility of removing some of the potential harmful social and environmental impacts of the product before they occur via the design process. Consideration of the full life cycle allows the designer to ask questions like:

- Where does the raw material for this product come from and how has it been produced? What impact has that production had?
- Where will the product that I am designing eventually be produced? Under what social and environmental conditions?
- What will happen to the garment if a consumer does not want it anymore?

Understanding the potential wider social and environmental impact of a garment during its full life cycle gives designers important background information which they can use in the design process.

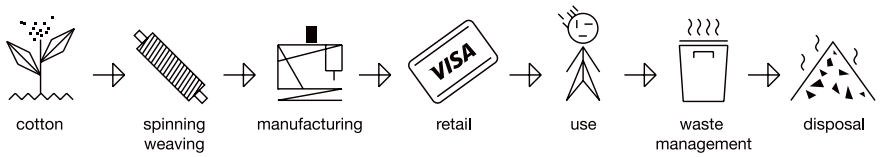


Figure 2. The main phases of the life cycle of a typical garment

Cotton – Growth, Acquisition, Processing

As the main raw material used in the textile industry, cotton is mostly produced in developing countries. "Developing countries account for almost three quarters of the world's clothing exports and for half of world's textile exports" (Allwood et al. 2006: 10). Cheap labor in developing countries means workers are mostly children and adults who are unable to choose better employment. Working at remarkably low wages in inhumane conditions and living below the poverty level have become inevitable parts of life for one sector of the global population.

Cotton plantations are tied also to a number of health issues, as the plants are sprayed with pesticides and herbicides during production. The use of toxic chemicals for the production of conventional cotton is extremely harmful to the environment and to humans (October 2008, Agriculture, http://www.wbcsd.org/), while fertiliser production is energy intensive.

Interview 3:

> *In October 2010, I conducted an interview with Eliza Anyangwe from PAN UK in London, an organisation working to solve the problems related to cotton plantations in the West Africa. The interviewee describes the abundant use of pesticides in plantations: "They don't know what the pesticide does. I just came back from a meeting in West Africa and we went to the market and they had herbicides that were marked as hazardous. There is all this care and health and safety information and it's all in English, and because farmers are French-speaking if they speak, they don't understand and they will not attempt to learn. There are some rules now, because before the pesticides used to come in big drums and poor farmers would finish using the pesticide and then start storing grain, start storing water in those drums because again they spend so much money buying those pesticides. It's one of their most prized possessions. So they have the pesticides in the house, next to the food, next to the baby because they don't want to leave it outside." See the full interview in Addendum 3 and short interview on http://www.trastotrend.com/.*

The world's cotton plantations are located in places such as South America, Central Asia, India, and Africa. As time passes and conditions in the world market change, cotton plantations become more and more hostile towards the environment. Every year, 27 million tons of cotton crop is grown on 2.5% of the world's cultivated land but the plantations account for 16% of the world's insecticide use (EJF 2007). 150g of fertilisers are used to grow the cotton needed to produce one t-shirt (c.450g) in the US. Such extensive use

of chemicals has many negative side effects, among them the eutrophication of bodies of water and numerous human health issues (Laursen 2007).

The cultivation of cotton relies on heavy consumption of fresh water – around 2,700 litres per kg of cotton fibre (Allwood et al. 2006). Rainfall does not produce enough water in most cotton growing regions so farmers resort to irrigation methods. This, in turn, affects a region's water consumption. The most vivid example of the effects of irrigation is the Aral Sea. The water level in the sea has decreased constantly ever since the water started to be used to irrigate cotton plantations in Uzbekistan (Farrer 2006).

Production – Spinning, Weaving, Dyeing, Finishing, Packaging

The biggest environmental impact of the textile production stage is connected to post-production, including dying, printing or applying finishes to fabrics, bleaching, and washing. All these processes employ toxic chemicals. They also use a very large amount of water. Textile post-production factories create large volumes of untreated waste, which has a dire effect on the environment.

Dr. Samuel C. Winchester, from the College of Textiles at North Carolina State University, has said that while the textile-processing footprint covers yarn spinning, fabric formation, fabric colouration, and garment formation, it is most visible in the dyeing and finishing segment. Of the one trillion gallons of water consumed for annual cotton production, this is where 85% is used. This is also the point in the textile production process where 65% of the 20 billion pounds of chemicals are applied (http://www.cottoninc.com/EFS-NewsNotes/EFS-News-and-Notes-Issue-55/).

The fast fashion industry's largest outsourcing companies are located in Bangladesh, India, China, Vietnam, and beyond. Greenpeace data show that, in 2008, 260 million pairs of jeans were produced in China's Pearl River region, specifically the cities of Xintang and Guangdong. This equates to 40% of the total number of jeans bought in the USA that same year. Data produced by the Guangdong Geology Bureau in 2004 and 2005 show that the Pearl River Delta bank – where the largest denim factories and clothing manufacturers are located – has become the most severely polluted area in China. According to their survey, 5,500 square kilometers around the mouth of the Pearl River became heavily polluted in 2004, also contaminating 95%

of the seawater (Jia Xu 2010). According to the National Marine Environmental Monitoring Centre, the Pearl River dumps 8,655 tons of heavy metals, 65,637 tons of nitrates and ammonia, and 59,853 tons of petrol into the sea each year. Such environmentally hostile practices have caused widespread pollution and severe ecological changes in developing countries (including the extinction of plant and animal species).

Transportation

In a global production cycle, raw materials and finished garments must be moved between different continents and countries. For example, it is common for the cotton in a pair of jeans to be grown in Peru, woven into fabric in India, and sewn into jeans in Bangladesh. Then the jeans are sold, for example, in the US. Transportation is tied to the abundant overuse of non-renewable natural resources (oil) and the pollution of oceans, and it is one of the primary generators of greenhouse gases.

Interview 4:

Interview with Duncan Wingham, PhD, Professor of Climate Physics at University College London; the interview was conducted in October 2010 in London. Prof Wingham referred to the circumstances which have caused climate change on planet earth and what they are by identifying the changes in the human relationship: "This is having a number of directly observable consequences, so it is a straight fact that the sea level is rising, for example. It is a straightforward fact that land temperature is rising. It is a fact that ocean surface temperatures are rising. It is a fact that, particularly in the Arctic, extensive reductions in the area around the ice in which each year, more or less, is covering a smaller and smaller area. All of these are not things which one needs to really discuss the truth of or not. They are observed facts. I think that it is fair to say there is no reasonable alternative to these being and explaining these as being a consequence to our human use of fossil fuels, because there simply isn't any reasonable explanation of the accelerated rises we have seen in the last 50 years. So I think that one can take, quite reasonably, the view that we are starting to alter the planet. That we are in particular starting to make it warmer. The next question really is what will happen if we really don't do anything about it. It's actually an extraordinarily difficult question to answer." See the full interview in Addendum 4 and short interview on http://www.trashtotrend.com/.

Consumer Use – Caring for Garments

Up to 60% of the environmental impact of garments may come from washing and caring for them (Minney 2008). The environmental effect of the use of a garment is closely tied to consumer awareness. For example, if clothing is washed in 30-degree water instead of 60-degree water, dried without an electric dryer, and washed less frequently, the amount of energy used in the care process would be significantly reduced – and with it, the amount of CO2 released and water used. The industry extensively uses fossil fuels to create energy for water heating and laundering (Allwood et al. 2006).

End of Life – Landfill, Incineration, Recycling

Consumer awareness also determines what happens to a fashion garment at the end of its first use. The vast majority of garments become discarded waste that ends up in a landfill, directly contributing to the environmental problems related to landfills, including the production of greenhouse gases. Over 90 million items of clothing end up in landfill sites globally each year. The UK population purchases around two million tons of clothing per annum and discards approximately one million tons of unwanted clothing a year – 50% of which ends up in landfills (Defra 2011). The average American throws away about 68 pounds (31kg) of clothing and textiles every year (Fraser 2009). Textiles present particular problems in landfills. Synthetic or man-made fibres do not decompose, while woolen garments will decompose but produce methane gas, which contributes to global warming (Blanchard 2007: 102). The synthetic fibres in these mountains of clothing break down slowly, releasing toxic gases into the atmosphere. Ironically, fashions designed to last one season may take many years to decompose (Earley 2006; Fraser 2009).

Example:

Wolfgang Uchatius, a journalist at the German weekly paper Die Zeit, considered a 4.95 euro H&M brand t-shirt with the goal of finding out how it is possible for a t-shirt to cost so little (Uchatius 2010). He calculated that the t-shirt used 400g of cotton at a cost of 40 euro cents. The cotton used came from the US. It was processed and sewn into t-shirts in Bangladesh. In a backyard-sewing factory in Dhaka, he met a local worker named Nazma, whose job is inspecting the finished t-shirts. Nazma works so fast that she does not even dare to take a drink during her shift because she could have to go to the bathroom. She works 12 hours a day, 6–7 days a week, inspecting about 250 shirts an hour.

She makes about 36 euros a month, or 1.18 euros a day. The company where Nazma works sells the shirts for 1.35 euros each. Next, Uchatius calculated the transportation cost incurred by H&M. In a container of t-shirts shipped by water, the transportation to Europe costs 6 cents per shirt. So the total cost of material, manufacture, and transportation comes to 1.41 euros. Accounting for transportation inside Europe, rental fees for the branch stores, and employee salaries adds up to around 2 euros. Excluding VAT, H&M's profit from one t-shirt is therefore in the region of 60 cents.

The Die Zeit experiment shows that the real cost of the production process and its side effects often go unnoticed. The production of too many cheap t-shirts has cost humanity a much higher price than we would like to admit.

The UN Human Rights Declaration, signed on 10 December 1948 in Paris, states: "All human beings are born free and equal in dignity and rights. They are endowed with reason and conscience and should act towards one another in a spirit of brotherhood." The UN has 192 members (including Bangladesh, the US, Estonia, and others) who have all acknowledged this document. It could be argued that the practices of the fast fashion industry display a conscientious disregard for human rights.

Landfill in Peru 2011

Landfill in Estonia 2011

Photos by Lennart Laberentz

3.

Upcycling – a Solution to Textile Waste?

As the practical research in this thesis focuses on upcycling, a sub-dimension or one method through which to recover textile waste, then the aim of this chapter is to open up the concept of upcycling in general and give an overview and practical examples of how upcycling has been put into practice in the context of fashion design. Examples drawn upon include Junky Styling, Cristopher Raeburn, From Somewhere, and the author of this thesis, Reet Aus.

Since upcycling is only one of several existing textile waste recovery methods, then this chapter gives an overview of other waste recovery strategies such as the reduce, reuse, and recycle (3Rs) method. It also gives a short overview of the general dynamics of the sustainable and eco fashion spheres.

The main authors I rely upon in opening this topic are William Mc Donough and Michael Braungart, Jason F. McLennan, Kate Fletcher, Stuart Walker, Joan Farrer, and Sandy Black. I also draw on many other practitioners and theorists of sustainable design and fashion. I draw also on an interview with Orsola de Castroga, the creator of and designer for the upcycling label From Somewhere.

3.1 Sustainability in Fashion Design

Although at first glance it may seem that fashion is fundamentally contradictory to the principles of sustainability, a closer look reveals that this does not have to be the case. “If we approach it in the right way, and ensure that we are discerning and receptive to the aims of sustainability then, somewhat paradoxically, fashion in design can prove a valuable ally in the evolution to-

wards more ecologically and socially responsible ways of producing material products" (Walker 2006).

Sustainable fashion belongs to the growing sustainability trend, which in the fashion industry is directly linked to the philosophy of sustainable design and production. Sustainability is described as "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundland Commission 1987). This is where a product is produced with careful consideration for the environment and the social impact that it may have in its lifetime.

Data shows that the eco fashion market segment is rapidly growing. For example, global retail sales of organic cotton garments increased from $245 million in 2001 to $583 million in 2005 (Vardas 2010). Consumer awareness and concerns about issues like sustainability and ethical production and trading are higher than they have ever been. This is the main reason why designers, manufacturers, and retailers are turning their attention to sustainable development.

The sustainable development paradigm revolves around the three Es: Economy, Equity, and Environment (McDonough and Braungart 2002, Eija Nieminen 2008). For any operation to be sustainable, it needs not only to be profitable, but also take human rights and the environment equally into consideration (Lin and Zheng 2008). While the fashion industry has addressed economic and social sustainability, environmental sustainability often remains unclear. It has been understood that fashion is sustainable only if the industry adopts a new norm accepting environmental sustainability as lowering output investing in long-lasting clothing (Ibid.).

To address the environmental impact of fast fashion at its source and find a niche in an rapidly growing and increasingly competitive market, designers, major manufacturers, and retail players like Marks & Spencer, H&M, Topshop, and Tesco have started to develop their own sustainable or eco fashion lines.

The following are a few examples of sustainable and eco fashion approaches:

- Sustainable and eco materials. Textiles are made from a renewable or sustainably grown raw material or materials that are not toxic and pesticide free. This includes preference for durable fibres (linen, hemp, bamboo) and the use of recycled fibres in textile production. An example here is Danish label Katvig, which uses organic cotton and recycled polyester

made from used plastic bottles and recycled organic cotton (see more at http://www.katvig.dk/).

- Human rights. Several retailers have started to use fair trade certification and membership to show that fair payments have been passed down to those growing raw materials. In this area the UK label People Tree is a pioneer. They actively support 50 fair trade producer groups in 15 developing countries (see more at http://www.peopletree.co.uk/).
- Environmentally friendly manufacturing. Regulations and standards, coupled with increasing awareness about less toxic and sustainable products, has pushed the garment industry to implement different eco labels and management systems (EU Ecolabel, Oeko-Tex, ISO standards, etc). These aim to control the environmental impact caused by manufacturing as well as products themselves. Outsourcing company Utenos Trikotažas in Lithuania is good example of how sustainability can provide market advantage. The company has certified in a number of sustainable standards and eco labels including OEKO-TEX 100, ISO 9001, ISO 14001, EU Ecolabel, GOTS, OE 100, etc (see more at http://www.utenostrikotazas.lt/en/).
- Local production. To avoid the increasing globalisation of the fashion industry and the resulting social and environmental effects, manufacturers have started to turn more and more attention towards so-called local production chains. Among other positive effects, this practice contributes to increased transparency and quality control in the supply chain. Local production also affords more flexibility and the ability to produce smaller quantities quickly. A good example is Eloise Grey, who produces her garments in England with the raw materials – tweeds – woven in Scotland. She is interested in the challenges of the rural economy and actively seeks local suppliers and similar-scale businesses and creative workers in South West Surrey to cooperate with (see more at http://www. eloisegrey.com/).
- Environmentally friendly garment care. Several retailers are taking steps to directly address the environmentally conscious consumer and increase their awareness of the negative environmental effects of garment use and care. Examples are the propagation of the idea that clothing can be effectively washed at low temperatures (40 degrees or below) and using phosphate free detergents.

3.2 Strategies for the Sustainable Management of Textile Waste

The fashion industry is seen as one of the most wasteful industrial sectors, given the ever changing, fickle nature of fashion. Studies of the environmental impact of products identify clothing as having significant effects over its life-cycle (Defra 2009). This has given rise to several designers and producer-led initiatives focused on the sustainable management of textile waste. These initiatives try to reduce harmful impacts through different strategies based on the waste hierarchy that is the basis for the waste policy and management practices in most developed countries.

The concept of waste hierarchy refers to the 3Rs – reduce, reuse, and recycle – which classifies waste management strategies according to their desirability. This means that, ideally, waste generation should be prevented or reduced, and that generated waste should be recovered by means of reuse, recycling, and other recovery options, thus reducing disposal and landfill operations. In the fashion textile industry, the aim of the waste hierarchy scheme is to extract the maximum practical benefits from garments while generating the minimum amount of waste and causing the least environmental impact. Textiles are considered as nearly 100% recyclable and nothing in the textile and fashion pipeline should be sent to landfills (Hawley 2008). The EU Landfill Directive targets imply that all textiles will be banned from landfills by 2015 and will have to be collected separately from other waste (Fletcher 2008). This means that all stakeholders playing a role in the fashion industry must adapt to face the new situation and related challenges.

The approach to implementing the 3Rs in the fashion textile industry can be briefly described as follows:

- Reduce means, in general, buying less and using less. The concept of zero-waste (Gwilt and Rissanen 2011) in fashion design, which is about designing clothes where no scraps are left after the pattern is cut out, can be classified as a reduce strategy. Sometimes reduce is also understood as repairing and reconditioning, either of the whole product or parts of the product to keep them useful as long as possible (Fletcher 2008).
- Reuse deals with products in the same way as redistribution and re-sale. Reused garments include those that go to sorting centres, and, from there, to second-hand stores, and also items that are passed on from mother to child, sibling to sibling, between friends, etc. Reusing

garments significantly helps reduce the negative environmental impact of fashion textiles. For example, the energy used to collect, sort, and resell second-hand garments is between 10–20 times less than that needed to make a new item (Fletcher 2008). Reusing can also generate profit: in 2000 alone the second-hand sector was worth over one billion dollars in the United States (Allwood et al. 2006). In the best-case scenario, the reuse concept is applied locally, within one country. There are countries – for example, the UK – where the collection and sorting of garments is well organised. Some garments are directed into domestic reuse, others are sold to countries with inadequate sorting systems, such as Estonia, and some are sent to the needy in developing countries. Garment reuse is a rising trend in the world. Vintage and retro garments from an era where quality mattered have become highly prized due to fast fashion; unfortunately, clothing from the last two decades is no match for garments from the 1940s–1970s in terms of quality. Reuse mainly refers to fashion garments that are manufactured from scratch. However, when considering a fashion product's whole lifespan, about 45% of fashion products can have a second or third life cycle prior to their disposal (Hollingsworth 2007).

- Recycle is concerned with providing the manufacturer with re-processed raw material to use as an input to make new goods. Recycling material saves resources and usually uses less energy than the production of new material. Generally, the quality of material is reduced when it is reprocessed, and thus this process is called downcycling. Most recycling involves converting useful materials into new ones and creating a different product or material than the initial one. Recycled textiles can be upcycled into higher value or more technically demanding applications, or downcycled into less demanding, lower value applications (Defra 2009).

3.3 Upcycling as a Method for Fashion Design

Recent years have seen the fashion textile industry expanding the use of a method known as "upcycling" which aims to guide textile waste back into production. The so-called upcycling method, or upward re-processing, is defined as bringing waste back into the consumption chain through design by placing it higher up in the chain than it previously was – this includes envi-

ronmental as well as commercial and aesthetical value – while also accounting for the product's future (McDonough and Braungart 2002). Compared to the above-mentioned waste recovery strategies, upcycling brings about the greatest change with the least amount of energy use. Via upcycling, the source material moves from the lowest to the highest level of the production cycle.

By allowing the largest possible amount of textile waste to be given new value, upcycling solves the problems associated with fashion textile waste. Whereas reuse assumes state-led or private contribution action and recycling closely tied to the development of material technology, upcycling is one of the easiest methods to be deployed within fashion design because the main input comes from the designer. It is also important to recognise, that, while reuse and recycle methods focus on eliminating consequences, with skillful upcycling within a company it is possible to eliminate the production of waste altogether. Another advantage of upcycling is its intra-sector approach: problems are solved within the textile industry, not at the level of waste management.

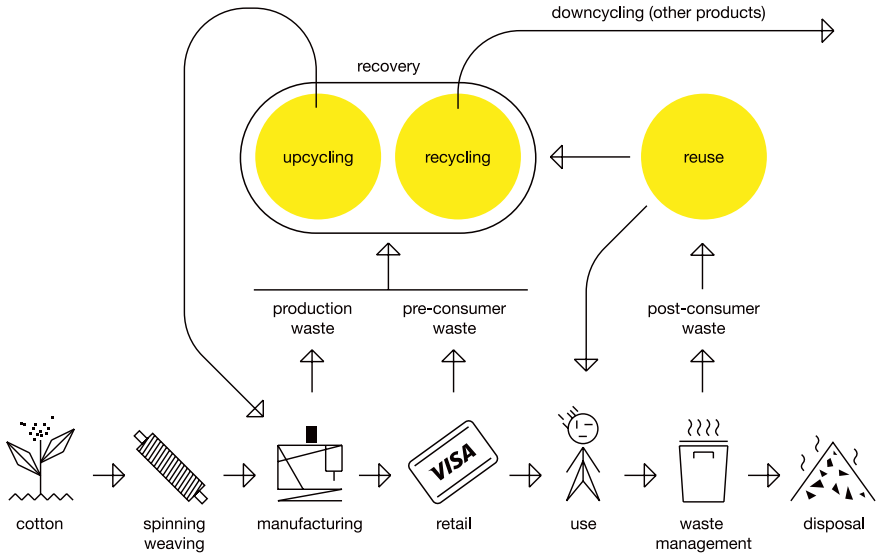


Figure 3. Textile waste strategies – upcycling, recycling, reuse.

In making new from old and creating unique garments from mass production, the upcycling process reformulates one of the basic logics of fashion. As such, it is a kind of shortcut to the unique object, as the fabric itself is distinc-

tively heterogeneous (Busch 2009). It is therefore important for the designer to learn to value and use existing materials.

Equally, implementing the upcycling method gives the designer the possibility to make decisions about the design process and production methods from the perspective of the environment and ethics. That is one reason why upcycled labels are usually independent brands: the choice of material and method is not motivated primarily by beneficial opportunity or current trends but from concern for sustainability.

Upcyling as a concept was first used in the context of waste management. The first recorded use of the term was by Reiner Pilz, who gave an interview in 1994 where he criticised the EU Demolition Waste Streams Directive and questioned the strategy of recycling. In his words: "Recycling, I call it downcycling. They smash bricks, they smash everything. What we need is upcycling, where old products are given more value not less" (Pilz 1994). This concept was then incorporated by William McDonough and Michael Braungart in their book Cradle to Cradle: Remaking the Way We Make Things (McDonough and Braungart 2002).

It is important to underline that, ideally, the upcycling method also respects the principle of local production. The source material in upcycling is usually gathered in the same region where production take place which, in turn, also contributes to resolving environmental and social issues related to the globalisation of the fashion textile industry and its reliance on transportation.

The fashion sphere actively began discussing upcycling in the mid-2000s. Implementing upcycling to create unique, one-off designs is playful and gives an easy opportunity to use a variety of types of textile waste. UK label Junky Styling has been successful in using upcycling in their studio work and are a good example of using local post-consumer waste. Their label has been described as follows: "Junky is an innovative design-led label. All garments are made from the highest quality second hand clothing, which is deconstructed, re-cut and completely transformed" (see more at http://www.junkystyling.co.uk/). Junky Styling designs are unique, and the company puts a lot of effort into good construction. At the same time, they maintain characteristic details from the original product. As a result, the client will always know what the garment has been before – whether a jacket, skirt, or trousers.

Another good example is Christopher Raeburn's label, launched in 2008 at Estethica, part of London Fashion Week. He uses re-appropriated military fabrics, and his work demonstrates how written-off textiles – in Estonia these

items are destroyed – can be ideal input material for fashion design using clever design and good quality execution. Raeburn's products give no clue as to the input material. His homepage describes his work in the following way: "Christopher Raeburn's collections are highlighted for their intelligent design, high quality and extreme attention to detail. Staunchly British, all Raeburn garments are proudly "Remade in England" and produced in East London". February 2011 saw the industry launch of "Remade in Switzerland", a collaboration between Raeburn and Swiss heritage brand Victorinox, which is a very good example of co-operation between a small independent label and a big company. It also demonstrates that larger companies have started to consider and implement upcycling methods (see more at http://www.christopherraeburn.co.uk/).

Other environmentally sustainable designers have also considered how to deploy upcycling to mass production. Orsola de Castro is an example of one such designer.

Interview 5:

In October 2010, I conducted an interview with Orsola de Castro, the founder of Estethica and designer for the upcycling brand From Somewhere (see more at http://fromsomewhere.co.uk/). De Castro gave an overview of her brand's ethical design and the development of ethical fashion in her time working as designer. "I started in 1997 and for a good 6 years, even more, 8 years, the word eco fashion did not exist. You were just recycling, you were creative because if you reused something that was already there in existence that was not ecological or saving a world . . . . And then suddenly around 2004/2005 this eco kind of came along". Talking about co-operation with Tesco and Speedo, she illustrates how big companies are now moving toward sustainability. My conversation with de Castro shows that 2010 was a pivotal year during which the concept of upcycling became understood by mass production companies in the fashion industry: "We personally are working more than ever. We did a collection for Tesco even, the second biggest clothing supermarket in the world. We analysed their waste. If someone like Tesco would approach a label of our size, it's quite unprecedented. At the moment we are working with Speedo who is giving us all their unsold swimming suits, as well as pre-consumer waste from their Italian factories". As for the question of where the sustainable fashion movement is going, de Castro states: "I think in 20 years there is not going to be eco fashion and fashion, it's going to be fashion and non ethical fashion". Read the full interview in Addendum 5 and see the short video on http://www.trashtotrend.com/.

As the author of this thesis, I have been exploiting upcycling as method of recovering textile waste in fashion design since 2006, being a pioneer in Estonia and one of the few designers internationally to talk about using upcycling in mass design and production. The fashion collections that I have produced as part of my research and practical work have been experiments in understanding what kinds of fashion textile waste it is possible to use and under what conditions and how to translate these results to mass design and production (see Chapter 5).

In my first fashion collections, I began to work with post-consumer waste. Co-operating with an Estonian recycling centre, I launched in 2006 my label ReUse, which consisted of one-off pieces handmade in my studio from second-hand clothes. Since then, I have produced collections from old home textiles, re-appropriated military fabrics, old uniforms from Estonian Police, and other such textile waste sources. During this period, I also used upcycling methods in my theatre work, using surplus theatre costumes from storage.

In 2008, I launched my first serially designed and produced collection at Estethica, a part of London Fashion Week. The collection was made from post-consumer waste jeans. This involved taking the fabric input from old clothes and, after that, cutting out new designs and sewing them together. Since 2009, I have been working simultaneously with post-consumer waste and production waste derived from outsourcing companies. My current techniques use leftovers emerging in the course of mass production to produce new clothes which are easily replicated and reproduced.

Since 2008, I have shown collections in Paris, Berlin, Helsinki, and New York, designed upcycled costumes for around 30 theatre performances, appeared at a number of conferences where I have presented my practices, given lectures in universities, and taught fashion design students. This thesis presents my upcycled collections completed between 2006 and 2011 (see Chapter 5) and the Trash to Trend model I have developed which allows for mass designed and produced upcycled fashion (see Chapter 6).

Trousers made from post-consumer waste. Photo by Mark Raidpere

4.

The Use of Textile Waste in Upcycling

In order to implement the upcycling method, it is important to have an overview of the textile waste available because this is what dictates the garment that can be created. Using upcycling in fashion design emphasises the importance of a local approach. Thus, both the input material (waste) and the production ideally should be local. Since levels of waste production and volumes of waste can differ by region, the first step to collecting materials for upcycling is to carry out a local textile waste study.

The definition of textile waste in the context of this thesis means the textile waste and garment leftovers from the production and sale of clothing (pre-consumer waste) as well as used clothing from consumers (post-consumer waste). In other words, all items whose usual next step in the life cycle would be landfill or recycling.

This chapter gives an overview of the types of textile waste and their suitability as an input material for fashion design. It also summarises the waste study performed as part of my practical research. The objective of the study was to get an overview of the main waste producers and amounts of textile waste found in Estonia in order to enhance the wider use of upcycling in fashion design. A parallel aim was to create connections between different Estonian textile waste-producing manufacturers, students, and fashion designers in order to develop a network of cooperation and product development.

4.1 Types of Textile Waste

Textile waste suitable for fashion design can be divided into three groups based on their source:

- post-consumer waste
- pre-consumer waste
- production waste

They each have different characteristics and potential for being used in fashion design.

4.1.1 Post-Consumer Waste

Post-consumer textile waste is created at the end of a garment's first use. This mostly includes used garments and domestic textiles. In common with many other countries, Estonia currently lacks a large-scale system for collecting and reusing this type of waste. Such a system would enable the sorting and separation of products and materials fit to be reused. Within such a system the majority of used clothing is discarded alongside other consumer waste and ends up in landfills. Even in England, where a fairly functional system of collecting reusable clothing is in place, 1.2 million tons of the total 2 million tons of discarded clothing ends up in landfills each year. In less developed countries like Mexico and Poland, 98% of textile waste is sent to landfills (OECD 2009).

In Estonia, most used clothing ends up in landfills as mixed consumer waste. According to a survey conducted in 2008 (SEI-Tallinn 2008), used clothing and domestic textiles amount to 4.5% of the mixed consumer waste in landfills. This equals 17,000 tons per year that in its turn equals 12.7kg per person per year. Only one third of the textile waste is composed of natural fibre, the rest is synthetic. The percentage of textile waste is greater in urban areas, on occasions twice the amount in rural areas.

In Tallinn, Uuskasutuskeskus (New Use Centre) systematically collects used clothes. According to their data, in 2010 they sent 49 tons of textile products back into circulation (including 14 tons resold, 35 tons given to charity and for handcrafts, and then 1 ton discarded). In 2009, they sent 40 tons back into circulation (with 10 tons resold, 30 tons given to charity and for handcrafts, and then 3 tons thrown in the trash).

The biggest challenge to the establishment of a system for sorting and reusing used clothing is the large amount of fabrics with different composition that makes sorting them according to the material very difficult and expensive. The quality of fabric and sewing is also often so poor that reusing used garments is practically impossible. For the same reason, a large amount of this material is also unsuitable for redesign and upcycling. Thus, post-consumer garment waste is more often reprocessed/recycled, e.g. as an insulation material, sound insulation, or in the furniture industry, or it is incinerated. From this, it is clear that wider solutions to post-consumer textile waste will need to come from outside the fashion industry because it is impossible to use the majority of low quality textile waste to make new clothes.

4.1.2 Pre-Consumer Waste

With the domination of fast fashion and the accompanying overproduction of clothing, a new type of waste has emerged: sales leftovers. This includes leftovers from stores and company product development, defective returned goods, and outsourced garment shipments that are not redeemed from customs for various reasons. Pirate product seized by customs which would normally be destroyed also forms a part of pre-consumer waste.

New York Times journalist Jim Dwyer published a story in January 2010 wherein he discovered several instances where fast fashion retailers (H&M, Wal-Mart, and others) had asked their employees to cut holes in unsold garments and discard them. Employees were forbidden to keep these garments or to give them to the poor because this could damage the company's reputation. An alternative method is to destroy sales leftovers by burning them or shredding them, though these methods are becoming increasingly expensive. Instead of sending unsold goods back to headquarters, stores are instructed to cut them into pieces and throw them in the trash. Competition for the biweekly changing collections that have become the basis of the fast fashion industry is also provided by constant sales. This increases the amount of sales leftovers even more (Dwyer 2010).

In the Estonian context, sales leftovers do not constitute a significantly large percentage of textile waste since the market is small and so are the quantities of garments sold. Because this kind of information is very difficult to obtain from manufacturers, the current situation remains unmapped. Therefore, sales leftovers as an input for upcycling are primarily only valuable internally within a company. There are also opportunities for cooperation with customs

officials in this area. They have non-standard or forbidden goods in their possession, which are generally destroyed but could be used by designers working within the upcycling model. The Estonian Police, Prison Board, and other large organisations deploying uniforms or other standard issue textiles also have leftover textiles stored in their warehouses which could be used.

4.1.3 Production Waste

Production waste that comes from the garment industry itself is a prospective input for upcycling – meeting the need both in terms of quantity and quality. It consists of leftovers from garment manufacturing, such as trimmings, proofs, leftover fabric, off-cuts, ends of rolls, etc.

A practical example is Rosiine, a small outsourcing manufacturer in Tallinn that I have been working with for three years. The waste from their cut-outs for outsourced jobs is 10% of the fabric, which is usually comprised of the scraps from cutting and the ends of the rolls – all different-sized pieces. Until now, this textile waste has mainly ended up in the garbage: waste management costs have so far been relatively low in Estonia, eliminating any motivation that manufacturers may have to reduce the amount of textile waste produced or to reuse the scrap fabric to make new garments. However, the costs of waste management, labor, and raw material costs are increasing, and therefore Rosiine and many other textile industry manufacturers in Estonia have started to look for alternatives to discarding their textile waste.

Production waste is the easiest material to use in upcycling because the volume produced is generally quite large and regular. A good example of how this can work for the company and the upcycled designer is demonstrated in the author's long-term cooperation with the Masi Company, an outsourcing operation making jeans in their factory located in Valga, Estonia. Their material flow remains steady; the only fluctuations are in the amount of textile waste produced and the composition and colour of the material.

4.2 Textile Waste Study

Up until now, there has been no clear overview of the producers of textile waste or of the sources and volume of waste produced in Estonia. Certain information is available in the waste registry kept by the Estonian Environmental

Information Centre that collects data from companies' waste management reports. However, the official waste management reports are incomplete because most textile and clothing waste is categorised as mixed municipal waste. Thus, the existing waste statistics do not give designers enough information. A similar situation is observed in many other countries.

I therefore initiated a study of textile waste as a part of this PhD thesis. The objective of the analysis was to get an overview of the manufacturers, main sources (waste producers), and amounts of textile waste to be found in Estonia and to create connections between different textile waste-producing manufacturers and fashion designers in order to develop a network of potential cooperation and product development.

The waste mapping information was supplemented with interviews and questionnaires given to clothing and textile producers. During the research project, some of the companies were visited in person, their waste was photographed, and samples were collected. The aim of the questionnaire was to collect information about waste management and flow for one month and for one year – about the sources of waste, the composition of waste, and the appearance of the location. By the end of March 2011, six manufacturers had responded to the questionnaire. The questions and answers are set out in Addendum 6.

Estonia's biggest textile companies – Qualitex, Wendre, Baltika, Marat, Ilves Extra AS, and Coats Eesti AS – were included in the survey. Information on the waste related to the production of fabric and accessories as well as garment manufacturing was gathered. The information demonstrates that, while all companies try to avoid discarding waste in order to avoid incurring waste management fees, there is no coherent system for upcycling within the textile industry. Some of the companies are not even aware of the amount of waste they have created.

Two interesting examples which demonstrate the differences in approach are those of Qualitex and Wendre. Qualitex stores all its leftovers in a warehouse. They have neither an exact overview of their waste nor a clear idea of how to deal with it. A very different example is Wendre, whose biggest client is Ikea. Wendre specifically aims to use their production leftovers in new products, for example cushion fillings. In 2010, Wendre received an award for being the most environmentally friendly company in Estonia. They also have certified as ISO 9001, OEKO-TEX 100, and ISO 14001. A more detailed overview of the results of the survey is provided in Addendum 7.

The results of the study of textile waste are grouped together as a database (and available at http://www.reuse.ee/) which is part of the upcycling model proposed via the Trash to Trend web platform (see Chapter 6.1.3). The focus of the database is to give an overview of the volume, flow, and types of textile waste found in Estonia. The Trash to Trend web platform also helps to bring together fashion designers, manufacturers, and retailers to find versatile but realistic solutions to create a cooperative network. Manufacturers can indicate the amount and type of discarded textile waste they have on the web, and designers can join the database and easily find this information at the touch of a button.

The main goal of the textile waste study was to promote the idea to designers and producers that waste textiles can be a valuable input material for fashion design. Making new clothing out of pre-existing material is usually more environmentally sustainable than recycling, disposing of, or using new materials.

In my practical research I have tested all the types of textile waste set out above. Post-consumer waste is good for one-off pieces and theatre costumes but is not so easy to use in mass production because of the constraints on sorting and cleanliness. Addressing these two issues by processing the material before use makes it quite expensive to use. For mass production, the best solution is to use production waste and textile industry leftovers. In this area, the least costly option is to produce the end clothing inside the same factory which provides the waste because this option avoids transport costs.

One of the principal solutions to textile waste is to elongate the life cycle of the basic components which make up garments. Fashion labels, which generally outsource to developing countries, could direct their warehouse scraps back into production. This would rule out the destruction of new garments, textile waste piling up in landfills, reduce the constant use of new materials, which in turn reduces the use of water and energy in fashion production. There are additional opportunities to increase environmental sustainability at the point of sale too. A store that sold a garment could recuperate it once not used anymore and send it to the nearest brand office. This brand office would direct the garment back into production through the upcycling process. It remains clear that this kind of production cycle requires a more proactive and different approach by companies, given the fact that outsourcing leaves the actual production of garments somewhat disconnected from its designing process. In Chapter 5 I will present different solutions for different type of textile waste.

5.

Upcycling in Practice: Case Studies

I began the practical application of upcycling in 2005. This chapter describes my theatre costume design as well as my fashion collections, which were practical experiments of the upcycling production model using different materials and methods. I selectively focus on specific examples of problem solving in the design and production of theatre costumes. Chapters 2 and 4 cover topics directly inspired by these experiments.

The different types of waste described in Chapter 4 were used as input material in theatre, unique, one-off collections and both for small- and large-scale production.

The case studies are classified and presented according to the type of input material: post-consumer waste, pre-consumer waste, and production waste. This division highlights and gives an overview of the problems specific to each type of waste and the tested technology. The three areas of distribution are built on the application of waste mapping, which allows the material to mediate and facilitate the implementation of upcycling at four levels: personal (DIY), unique, one-off (design studio), small-scale production, and mass production (see Chapter 6). The final result was the practical implementation of the model by enacting a life cycle assessment (LCA) of product D8 in the Reet Aus S/S 2011 collection. This process revealed the real advantages and disadvantages of local production, and the upcycled product's environmental impact. The summary of the LCA is provided in the final section of this chapter.

Uuskasutuskeskus (New Use Centre). Photo by Lennart Laberenz

5.1 Case Studies 1 – 4: Post-Consumer Waste

Post-consumer waste is the most abundant form of textile waste in terms of volume. Uses of post-consumer waste in the author's designs include: using fast fashion garments and domestic textiles from the Uuskasutuskeskus (New Use Centre), in theatre design and eponymous collections; through cooperation with the Estonian armed forces; and by redesigning existing theatre costumes.

Several of the examples below include costumes designed for the theatre as this field provides a very welcome opportunity for testing and trying out the upcycling method. Theatre design gives a designer the time and space for creative growth by fostering in-depth, focused learning. Taking apart the seams of an old costume can provide valuable insights into the technologies and styles of the past. It is characteristic of a theatre that unused costumes pile up with time since it is common practice for costumes for every production to be made of new material. When a play is dropped from the theatre's repertoire, the costumes are put in storage.

Upcycling in the theatre depends solely on a designer's creativity and ability to visualise new possibilities in creating a costume. It is important to tie material and design together in such a way that the use of existing materials is justified by the artistic merit of the results. The existing material is treated as an input material and not as an old garment. Although stage costumes conform to lower standards than garments sold in stores, redesigning a new garment using material from existing theatre costumes has been a valuable experience for the author. This work supports the idea that it is a designer's ingenuity, rather than the material, that matters.

5.1.1 Case Study 1

The Magic Flute

Von Krahl Theatre, Tallinn
Estonian Premiere: 8 March 2006
Composer: Wolfgand Amadeus Mozart
Director: Peeter Jalakas
Video: Ville Hyvönen
Costume Design: Reet Aus
Number of Costumes: 18 costumes plus accessories.

Idea:

In 2006, I was a costume designer with a choice to make. What kind of material should I use to make theatre costumes? Should I buy the fabric from the shop? I did not want to buy new materials, and alternative fabrics like organic fabrics were not readily available in Estonia, even with a growing demand for them. I started searching for alternative green materials. That same year, the Tallinn Recycling Centre (now known as Uuskasutuskeskus) opened. The Tallinn Recycling Centre and I were to begin a long and fruitful collaboration. The idea initially was to use used clothing in the design of the costumes. The Recycling Centre aimed at reducing the amount of used clothing and accessories that end up in landfill, and The Magic Flute production wanted to contribute to this cause. The use of used materials in the production was one of its main objectives.

Materials:

The material for The Magic Flute's costumes was entirely gathered from the Recycling Centre. What surprised me the most was the relatively large number of new clothes that we found there – the theoretical knowledge of the phenomenon of fast fashion suddenly became a reality for me. Most of the clothes had only minor defects, or had only been worn a few times. At the same time, however, the quality of the fabric and the stitching was poor, clearly not intended for long-term wear. I chose different pieces for each of the costumes: the Queen of the Night's (Riina Maidre) costume was made from men's pleated trousers; Pamina's (Tiina Tauraite) costume was made

from brand name women's fashion; Sarastro's (Juhan Ulfsak) costume was made from men's outerwear, and so on.

Technology:

All of the costumes were made in the studio and modelled on a mannequin, with two to three fittings on the actors themselves. The object of the design was to transform the clothing into new pieces, while still leaving the original piece recognisable. Old articles of clothing were pulled, cut, washed, and then re-cut into costumes.

Conclusion:

I discovered that a lot of the garments could not be reused outside of the theatre. This is because theatre costumes do not set such high demands in terms of the quality of the raw material as retail clothes tend to. Thus, this experience also confirmed that a large part of post-consumer textile waste must be recycled outside the clothing industry because the quality of the material is so low that it cannot be sent back into the consumption cycle.

See the video on the DVD or at http://vimeo.com/1277469/

Photos by Alan Proosa

5.1.2 Case Study 2

Estonian Women's Songs

Nargen Opera and Von Krahl Theatre, Naissaar
Estonian premiere: 15 June 2006
Composer: Veljo Tormis
Musical direction: Tõnu Kaljuste
Director: Peeter Jalakas
Production Design: Reet Aus
Number of Costumes: 54 pieces plus accessories.

Idea:

When we began to prepare for the play and we went to look at the performance venue on Naissaar Island, we discovered that there would be no electricity. Candles therefore provided lighting. As the Estonian Women's Songs were to be performed on an open stage, the stage had not yet been set, nor any chairs put in place. An empty barn was the ideal place for a fashion catwalk. We divided the space with two elongated narrow stages, to allow for activity at either end. This type of staging is influenced by many elements of fashion design and creation. The lighting was strategically placed to accentuate the costumes and allow for costume changes to take place at the sides of the stages.

Material:

I made the costumes for this production from the following domestic textiles found at Uuskasutuskeskus (New Use Centre): bed sheets, tablecloths, pillowcases, curtains, tea cloths, etc. Most domestic textiles are made of cotton, plain weave fabric, and generally they are of high quality. This makes it possible for the material to be partially used as the fabric for new garments. The existing details – hand-made embroidery, prints, and lace – determined the feminine style of the costumes, which fitted with the production's general concept which spoke of the lives of Estonian woman from birth to death throughout the centuries. The piece consisted of ancient songs sung by women and passed down through generations. An important part of the identity of Estonian women has always been handcraft, so the hand-made design elements in the costumes strongly reinforced the message of the piece. In order to achieve stylistic unity and tone, the fabrics were dyed with black tea.

Technology:

The material was collected, washed, and then pulled apart. I then started to look at what could be made. Costumes were prepared from all types of material but I asked myself, how could a dress be made from a tablecloth without changing the tablecloth?

Conclusion:

Old home textiles show very clearly the varying qualities of fabrics as they have been produced over the decades. Old handwoven linen and towel fabrics from the early 1900s, when flax was still grown in Estonia, proved to be particularly durable. In 2009, the last Estonian linen company, based in Pärnu, went bankrupt. I used its remaining fabrics in my A/W 2010 collection (see 5.3.3). I also realised that a wide array of materials can be used to make a wide array of items. The end result depends on the designer's ingenuity and willingness to experiment.

See the video on the DVD or at http://vimeo.com/1357620/

Photos by Ville Hyvonen

5.1.3 Case Study 3

“ReUse” Collection 2006

Idea:

The idea for the ReUse Collection was born from my collaborative work with the Tallinn Recycling Centre aimed at finding ways to use post-consumer waste in fashion design. This collection was made with the leftover costumes from The Magic Flute and Estonian Women’s Songs productions. The Recycling Centre staff helped me sort materials by type of textile in order to test which materials best went together.

Material:

Pre-consumer waste. In this collection, many different types of materials were combined. There are some 60s brocade wedding dresses, men's cotton shirts, velvet trousers, taffeta curtains, velvet dresses, silk blouses, women's cotton clothing, printed curtains from the Soviet era, etc.

Technology:

The material was collected, pulled apart, and washed. As the pieces in the collection were all unique, they were handcrafted in the studio and pieced together on the mannequins. Each of the different materials required a different approach.

Photos by Madis Palm

Where the collection was shown:

This collection was shown in the ReUse Fashion Concert, a fashion, music, dance and video performance performed by Anne Türnpu, Maret Mursa, Maarja Jakobson, Kristina Pashkevicius, Eleonora Kampe, Eva Klemets, Ingrit Vaher, Reet Aus, and Ville Hyvönen. The initial purpose of the concert was to exhibit fashion alongside other creative outlets. All sounds generated on stage were through improvisation, using words, body rhythms, ancient Estonian singing techniques, breathing, voice projection, etc. The fashion concert was performed at the Design Evening held at the Tallinn Hobuveski Theater, the Viinistu Art Gallery, Gloria in Helsinki, and the Von Krahl Theatre in Tallinn.

Visual Materials:

A photographic series is on display at the Viinistu Art gallery, featuring model Eleonora Kampe, with photography by Madis Palm and make up and styling by Reet Aus.

Conclusion:

While designing this collection I learned a considerable amount about the compatibility of various materials – how they behave together, stretch, and withstand washing. Also, while pulling apart clothing from the past few decades, I saw the different styles of cuts and technological innovations. My main finding was that one product is needed with a single type of material and the combined effects are unexpected and the creative results can achieve a sense of variety.

5.1.4 Case Study 4

“Reet Aus” A/W 2008 Collection

Idea:

This idea for this collection came from the need to understand how consumers behave towards their no longer necessary clothing. Interviews with acquaintances showed that, on average, each woman has up to 13 pairs of jeans and only wears about 4 pairs. When asked what happens to the ones that are not actively used, it became clear that they eventually migrate to the garbage. I then launched a public campaign, sending out a press release asking people to bring their old jeans to my studio at Müürivahe 19, in order to design a new collection. The campaign was a success and within a few weeks, I accumulated the necessary amount of materials. To this day I am still contacted by people who want to donate their old jeans.

Material:

Post-consumer denim jeans, jackets, skirts.

Technology:

As I began to sort through the jeans in my studio, I began to see what to do with them and how to use them. I first washed the clothes and then pulled them apart. There were many different shapes and sizes of pants. The detail on the jeans was different in every pair as well. I then cut 7x7 squares and sewed a new piece together. The pieces in the collection (mainly jackets and skirts) were designed with a simple cut, mainly because the material was thick and hard to sew together. A lining also had to be sewn in to complete the pieces.

Where the collection was shown:

The collection was presented at the London Fashion Week’s Estethica (catwalk show at Ambient Space), Riga Fashion Week (catwalk), Usdom in Germany, München, Frankfurt, Tallinn Design Night (Kultuurikatel), as part of a ReUse concert at the Lyon Light Festival in France, Viljandi Pärimusmuusika Barn, and Tartu Ateena.






Conclusion:

The use of post-consumer waste in this way creates the scope of upcycling similar materials on a large scale. This type of work comes at a high cost, as the pieces must be hand cut and the process of selecting the materials is time consuming. The clothes must be collected, taken apart, washed, cut, sewn together, and then finally the new article of clothing can be made. This method is best used for small-scale production and one-off design. It is also an ideal method for use in costume design and DIY projects.

See the ReUse installation in Lyon, the fashion show in the Tallinn Kultuurikatel and the catwalk at Riga Fashion Week on the DVD or videos at http://vimeo.com/1850671 and http://vimeo.com/6188913/

Photos by Madis Palm

5.1.5 Case Study 5

Us, the Heroes

Tallinn City Theatre,
Estonian premiere: 9 April 2009
Author: Jean-Luc Lagarce
Director: Elmo Nüganen
Set Design: Vladimir Anshon
Musical landscape: Jaak Jürisson, Riina Roose
Costume design: Reet Aus
Number of Costumes: 52 plus accessories.

Idea:

The play takes us back in time to before the Second World War, where Jewish travelling theatre actors lived their difficult daily lives. As the plot revolved around theatre productions, specifically poor travelling theatre companies, the costume design would incorporate old costumes from the Tallinn City Theatre. It turned out that the theatre had warehouses that had stood untouched since the start of the theatre in the 1960s. This resulted in costumes that were in poor condition, but on the other hand provided the ideal materials for use in upcycled costumes. We therefore had to start by sorting these costumes to begin their redesign.

Material:

The costumes for this production were designed by upcycling the items found in the theatre's costume warehouse. The author sorted the items and upcycled costumes that were worn out and had lost their practical value.

Most of the costumes were historical, some mouldy, eaten by rats, and rotten. After cleaning, the material could be reused. Their fabric was natural (e.g., linen, silk, jersey, velvet, etc.). It was particularly interesting to learn the history of costumes in the context of the theatre's history; for example, Voldemar Panso's pants from 1967 were worn by Andrus Vaarik in our performance, after a little tweaking.

Technology:

Since the base material was that of old costumes, there was a lot of washing and pulling apart that had to be done. I worked on the costumes directly from the mannequin, and the seamstress assembled the costumes from there as well. Each outfit was fitted many times, as they were made specifically for the actor.

Conclusion:

Upcycling is definitely the most environmentally friendly option for costume making in the theatre. However, such work requires staff cooperation. It also takes the costume designer more time and effort and increased participation in the sewing process, as many issues can arise while creating the costumes. However, it is very instructive to take apart old costumes and study old sewing patterns. For me personally, this approach to theatre is especially rewarding. The only new item that was bought for the costumes was a bra.

See the video on the DVD

Photos by Siim Vahur

Damaged pre-consumer waste, New York 2010. Foto by Ville Hyvönen

5.2 Case Study 6: Pre-Consumer Waste

Unsold retail collections and unsold products from bankrupt companies or large organisations can be called “virgin” waste because it ends up in landfills without ever reaching the consumer. There are also containers full of finished goods shipped from Asia left standing in the harbors of the European Union because they do not meet quality requirements or the customer does not have the resources to pay customs duties. The destruction of unsold stock of fast fashion brands is described in Chapter 4. State institutions (e.g., police, armed forces, prisons) also destroy their unused stock. This unused stock is a valuable input material for upcycling as it consists of new products made of new materials. However, its use is complicated because the seams have to be cut open and the pieces are of various shapes. Thus, there is a challenge for the designer to account for an unstable material flow and input that is very different from the standard roll of fabric. The case described below is an example of the author’s cooperation with the Estonian Police.

The purpose of the Trash to Trend model (see Chapter 6.1) is to introduce other brands and designers who set aside their material waste for upcycling designers and DIY activists. In Estonia, for example, G-Star and Monton gives their off-specification products to the Estonian Academy of Arts’ brand HULA. Such collaboration will help large enterprises make use of their off-specification products, and reduce the volume of clothes that go to waste. The same phenomenon is discussed in the interview with Orsola de Castro (see Addendum 5) where she tells how their brand From Somewhere collaborates with Speedo bathing suits. The opposite example is the Diesel brand, whose view was that their brand image does not go with such activities, and who therefore withdrew from this collaboration.

5.2.1 Case Study 6

Estonian Men's Songs

Nargen Opera and Von Krahl Theatre
Estonian premiere: 7 June 2008
Composer: Veljo Tormis
Musical Director: Tõnu Kaljuste
Director: Peeter Jalakas
Choreographer: Arnold Chiwalala
Costume design: Reet Aus
Number of costumes: 81 plus accessories.

Idea:

The initial idea for this play was the creation of the first man in Estonia. It was designed to be performed by a similar group of men, whose different characters became more distinct as the story progressed. The location of the show was the Tallinn Kultuurikatel industrial environment, the first performance in this theatre. The interior of the Kultuurkatel was the main inspiration for the set design as well as the costumes' materials and colours.

Material:

The costumes for the production were made out of old uniforms and coats previously belonging to the Estonian Police. A batch of uniforms ordered by the Estonian Police turned out to be impractical so they immediately ordered new ones. Therefore, brand new uniforms and coats – enough to fill an entire warehouse – were left unused. If the uniforms hadn't found alternative use, they would have been shredded and discarded. The garments were made out of polyester fabric. Since this is not a high quality material, it would have been difficult to upcycle it into a high-quality design product. Nonetheless it was a very good material for a theatre stage.

Technology:

Police coats, jackets, and pants were pulled apart and ironed. Since all the costumes were different sizes, they were made in-studio. Trousers were cut in the kalife style and were designed like that to make good use of the material (under the cross-section of the knee). Hats were made from coat fabric and produced in mass quantity by Stoola. Waste cotton jersey was used to manufacture vest tops.

Conclusion:

The importance of access to information became apparent during the collaboration with the Estonian Police. On a daily basis, leftover material is going to waste which could instead find a creative application in theatre, design, or elsewhere. The show used shoes (men's military boots) that we obtained from the Estonian Defence Forces. To obtain these shoes, we sent several letters and made several phone calls to various officials and finally the Minister of Defence directly in order to ask to borrow the used boots.

See the video on the DVD or at http://vimeo.com/3511594/

Photos by Peeter Jalakas


SOIDAME KOGU AEG

Production leftovers at Masi Company, Estonia 2010. Photos by Lennart Laberenz

5.3 Case Studies 7 – 10: Production Waste

Using industrial textile waste and leftovers to manufacture new garments decreases the volume of industrial textile waste and gives new value to material designated for the landfill. The same material can also be upcycled again later, i.e., it can start another life cycle in the consumption chain. The examples below illustrate how industrial and fashion studio scraps can be upcycled.

In the first example, the material used came from the author's studio. It mostly consists of scraps and leftovers from individual designs commissioned by customers and collected over a period of two years.

In the following examples, the input material is the textile waste from the Masi Company located in Valga, Estonia. They manufacture jeans for Lee Cooper as well as other athletic clothes and headwear (http://www.masicompany.fi/site/).

5.3.1 Case Study 7

“Reet Aus” A/W 2007 Collection

Idea:

One of the rules in the Reet Aus studio has always been that all waste we create must be collected. This collection was a so-called mid-season collection, where the goal was to use all the scraps from the previous collections since 2005. The aim was to find an application for pieces five centimetres in size.

Material:

100% of the material for the items in this collection was scrap from a fashion studio, including leftover fabric samples and scraps from the Recycling Centre. There was an assortment of fabrics including silk, cotton, mixed fibres, velvet, etc.

Technology:

Since we were working from bags of small pieces of fabric, sewing the pieces together created decorative features which become the aesthetic of the collection. All items are one of a kind as the material was collected from different sources.

Where the collection was shown:

ReUse fashion concert AntiMassFashion was shown in Tallinn during Design Night in Kultuurikatel and in Tartu theatre Ateena. This involved Ingrit Vaher, Anne Türnpu, Kärt Johanson, Maarja Jakobson, Maret Mursa, Eleonora Kampe, Kristina Pashkevicius, Reet Aus, and Ville Hyvönen.

Visual Materials:

Poster photography by Madis Palm, modelling, make up, and styling by Reet Aus.

Conclusion:

The design of this collection was very creative, and closely related to the performance concert AntiMassFashion. It was an independent performance and the clothes were made for it. This performance verged on performance art. These creative fashion shows have moved and expanded beyond what we are doing, which we could not have predicted.

See the ReUse fashion concert AntiMassFashion on the DVD or at http://vimeo.com/1277505/

Photos by Peeter Jalakas

5.3.2 Case Study 8

“Reet Aus” S/S 2009 Collection

Idea:

This was the natural progression from the A/W 2009 collection (where denim collected from consumers was used for clothing). As the material of choice for the last collection had not satisfied me with its quality, I continued searching for something better. After a short search, I came across a local denim manufacturer who provided me with leftover material and with whom I still collaborate to this day. This was the first time I used scraps direct from the industry. The advantage was that I could predict the quantities of material that would be available. The idea was to create a comprehensive collection, mixing strong, clear forms of denim with light organic cotton products.

Material:

This collection used cut scraps from Masi, who use organic cotton in their lining. Organic cotton is also used in the collection's lighter pieces.

Technology:

The denim was washed and ironed, then cut for use. Samples were prepared by hand in the studio. The patchwork technique was used but the square pieces were made bigger than the previous collection. The products are lighter and more comfortable to wear and hence more suited to lining, outerwear, and accessories.

Where the collection was shown:

Paris Fashion Week, London Fashion Week, Berlin Fashion Week, Riga Fashion Week, and Tallinn Design Night at the Rukkijahu Veski.

The collection is for sale in Helsinki, Tallinn, and Riga.

Photos by Ville Hyvönen

Visual materials:

Modelling by Reet Aus on location in the designer's own house, with photography by Ville Hyvönen, make up and styling by Anu Konze.

Conclusion:

Feedback on the collection was positive. The use of industry scraps attracted a lot of media interest. With the conclusion of that season's Fashion Week, the market for organic fabrics remained unclear and complicated. I decided to focus on industrial by-products and to test another textile manufacturer, MoralFibre, for sustainable materials (see Chapter 5.3.3). We also continued to develop the product, trying to make the process easier and easier.

See the ReUse Fashion Concert in Tartu on the DVD or at http://vimeo.com/8000044/

Photos by Ville Hyvönen

5.3.3 Case Study 9

“Reet Aus” A/W 2010 Collection

Idea:

This collection keeps the technology of the previous collection in mind. The goal was to make the product easier to transform and reduce the amount of seams. Therefore, I gave up the patchwork technique and examined the possibility of using larger pieces of fabric. This made the selection of products easier, but I could no longer use the scraps from the previous collections.

Material:

In this collection I used scraps from the Masi Company. The lining was made from unsold stock material produced in Estonia. The fabric comes from the warehouse of linen manufacturer Pärnu Lina that went bankrupt in the summer of 2009. I also tested the organic cotton and silk from MoralFibre in Ahmedabad, whose raw materials are sourced locally and dyed using vegetable dyes. The company website says the following:

We work with natural fibres and natural dyes which protect the workers and the end users from developing allergies or illnesses and reduce water and air pollution. The fact that the fibres do not go under machines for its spinning and weaving means we can do without many chemical processes harmful to health. We do not use petroleum scours, silicon wax, fermaldehyde, anti-wrinkle agents and Chlorine based bleaches. Instead we use natural oils, and starch from boiled rice. When we use natural dyes, it is not required to bleach the fabric before dying. . . . We believe in a “Cradle to Cradle” approach of living (see http://www.moralfibre-fabrics.com/sustainabilityagenda.asp/).

Technology:

One of the goals of using the fabric was to figure out how to bring together the details of each cut. This in turn dictated the appearance of the product, which became the start of an exciting design. The samples were sewn with clean lines to prevent unravelling.

Where the collection was shown:

I presented this collection at the Berlin and Paris Fashion Weeks, and the Seven Showroom in New York. From there, pieces went on sale in Brussels, Helsinki, Stockholm, and New York.

Visual Materials:

I decided to try and see how much of the marketing I could do as a designer by myself. The catalogue shoot took place in my own studio; I was the model, and photographed myself through a mirror. I did my own hair and makeup as well. Having previously worked for several stylists, I often thought how the photographic process could be made more economical. Usually 7–13 people worked on a set. Doing it all alone, it took me four hours. Ville Hyvönen processed the photos, and Kärt Villmann designed the catalogue (Addendum 8). The video of the collection was shown in New York in January 2010 at the Seven Showroom and was the first presentation of the Reet Aus brand in America. Ville Hyvönen made the video, I was the model, and it was all shot on location at my home.

Conclusion

After that collection I decided to focus only on waste materials. One reason was difficulties in the field of organic fabrics – it was hard to get materials on time. My next task designing the collection was to find a technique to make garment lighter and easier to wear.

See the video on the DVD or at http://vimeo.com/9154100/






5.3.4 Case Study 10

Dancing Tower

Dancing Tower Turku Aurinkoballett
Finnish premiere: 14 April 2011
Concept, direction, choreography: Sasha Pepelyaev
Tower Design: Pavel Pepelyaev
Music: Ülo Krigul
Costume design: Reet Aus
Number of Costumes: 41 plus accessories.

Idea:

The costumes for the play The Dancing Tower are inspired by its structure. The difficult choreography and operational development was characterised by its establishment, construction and operation. The costumes are inspired by the era during which New York was being built. Accordingly, the basic material of choice is denim, the fabric worn by the construction workers.

Photos by Reet Aus

Material:

The main material used was off-cut jeans and stock from the Masi Company. As the roles of the actors in the play require much physical exertion, jeans were the best choice as they are made from natural and breathable material (cotton). Since most of the base material came in unevenly sized pieces, this dictated the costume design. A small amount of material was acquired from the Recycling Centre.

Technology:

The costumes were sewn together with strong stitching to achieve the necessary strength. Attention was given to jean technology. The costumes were sewn individually to the dancers' measurements, with two fittings.

Conclusion:

This work is a culmination of the upcycling theatre costume series. It is a clear example of how it is possible to integrate industrial textile waste and other types of waste into theatre costumes. The types of waste used in the previous cases are also used here: household textiles, pre-consumer waste, industrial waste, and post-consumer waste. The materials used are denim, jersey, curtain lace, linen, and cotton.

See the video on the DVD

5.4 Case Study 11

Installation in Prague Quadriennal – Upcycling in Theatre Design

Video: Lennart Laberenz and Reet Aus

Box: Reet Aus

Curator: Ene-Liis Semper

Manager: Maret Kukkur

Technical Assistance: Lauri Sepp, Madis Kirkman

This installation brings together my experience with upcycling in creative theatre from 2006 to 2011. It is also the practical creative aspect of this thesis.

Every four years, the global theatre artists' quadriennal takes place in Prague. In June of 2011, Estonia was represented by my installation – Upcycling in Theatre Design. The installation was intended to introduce the video "Upcycling principles and its uses in theatre". Part of the installation was a box, which was also made from pre-consumer waste. We made the front room out of old jeans, using a patchwork technique, with the title stitched in white denim. The inside walls of the box were sewn with old linen which came from the Recycling Centre and hotels. The walls were constructed to have five layers of sheets on top of each other, and every 3 centimetres were sewn from the back and cut open. This creates a soft, safe-feeling atmosphere. The room also contained 36 post-consumer waste Recycling Centre bags, which formed the seats from which to watch the video. One aim was also that visitors take clothes with them after the performance. At the end of the show, it was determined that we had begun with 22 bags of clothes, most of which returned into circulation. The rest remained in Prague at the clothing-recycling centre where they were sold.

See the video on the DVD or at http://vimeo.com/26199068/

Photos by Reet Aus

Photos by Madis Palm

5.5 Case Study 12

“Reet Aus” S/S 2010 Collection and Life Cycle Based Environmental Impact Assessment

Idea:

To design a durable lining-free piece without purchasing new materials.

Material:

The Reet Aus S/S 2010 collection was the first that was made completely out of the scraps from a jeans manufacturer (the Masi Company, located in Valga and outsourced by Lee Cooper).

Technology:

The collection further develops the patchwork technique from the A/W 2010 collection. In the light of the main question in this study – how to use industrial textile waste to make mass-produced goods – i.e., how to use waste from the textile industry within the industry itself – this collection went a step further than the last one because it searched for ways to use differently sized production leftovers. The collection is reproducible, the garments are lighter, and they sit better on the body. S/S 2010 was the culmination of research and experimentation with different upcycling techniques (see examples above). My goal for this collection was to find a solution for a large percentage of the waste produced by the textile industry by redirecting the usable scraps back into use via design. The collection was designed keeping in mind the potential environmental impacts of the design process in the hope of reducing waste. The main focus for the design was to make maximum use of differently sized scraps.

- The products do not use new fabrics, avoiding the first stages of the classic product life cycle.
- The garments are designed without linings to make them lighter and more distinctive.
- Textile waste is used as the input material.
- This collection is technologically simpler than its predecessor, using less energy and man-hours.
- The stitches are made with a coating machine check to ensure the garments' durability.
- The buttons are taken from old police uniforms.
- The only new fittings in this collection are the zippers.
- The products may be machine washed.
- The end product can be disassembled and redesigned into something new.

Where this collection was shown:

The Ethical Fashion Sourcing Trade Show in London, Showroom Seven in New York, Design Night in Tallinn (Out of Fashion concert), and Riga Fashion Week (catwalk).

Visual Materials:

The photo campaign models are Reet Aus and her daughter Niina, with photography by Madis Palm and make up and styling by Reet Aus, on location at Patarei Jail. Catalogue photos are taken in the designer's shop with photography by Ville Hyvönen, and catalogue layout and design by Kärt Villmann (see Addendum 9).

Conclusion:

While designing this collection, all of the previous knowledge I had acquired was put into practice, and it was difficult to take the next step. In order make choices in the design process and decide what needed further attention, I decided to resort to an internationally accepted method of product evaluation – LCA. It became a turning point in my creations. LCA led to further steps that needed to be amended, and proved once again that a solution must be sought for the wider fashion industry.

Garment D8 . Photo by Ville Hyvönen

5.5.1 Life Cycle Based Environmental Impact Assessment

The upcycled Reet Aus S/S 2011 garment D8 described above is the most characteristic illustration of the upcycling method. Thus, this item – a dress – from this collection was chosen to assess the environmental impacts of an upcycled product during its life cycle.

The objective was to identify the negative and positive environmental impacts of a product at every stage of its life cycle and the key points to bear in mind while developing a new production model. The results of the analysis also highlight the advantages of an upcycled garment over a regular product.

Input Material

The choice of material for the collection was based on existing resources, thus it precludes one part of a garment's production cycle (material production). The testing in this field, done between 2005 and 2010, had shown that production waste can successfully be used for collections with a small production, and that similar principles could also be applied to mass production if the industrial scraps and unused goods are redirected into production through design. The garment patterns are made so that the least possible amount of material is wasted. But since the input material is mostly small pieces and strips of fabric, an average of 25% of the material is still lost (with the actual amount depending on the specific design). Thus, a 500g garment requires 670g of input material. This analysis does not account for the environmental impact of thread, buttons, zippers, etc. because the use of these fittings varies greatly per product.

Energy Consumption in Garment Manufacturing

The garment manufacture was outsourced to the Rosiine Company on Raba Street in Tallinn. The design of one item took about thirty minutes so the environmental impact of this activity is not noteworthy.

Manufacturing one product in a sewing factory takes around 5 hours. This time includes cutting, sewing, and ironing. The sewing machine (Brother SL-777B) and cutting machine work for 2.2 hours of that time. The machines consume around 0.4kWh of electricity. Thus, sewing and cutting one garment uses 0.4kWh*2.2h=0.88kWh of electricity. Ironing consumes 1kWh and takes 10 minutes per garment. The ironing power consumption per product is thus 1kWh*0.167h=0.167kWh.

Washing the textile waste should also be accounted for in the energy consumption. The material is washed in a washing machine with a maximum load of 10kg, which consumes 2.1kWh of energy for 1.5 hours of washing in 60-degree water. Thus, 2.1kWh of electricity is consumed to wash 10kg of material and the amount of electricity consumed to wash the material for one product (670g) is 0.14kWh. The finished garments are also washed. In this case, the product's weight is 500g so washing one product consumes around 0.1kWh of electricity.

In total, the amount of electricity consumed to manufacture one garment is 0,88+0,167+0,14+0,1=1,287kWh.

Energy Consumption and Environmental Impact from Manufacturing

The most substantial environmental impact of the production process comes from its large energy consumption. 1,287kWh of electricity is used to make one garment, which equals about 4.63MJ (1kWh=3.6MJ). If we consider that only 27% of the amount of oil shale energy produced by Estonian power plants reaches the consumer after it leaves the power plant and flows through the power grid (Puura 2010), then the energy needed to make one garment requires 17.1MJ of oil shale to be burned. On average, the calorific value of oil shale is 11.4MJ/kg (Ibid.) and thus 1.5kg of oil shale is consumed. The oil shale production process emits about 1.5kg of carbon dioxide and about 750g of solid waste (calculations based on Thalfeldt 2002), including hazardous waste such as heavy metals, poisonous organic substances, aromatic hydrocarbons, and carcinogenic substances (Gavrilova et al. 2005).

This analysis does not account for heating, lighting, and other costs related to the production room because it is impossible to calculate the exact amounts consumed only for one, small, outsourced clothing line.

Water Consumption

The textile waste (raw material) is washed for one cycle which uses 55 litres of water, and thus the water consumption for the material used to make one product (670g) is around 3.7 litres. The finished goods are also washed and with a weight of 500g, which consumes 2.75 litres of water. In total, 6.45 litres of water is consumed to manufacture one garment.

Laundry Detergent

Laundry detergent is only used to wash the textile scraps. The finished garment is washed without detergent. One wash at full capacity (10kg) consumes about 120g of detergent – that means 6g of detergent per product. Detergents with eco certificates are used where the level of phosphates is reduced to a minimum to avoid the eutrophication of water bodies.

The manufacturing process creates 6.45 litres of “gray water” per product, which is water that has been mixed together with detergent. Because of the small amount of detergent used, the environmental impact of the washing stage is minimal.

Waste Generation

The input material for the production process is scraps from the textile industry, which are generally small-sized, meaning that up to 25% of the material is wasted. When possible, this waste is used to make new products, but for the most part it either ends up as technical rag material for the industry or it is sent to a landfill. Since this material was originally intended to be discarded as waste, then we can speak of decreasing the amount of waste by 75% rather than creating new waste.

Input Material Transportation to the Sewing Factory

The textile waste (input to upcycling) is transported from Valga to Tallinn (249km) in a small van together with the finished goods from the Masi Company. We assume that the van is a Mercedes-Benz Sprinter 316CDI with characteristics average to that type of vehicle (CO2 emissions: 214g/km; highway fuel consumption: 7.5L/100km; capacity: 7.5m^3; load capacity: 3000kg). Since the relative density of cotton is quite high (1.54), then we can expect the weight capacity to be reached before the volume capacity. In other words, we are supposing that the van is at maximum load capacity.

Based on the characteristics of the van, the fuel consumption for the whole journey can be calculated as follows: 249*0.075=18,675 litres (diesel) with 249*0.214=53.3kg CO2 emissions. If the van is at maximum load capacity (3000kg), then the fuel consumption for one kilogram of material is 6ml (≈5.4g) (18,675/3000=0.006) and the CO2 emissions are 18g (53.3/3000=0.018).

If we consider that about 25% of the input material of a 500g garment is wasted and thus 670g of material is required for one product, then the total transportation fuel consumption for this material is 6*0.67≈4ml (3.6g) and the

CO2 emissions are 18*0.67≈12g. The energy consumption from the diesel fuel burned is 0.162MJ per garment (0.0036 kg*45MJ/kg).

Transportation of the Finished Garment from the Sewing Factory to the Store

The finished garments are transported from Rosiine's sewing factory located in the Pääsküla neighborhood in Tallinn to the store located in Old Town Tallinn in a car. The distance between the two objects is around 12km. Since the car has to make a special trip to get the products, the total transportation distance is doubled (24km). The following calculations presuppose that the whole garment line (28 products) is transported at once and that this is done with a small consumer car with an average fuel consumption in the city of 7 litres to 100km and a CO2 emission of 140g/km. Thus, the fuel consumption for the whole trip is 0.07l*24=1.68 litres and the CO2 emissions are 0.14kg*24=3.36kg.

These results were divided by the number of garments (28) to get the fuel consumption per product, which is 60ml (45g) with a CO2 emission of 120g. The energy consumption from the gas is 2MJ per product (0.045 kg*44MJ/kg).

Garment Use and Care

The garments are intended for everyday use and thus do not require specific methods of care. The products are designed to be durable and high quality.

The main environmental impact from the product comes from its care. As we know, clothing needs to be washed and cleaned and this process consumes a lot of energy. These garments can be washed with other clothes in a washing machine and 30-degree water is adequate to get them clean. The garments can also be dry cleaned. The products do not need to be ironed. Taking into account the environmental awareness of the target group, we can assume that the clothing is hung up to dry and not dried in a machine. The following analysis supposes that a garment is washed 50 times during its life cycle. If the garment weighs 500g, then 50*500g (or 25kg) of denim material is washed during its life cycle. Supposing that the garment is washed using an average household washing machine with a maximum capacity of 5kg, then the life cycle of the test garment equates to five hypothetical full loads of wash. Modern A+ energy class washing machines consume 0.85kWh of electricity for a 40-degree wash cycle. Thus, five loads of laundry consume 4.25kWh of electricity.

Using Estonian oil shale energy, this requires 5kg of oil shale to be burnt in this process, 5kg of CO2 is emitted and half that amount of solid waste is produced. If we account for the abovementioned data (showing that only 27% of the oil shale energy produced reaches the consumer after leaving the power plant and running through the power grids) then 4.25kWh of electricity production consumes around 56.7MJ of energy. For five washing cycles, an average of 300g of laundry detergent is needed. Regular detergent contains 5% phosphates, 9% surfactants, and 25% bleach, as well as enzymes, brightening agents, and fillers (Ruut 1997). Though phosphates are not poisonous, their artificial increase greatly affects the Baltic Sea and other bodies of water, and is a key factor in eutrophication. Decaying surfactants can be poisonous to fish and aquatic plants, and brightening agents and enzymes can cause allergies in sensitive humans (Ibid.). Five loads of washing consume about 225 litres of water.

Another care option is dry cleaning. Depending on the method used, this activity could be categorised as "toxic" (perchlorethylene), "very high energy consumption" (silicone), or "low environmental impact" (liquid carbon dioxide) (Dry cleaning 2010). According to a comparative study conducted in the US, "wet care" is the most environmentally friendly means of caring for garments, at least as far as energy consumption is concerned. Dry cleaning the test garment throughout its life cycle (equal to caring for 25kg) using perchlorethylene would consume about 15kWh of electricity; using carbon dioxide consumes 17.5kWh of electricity. The same study found that professional wet care respectively consumes only 5kWh of electricity (Sinsheimer 2009). If we suppose that the same data can also be applied to dry cleaning services in Estonia, then washing clothing at home is more environmentally friendly as far as energy consumption is concerned than professional dry cleaning. The creation of other waste is dependent on the specific laundry detergent used.

Discarding a Garment: Reuse Options, Materials, Waste Management, Environmental Impact of Discarding

The items belonging to the "Reet Aus" Collection can be returned to the store when the customer no longer wishes to use them. They can also be returned to various reuse centres like Humana or Uuskasutuskeskus where they are sent back into circulation. Clothing made using the upcycling method can also be almost completely recovered in the same way that the garments

were made in the first place. The garments are slightly redesigned or cut into pieces and sewn into new products. In addition to the fabric, the other details – zippers, buttons, snaps, ribbons, etc. can be reused.

If the garment cannot be sent back into circulation – for example, if it is irrecoverably worn or soiled – then it can first be used as a cleaning rag and later sent into waste management together with other domestic waste. Most of the textile waste ends up in a landfill, where the environmental impact of garments made out of natural fibres is minimal.

There are potential plans for a large scale waste incinerator in Estonia in the near future. If this were the garment's final phase, the environmental impact of the test garment is minimal, though some cinders and ash are created. At the same time, this process inputs a certain amount of energy back into the system, thereby positively contributing to the energy balance of the product's life cycle.

Conclusion

As the appraisal of the environmental impact of the test garment's life cycle shows, the whole life cycle consumes 76MJ of energy, emits more than 6kg of carbon dioxide, and uses more than 230 litres of water. More than 3kg of solid waste is produced (mainly oil shale ash) and smaller quantities of other waste products, including hazardous waste.

Manufacturing the garment means that the garment's weight worth of material is "saved from ending up in the landfill". The production process and transportation do not consume very much energy nor are they hostile towards the environment. About one quarter of the impact during the product's life cycle comes from production and transportation and the rest is in the hands of the consumer.

About three-fourths of the garment's total energy consumption comes from caring for the product. This phase also creates the largest amount of waste – both solid waste in energy production as well as waste water created by the garment owner. If the product care phase also included an electric drier and iron, then this stage of the life cycle would consume many times more energy than it already does.

	Energy/MJ (%)	CO2	Waste water	Solid waste	Other emissions
Production	17.1MJ (22%)	1500g	6.45 l	170g textile waste; 750g ash, etc. (from electricity production)	(hazardous waste from energy production)
Transportation	2.2MJ (3%)	132g	-	-	Other car emissions (NOx, CO), organic compounds
Use (50x care)	56.7MJ (75%)	5000g (electricity)	225 l	2500g ash, etc. (from electricity production)	Phosphates, surfactants, (hazardous waste from electricity production)
Displacement, waste management				The product, itself	
TOTAL	76MJ (100%)	6632g (100%)	231.45 l (100%)	3420g (100%)	Phosphates, surfactants, hazardous waste (heavy metals)

Table 1. The environmental impact of a garment's life cycle

The largest negative environmental impact throughout the whole garment life cycle stems from the use of electricity. Since the garments are manufactured by outsourcers and the designer has little influence on this phase of the production process, it is unlikely that the production process will switch to using renewable energy sources. The consumer does have this option at home.

The manufacturer can direct the consumer's attention to sustainable care methods and thereby attempt to reduce the environmental impact of the care stage (washing less frequently, using less energy intensive washing ma-

chines, hanging garments to dry, using environmentally friendly detergents).

Considering that the raw material used in the garment is textile waste that is prevented from ending up in a landfill by the upcycling production process, the final product can be considered environmentally friendly. The larger energy consumption inherent to the production of smaller clothing lines is compensated for manyfold by the reduced amount of waste and avoiding the use of new materials.

The analysis of life cycle assessment of a studied garment in this collection shows that upcycling as a method has a minimal environmental impact that can, in certain cases, even be positive. The largest influence in this regard comes from avoiding the growth and production of new raw materials, particularly cotton.

6.

Trash to Trend: A Model for Upcycled Fashion Design

In this chapter I present a model aimed at making upcycling solutions globally available and locally feasible, called Trash to Trend. This upcycling model offers a solution based on my six years of practical research in fashion design and theatre costume design as well as an answer to my research question: how to bring textile waste back into the production cycle in the fashion industry. The model's feasibility is demonstrated by the 2011 Reet Aus Upcycled collection as well as HULA collections based on waste studies and the Trash to Trend concept. These collections move away from the classical cycles of the fashion industry — rather than creating new collections twice a year, old garments are improved and new designs added to the collection as needed. The result is upcycled garments with a minimal environmental impact and a transparent production cycle.

6.1 The Trash to Trend Model

The purpose of the Trash to Trend model is to provide a practical solution which allows a designer to create fashion using local textile waste in a way that minimises the environmental impact of the garment but still allows for its serial production.

Designers who would like to control their production chain, who want to produce locally, and who wish to employ sustainable fashion design techniques in their work are the main target group of the Trash to Trend model. The model also provides solutions for companies interested in finding a more environmentally sustainable solution to their textile waste problems and to clients who are aware of the environmental risks and who would like to see the production chain of the product they are buying. The model also allows for the fashion textile consumer to be involved in the design process, makes the production chain more transparent for the consumer, and raises consumer awareness of the social and environmental issues arising from fashion textiles. Other potential users include outsourcing companies who could source input material to fulfil their orders from the waste database, researchers who wish to share information, and local schools, kindergartens, and handcraft workshops that are looking for materials and ideas for their work.

The Trash to Trend model consists of the three following elements:

1. Waste mapping and database – gives the designers an overview about where the textile waste is being produced, its type, amount, and location.
2. Design techniques – offers the designer techniques for how toupcycle textile waste in fashion design. Within the model there are a variety of techniques which provide for one-off pieces, small-scale, and mass production.
3. Web-based platform – provides an interactive framework of the model that integrates the different elements and makes direct communication between waste generator, designer, and client possible. This way a transparent product chain is created, waste data is accessible, techniques are shared, and upcycled products can be sold and marketed. This also facilitates general awareness.

The elements of the Trash to Trend model combine to create an integrated web platform. At the same time, these elements can be used individually according to the needs of the designer or other users.

The use of the Trash to Trend web platform is open to all who wish to obtain the information included in it. Only the companies who share their waste information and designers have a personal account to ensure that the data is reliable. Interested companies can add their textile waste information and are free to use the waste database. Designers and studios can join the platform from different regions. It is the users who take responsibility and open up the

production process by joining the platform. Under such conditions, designs can be global but production local.

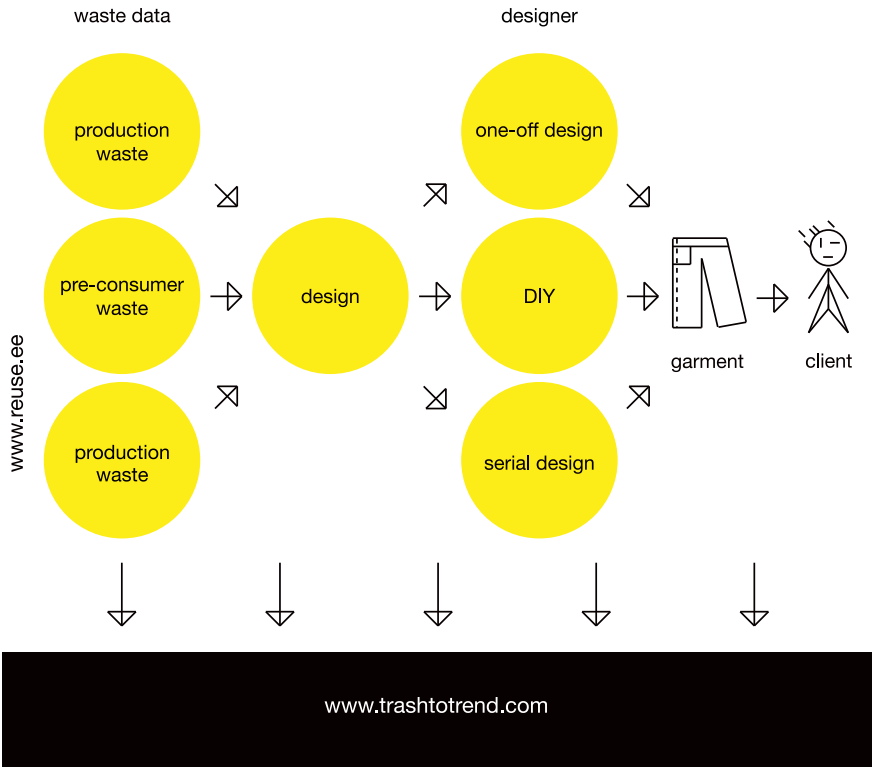


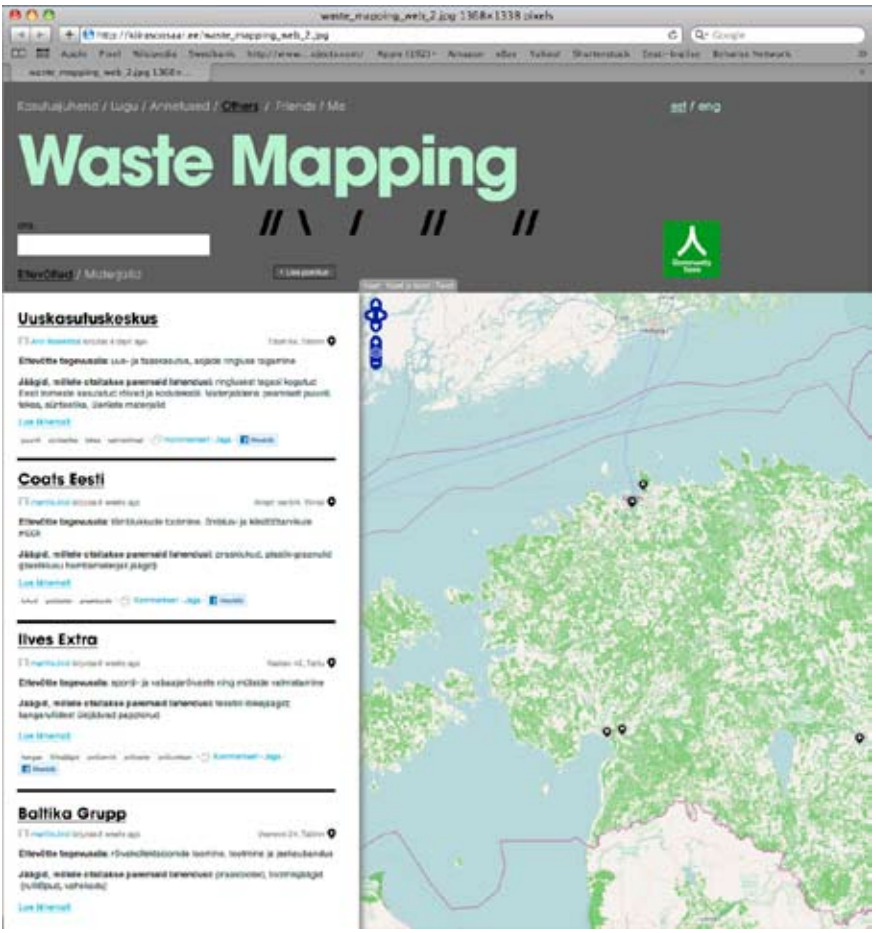
Figure 4: Web-based model Trash to Trend

In this thesis I have focused on developing a model that is based on Estonian conditions, but it is also applicable for other regions and can be adapted to other contexts and local conditions. The sole prerequisite for implementation is an accessible source of textile waste and a designer who is able to use upcycling techniques.

6.1.1 Waste Mapping and Database

As described in the previous chapters, upcycled fashion design is based on information about the suitable textile waste. In order to gather relevant information and make it available to the designer requires a functional regional database of textile waste and its producers/sources. The model introduced in

my thesis combines the information about available fashion textile waste and its producers and presents this in a more transparent way using an internet-based map (see http://www.reuse.ee/), which also forms a part of the Trash to Trend model.



Picture 1. Waste map and database at http://www.reuse.ee/

The textile waste database containing the information about waste producers creates an opportunity for both the designer and the waste producer to find one another and choose to cooperate.

Since waste-related information is inadequate in official databases, it is recommended to begin the development of such a database by conducting a

textile waste study specifying the type of textile waste, its quality, and sources in the region (see also Chapter 4, Addendums 6 and 7). The study could be conducted, for example, by volunteers or students. Carrying out such a study would also be a good opportunity to approach the textile production companies and other sources of textile waste in order to make the first contact.

Once the initial study has been conducted, the information is uploaded to the database and, by using the web platform, transformed into a visual map of companies and textile waste information. Once added to the map, companies can upload real-time information about their textile waste, add pictures, and describe the material and where it can be picked up. Textile waste can be mapped in a large number of regions in order to provide input material for designers and manufacturers locally, closest to the end consumer.

6.1.2 Techniques of Upcycling Design

Having established an overview of generated waste, including its type, volume, and flow, the next challenge is to explore how to use pre-existing materials as the input material for fashion design. Drawing from my practical experience, I propose a number of techniques. These involve different ways of making clothes – from the end consumer constructing an environmentally sustainable garment for themselves to serial design and production. Across this spectrum we can distinguish three groups – an individual sewing at home, an independent designer or a small producer working in a studio, or a mass producer:

- using an upcycling method for one-off design;
- using an upcycling method in serial design (small-scale and mass production);
- using an upcycling at home (DIY)

6.1.2.1 One-off Design

Up until now, upcycling has mostly been employed by independent designers for unique, one-off designs. More often than not, upcycling involves the designer using all three types of textile waste in the design process (see also Chapter 4). The use of post-consumer waste mostly leads to a uniquely designed product. For this reason, several brands that use post-consumer waste in their products use the service of small studios in close geographical

proximity. It is expensive and time-consuming to use upcycling for unique pieces. Yet, this type of upcycling enables the designer to substantially reduce the amount of waste sent to landfills and minimise the use of raw materials. Based on my practical experience in upcycling and especially in working with individual clients, I offer techniques which use upcycling in individual designs directed towards the client.

Garment designs are made available via the Trash to Trend web platform and the client has the following options:

- To use the virtual fitting room fits.me. In this case, the client enters the necessary measurements and can then select a product that fits his or her body type.
- To choose a product with standard measurements. This is the fastest and cheapest garment to produce.
- To choose a garment that fits his or her measurements exactly. As this presumes that adjustments will need to be made to the garment, this option is more time-consuming and costly.
- To choose what kind of input material their product should to be made from: pre-consumer waste, production waste, or post-consumer waste (see Chapter 4). By using local waste mapping, the client could even choose locally generated textile waste without leaving their home.
- To offer their own material (such as used clothing) to the designer and ask for a garment to be made out of it (personal pre-consumer waste)

In this type of "individualised" upcycling, the product is always made after ordering, to avoid over-production. By involving the client in the process of completing the garment, a more personal relationship with the designer and the product will be developed and, consequently, the produced garment will be more "valuable" for the consumer and would therefore likely be used for a longer time. Moreover, the upcycled product could be designed so that the material can be used all over again in the future.

The internet-based fitting procedure creates a valuable method for linking the production facilities situated close to the source of waste fashion textiles and the design, which does not need to be sourced from any specific location. The Trash to Trend textile waste database directs the clients towards studios which have an overview of the local textile waste flow and are able to produce clothes using patterns and designs which could be produced in another region altogether. The aim is to share design globally but keep production local, including using local input material. Furthermore, it is easier to sell garment

designs and prepare precise instructions for local sewing companies by using the individualised fitting process. This means that a customer can choose from a large variety of basic materials and designs, individualise them by using the fitting, and have them produced locally.

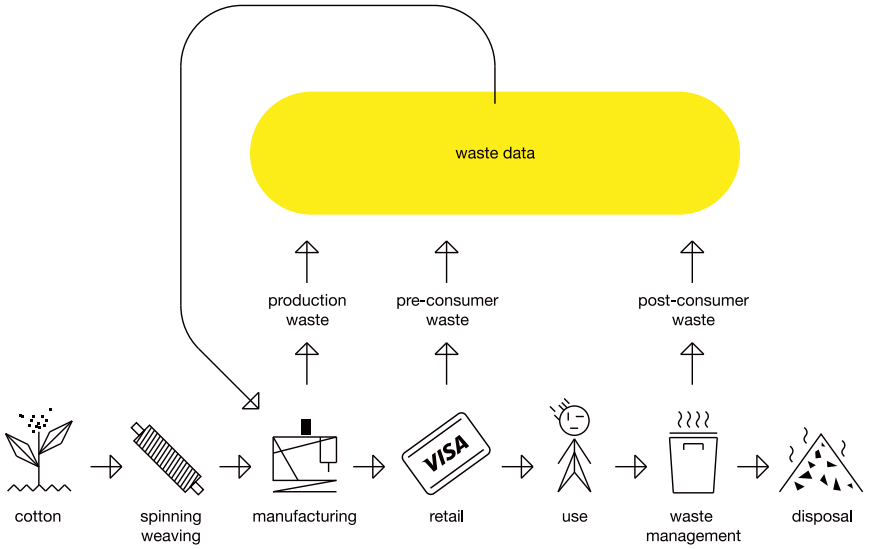


Figure 5: Material flow in the context of one-off pieces within the Trash to Trend model

6.1.2.2 Mass Design and Production

Up until now, upcycling in serial design and production has mostly been applied by small-scale fashion textile companies. However, if the aim is to apply upcycling in mass production more widely, two approaches can be distinguished:

1. The textile waste is used by the company that produces it.
2. The input material is obtained from other manufacturers.

A company using the first approach to upcycling must begin by re-thinking the design process so that the technology applied to the primary garment would produce leftovers during the production process. This means designing additional products alongside the main product that can be cut out from the same fabric as the primary product at the same time and therefore move towards a zero-waste concept. When an upcycling method is used in the design process of a mass production factory, the value it generates can be

measured on the basis of to what extent the waste is being minimised.

This type of upcycling is the most efficient: it prevents disposal of new material, waste does not need to be stored or transported, and it can be used immediately within the same factory. With this approach, the environmental impact created is only the energy required during the production process and the transportation of the product.

Cooperation between designers and technical staff is of vital importance to reach this kind of production.

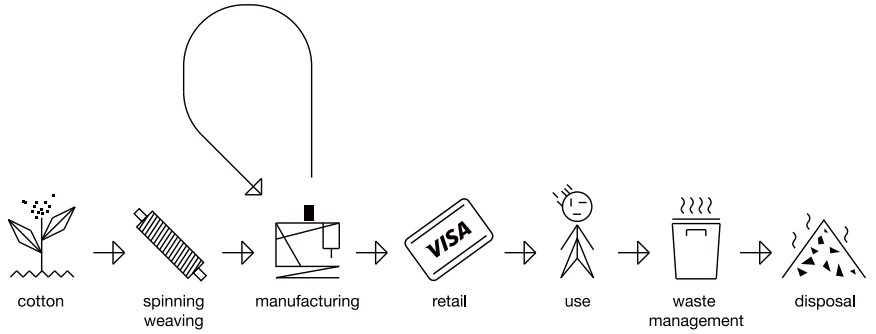


Figure 6: Material flow in the case of serial design and production within the originating factory within the Trash to Trend model

If the company receives the input material from external sources (e.g., by using the waste database application), costs of transporting, sorting, classification, and washing incur.

As a general rule, if the fashion textile waste is not obtained as a part of the main production process, an upcycling method based on small-scale and hand production will be necessary. This is because the small and irregular pieces that make up most of the production leftovers make it impossible to mechanise the design and cutting process.

Nonetheless, for a designer, production leftovers are one of the easiest types of material to upcycle: the sizes and quantities are usually predictable if the designer collaborates with a stable provider. If the designer focuses on one particular type of material, there is no need to test and change technology mid-design.

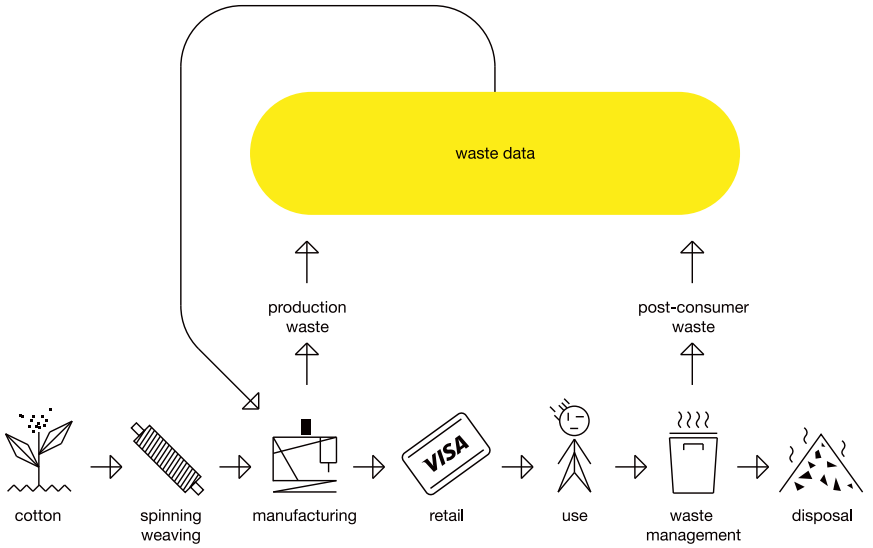


Figure 7: Material flow in case of mass design and production by an external factory using the Trash to Trend model

6.1.2.3. DIY – Do It Yourself

Implementing a DIY approach to upcycling means that the design and the creation of a garment have minimal environmental impact. The use of the Trash to Trend model alongside DIY allows that technique to be taken to a more professional level by the use of designer patterns.

Designed products are available virtually on the Trash to Trend webpage and the DIY client is offered the following options:

- The client uses the virtual fitting room “fits.me”. Here the client enters their own measurements and can then select a product that fits their body type;
- The client orders a digital pattern and manufacturing instructions for a garment according to his or her measurements;
- The client uses the upcycling method at home using their own used clothing.

This technique diminishes the need to purchase new products, prevents waste creation, and ensures that the new garment is produced with minimal environmental impact. The ultimate goal here is an individual design where a

person makes a new product out of their own used clothing using a digital pattern and manufacturing instructions.

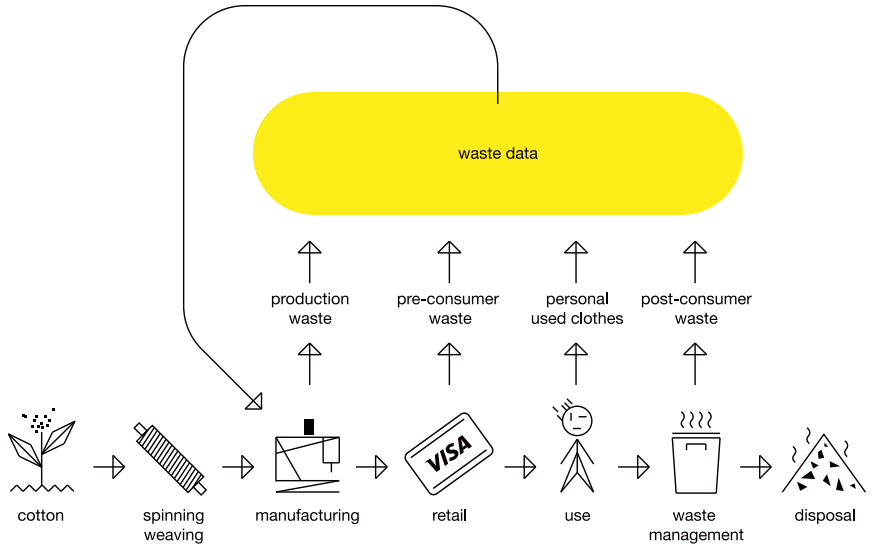


Figure 8: Material flow in the context of DIY within the Trash to Trend model

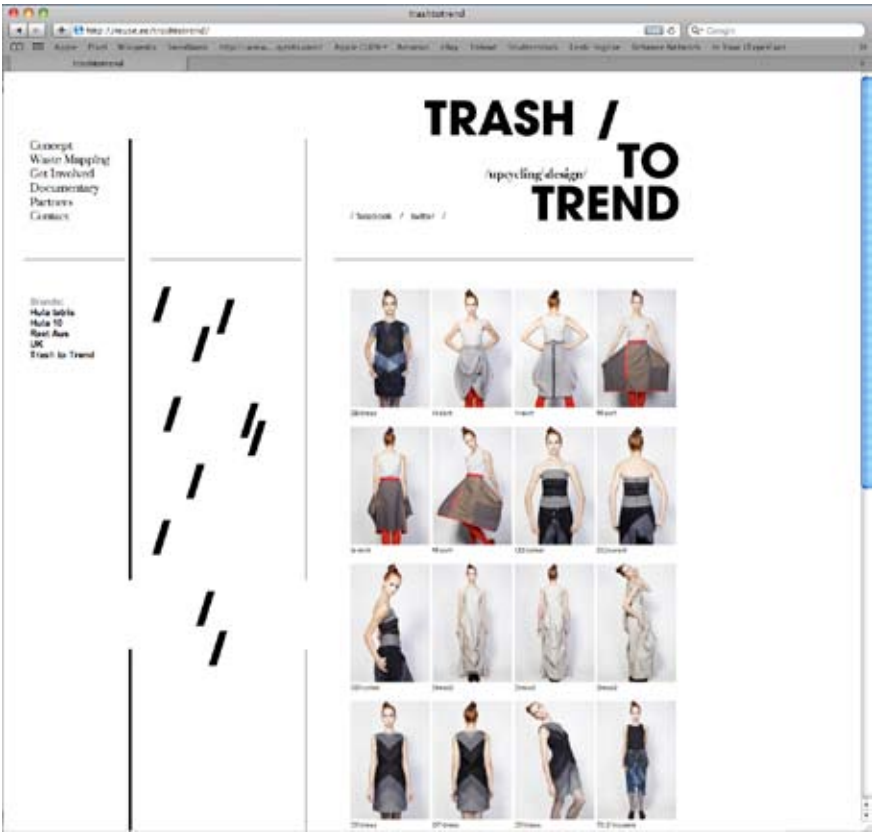
6.1.3 Web-Based Platform

The interactive web-based platform integrates the waste database and includes user guides for different techniques, forming one integrated Trash to Trend model. The web platform provides a medium for introducing the upcycled product and selling it to buyers as well as directly to the consumer. In selling directly to the customer, it is possible to use the same technique as in unique, one-off design (see 6.1.2.1).

As a key user of the platform, the designer has access to all of its information and, being a member of the platform, can also use it to market their products. The platform also offers an open discussion forum, allowing the designers, companies, universities, and clients to share research and practical experience. Since the client is involved, the platform becomes multi-level and alive and gives the client an opportunity to become a part of the design process. The client can follow the production process from beginning to end – starting with selecting the materials from which the garment will be made. Importantly, the Trash to Trend web platform allows the designer to track the product after it is sold, by using a personal product code. The web platform

gives the designer the opportunity to stay in contact with the consumer and for the consumer to upload information such as how many times the product is washed, how many times it has been worn, when and why they choose to discard the item, and what happens to it then.

In this way, the Trash to Trend platform is also a communication tool aimed both at educating the consumer about the opportunities to upcycle and increasing the number of environmentally aware clients.



Picture 2. Platform Trash to Trend – http://www.trashtotrend.com/

Trash to Trend / HULA 10. Designed by Reet Aus
Material: Leftover trousers from Monton, Baltika, Estonia
Photo by Mark Raidpere

Trash to Trend / HULA 10. Designed by Anu Lensment and Reet Aus
Material: Leftover trousers from Monton, Baltika, Estonia
Photo by Mark Raidpere

Garments B7 and T3. Photos by Mark Raidpere

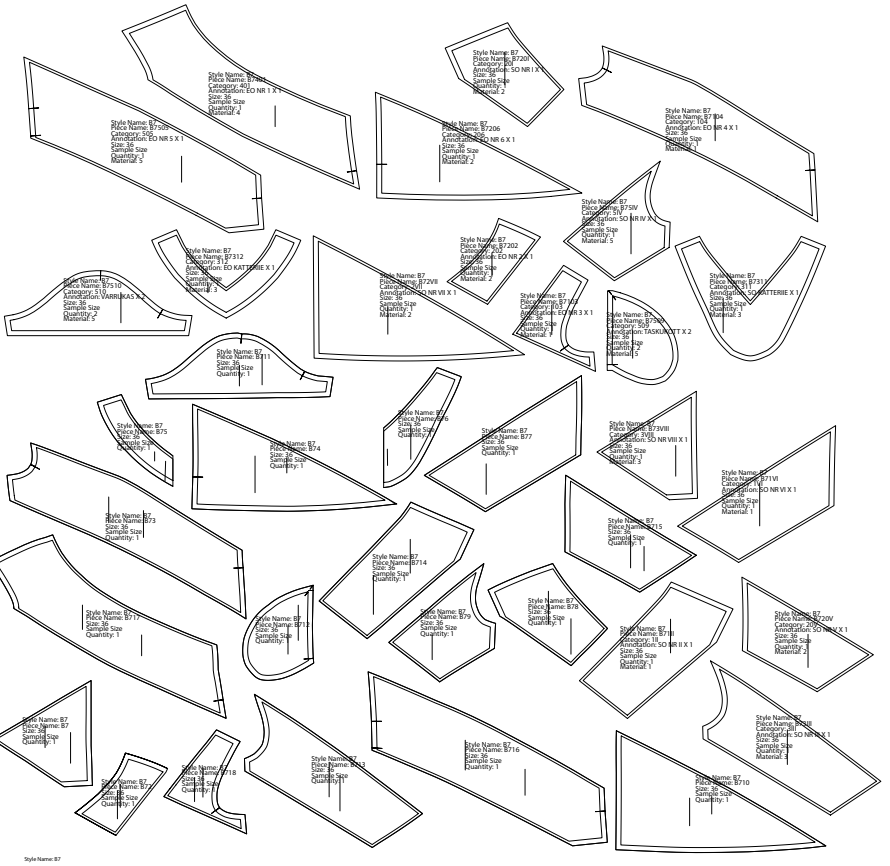
6.2 The collection: Reet Aus Upcycled

My previous practical work opened my eyes to the problems in my collections' life cycles, with the focus on the environmental impact. Next I looked for solutions on a different level – how to make clothes for both the DIY movement and mass production, and how to educate the end consumer who has the most power to influence the market.

In designing the S/S 2011 Reet Aus Upcycled collection the collected waste data was used, and in one collection several upcycling techniques were implemented to illustrate how the Trash to Trend model works.

All in all, the collection is based on the LCA made for the S/S 2011 product D8. Alongside that analysis, I integrated my previous practical experiences in fashion and theatre design and drew the conclusion that, while making an upcycled collection allows for the creation of environmentally sustainable fashion, it does not provide a sufficient solution to the fashion industry's textile waste problem and nor does it change consumer habits.

The design draws on the previous collection – the appearance of the product has been changed in a minimal way, for example using different colour thread, using cut details in one colour, etc.



Pattern of the garment B7

Garment B7 made from pre-consumer waste and from production waste

For example, the design of blouse B7 allows for it to be produced at scale using industrial leftovers, pre-consumer waste, and also post-consumer waste. It is also possible to make the product from the client's old clothes and the client can also order a size-specific pattern for the product and make it at home using his or her own post-consumer waste.

Material:

Samples of the collection are made from local textile waste (see Chapter 5.5.1) on which information was gathered by doing a textile waste study. The garments in the collection are designed so that it is possible to use all three types of textile waste described in Chapter 4 – industrial leftovers, post-consumer waste, and pre-consumer waste – to produce a single design. This demonstrates that it is possible to use all upcycling techniques within one product. The buttons used in the product are reused from Estonian Police uniforms. The only new items are the thread and the zippers.

Technique:

The collection highlights the possibility to produce a garment with minimal environmental impact in both mass production and one-off pieces. The design makes the use of a lining and labels unnecessary. Relevant product information is printed on the inside of the product itself. If the client orders a pattern, a product code will be registered on the Trash to Trend webpage which allows the life cycle of the product to be tracked.

Presented:

Berlin Fashion Week January 2011, Tallinn Design Night September 2011

Visual materials:

Product photography by Ville Hyvönen. Fashion photography by Mark Raidpere.

Garment T4

Garment T4 production

Garment D7

Garment D6

Garment S5. Photo by Mark Raidpere

c.

Conclusion

This PhD thesis is a summary of my six years of practical work and research in sustainable fashion design. The primary aims of the thesis were twofold: to consider how to bring textile waste back into the production cycle in fashion design; and to understand and test the use of different approaches to waste upcycling and different techniques of putting this method into practice for serially produced garments and one-off and unique designs.

Textile Waste as a Source Material for Upcycling

The availability of waste material in fashion design is essential in implementing upcycling, since the design and production process is much determined by the material used. Because of that it is necessary to get an overview of the existing waste producers, which also facilitates finding potential input material and determining its types.

Using upcycling in fashion design emphasises the importance of a local approach. Thus ideally both the input material (waste) and the production should be local. Since information concerning textile waste tends to be inadequate in official databases, it is recommended to start developing a database by conducting a textile waste study specifying the type of textile waste, its quality, and sources in the region. This also allows contacting waste producers and creating relationships important for further cooperation.

By and large, textile waste can be divided into three groups: post-consumer waste, pre-consumer waste, and production waste. All three types of textile waste can be used in fashion design, each, however, requires a different technique when used as an input material. This depends on the objective of the designed product and its functionality. While post-consumer waste is a suitable and easy-to-use material for one-off design and for making theatre costumes, it stipulates certain conditions for serial production and can be regarded as a rather complicated material. Thus we can look at different

techniques for each type of textile waste.

As my practical tests in upcycled fashion design – in terms of one-off and serial design – demonstrate, the following conclusions could be reached:

Using Post-Consumer Waste in Fashion Design

In terms of creative work, post-consumer waste (such as used clothes, old home textiles, etc.) makes a valuable material for designing one-off pieces such as theatre costumes – you can find different materials and each product made is unique. A major common problem for Estonia as well as for many other countries is the difficulty in accessing post-consumer waste because there is no systematic collection of used clothing. Usually the consumer throws unneeded garments directly in the trash and so the journey ends at a landfill. Working with post-consumer waste, dismantling old garments can reveal several new technical solutions. The problem with using this type of material in serial production is the fact that it is always a non-standard material. The quality of used clothing varies, and similarly, the availability of a particular type of fabric. Post-consumer waste can be used in serial production if products made of a certain fabric are collected over a long period of time. This is unfortunately a method too slow and costly to be used for serial design – the material would have to be collected, washed, unstitched, ironed, and sewn. Having invested so much time in preparing the fabric, the price of the product will eventually become high, much in contrast to the impression that garments made of used clothing are less expensive. The main goal here is to make the client understand why local small-scale production and the use of upcycling are reasonably more expensive than mass producing fast fashion.

Using Pre-Consumer Waste in Fashion Design

Pre-consumer waste is the typical waste generated within any textile company. Defective products, unsold collections, unused uniforms, etc.; but also new clothes that for some reason never reach the end consumer. Using this type of waste in serial production is less complex if talking about defective batches or the leftovers of a bankrupt company where we would usually see large volumes of similar products made of the same type of fabric. This is well suited for producing small-scale collections and is an excellent input material for designers. The ways of using this material is only limited to the creativity of

the designer, thus, endless. However, the amount of usable material narrows the collection volume down to a definite quantity. A potential solution could be focusing on a certain type of material, so that the collection can easily be adapted to the characteristics of the material available.

Using Production Waste in Fashion Design

Production waste (industrial leftovers) has the most potential in terms of serial design, since the flow of the material is predictable and standard. If a designer collaborates on a regular basis with a company producing tricot, for example, they can form their design and production process in line with the flow of the material. Upcycling is most efficient if used within the production company itself and under the same brand, sending all generated waste back to the production process. This entails implementing upcycling in the design process of the main product – pre-calculating the textile waste generated and designing the patterns for side products so that they can be easily made of the textile leftovers.

How to Make Upcycling Globally Available and Locally Feasible – a Model for Upcycled Fashion Design

Mapping local input material and developing potential techniques for fashion design is not enough to start using upcycling more widely. It is necessary to put that into a framework that integrates the information about the waste data and techniques as well as offers a platform for communication and networking between the designer, the waste provider, and the client. The web-based Trash to Trend model that I have proposed in this thesis is a tool facilitating the use of upcycling in the regional production of fashion design. It bridges gaps within the industry and allows designers, manufacturers, and consumers to work together to deal with the problem of waste. It centralises the existing information, thus making it possible to use the mapping application and upcycling techniques in other regions. Using the relevant elements of the model, upcycling can be implemented in one-off design as well as in serial production.

What is important is the opportunity to share design solutions globally and to be able to use local textile waste for production.

My practical research and presented cases prove that upcycling offers a sus-

tainable method for fashion design and can be successfully applied in the fashion industry – not only in small-scale or one-off design, as it has mainly been until the present day, but also in mass and serial production. As my personal experience indicates, producing an upcycled product based on the model and at a competitive price is possible. This is an important prerequisite for making upcycling attractive for fast fashion labels (Mango, H&M, Zara, etc). In addition, upcycling via the Trash to Trend model becomes a way of preventing waste in advance, rather than simply a solution for dealing with leftovers at the end of the manufacturing process. Once it is used in mass production, its broad objective in terms of reducing the environmental impact of today's fashion industry will be achieved.

Further Research

Although the proposed upcycling model has been tested to some extent in the Estonian context, its real implementation would require even further collection of waste data and testing of the described upcycling techniques by the corporations behind fast fashion labels. The model should also be expanded to cover other regions to comprehend the global problem of textile waste and to ensure the Trash to Trend model is applicable under other conditions. Future research faces the question of how to put the upcycling method into practice in mass production companies to an extent that would actually diminish the waste generated by the textile and fashion industry. And even that is just the beginning. This upcycling model should be tested in other design sectors, such as interior architecture, industrial design, and furniture design. It would definitely be useful to test the model in cooperation with a major mass production company. Practical implementation in serial production will also pinpoint the potential bottlenecks. As the fashion market is greatly influenced by consumer behaviour and preferences, it would be wise to study consumer behaviour, their inclination to prefer an upcycled product, and ways of involving the consumer in the process of making a fashion product and trend creation.

S.

Summary

This PhD thesis is a summary of a six-year research project. During my practical work I discovered a lot of problems related to the fashion industry. That motivated me to take a closer look at what is happening in each step of garment production. As I was interested in how to reduce textile waste generated by fashion industry, I focused on upcycling as a fresh method in sustainable design.

The primary objectives of this thesis were two-fold: (i) to consider how to bring textile waste back to the production cycle in fashion design; and (ii) to understand and test how to put this method into practice – using different approaches to waste upcycling and different technologies – for both serially produced garments and one-off and unique designs.

An additional objective was to create an overview of existing and emerging textile waste suitable for upcycling available in Estonia and, through this, to promote the wider use of upcycling in fashion design, both in Estonia and globally.

Based on my academic research and the experience gained from practical experiments, a design model that employs the upcycling method to create a fashion product with minimal environmental impact is introduced.

To achieve those goals I have adopted different methods, not only of artistic research but interviews, questionnaries and life-cycle analysis.

The methodological framework of inquiry that was adopted in this research project, largely intuitively at the outset, falls within the confines of practice-led research paradigm that considers artistic or design practice and artistic and design artefacts as pivotal to the entire process of research. However, like any other research paradigm, practice-led research also has established standards for rigorous research practice and the criteria that enable to evaluate the validity of the outcome and the sufficiency of the adopted methods. Those criteria were introduced in the introduction to this dissertation.

The main driving force of my research has been a series of theatre designs and fashion collections that are both experiments along the way towards a suitable design and production model as well as artistic work in its own right. These experiments have been informed by previous experiments, as well as information gathered from free-form interviews with practitioners and researchers and work with the literary resources. I also adopted life-cycle analysis to evaluate the environmental impact of one of my collections and a questionnary based waste-mapping inquiry that was later used as an input for the waste mapping platform in the web.

The dissertation consists of six chapters. In the Introduction, the goals, purposes and methodology of the dissertation is established. Introduction also includes a general introduction to the problem of textile waste in textile industry.

Chapter 2 briefly introduces the developments in the fast fashion industry and its social and environmental impacts – each step of a garment's life cycle has environmental consequences. One of the biggest types of waste generated by the fashion textile industry is used low quality clothes made to last one season. As fast fashion is cheap, the consumer can afford new clothes every season and throws away the old ones without reconsideration. In countries like Estonia, there is no systematic approach to handling textile waste and it is deposited to landfills as household waste. What's more, the fashion textile industry produces waste in every step of the production chain – growing raw material, preparing the fabric, finishing, sewing, etc.

Chapter 3 provides an overview of the concepts of sustainable design and upcycling. The practical method I exploited in using textile waste in design is called upcycling. Since the area is fast-growing and developing, a lot of information was also obtained from interviews with individuals who are closely connected to the topic as well as from people with academic background, practitioners, and designers. The interviews presented in this thesis helped me form an overview of what is happening in the field of outsourcing, environmental science, cotton farming, and how fashion upcycling has developed over the recent years. Having such first-hand information was essential to understanding the current situation. Upcycling is the opposite of downcycling, which is the other part of recycling. Upcycling aims for resolving the problems associated with textile waste in the broadest sense, i.e., this method allows the largest possible amount of textile waste to be given a new value through design, despite the composition or quality of the textile material.

Chapter 4 focuses on the waste study conducted in Estonia and points

out three types of waste: post-consumer waste, pre-consumer waste, and production waste. Until now, textile waste has been mainly discarded and shipped to landfills or occasionally recycled (downcycled) for different commodities produced outside of the fashion industry (e.g., insulation, energy production). Using textile waste instead of new fabric in production is more time-consuming – it means collecting the material, analysing the waste, and processing it to be ready for production. Difficulties also arise because textile waste is non-standard and the material flow is irregular.

To get a clear overview and practical basis for my experiments, I carried out a local waste study and the resulting database is public. The textile waste database I created is based on the information from the local textile and garment industry enterprises and on the results of a previous waste study. Interviews with Estonia's biggest textile companies (Qualitex, Wendre, Baltika, Marat, Ilves Extra AS, and Coats Eesti AS) were conducted in order to map the amount and type of textile waste generated in Estonia. The representatives of these six garment manufacturers were interviewed over a two-month period with the help of volunteers. The results can be seen at http://www.reuse.ee/. The aim is to expand waste mapping to other countries so that the textile waste database would cover a larger area. The objective is to bring the available textile waste back into the production cycle, presumably locally.

Chapter 5 includes my practical case studies from 2006–2011. The thesis highlights twelve case studies that illustrate the most important parts of my past work as well as the practical side of upcycling as a sustainable fashion design method. The case studies focus on designing and testing techniques to implement an upcycling method. Each grew out from a specific problem encountered when implementing upcycling in fashion design or theatre design and deals with it in a practical way. This chapter focuses on two important fields where I have conducted experiments – fashion and theatre. Unlike fashion design, where the desired serial production poses a real challenge, it is much easier to implement upcycling in theatre costume design and also to apply a local approach. These practical experiments were aimed at demonstrating that the use of upcycling is possible in serial production. An important element of my work was the LCA (life cycle assessment) I carried out for the product D8 in S/S 2011 collection. It describes an upcycled product made locally using local textile waste. As the appraisal of the environmental impact of the test garment's life cycle shows, the whole life cycle consumes 76MJ of energy, emits more than 6kg of carbon dioxide, and uses more than 230 litres of water. More than 3kg of solid waste is produced (mainly oil shale ash) and smaller quantities of other waste products, including hazardous waste.

Also, the analysis of the upcycling method and comparisons with other methods of re-use and redesign clearly show that the upcycling method presented in this work is most suitable for the fashion industry in terms of production process management, the amount of textile waste that can be handled this way. It also has the least environmental impact. For me as a designer this LCA clearly identified what I should change in my production chain. The conclusion here is that upcycling is one of the best ways of making environmentally sustainable fashion; however, a bigger solution is needed to achieve real change in the production patterns of fast fashion labels and to find a way to implement upcycling in mass production.

Chapter 6 introduces the waste data derived from the waste study and the different upcycling techniques – from one-off to serial design – that are combine to form a web-based model called Trash to Trend that implements the principles and practices described in the research. This model helps to solve problems related to textile waste within the industry at many levels. By implementing the model in the planning and design process, many of the steps involved in the classical product life cycle can be avoided, e.g., growing raw material, some transport, fabric manufacture, etc. Thus, the model I propose reduces energy and water consumption in the product life cycle.

In this model, a uniquely made garment is always made after ordering and thus over-production is prevented. The client is involved in the process of completing the garment and therefore a personal relationship with the designer and the product is developed and, consequently, a garment is produced which is more 'valuable' to the consumer and would therefore likely be used for a longer time. Moreover, an upcycled product can be designed in a way that it is possible to use the material all over again. The client has the opportunity to use different kinds of waste material, even her or his own used clothing.

Waste can be obtained internally from the same label/factory, or production waste created by another company can be utilised. In terms of environmental impact as well as economic viability and the complexity of the design, upcycling within a company or one label is most efficient. Implementing a DIY approach to upcycling minimises the environmental impact of the design and creation of a garment. Using the Trash to Trend model in DIY creations takes the technique to a more professional level since designer patterns are used. Upcycling your own textile waste at home is very economical.

The model brings together the producer of waste, the designer, and the client. To increase client involvement in the process of making a product, it is

important to show how the product is produced and to make the production chain more transparent. This influences the future choices of the consumer. The functioning of the Trash to Trend model is illustrated by the Reet Aus Upcycled collection from March 2011.

The Trash to Trend website (see http://www.trashtotrend.com/) is a communicative platform for sharing information between designers, companies, consumers, DIY activists, and university faculty and students. The concept of upcycling is introduced to designers, information about textile waste is distributed, research shared, practical experiences and interviews can be published and commented upon. The platform provides a viable source of background information as well as practical assistance and interactive exchange – both of materials as well as design ideas and experiments.

To summarise, the main outcomes of this six year long research project are:

- a model of design and production called Trash to Trend,
- a series of fashion and theatre designs that were experiments in the research process that also served as designs in their own right.
- fashion brand Reet Aus Upcycled that embodies the Trash to Trend design and production model,
- a web-plaform Trash to Trend to disseminate knowledge and data gathered during this research as well as the proposed design and production model,
- a waste mapping platform Reuse that will continue to develop also after the completion of this thesis.

To conclude, the dissertation served to sufficiently demonstrate that implementing the upcycling method in the design process significantly decreases the environmental impact of a garment, alleviates social problems, develops local production, provides a solution to the problem of textile waste, and reduces the use of new material. This research demonstrates that upcycling as a sustainable method for fashion design can be successfully applied within the fashion industry. It seems feasible and both ecologically and economically important to apply upcycling in mass production. In this area, most of its environmental as well as social benefits could be realised.

Trash to Trend / HULA 10. Designed by Reet Aus
Material: Leftover trousers from Monton, Baltika, Estonia
Photo by Mark Raidpere

G.

Glossary

DIY (do-it-yourself) – The DIY movement is a re-introduction of an old pattern of personal involvement and use of skills in making clothes.

Downcycling – The recycling of a material into another material of a lesser quality.

Energy Recovery – The conversion of solid waste into energy or saleable fuel.

Fast Fashion – Fast fashion brings cheap copies of high-fashion trends to the consumer at maximum speed, affordable price, and as cost-effectively as possible.

Household (Municipal) Waste – Waste generated in the home including food scraps, packaging, pet litter, and nappies.

Landfill – A least preferred method for solid waste treatment. Landfill site refers to the final placement of waste in or on the land in a controlled or uncontrolled way according to different sanitary, environmental protection and other safety requirements.

Man Made Materials – Substances made by human beings which do not occur naturally.

One-off Design – A unique, one-of-a-kind product which will not be replicated.

Post-Consumer Waste – Textile waste created at the end of a garment's first use. This mostly includes used garments and domestic textiles.

Pre-Consumer Waste – Collective term for leftovers from stores and company product development, sales leftovers, returned goods, and outsourced garment shipments that are not redeemed from customs for various reasons.

Production Waste – A prospective input of materials for upcycling from the garment industry. It consists of leftovers from garment manufacturing, such as trimmings, proofs, leftover fabric, off-cuts, ends of fabric rolls, etc.

Raw material – An unprocessed natural material that is used in manufacture.

Recycling – Using waste as material to manufacture a new product. Recycling involves altering the physical form of an object or material and making a new object from the altered material. It thereby distinguishes itself from re-use, which does not alter the physical form of an object.

Waste Recovery – is about using waste to replace other non-waste materials to achieve a beneficial outcome in an environmentally sound manner. Waste recovery includes recyling, composting and energy recovery from waste materials.

Reuse – Using an object or material again, either for its original purpose or for a similar purpose, without significantly altering the physical form of the object or material.

Sales Leftovers – A specific category of pre-consumer waste. With the assertion of fast fashion and the accompanying overproduction of clothing a new type of waste has emerged: sales leftovers.

Serial Design – Serial design or production is the production of large amounts of standardised products.

Textile Waste Analysis – The successful implementation of sustainable fashion methods based on textile waste recovery (including upcycling) which requires a thorough overview of the producers, types, and volumes of textile waste created.

Upcycling – Upward re-processing, is defined as bringing waste back into the consumption chain through design.

Waste – An unwanted or unusable substance or material.

Waste Management – The collection, transportation, processing, or disposal of waste materials, in an attempt to reduce their effect on human health or local amenity.

K.

Kokkuvõte

Antud töö keskmes on disaini- ja tootmismudel Trash to Trend. Tuginedes akadeemilisele uurimistööle ja pikaajalisele disainerikogemusele töötasin ma praktiliste näidete ning eksperimentide najal välja väärtustava taaskasutuse (i.k upcycling) meetodist lähtuva disaini- ja tootmismudeli, mis võimaldab luua minimaalse keskkonnamõjuga moetooteid.

Doktoritöö ajend on aga kaugemal. 2002. aastal kaitsesin ma Eesti Kunstiakadeemias magistrikraadi moekunsti erialal. Eelnevad kuus aastat õpinguid olid mulle aga näidanud, et moetööstuse toimimise põhimõtted ei lähe kokku minu kui disaineri vaadetega sellele, kuidas rõivaid tuleks toota.

Magistriõpingute ajal rajasime me Anu Lensmenti, Marit Ahvena ja Eve Hansoniga Kaubamärgi “Hula”. Me püüdsime järgida rahvusvahelise moetööstuse reegleid, et teha sellest edukas rahvusvaheline noortele suunatud kaubamärk. Selleks õppisime me süviti tundma moe- ja tekstiilitööstuse toimemehhanisme, s.h kangaste päritolu ning rõivaste ja kangaste peamised tootmispiirkonnad. Me viisime läbi turu-uuringuid, tegime hinnavõrdluseid, analüüsisime turundusstrateegiaid jne. Lühidalt, me õppisime rahvusvaheliste spetsialistide abiga tundma moetööstuse telgitaguseid.

Mida rohkem informatsiooni me kogusime, seda vähem soovisin ma sellesse maailma sukelduda. Ma tundsin vajadust teha asju täiesti teistmoodi, sageli risti vastupidi tavapärasele praktikale. Põhjus oli selles, et meie kogutud informatsioon näitas ka seda, kui raiskav ning kui sügavalt keskkonda kahjustav võib moetööstuse tegevus olla. Märgid olid liiga ilmsed et neid ignoreerida.

Doktoritöö eesmärk

Minu doktoriuurimuse peamine eesmärk oli:

1. leida vastus küsimustele, kuidas rakendada disaini moetööstuse keskkonnamõju vähendamiseks ja kuidas tuua disaini abil tekstiilijäätmed ta-

gasi eluahelasse, andes neile uue väärtuse

2. töötada välja väärtustava taaskasutuse (i.k upcycling) meetodist lähtuv disaini- ja tootmismudel, mis oleks rakendatav ühteaegu nii unikaaldisainis kui seeriatootmises. Levinud taaskasutusmeetodid on rakendatavad üldjuhul vaid unikaaldisainis, seetõttu ei paku nad aga tegelikku lahendust jäätmete probleemile tekstiilitööstuses.

Doktoritöös kirjeldan ma protsessi käigus välja töötatud disaini- ja tootmismudelit ning annan ülevaate uurimustest ning disainieksperimentidest, mis selleni viisid: teatridisain võimaldas väikeses mahus katsetada eri tüüpi jäätmete ning töövõtetega, kaubamärgi "Reet Aus" kollektsioonide ettevalmistamise käigus testisin meetodi praktikasse rakendamise võimalusi nii unikaaldisainis kui seeriatootmises. Viimast tuleb pidada eriti oluliseks, sest vaid väärtustava taastootmise viimisel seeriatootmisesse on võimalik leida lahendus tekstiilijäätmete vähendamiseks rõivatööstuse enda sees.

Selleks, et edendada laialdasemat taaskasutuse rakendamist moedisainis, seda nii Eestis kui kogu maailmas, alustasin ma pikemaajalist projekti ülevaate loomiseks olemasolevatest väärtustavaks taaskasutuseks sobivatest tekstiilijäätmetest. Lähteuurimuse tulemused kajastuvad ka käesolevas töös ning avaliku veebiplatvormina "Reuse" (http://www.reuse.ee/).

Metodoloogia

Uurimuse alguses suuresti intuitiivselt loodud metodoloogiline raamistik kuulub praktikast-juhinduva uurimuse paradigmasse (i.k practice-led research), nii nagu see on määratletud ennekõike Steven Scriveneri (nt Scrivener 2000, 2002, 2006) ja Michael Biggsi (Biggs 2003, 2004, 2006) töödes. Viimati nimetatud autorid on mänginud viimase 10 aasta jooksul võtmerolli ka antud uurimisparadigma aluste kujundamisel.

Väga kokkuvõtlikult on praktikast-juhinduv uurimus "uurimus, milles kunstniku ja disaineri professionaalne loominguline tegevus mängib uurimuse läbiviimisel keskset rolli" (Mäkelä and Routarinne 2006: 12).

See, mis eristab praktikast-juhinduvat uurimust teistest traditsioonilistest uurimisparadigmadest on kunsti- või disainipratika ning kunstiteose või disaineseme tähtsustamine peamise uurimust edasi viiva jõuna. Kui teaduslikus uurimuses viiakse eksperimente läbi üldjuhul teatud eelduste kontrollimiseks, näiteks teatud probleemi lahendamiseks või teatud küsimusele vastuse sa-

miseks, siis paktikast-juhinduva uurimuse puhul on millegi loomine ise uurimust edasi kandev jõud ja teatud juhtudel ka ideede genereerimise vahend (Mäkelä and Routarinne 2006: 22). Uurimuse teemasid, probleemkohti ning huvipunkte uuritakse ja antakse edasi artefaktide loomisega, seejuures ei ole loodud kunstiteosed või disainiesemed mitte ainult vahendid teatud uurimiseesmärgi saavutamiseks, vaid "kogemuse objektina on loominguline teos / toode ise sama oluline kui selles kehastuv teadmine" (Ibid. 23).

Praktikast-juhinduva uurimuse paradigma raames läbi viidav uurimistöö võib tõukuda nii kunsti- või disainipraktikast kui ka uurimisprobleemist. Loomingulise protsessi kasutamine uurimistöö kandva jõuna ei tähenda, et uurimuse hingamisel ei oleks oluline uurimuse korrektsus või eesmärk luua uusi teadmisi või uut mõistmist. Steven Scrivener (2006: 175) toob samuti välja, et "kuigi loomeprotsessi teatud osa võib olla intuitiivne või tugineda vaikimisi teadmistel, siis enamik sellest protsessist peab olema teadvustatud, planeeritud, läbi mõeldud, tuginema konteksti mõistmisele ning mõtestamisele kogu oma ulatuses". Michael Biggs on kirjeldanud praktikast-juhinduvas uurimuses kasutatud meetodite valiidsuse ja asjakohasuse hindamise alusena järgmise kriteeriumi: "meetodi kohasust tõestab veenev seos küsimuse ja vastuse vahel" (Biggs 2004, 12-13, via Mäkelä and Routarinne 2006).

Minu uurimistöö keskendus tekstiilijäätmete probleemile tekstiilitööstuses ning küsimusele: kuidas saab rakendada disaini tekstiilijäätmete tekkimise ning sellega kaasneva tekstiilitööstuse keskkonnamõju vähendamiseks? Algusest peale on minu eesmärgiks olnud toimiva disaini- ja tootmismudeli loomine, mis oleks rakendatav mitte ainult unikaaldisainis vaid ka seeriatootmises.

Nende eesmärkide saavutamiseks olen ma kasutanud tervet rida erinevaid lähenemisi ja konkreetseid meetodeid, mitte ainult oma loomingul põhinevaid eksperimente ja näiteid, vaid ka intervjuusid, küsimustikke ning olelusringi hindamise meetodit.

Peamiseks minu uurimust edasi viivaks jõuks on olnud rida teatridisaine ning moekollektsioone, mis on ühteaegu eksperimendid leidmaks sobilikku disaini- ja tootmismudelit ning iseseisvad disainid. Eksperimentide juures olen lähtunud nii eelnevates teatridisainides kui kollektsioonides omandatud kogemustest, aga ka teabest, mille kogumiseks olen kasutanud vabas vormis intervjuusid disainerite, ettevõtete, organisatsioonide ja uurijatega ning erialast kirjandust. Samuti rakendasin ma olelusringi hindamise meetodit, hindamaks ühe oma kollektsiooni keskkonnamõju ja viisin läbi küsimustikul põhineva tekstiilijäätmete kaardistamise uurimuse, mis oli sisendiks ka veebipõhise jäätmekaardistamise platvormi loomiseks.

Erinevate üksteist täiendavate meetodite kasutamine uurimisprotsessis andis tulemuseks rea osalt sõltumatuid, osalt üksteisega seotud väljuneid: disaini- ja tootmismudel Trash to Trend, rida teatridisaine ning moekollektsioone, kaubamärgi Reet Aus Upcycled, mis kehastab kõige ehedamalt Trash to Trend tootmis- ja disainimudelit, veebiplatvormi Trash to Trend, mis on mõeldud minu uurimistöö jooksul kogutud teadmiste ja andmete ning välja töötatud disaini- ja tootmismudeli vahendamiseks, tekstiilijäätmete kaardistamise veebiplatvorm Reuse, mille arendamine jätkub ka pärast doktoriuurimuse lõppu. (Vt joonis 1, mis illustreerib viisi, kuidas praktikast-juhinduva uurimuse paradigmat on käesolevas dokotritöös rakendatud).

Struktuur

Doktoritöö koosneb kuuest peatükist. Sissejuhatus annab ülevaate probleemistikust ning selle käsitlemisest erialases kirjanduses.

Teine peatükk tutvustab lühidalt kiirmoe arenguid ning annab ülevaate selle sotsiaalsest ja keskkonnamõjust (iga samm rõiva elutsüklis avaldab teatud määral mõju nii inimesele kui keskkonnale). Üks suurimaid tekstiilitööstuse poolt tekitatavaid tekstiilijäätmete liike on kasutatud rõivad, valdavalt kiirmoe lühikese tarbimistsükli ning seetõttu juba planeeritult madala kvaliteediga rõivad: odav kiirmood võimaldab tarbijal osta endale uusi riideid igal hooajal ja visata eelmised olmeprügisse. Paljudes riikides, sealhulgas Eestis, puudub süstemaatiline tekstiilijäätmete kogumise ja käitlemise süsteem ning tekstiilijääde liigub prügilasse olmejäätmetena. Kuid sellega moe- ja tekstiilitööstuse tekitatud keskkonnamõju ei piirdu: rõivaste tootmine tekitab muu hulgas ka ohtlikke jäätmeid oma tootmisahela igas etapis: tooraine kasvatus, transport, ketrus, kanga kudumine ja viimistlus, õmblemine jne.

Kolmas peatükk annab ülevaate jätkusuutliku disaini kontseptsioonidest ja väärtustava taaskasutuse meetodist, mida olen kasutanud oma praktilises töös tekstiilijäätmete taaskasutamisel moedisainis. Taaskasutus (i.k recycling) jaguneb kaheks: materjali väärtustav (i.k upcycling) ning tootmisahelas materjali väärtust kahandav (i.k downcycling) taaskasutus. Minu uurimuses on kesksel kohal materjali väärtustava taaskasutuse meetod, mis võimaldab kasutada suurimas mahus tekstiilijäätmeid tekstiilitööstuse sees, andes neile uue väärtuse läbi disaini. Teiste taas- või korduskasutuse meetodite puhul ei ole võimalik saavutada tekstiilijäätmeprobleemidega toime tulekuks vajalikku tootmismastaapsust või tähendab see materjali ümbertöötlemist teistes toot-

missektorites (nt mööblitööstus, energeetika jmt).

Neljas peatükk keskendub jäätmete uuringule Eestis ja toob välja kolme liiki tekstiilijäätmed: tarbimisjääde, tarbimiseelnejääde ja tootmisjääde. Praegune praktika näitab, et tekstiilijäätmed saadetakse peamiselt prügilasse või harvadel kordadel töödeldakse materjali väärtust kahandades ümber (i.k downcycling) teisesteks toodeteks väljaspool moetööstus (näiteks isolatsioon, energia tootmine). Tekstiilijäätmete kasutamine tootmises on ajamahukam kui uue kanga kasutamine, kuna see sisaldab enam tegevusi kui uue materjali kasutus: materjali tuleb koguda, jääkide võimalikku kasutust analüüsida ning materjal tootmiseks ette valmistada (ennekõike tähendab see puhastamist). Tekstiilijäätmete kasutamise muudab keerukamaks ka ebastandardses mõõdus materjal, samuti on materjali vood tihti ebaregulaarsed.

Saamaks selget ülevaadet ja praktilist sisendit loomingulistele eksperimentidele, hakkasin koguma andmeid tekstiilijäätmete kohta Eestis, võttes ühendust kohalike tekstiili- ja rõivatööstuse ettevõtetega, et kaardistada Eestis tekkivate tekstiilijäätmete liigid ja vood. Selleks töötati välja vastav küsimustik (vt töö lisad). Uurimuse käigus viisin lisaks läbi intervjuud Eesti suurimate tekstiiltoodete ettevõtete (“Qualitex”, “Wendre”, “Baltika”, “Marat”, “Ilves Extra” AS ja “Coats In” AS) juhtidega.

Kaardistuse esimesi tulemusi saab näha alates septembrist 2011 avalikustatud andmebaasis internetis, aadressil http://www.reuse.ee/. Plaanis on laiendada selle platvormi kaudu jäätmete kaardistamist teistesse riikidesse, nii et tekstiilijäätmete andmebaas kataks aktiivmad tekstiilijäätmete tekke piirkonnad: platvormi suuremaks eesmärgiks on muuta tekstiilijäätmed kättesaadavaks disaineritele ja tootjatele, et suunata need tagasi tootmistsüklisse, soovitavalt lokaalselt.

Töö viiendas peatükis kirjeldan oma loomingulise uurimuse praktilisi eksperimente aastatest 2006-2011. Kokku üksteist näidet illustreerivad praktilise uurimuse protsessi, milles otsisin praktilisi lahendusi väärtustava taaskasutuse rakendamiseks rõivadisainis. Iga näite puhul on lahatud meetodi rakendamisel tekkinud probleeme ning püütud leida neile praktililsi lahendusi. Eksperimentide kaheks olulisemaks valdkonnaks olid seejuures mood ja teater. Moedisaini puhul on väärtustava taaskasutuse rakendamise seeriatootmises tõsine väljakutse, teatridisainis seevastu on selle rakendamine kordades lihtsam. Samuti on teatri puhul hõlpsam kohaldada lokaalset lähenemist. Kirjeldatud näited on olulised illustreerimaks ka doktoritöö kuuendas peatükis tutvustatavat väärtustaval taaskasutusel põhinevat disainimeetodit ning selle kujunemist.

Praktiliste eksperimentide läbiviimise üheks eesmärgiks oli tõestada, et väärtust loov taaskastus on võimalik ka seeriatootmises. Minu praktilises töös oli oluline rõhk kaubamärgi “Reet Aus” väärtustavast taaskasutusest lähtuva tootesarja Reet Aus Upcycled disani ja tootmismudeli välja töötamine ning selles omakorda oli sisendina suur kaal kaubamärgi Reet Aus Upcycled kevadsuvise kollektsiooni toote D8 olelusringi hindamisel, mis vaatleb kohalikust tekstiilijäätmest valmistatud toote olelusringi. Antud toote olelusringi hindamine näitab, et kogu elutsükli jooksul kulub toote valmistamiseks ja hooldamiseks 76MJ energiat, toodetakse rohkem kui 6kg süsinikdioksiidi, enam kui 3kg tahkeid jäätmeid (peamiselt põlevkivituhk) ja väiksemas koguses muid jäätmeid (s.h ohtlikke jäätmeid) ja kasutatakse ära rohkem kui 230 liitrit vett.

Praktiliste eksperimentide põhjal on võimalik hinnata ka väärtust tõstva taaskasutuse eelist võrreldes ümberdisainimise (i.k redesign) ja korduskasutusega (i.k reuse). Erinevalt kahest viimati nimetatust on võimalik rakendada väärtust tõstva taaskasutuse meetodit ka seeriatootmises ning selle ulatuslikum rakendamine aitaks oluliselt kaasa tekstiilitööstuses tekkivate jäätmete probleemi lahendamisele tekstiilitööstuse enda sees. Kuna materjalide ulatuslikum taaskasutus vähendaks ka vajadust uue toorme järele, aitaks väärtustava taaskasutuse rakendamine kaasa ka tooraine tootmisest tuleneva keskkonnamõju vähendamisele.

Minule kui disainerile näitas Reet Aus Upcycled toote D8 olelusringi hindamine (LCA) selgelt, mida on vaja tootmisahelas muuta, et jõuda veel keskkonnasäästlikuma tooteni. Sellest on võimalik järeldada, et väärtust tõstev taaskasutus on üks lihtsamaid võimalusi, kuidas muuta moedisain keskkonnasäästlikumaks. Laiahaardelisema muutuse saavutamiseks on vaja teha olulisi muudatusi globaalse kiirmoe tootmisahelas ning leida võimalused, kuidas rakendada antud doktoritöös välja töötatud ning juba ka seeriatootmises läbi proovitud disaini- ja tootmismudel veel suuremates mastaapides masstootmisse.

Töö kuuendas peatükis tutvustan ma kuueaastase uurimistöö kõige olulisemat tulemust: väärtustava taaskasutuse meetoditele üles ehitatud disaini- ja tootmismudelit Trash to Trend. Selle mudeli praktiliseks väljundiks on kaubamärk Reet Aus Upcycled ning veebipõhine platvorm Trash to Trend. Peatükk kirjeldab toodete disainipõhimõtteid ning loodud disainide väljundeid unikaal- ja seeriatootmises.

Töö tulemused ja väljundid

Disaini- ja tootmismudel Trash to Trend

Trash to Trend mudeli välja töötamise ajendiks oli eesmärk leida kompleksne lahendus tekstiili- ja moetööstuse poolt tekitatavatele jäätmetele. Trash to Trend mudelit planeerimise ja disainiprotsessis rakendades on võimalik vältida mitmeid suure negatiivse sotsiaal- ja keskkonnamõjuga etappe klassikalises toote elutsüklis: tooraine kasvatus, osaline transport ning kanga valmistamine. Samuti vähendab välja pakutav mudel energia ja vee kasutust toote elutsükli jooksul.

Trash to Trend mudeli puhul toimub tootmisprotsess alati peale tellimuse esitamist ja seega on ületootmine välistatud. Klient on kaasatud disainiprotsessi, mis tagab isikliku suhte disaineri ja kliendi vahel kogu tootearenduse protsessi jooksul. Selliselt omandab valmistatud rõivas tarbija jaoks suurema emotsionaalselt suurema väärtuse, mis on oluline selleks, et loodud ese püsiks pikemalt kasutuses.

Ka siis, kui klient ostab n-ö valmistoote, on kõik tooted nummerdatud ning kliendil on veebiplatvormi vahendusel võimalik oma toote elutsüklit jälgida.

Kliendil on võimalus valida isikliku toote valmistamiseks eri liiki jäätmete vahel (tarbimiseelne jääde, tarbimisjääde ja tootmisjääde), sealhulgas kliendi enda kasutatud rõivad. Materjal valitakse jäätmekaardi vahendusel tootmispiirkonnast. Ideaaliks oleks lokaalsete tootmisüksuste võrgustik, kus konkreetne ese valmistatakse kliendiga samas regioonis paikneva tootja poolt samast regioonist pärinevatest jäätmetest.

Trash to Trend disaini- ja tootmismudelisse on võimalik integreerida ka Tee Ise (DIY) meetod: kasutades disainerite lõikeid saab klient ise oma kodus oma tekstiilijäätmetest luua uue rõivaeseme. Selline lähenemine võimaldab Tee Ise (DIY) tehnikal tõusta professionaalsele tasemele. Kodustes tingimustes oma isiklike kasutatud rõivaste või tekstiilijääkide kasutamine on väga ökonoomne, sest minimeerib m.h uue toote transpordikulud ja kasutatud rõivaste käitlemisega või ringlusse saatmisega seotud kulud.

Trash to Trend mudel on rakendatav ka seeriatootmises: tootmisprotsessis tekkivad tekstiilijäätmed on võimalik suunata taaskasutusse ettevõtte või kaubamärgi siseselt. Kõige optimaalsem tulemus on võimalik saavutada juhul, kus samal ajal lõigatakse välja põhikollektsiooni ja väärtustava taaskasutuse tooted. Nii minimeeritakse jäätmete tekkimine otse sündmuskohal – juurde-

lõikusliini ääres. Samuti on võimalik pakkuda jäätmeid toormaterjalina teistele ettevõtetele, kuid ettevõtte või kaubamärgi sisene väärtustav taaskasutus annab nii majanduslikult kui keskkonda silmas pidades kõige parema tulemuse.

Trash to Trend mudelist lähtudes disainitud toode võimaldab sama algset materiali üha uuesti kasutada. Kui kliendi jaoks on toode väärtuse minetanud, suunatakse materjal läbi jäätmekaardi tagasi tarbimisahelasse või tagastatakse disainerile, kes kasutab seda toormaterjalina uue toote jaoks. Samuti on võimalik kliendil endal antud toode taaskasutada, kui ta laadib Trash to Trend kodulehelt (vt allpool) sobiva toote lõike ja valmistamisõpetuse.

Trash to Trend mudel toob omavahel kokku jäätmetekitaja, disaineri ja kliendi. Oluliseks osaks on kliendi kaasamine disainiprotsessi, samuti tootmisahela läbipaistvaks muutmine ning toote valmimise näitamine. Läbi sellise tegevuse on võimalik tõsta ka tarbija teadlikkust antud teemadel.

Kaubamärk Reet Aus Upcycled

Trash to Trend mudeli toimimist illustreerivad kaubamärkide Reet Aus Upcycled ja “Hula” kollektsioonid 2011. sügisest. Antud kollektsioonide materjal on kogutud jäätmekaardistuse toel. Reet Aus Upcycled kollektsiooni puhul on oluline mainida, et osa tooted sai valmistatud tekstatootja “G-Star” tarbijaeelsest jäätmest. Teine osa materjali tuli Eesti ettevõttest “Masi Company”. “Hula 10” kollektsioon valmis tervensti “Baltika” kaubamärgi “Monton” tarbijaeelsest jäätmest.

Veebiplatvorm Trash to Trend

Veebiplatvorm Trash to Trend (http://www.trashtotrend.com/) on loodud disainerite, ettevõtjate, tarbijate, Tee Ise aktivistide ja üliõpilaste vahel teabe vahetamiseks. Platvormi kaudu tutvustatakse väärtustavat taaskasutust disaineritele, antakse informatsiooni jäätmematerjalide kohta, jagatakse praktilisi kogemusi, tutvustatakse disaine ja disainipõhimõtteid. Sellesse platvormi on integreeritud ka tekstiilijäätmete kaardistamise veebiplatvorm “Reuse” (http://www.reuse.ee/).

Tekstiilijäätmete kaardistamise veebiplatvorm “Reuse” (http://www.reuse.ee/)

Tekstiilijäätmete kaardistuse platvorm tekkis reaalsest ka selle uurimuse käigus avaldunud vajadusest antud informatsiooni järele. Infot jäätmete kohta

saavad vastava vormi abil sisestada kõik tekstiili- ja rõivatootjad, samuti rõivaste käitlemisega seotud ettevõtted ja organisatsioonid. Platvormi eesmärk on jagada infot taaskasutuseks sobivate tekstiilijäätmete kohta ettevõtete, disainerite ja tekstiilitootjate vahel. Kaardistus on välja töötatud Keskkonna Investeeringute Keskuse toel. Platvormile lisandub pidevalt uut informatsiooni. Pikemas perspektiivis on soov haarata sellesse suuremad piirkonnad kui ainult Eesti. Samuti on juba praegu näha, et kaardile lisandub infot ka teist tüüpi jäätmete kohta.

Välja töötatud disaini- ja tootmismudel Trash to Trend ning selle eespool kirjeldatud väljundid näitavad, et väärtustava taaskasutuse meetodit disaini protsessis vähendab oluliselt rõiva keskkonnamõju, aitab leevendada sotsiaalseid probleeme, arendab lokaalset tootmist ning pakub esialgu vähemalt osalise lahenduse tekstiilijäätmete probleemile ja vähendab uue materjali kasutust.

Antud uuring näitab, et väärtustavat taaskasutust kui säästva disaini meetodit saab edukalt rakendada nii unikaaldisainis kui seeriatootmises. Sellest uurimusest tõukuvaks uueks väljakutseks on materjali väärtustava taaskasutuse meetodi süstemaatiline rakendamine suurettevõtetes ja masstootmises, eesmärgiga muuta disainiprotsessi nii, et jäätmeid ei tekiks.

Trash to Trend / HULA 10. Designed by Anu Lensment
Material: Leftover trousers from Monton, Baltika, Estonia
Photo by Mark Raidpere

R.

References

Allwood, Julian M; Laursen, Søren Ellebaek; Malvido de Rodríguez, Cecilia; Bocken, Nancy M. P. (2006). Well Dressed? The present and future sustainability of clothing and textiles in the United Kingdom. Cambridge: University of Cambridge Institute for Manufacturing.

Biggs, Michael (2006). Modelling Experiential Knowledge for Research. In: Maarti Mäkelä and Sara Routarinne (eds.), The Art of Research: Research Practices in Art and Design. Helsinki: University of Art and Design, pp. 180-204.

Birtwistle, G., & Moore, C.M. (2007). Fashion clothing – where does it all end up? International Journal of Retail & Distribution Management, 35 (3) pp. 210-216.

Black, Sandy (2008). Eco-chic: the fashion paradox. Black Dog.

Brown, Sass (2010). Eco Fashion. Lawrence King Publishing.

DEFRA (2009). Maximising Reuse and Recycling of UK Clothing and Textiles EV0421. Technical Report. Final report for Defra. Oakdene Hollins.

DEFRA (2011). Sustainable clothing roadmap. Progress Report.

EJF (2007). The deadly chemicals in cotton. London: Environmental Justice Foundation in collaboration with Pesticide Action Network UK.

Environmental improvement Potentials of textiles, European Commission report – report pending publication from the European Commission Joint research Centre, institute for Prospective technological studies.

Farrer, Joan, & Fraser, Kim (2011). Sustainable vs unsustainable.

Fletcher, Kate (2008). Sustainable Fashion and Textiles: Design Journeys. London: Earthscan Publications.

Gwilt, Alison, & Rissanen, Timo (2011). Shaping Sustainable Fashion: Changing the Way We Make and Use Clothes. London: Earthscan Publications.

Gavrilova, O., Randla, T., Vallner, L., Strandberg, M., Vilu, R. (2005). Life Cycle Analysis of the Estonian Oil Shale Industry. Tallinn: TTÜ/ELF

Hannula, Mika; Suoranta, Juha; and Vadén, Tere (2005). Artistic Research - Theories, Methods and practices. Helsinki and Gothenburg: Academy of Fine Arts, Helsinki, Finland and University of Gothenburg / Art Monitor.

Hawley, J. (2008). Economic impact of textile and clothing recycling. In: Ulasewicz, C. & Hethorn, J. eds. (2008). Sustainable Fashion: Why Now? A conversation exploring issues, practices, and possibilities. New York: Fairchild Books, Inc.

Hubble, Leesa (2010). Re-Fashion, Re-Purpose; Designing With Sustainable Style. Surface Design Journal. Vol. 34 no 3 (Spring 2010) pp. 16-21.

ISO 14040 (2006). Environmental management – Life cycle assessment – Principles and framework, International Organisation for Standardisation (ISO), Geneve.

Joergens, C. (2006). "Ethical Fahion: Myth or Future Trend?". Journal of Fashion Marketing and Management, Vol. 10, No3, pp. 360-371.

Labor Behind the Label (2009). Report.

Lee, M. (2007). Eco chic. The savvy shoppers guide to ethical fashion. Octopus Publishing Group Ltd.

Hunter, Lovins (2008). Rethinking production. State of the World. Innovations for a Sustainable Economy.

Lee, Suzanne (2005). Fashioning the Future. United Kingdom: Thames and Hudson Ltd.

Lin, Jennifer, & Zheng, Amanda Cornell (2008). University CRP3840: Green Cities.

McDonough, William, & Braungart, Michael (2002). Cradle to cradle: Remaking the Way We Make Things. New York: North Point Press.

McLennan, Jason F. (2004). The Philosophy of Sustainable Design. Kansas City: Ecotone.

Minney, Safia (2008). By Hand: The Fair Trade Fashion Agenda. London: People Tree Ltd.

Mäkelä, Maarit and Routarinne, Sara (2006). Connecting Different Practices: An Introduction to the Art of Research. In: Maarti Mäkelä and Sara Routarinne (eds.), The Art of Research: Research Practices in Art and Design. Helsinki: University of Art and Design, pp. 10-39.

Nieminen, Eija (2008). Creative Sustainability. Case Studies on User-Driven Business Innovation.

OECD (2009). OECD Environmental Data Compendium 2006-2008. Environmental Performance and Information Division OECD Environmental Directorate. Working Group on Environmental Information and Outlooks.

Palmer, A., & Clark, H. (2005). Old clothes, new looks: Second hand fashion. Berg Publishers.

Pauli, Gunter, and Hartkemeyer, Johannes F. (1999). UpCycling: Wirtschaften nach dem Vorbild der Natur für mehr Arbeitsplätze und eine saubere Umwelt. Gütersloh: Riemann.

Prada, Miuccia, and Sander, Jil (2009). From Prada to Zara: Is the global recession out of fashion? Strategic Direction Volume: 25, Vol. 3, pp. 9-11

Scrivener, Steven (2002). Characterising Creative-Production Doctoral Projects in Art and Design. International Journal of Design Sciences and Technology 10(2), pp. 25-44.

Scrivener, Steven (2006). Visual Art Practice Reconsidered: Transformational Practice and the Academy. In: Maarti Mäkelä and Sara Routarinne (eds.), The Art of Research: Research Practices in Art and Design. Helsinki: University of Art and Design, pp. 156-179.

Siegel, L. (2008). “The History of Ecofashion”

Silverman, D. (2005). Doing qualitative research: A practical handbook. Sage Publications Ltd.

Summatavet, Kärt (2005). Folk Tradition and Artistic Inspiration. A Women’s Life in Traditional Estonian Jewelry and Crafts as Told by Anne and Roosi. Helsinki: University of Art and Design.

Summatavet, Kärt (2006). Tradition, Inspiration and Artistic Innovation. In: Maarti Mäkelä and Sara Routarinne (eds.), The Art of Research: Research Practices in Art and Design. Helsinki: University of Art and Design, pp. 86-113.

Von Furstenberg, D, Hoffman, L., & Earth Pledge (2008). Future Fashion: White Papers. Chelsea Green Publishing.

Thomas, S. (2008). “From “Green Blur” to Ecofashion: Fashioning an Eco-lexicon”, Fashion Theory, Vol. 12, Issue 4, pp. 525-540.

Tokatli, Nebahat (2006). Global sourcing: insights from the global clothing industry - the case of Zara.

Vardas, Hebe (2010). Marketing eco-fashion: is eco-fashion a fad, the future or utopia? Examining the role of sustainability marketing in the evolving eco-fashion segment.

von Busch, Otto (2009). Upcycling fashion, Upfashioning craftsmanship.

Walker, Stuart (2006). Sustainable by Design: Explorations in theory and practice. London: Earthscan Publications.

Yin, R. K. (2003). Case Study Research. Design and Methods (3rd ed.). Thousand Oaks, California: Sage Publications.

SEI Tallinn (2008). Eestis tekkinud olmejäätmete kooostise ja koguste analüüs. Tallinn: Säästva Eesti Instituut.

Internet resources (links confirmed on April 20, 2011):

Biggs, Michael (2003). The Role of 'The Work' in Research. Paper presented on September 11-14, 2003 at the PARIP conference, University of Bristol. URL: http://www.bris.ac.uk/parip/biggs.htm

Biggs, Michael (2004). Learning from Experience: Approaches to the Experimental Component of Practice-based Research. Paper presented May 13-14, 2004 at the Forskning, Reflection, Utveckling seminarium i Sigtuna. URL: http://www.herts.ac.uk/artdes.research/2004a.pdf

Carpenter, Susan (2010). Recycled denim finds its way into new Ford Focus. Los Angeles Times, 02.12. 2010. URL: http://latimesblogs.latimes.com/alltherage/2010/12/recycled- denim-finds-its-way-into-new-ford-focus.html

Dry cleaning (2010). Wikipedia. URL: http://en.wikipedia.org/wiki/Dry_cleaning

Reet Aus. Upcycling textile waste – adding value through design

Dwyer, Jim (2010). A clothing clearance where more than just the prices have been slashed. New York Times, 05.01.2010. URL: http://www.nytimes.com/2010/01/06/nyregion/06about.html?ref=jimdwyer

Fast fashion (2010). Wikipedia. http://en.wikipedia.org/wiki/Fast_fashion

Humana Estonia (2009). Pluus kui pakend. Bioneer, 28.04.2009, URL: http://bioneer.eu/ eluviis/tarbimine/aid-4424/Pluus-kui-pakend

Jia Xu (2010). IT pollution threatens Pearl River Delta.China Daily, 31.05.2010. URL: http://www.chinadaily.com.cn/china/2010-05/31/content_9913000.htm

Kittler, R., Kayser, M. and M. Stoneking. (2003). Molecular Evolution of Pediculus hu- manus and the Origin of Clothing. URL: http://www.eva.mpg.de/genetics/pdf/Kittler.Cur- Biol.2003.pdf.

Laursen, S. E., Hansen, J., Knudsen, H. H., Wenzel, H., Larsen, H. F. and F. M. Kris- tensen (2007). EDIPTEX: Environmental assessment of textiles. Working report No. 24, 2007. Danish Ministry of the Environment. URL: http://www2.mst.dk/Udgiv/publica- tions/2007/978-87-7052-515-2/pdf/978-87-7052-516-9.pdf

Inditex (2009). Inditex Annual Report 2009. URL: http://www.inditex.es/en/shareholder- s_and_investors/investor_relations/annual_reports

Mintel Oxygen (2009). Ethical Clothing Research Report - February 2009. http://oxygen.mintel.com/sinatra/oxygen/display/id=393875

Pilz, Reiner (1994). Reiner Pilz. Salvo Monthly No 23, October 1994. URL: http://www. salvoweb.com/files/salvonews/sn99v3.pdf

Puura, E. (2010). Kuidas võiks keskmine eestlane igapäevaselt energiat kokku hoida? Novaator, 15.01.2010, URL: http://www.novaator.ee/ET/energia/kuidas_voiks_keskmine_eestlane_igapae- vaselt_energiat_kokku_hoida/

Ruut, Juhan (1997). Kuidas saada rikkaks? Tallinn: Eesti Roheline Liikumine. URL: http:// www.roheline.ee/books/rikkaks.html

Scrivener, Steven (2000). Reflection in and on action and practice in creative-production doctoral projects in art and design. Working Papers in Art and Design 1, URL: http://sitem.herts.ac.uk/artdes_research/papers/wpades/vol1/scrivener2.html ISSN 1466-4917

Scrivener, Steven and Peter Chapman (2004). The practical implications of applying a theory of practice-based research: a case. Working Papers in Art and Design 3. URL: http://www.herts.ac.uk/artdes1/research/papers/wpades/vol3/ssabs.html

Sinsheimer, P. (2004). Comparison of Electricity and Natural Gas Use of Five Garment Care Technologies: Evaluation the Potential for an Electricity Rebate Program for Profes- sional Wet Caring. UEP Faculty Scholarship. Paper 342. URL: http://scholar.oxy.edu/ uep_faculty/342

Sustainable Clothing Action Plan (2008). London: Department for Environment, Food and Rural Affairs. URL: http://aestivaltd.web.officelive.com/Documents/sustainable-clothing- action-plan.pdf

Thalfeldt, R. (2002). Kui palju kulub põlevkivi ja vett 1 kWh elektrienergia tootmiseks? URL: http://www.hot.ee/thalfeldt/1kwh.htm

Uchatius, Wolfgang (2010). Das Welthemd. Die Zeit, 16.12.2010 URL: http://www.zeit.de/2010/51/Billige-T-Shirts

Interviews:

Interview 1: Alo Lepp, the CEO of the garment company Marat, the interview was conducted on February 2011 in Tallinn.

Interview 2: Sashi Anand, the owner of Blue Plate Fashion, the interview was conducted in December 2010 in New York.

Interview 3: Eliza Anyangwe, PAN UK, the interview was conducted in October 2010 in London.

Interview 4: Duncan Wingham, PhD, Professor of Climate Physics at University College London, the interview was conducted in October 2010 in London.

Interview 5: Orsola de Castro, the founder of Estethica and designer for the up-cycling brand From Somewhere, the interview was conducted in October 2010 in London.

A.

Addendum 1

Interview with Alo Lepp

the CEO of the garment company Marat,
the interview was conducted in February 2011 in Tallinn.

Reet Aus – How would you describe the situation in the cotton industry?

Alo Lepp – Cellulose based fabrics, bamboo, etc., could be an alternative, but I don't think cotton will disappear.

RA – Does the big industry talk about its environmental impact?

AL – No, not at all. Other things are more topical. This trend has emerged over the past few years and was not initiated by the producers. I don't see any alternative material that could replace cotton entirely. The best option here could be reuse.

RA – What is the future of subcontracting?

AL – Subcontracting from Asia is shrinking, mostly because of the rise in the local consumption and prices. It is no longer attractive to produce there. Soon it could be just as efficiently done here, closer to the end consumer. It's the reorganisation of the subcontracting market.

RA – Do you use viscose made in Asia?

AL – So far we have used viscose produced here by us. We had the weaving done here, but it was closed down 5 years ago.

RA – Would you be prepared to reopen the weaving unit?

AL – It would be unreasonable. It consumes a lot of energy. The cost of water and energy has rocketed compared to what it used to be ten years ago. This is also what killed the Kreenholm factory. What we could alter is the end product, the sewing process. The problems today, as I see it, are the high production volumes and consumption. High volumes of unsold products that will be discarded in order to avoid them ending up on the black market. Surplus is not given to those who would need the products, either. Reusing these products would be the first step in order to change something in the process. The question is, how to get hold of the products, how to

make the people who decide such matters to change their minds. However, it could turn into a trend if a major brand adopts such practice and others follow.

RA – How much waste material does Marat have?

AL – Not very much any more. We have tried to use them up over the years. But there are certain product groups that remain. This happens for several reasons. It could be that the fashion changes, the measuring scale is unsuitable, only some colours or sizes are left over. Also, in some cases too big orders were placed and products were simply left over. What's more, we used to produce for others, not for our own clients, and the products were very good and trendy. But since it was not our own client, the products have not been used.

RA – What kind of waste material does Marat have?

AL – It's materials from our subsidiary Patricia, which took its production to Asia. The warehouse remains in Estonia, though. Producing in Asia is about half as expensive, including transportation. We have materials and auxiliaries from more than ten years ago. It was a lingerie brand, thus we have all related materials – fabrics, accessories, elastic bands, etc. We would still be prepared to produce lingerie.

RA – What happens to the production waste you generate?

AL – It will be indirectly recycled. We have a recycling company that collects all this waste, a recycling foundation. What happens after, I don't know. There is a new company – Waste Land - who works with this. They pay for this waste. Small waste goes into plastic bags and is taken away.

RA – Is the quality of the materials becoming better?

AL – Marat attempted to maintain good quality, to make durable products, but in order to meet the needs of some of our clients, we also made our fabrics thinner and not as durable. It was a market requirement – to get a cheaper and not as durable product. In fact, Marat has historically made very durable products of very high quality. It all boils down to technologies, starting with how the fabric is made.

RA – Who were these clients?

AL – s.Oliver, Tom Taylor, Esprit, H&M, Jeans & Clothes from Sweden, and big mail order department stores like Quelle, which just recently went bankrupt. They fed from the cash flow generated by their customers; it wasn't a very sustainable business model.

RA – In principle, would the fashion industry be ready to make a high quality product again, if such consumer demand existed?

AL – Yes, absolutely. But since we don't have many Estonian brands, we are primarily subcontractors and there is no such notion coming from this direction. Ten years ago

Asia was three times cheaper, but it has gone up considerably. In other words, the more complex the product, the more expensive it is – it is rather the question of time, not the material. The prices have doubled over the past four years. The price of cotton has gone up by 100%, depending on the region.

RA – Where does Marat get its cotton from?

AL – From Pakistan, China, India.

RA – How much of it is discarded?

AL – I have heard that the volumes are cosmic, but I cannot give you any facts. There are also containers standing in the EU ports, full of unwanted products that will not be used, since the companies have gone bankrupt some time before the goods were shipped. Who knows at what price these will eventually be sold. Humidity has its effect, too, and the goods are not of good quality to start with. They sell these at about 1€ each and you have to buy the entire container, without even knowing what exactly is in it. The buyer only knows what was put in it.

RA – Do you, as the CEO of a company, fear the change in consumption?

AL – No, I don't. Then we would make other kind of products and in a different way. You don't have to produce volume; you can do less, of a higher quality and at a higher price.

RA – We have here a pair of children's wool underwear, marked 'Made in Norway'?

AL – The exact country of production does not have to be stated within the EU. 'EU' is enough. It all depends on the percentage. The fabric comes from Norway. Sewing makes up less than 10% of the production cost. Design is from Norway, too. So – according to this – Made in Norway.

RA – It means if an Italian company sews in Asia, delivers the products to Italy, and then simply adds the label: Made in Italy?

AL – Well, the label is added already there, yes. It is up to the company's philosophy how they prefer to present it.

A.

Addendum 2

Interview with Sashi Anand

The owner of Blue Plate Fashion,
the interview was conducted in December 2010 in New York.

Reet Aus – What is the situation in the outsourcing business?

Sashi Anand – Things have changed. We used to stock up to one hundred items at a time. Then the wholesalers would come to us. We were the middlemen and the wholesalers would buy the stock and then it would go stores to be sold. But slowly over the last few years that concept is totally gone. There are no wholesalers; there are only importers here. You give us the orders, we will import all the goods against that and will supply the stores. Now the trend has changed over the last, say seven to eight years. All the stores have their own labels, their own price tags, so if I am making something for you, I have to supply the goods to you, I cannot give your goods to her or her goods to a third person because every order has been ticketed and has their own label. Previously we used to get only one label and supply to ten, twenty, thirty, fifty different people. But that concept is totally finished. So now everything comes pre-ticketed, it goes to the particular store when it comes, and now there is no warehousing, we get the order when it comes and supply direct to the store. We do not stock any of the goods anymore. It comes in directly from the airport and either we distribute it directly or it goes to the general warehousing and from there we do the distribution to all the stores.

RA – Who are your buyers?

SA – Our buyers are Nordstrom, Bloomingdales, and the chain stores like Marshalls, T.J.Maxx, and these kinds of places. There is also Daffy's, Macy's, Steinmart. We have a lot of catalogue business.

RA – Where do all your garments come from?

SA – India, everything is 100% made in India. But now there are problems. There is a big problem with cotton. Cotton from India was the biggest item that we used to import. But now, this year, I think India has sold raw material of cotton to China, Bangladesh, and they're out of supply. It's going like the stock market.

RA – Does it have something to do with the weather?

SA – I don't know what this scam is and I can't really comment on it, but they are out if it. They don't have cotton.

RA – Is this the reason cotton prices have been rising?

SA – Cotton prices have gone up by 30–40%. I have been in business since 1980 and this is the first time I have felt so helpless, so today I took the order from you for $7.00 a garment. I used to import for $4.00 a piece and then you pay duty, freight, and shipping to the stores from $6.50 or $7.00. But now the same garment which was $4.00, that is becoming $6.00. A 40–50% increase, and then on top of that you are paying duty. And by the time it comes we cannot give it for $6.00. In this country the garment that used to sell for $7.00 because of the recession, every buyer says give us a discount, otherwise they just walk out. They don't give you an order, so we say fine we'll give a 50 cent discount because we are hungry for business now. So we take the order but now the problem is the $7.00 garment went to $6.50, and now this problem came from India. They are not selling to us for less than $5.50. So it's a big problem.

RA – When do you think the prices will rise for the customer?

SA – The prices – December 2009. All the increases have been done — 10–15% price increase we accepted this year in January. Whatever orders we sent in December, in January our manufacturer came back to us and he said sorry we cannot make that quote. We said what the hell, it is a commitment. You people accepted the orders when we sent. They said sorry there is no fabric, we cannot do it. You have to give us advance cash money and only then can we work on it. So we started giving them advances. Okay, buy the fabric and do it. But then the problem is coming up. For example, today you give them $100,000. Okay, this fabric is mine. Then number 8 goes to the fabricator and says, I give you for the same cloth $110,000, and then the third party goes and says I give you $120,000, so they give to the person who gives $120,000. And then the brokers give you your money back and say they can't do it as there is a shortage of raw material in the country. They can't do it. There was a big article today in Indian newspapers. They sent me the cutting today, and it's a big problem that they don't have the raw material.

RA – What do they think will be the solution?

SA – Right now, this minute in India, we don't know. They are talking big things, so let's hope for the best, but at present things are on hold because the US economy is very bad and buyers aren't buying and you can see empty shelves. Buyers are not coming and if they are they want cheap, cheap, cheap. From where do you bring in cheap anymore? You look at China, China is not cheap anymore. It's even more expensive, so then you talk about Bangladesh, and it means every country is getting expensive. In India, we used to think it was the cheapest, but you won't get cheap in India. Now India is the most expensive. I've imported since 1980, exactly 30 years now. I see now the inflation rate is very high, and today again I got emails that what-

ever orders you were given, cancel them because we can't do it or we have to raise the price. We are sitting and thinking what the hell to do, what do we tell the buyer, do we cancel the order? So it's very interesting. It's a big problem. Let's see, I don't know what the outcome is going to be.

RA – So what do you personally think the solution is?

SA – Overall everybody is suffering because where I live I know a designer, she works for Donna Karen and she met me two weeks ago and said, "My god, Sashi, do you know about the problems in India and what is going on with the stock market right now?" Our broker is finding it hard to help us because everyone sells to bigger brokers that have bigger clients like Donna Karen. She said they ordered the stuff, the broker called the next day and said cotton fabric had been sold to some one else and they were now out of it. So she said it's a major problem going on. But still those people can still survive because Donna Karen is Donna Karen. Their prices are high. But the lower price point people are suffering a lot because if we don't get cheaper merchandise, how can we supply the customers? That's our problem.

RA – But for the customer, what will be the situation next season?

SA – Right now what stores are doing is going to the market to see if you have any leftovers. They are bidding up the price. But now the situation is very tricky. We can't do it.

RA – Do you think production will start to come back to the United States or will it stay in Asia?

SA – But in the USA, the labour is expensive. Whatever they will do, they cannot outsource. So they still need to outsource to India, China, and any country. India they prefer because they are equally good, but the problem is language. So that's why you see most of our outsourcing right now. They do it with India, and if they will try to do it here how will they compete with the prices? They can't lower the price point if they do it there. It is very difficult. There you make a pattern you pay $300, to India to make a pattern you would pay $50 or less. So it's a big price difference. So let's hope for the best. That's what we can say.

RA – It's an interesting time. No one actually knows?

SA – Nobody knows, because in the buildings you see, on every floor the people are gone. Mostly leases expired and no one has renewed them. Because if you cannot make money, there is no reason to stay in the business. Everybody is suffering. Or you have an established brand, then it's a different story. Established name brands still bring people who have money. This means that if you have a brand name you will pay $200, or if you are not branded you will go to Conway and pay $7.00. You don't want to pay more money. For the same cotton blouse you go to Conway and pay $7.00, or you go to Macy's and you will pay $34.99 or $69.00.

RA – Coming from the same place?

SA – Coming from the same place but having different names. With their stores we can do private labels, same cotton top, same thing, but if you put the brand name on it you make money. So we do the brand name of course. If you establish your brand you can make a lot of money. Like Tori Birch? It's a huge company right now and stock is like simple blouses embroidered which you can do in India for $4–$5, sale price is $298.

RA – How is Bangladesh doing?

SA – Bangladesh, manufacturing-wise, has the same problem as the USA. But their main problem is that the United States is the biggest consumer right now. Europe can buy 240 pieces of each style. It means less quantity but they pay more price. So from India, people are very happy working with Europe, because you get the price. They will quote 7 pounds or 6 pounds or 8 pounds and we talk about $3–$4. But in the US the volume is huge — 12,000 pieces each style, 24,000 pieces that's how we work. Here buying is huge and all the manufacturers want to work with the US because then they have to run huge factories. So they need the US.

A.

Addendum 3

Interview with Eliza Anyangwe

PAN UK, the interview was conducted in October 2010 in London.

Reet Aus – What are the main issues facing cotton farmers?

Eliza Anyagwe –I am going to put it in the West African context because I work for the assistance section at work and we work predominantly with West African farmers. So the issues that they face are going to be very different from the issues that they face in India or in China or even Latin America simply because of the scale of cotton farming. So in West Africa the farmers are mainly growing cotton and on a very small pieces of land. So it is rain-fed first of all so you don't have irrigation issues, but it means they are dependant on rains and on climate and if they are having climate change issues that affects how often and how much rain they get. We tend to have not necessarily dumping but just lots of cotton and lots of pesticides that are banned in other parts of the world especially in the West. These are still being used on cotton plantations on cotton fields in West Africa. And so what you have is farmers probably who have no literacy or very little literacy are just given pesticides by the middlemen and they into a lot of debt to buy those pesticides. And it's getting the money back that tends to be paid by next season's crop. So what they will do is buy all these pesticides and they are told to spray every two weeks and that's all they know. They don't know what the pesticide does. I just came back from a meeting in West Africa and we went to the market and they had herbicides that were marked as hazardous. There is all this care and health and safety information and it's all in English, and because farmers are French-speaking if they speak, they don't understand and they will not attempt to learn. There are some rules now, because before the pesticides used to come in big drums and poor farmers would finish using the pesticide and then start storing grain, start storing water in those drums because again they spend so much money buying those pesticides. It's one of their most prized possessions. So they have the pesticides in the house, next to the food, next to the baby because they don't want to leave it outside. They spent a lot of money on them. And so we had every season, every growing season farmers are complaining of the health issues. Farmers were saying to me that their profit on conventional cotton was not profit, it was money for hospital bills. And so there are so many, so many social issues and then afterwards when they finally grow the cotton and they finally sell the cotton, the

middleman is telling them actually that we are taking this percentage for the pesticides. And there was so much corruption in the system that at the end of the day, the farmer makes so little money and that's before you talk about trying to sell it to Europe or America where there are subsidies and there are market barriers to stop the trade from these countries. So those are the problems that we have seen. Obviously when you use pesticides, it damages the soil so the farmer has to use even more pesticides the next season to get the same amount of crop. And it damages the biodiversity. One of the farmers said to me, I thought I had to kill everything and they don't know that some insects are bad for your soil, or for your crop, and some insects are good for your crop. And they just think I need to make money, so they grow as much cotton as they can every year.

RA – How long does it take to make the soil clean again?

EA – Three years. The first few years, and this is from a lot of the farmers, the first few years of growing organic cotton are very difficult because you have to invest in your soil, you have to improve the soil nutrition and that they say takes on average three years, the conversion process. So it is interesting to see how we still need to discuss the costs of going organic. Because the farmer has to bear all of those costs and has to bear the cost of getting started and think about where he is going to sell his organic cotton when it is in rotation. Because you cannot label it organic until after that period of time. And so it takes about three years and they have the crop rotation process which helps put more nutrients in the soil. We can also do something like mulching and putting the dead plants and dead leaves on top of the soil. But it takes awhile and the initial thing that happens is that the yields of organic cotton go down before it goes back up. You just need to be dedicated to it. You know you can't spray your crop and ignore it for two weeks and then come back and spray it some more. Because you have to manage your pest levels. But the positive thing about that is not only is it a good thing for the soil, but also when the farmers learn to do that they are learning to count and recognise insects. These are people with no education. They go away really excited and go say to their children, you have to go to school because it becomes important to know things, whereas the conventional farmer has no idea what is going on.

A.

Addendum 4

Interview with Duncan Wingham

PhD, Professor of Climate Physics at University College London, the interview was conducted in October 2010 in London.

Reet Aus – So our real interest actually would be to speak more about the background and what the situation is when talking about different industries in relation to climate change.

Duncan Wingham – Well I don't think there is any doubt that we are by our connection teaching the planet. This is having a number of directly observable consequences, so it is a straight fact that the sea level is rising, for example. It is a straightforward fact that land temperature is rising. It is a fact that ocean surface temperatures are rising. It is a fact that, particularly in the Arctic, extensive reductions in the area around the ice in which each year, more or less, is covering a smaller and smaller area. All of these are not things which one needs to really discuss the truth of or not. They are observed facts. I think that it is fair to say there is no reasonable alternative to these being and explaining these as being a consequence to our human use of fossil fuels, because there simply isn't any reasonable explanation of the accelerated rises we have seen in the last 50 years. So I think that one can take, quite reasonably, the view that we are starting to alter the planet. That we are in particular starting to make it warmer. The next question really is what will happen if we really don't do anything about it. It's actually an extraordinarily difficult question to answer. A great deal of time and effort and money is spent trying to answer that question, using sophisticated computer models. It's actually very difficult to know whether the results of those models are accurate of not. Indeed there is no obvious way of testing them. On the other hand, I think that the physics of why warming is occurring is simple and there's no real reason to doubt it, so it's clear that the average global average sea level around the world is going to increase. The difficulty about predicting the future is identifying what the regional variations are, and there are areas of the globe which are getting hotter faster that other areas of the planet. Similarly the sea level rise is not uniform. There are some parts of the earth where the sea level is rising much faster than other parts of the world. The ocean is a complex thing, it has currents which are moving heat around, so according to how the currents move the heat around the sea level can get higher in some places and less in others. In fact, a few places are even dropping.

So the regional picture is complicated and it is debatable the extent to which its possible today to say what the change in 50 years time will be in any particular region of the planet. I think that there are some scientists who are much more robust in claiming their ability in making those predictions and there are some scientists who are more sceptical about out own capability. I would say I'm in the sceptical camp.

What is certainly true is that the uncontrolled continued use of fossil fuels will get us to a place where I wouldn't want to be. I think it is possible to see this in a fairly simple way, as we have unused oil reserves which amount to about two times the amount of fossil fuel that has been used since the start of the Industrial Revolution. In other words, if you just look at oil then we've basically got about as much left as we've already burnt.

Roughly speaking, the usage so far will increase our global temperatures by two degrees or so if we go and burn all that oil as well. Well now we're talking about 4 degrees. And as I say, the regional variations are large. So that would condemn some parts of the planet to 8 degrees. Perhaps one could live with that. What really gets frightening is when you start thinking about the unused coal reserves on the earth, which are a factor that is 8 times bigger than we have used in 150 years since the industrial revolution. If we burn all that lot, then you are looking at a global average temperature rise of 10–11 centigrade and average temperature rises in some regions much higher still. Changes of that magnitude totally alter the entire natural environment. It is true to say that much of the environment today is not natural, although indeed there are very few parts of the world left that could be described as reasonably natural. And those are a rapidly disappearing, for example in South America. The oceans themselves are more or less emptied already. One could regard ocean as a biological desert compared to a hundred years ago.

If one changes the temperature by numbers like 12 or 13, then the entire basis of global agriculture cannot be sustained in that situation. So that seems to be that the world has a choice. It can either decide that it will deliberately seek ways of reducing consumption of these fuels with the intention of trying to maintain the climate in the present state that it is. Or we can go on and do the things we have already been doing and expect over the next hundred years that the planet will become an extremely difficult, different place.

The ability of the human population to adapt to that remains to be seen. One suspects of course that wealthy countries can adapt, poor ones cannot. That's always been true of course. But there is no question in my mind that we do face a choice that needs to be made. The difficulty one faces in the modern world or today's world, let us say, is that the world doesn't possess a system of decision making which lends itself to making these kinds of decisions. There is no sign of a reduction in the use of these fuels. In fact, there is not even a sign of reduction in the rate of the use of these fuels which continues to rise so that the political decision making, such as it is, is very difficult. It requires upwards of 150 separately organised and governed nation-states to act together. The decision-making apparatus doesn't really exist. Europe is unusual actually. Its population, by and large, is broadly sympathetic to the need for reduction in fuel consumption. Indeed Europe has clearly been vocally pushing for a reduction. It's equally true that Europe is exposed in its own consumption of energy due to sup-

plies from Russia, and so there is a clear motive in Europe to reduce its use of fuel and particularity its dependence on external supplies. So there are other arguments for Western Europe to reduce its consumption of fuel, which are separate from concerns of climate change. Nonetheless Europe, in particular, has been very supportive of the need for action. One couldn't say the same thing about the USA. China, which is another big player, has been recently altering its standpoint because it's coming to understand the enormous environmental impact that its own economic expansion is having on itself. So China's position is changing, although not very radically, and it's worth bearing in mind that its cement manufacturers contribute about 10% of the carbon dioxide in the world's atmosphere. There is no known alternative to concrete as a building material, nothing that can remotely compare with its cost and strength. So China is a huge consumer of concrete, and so that too is a considerable difficulty.

RA – What will you do? What is the solution there?

DW – Well firstly, the question seems to be based on the assumption there is a solution and what one means by that. It's very clear that there are areas of earth at present which have far more water than is needed. It's very clear that there are other parts of earth that have far less water than is needed. Transporting water is not an inexpensive affair. It is as expensive to transport water as transporting any other fluid.

In Greece, in summer, people are already paying 5 euros per litre of whatever it is to move their water around. There are certainly areas of the planet that have undergone expansion. A lot of this is based on ground water. This is true of the vast majority of the southwest USA. It's true of a great deal of the third world too. I noted recently that the Angor Palace in Cambodia is now under threat due to ground water extraction to supply the growing cities in its immediate vicinity. So ground water extraction at the moment is supplying large urban congregations. Mexico City is another one. Sooner or later that can't go on indefinitely either. Left to its own devices, there is not much doubt as to what will happen – that the price of water will go up and that nations with a lot of it, like for example Estonia, will no doubt start exporting it to countries with less of it. I mean, that is the way the economic system works. I don't think that's a good thing or a bad thing. That's another matter. This comes back to the observation I made before that our system is organised into nations which are essentially in competition. It's not easy to see why water should be regarded as a resource economically different from coal or oil or any other commodity on the planet. So I do not have a simple answer to your question. There are areas where people have so much of it, don't know what to do with it, they leave it hanging around in lakes, for example and other places where small quantities are adequate.

RA – Thinking about energy, what do you think the solution would be there?

DW – Well, I think that one has absolutely no choice but to accept that nuclear power has to be regarded as neither a good thing or bad thing. Because what is being discussed here is the least of the evils. One could argue that we should try to move to a situation where all energy is renewable or sustainable. I think it is straight forwardly true that there is no serious way of doing this for decades, and any strategy we are

using has to accept that the world will or want to consume energy on a fairly large scale. So I think my number one observation would be that we need to use nuclear power. I, as a physicist, am less worried about the question of leaks that occur from power stations. In fact, there is very little evidence that leaks have caused any significant damage. Certainly in the UK the largest source of radioactivity is natural and comes from uranium. People have lived with that for a long time without worrying too much. There is of course the question of safety involved in these reactors, and there is no question so that if they are not maintained properly they are extremely dangerous, as Chernobyl showed and an earlier American accident. But in some parts of the world reactors have been operated for the better part of fifty years without problems. I have no doubt that one has to accept that nuclear power has to grow as it is probably the only serious way of producing quantities of energy that our world demands.

If you got one of these websites to determine your carbon footprint, you'll find that if you've take one plane journey a year your carbon footprint is vastly larger than all the other bits of carbon you've already used. In other words your domestic consumption of energy is tiny compared to flying across the Atlantic. So aircraft travel is something we will have to reduce. Actually extraordinary travel occurs in larger numbers. Much of the travel in and out of airports is driven by business, not holiday-makers. I constantly have long discussions with people who can't afford air travel. Just use a computer to meet people all the time. Trains have very expensive infrastructure which is why the modern world has moved to aircraft, on the other hand their energy consumption is very much more efficient. Though as efficiency becomes more important, infrastructure is necessary. Trains will come back into fashion.

The energy standards of buildings vary enormously around the world. In your part of the world they tend to be very high because you have very cold winters. England historically had been a place with mild winters so that energy performance in England is very poor. No doubt the country is going to have to address that in a much more serious way than as it has before. So I think that one has to pursue alternative forms of energy such as wind. But it's hard today to see wind power replacing entirely our demand for oil, coal, or nuclear power.

Let's be careful with this idea of renewable and sustainable energy. There is no such thing really. These windmills have to be built and they have to be maintained so it is not exactly free, and maintaining windmills in the middle of the ocean is not exactly inexpensive and has it's own energy cost. So one has to be realistic about what we're talking about. So none of these things are easy; they all require changes of behavior. I think it's the issue of changes of behaviour that have led to the growth of climate skepticism. Reducing dependence on fuels now impacts economic activity, in particular economic freedom, by which I mean the freedom of individuals to seek whatever ways they wish of making a profit. Folks who take the view that that's a good thing are always opposed to any process which may seem to regulate their economic freedom. So there is no doubt that with the growth of political demand to do something about climate, we now start to see systematic organised moneyed interest seek to use whatever methods of modern politics and propaganda are on hand to persuade people of a particular untruth, which is that they are not responsible for climate change. So we have groups of people saying yes, we recognise climate

change is real but it has nothing to do with us. And by so saying that, one is free to go on doing whatever one wishes to do. As soon as one accepts the case that changing climate is the result of human activity, then one has to accept responsibility for it. Once one has accepted responsibility for it, one has to acknowledge that they need to change behavior. So it doesn't surprise me that we are now running into what could be realistically called serious organised political opposition. There is no doubt in my mind that if we wish to reduce fossil fuel consumption, we have to change behaviour. There isn't any alternative to that.

RA – What, in the last ten to fifteen years, has changed in your behavior because of your inside knowledge of climate problems?

DW – I would say my own behavior hasn't changed very much. Indeed I wouldn't regard my own behavior as particularly responsible in terms of energy consumption. I mean go back to the observation that the if you fly around the world, which I do, and probably that's how you got here too, the amount of energy you've consumed to do that will dwarf any energy that you will save in running your house for example or even running your car. I personally don't have a car but it is not for that reason. It's because I live in the middle of this city and it is not practical, at least it is very expensive to do so. One thing I don't do anymore is fly to Paris, and I'm sure that if there were high-speed trains to other parts of the continent I would use them. I would stop flying. If you were to ask me if I would stop having vacations in Greece, because of this issue, the answer is no. But I would sooner or later. We will have to stop using these planes. I don't believe in the argument that if every individual does something, it is a solution. So there is no question in my mind that these behaviors will need to be changed by legislation.

Take this city we are in. The vast majority of buildings were built between about 1840 and 1890, certainly half of all the buildings. They were built without regard to energy consumption at all because coal was so cheap. Every single room in the house had a fireplace, which burned only coal all the time. And indeed you probably know about London smog… well that's why. Because even if you look at the most ordinary of these houses you will see they have sixteen chimneys all of which smoke. So in order to make those houses efficient requires a considerable sum of money, and I don't think that individuals would be persuaded to do that unless there is legislation which either encourages them to do it or assistance to help them do that.

RA – Is it because disasters and catastrophes are still too far away from the industrial heartland to raise the consciousness about the necessity of the changes you describe?

DW – There are a number of difficulties. One is the difficulty of linking any particular event to climate change. This is widely done in the press and really cannot be regarded as a scientific point of view. So any given flood, any given hurricane, any given wave can't be blamed. It's impossible to ascribe that to be a consequence of climate change because there is a simply no way of showing scientifically that it couldn't have happened anyway. The other difficulty is the creeping effect. People think sea levels

go up 10cm in fifteen years. To me that doesn't sound like much, but you let that go for thirty years, now you've got half a meter and that's starting to be a significantly larger number. A lot of places are going to have difficulty if the sea level goes up half a meter; not so many if it's 10cm. But, at the same time, one can see signs of willful blindness. One area that has been clearly under threat for a long time, where the sea level is rising, is the southeast coast of the United States and Mexico.

I was quite astonishing to me to watch New Orleans get wiped out and then have a nation sit there and watch and to do almost nothing. So there seems to be something in many human psyches that allows people to sort of do this, to look away from any given consequence.

RA – How do you define climate refugees?

DW – There are already people coming from Africa just because their living place is not suitable for them anymore; because temperature is rising and there is not enough water and so they are moving into other countries. In that sense, they are climate refugees.

RA – Where would be the safest place to live in maybe 20 years?

DW – Well, the temperate latitudes are definitely going to be better than the tropics. Changes in temperate climates won't have huge interacting effects. The plant life will alter the sort of trees you now get in England to the ones you find in Northern Italy, for example. But it is very easy to see that one could adapt agriculture. Western Europe is appropriately highly industrialised anyways. So it's not difficult to change crops. I'd stay away from the tropics, I would stay away from sea level, and I would seek to be in temperate latitudes in countries with highly industrialised agriculture. I'm describing roughly Western Europe, parts of Australia, the Eastern seaboard of the United States, and some parts of the Midwest but not all of it, Japan, parts of China.

A.

Addendum 5

Interview with Orsola de Castro

The founder of Estethica and designer of the upcycling brand From Somewhere, the interview was conducted in October 2010 in London.

Reet Aus – What is your personal experience in sustainable fashion? What is happening right now and what can we expect to happen over the next two years?

Orsola de Castro – Right now I think it's the most exiting time, particularly in the UK. What they love in the UK is movements and this is a movement. It feels a little bit like a revolution. There is a real change in the attitude and it has to happen quickly. I am very proud to feel that Estethica is very central and has become the right place, the right home with the right attitude. So I'm happy and proud to have founded it with Filippo. The real change, I think, is that the big ones are coming to the small ones to ask for solutions. And the other thing that is particularly exiting in the UK is that it seems to be a major solution, whereas the most creative one is upcycling. And that is what is really firing imagination, for younger students and young people especially. So it's like a mix. On some level the high street really wants to respond to this with a product and is trying to find ways to do it. We personally are working more than ever. We did a collection for Tesco even, the second biggest clothing supermarket in the world. We analysed their waste. If someone like Tesco would approach a label of our size, it's quite unprecedented. At the moment we are working with Speedo who is giving us all their unsold swimming suits, as well as pre-consumer waste from their Italian factories. Again – a giant fish is turning to a tiny one – and this not just happening to us. It's happening to countless UK labels, such as Goodone, Christopher Raeburn… It seems that maybe, for the first time, the stigma – this kind of provincial idea of are they selling clothes or are they selling tractors – is starting to be removed from eco. Not everywhere, maybe, but certainly with Estethica. And this season we had the same type of buyers in Estethica that you would normally see at New Gen. This really was like standard successful high end fashion. It was quite different.

RA – Looking back, what have been the biggest concerns for eco fashion?

OdeC – For me personally the stigma has always been an issue. I started in 1997 and for a good 6 years, even more, 8 years, the word eco fashion did not exist. You were

just recycling, you were creative because if you reused something that was already there in existence that was not ecological or saving a world . . . . And then suddenly around 2004/2005 this eco kind of came along. And yet again people were wondering: are they selling tractors or are they selling clothes? Many of us were born to be labels not missionaries. I can understand where the ecological fashion has its roots – it is a combination of politicians, missionaries, and hippies. When you are talking about communities, about working in Africa, working in South America – that's where it comes from. But enormous work has been done within the fashion industry to turn it into a proper business. And I think that at one point we were just very heavily stigmatised – partly with reason, partly with no reason at all. I mean, there have always been creative minds behind all that. So for me it was the biggest hurdle. Somehow, pushing it from the periphery right to the mainstream fashion industry was the biggest challenge. And this is probably why I am so happy – for the first time it feels like this is where we belong, this is where we are, and we are taken seriously.

There are interesting things… in my opinion people thought for a long time that eco fashion does not have the right aesthetics, and I challenged that notion several times. I always believed that eco fashion was not presented well enough. Most labels did poorly with their marketing, did poorly with their look books, with all of their presentations. But there were always jams there to be found if you were looking for the right clothes. What I'm seeing now and I know particularly labels in London Fashion Week, Estethica, I know them inside out and I have seen enormous change in the way they are presented. They remained consistent with their aesthetics, it's improved. The quality has improved, there is more. But it seems to me that the utmost victory was that not much was changed. We are being taken for what we are. We have not ultimately compromised that much. We have not become like the fashion industry that we were born to antagonise, we are not emulating that. We have kept our identity and I think that more than ever, this identity is now regarded as creative, effective, and fashionable...

RA – What is happening outside the UK?

OdeC – Italy is picking up. Once we have Italy onboard, the tables will be turned. This is where the industry is and the moment the Italian industry understands that it would be a unique selling point for them. Eco fashion will suddenly become fashion without the prefix eco or ethical or sustainable or what not. There is a big shift, a big movement. In places like Sri Lanka, for instance, the entire manufacturing industry is going to be sustainable. They have an organisation called Garment without Guilt for which over 80% of their workers are unionised. Basically, what is done is in order to compete with China or Bangladesh. They use sustainability as an argument and they have attracted an enormous number of customers. The quality is perhaps not the best at the moment, but with events such as Sri Lanka Design Festival or Columbia Fashion Week, it is gradually growing. They are attracting all of UK high street – Walmart is going to produce there, starting now with small units and attracting some name designers. Once Italy wakes up to the phenomenon, we will have a place to produce. It will centralise it, in Italy everything is quality... And they really are beginning to wake up. The US is vast. There are a lot of labels; there is a lot going on. But because it is so

huge it feels almost like everything is slightly marginalised. The US is very big and also, I think, slightly different from the UK. They are more focused on the organic cotton because they have such massive producers and Made-By and this kind of approach to ethical fashion. I personally, and not because I'm designing an upcycling label, do feel upcycling is more advanced at this point. With organic, there are obviously questions like – is the quality good enough, is the print good enough, are there good enough textile designers to produce...

RA – Is it expensive to work with trash?

OdeC – From Somewhere dresses in Tesco are cheaper than anything else since waste costs one third of the normal material. Most companies overproduce by at least 20% so they get fabric from there. Of course, in terms of social benefits it cuts over time because it is already there, because of the environmental benefits it is not just the explicit idea that it will end up in the landfill or eradication. What really makes the difference is the fact that the waste is already there – it has already been washed, it has already been tested. That way, what we are really saving on is water and energy. That's the real story. I agree that the consumer still thinks landfill. But I think it very much varies from country to country. Once again, there is not much production in the US besides downtown Miami. If you don't have an industry, you would not know how to work with waste. This is why I find it interesting. I think China will understand the value of waste. Waste has always been reused, but we have never before produced as much waste as over the past 25 years, so we have become very, very lazy. I think it will start with colleges, they will have courses, teaching people how to go in to big companies and recycle. For big companies, I think, it will be standardised within the next 5 years.

RA – Is making eco friendly fashion a new form of making money or is it an awareness-based decision?

OdeC – It is both. In the sense that you cannot influence business unless you are making business. And you cannot change industry, such as the fashion industry, without starting from somewhere – I mean fashion industry covers everything from agriculture to communications. The change will not come overnight. It will take years and years and years. When we did the collection for Tesco, quite a few people accused us of greenwashing Tesco, and I'm super aware that for them the tiny amount of clothes they do with us is in a way a form of making themselves look green rather then making an enormous amount of money. But the correlation has to go hand in hand. We just had a huge financial meltdown. I think what we are looking at is a new way of producing and not just for the fashion industry but for industry in general. The last thing we need is apathy; the first thing we need is action. But we still live in a money-driven society. You can only bring about change by convincing the kind of people who are in power now, and what convinces them is money.

RA – What do you think, what trends are coming next?

OdeC – Fashion is ever so brilliantly predictable – so of course, after just having the

80s, we will be back in the 90s. But here is the link – the 90's are grunge, so grunge will be the ideal platform to actually revive the idea that we hated fashion. In terms of upcycling, grunge is made for it. So again, why upcycling interests me is because I think upcycling carries the seed of aesthetic of the eco fashion movement. I think you can wear yoga pants made from organic cotton or an organic cotton t-shirt – but who's to know it unless it's written on it? The aesthetics of upcycling is obvious to the consumer and it will be even more so as upcycling moves on to the high street. So I think we are witnessing a massive, massive shift in the fashion industry. We will go back to waiting; we will go back to wanting, will go back to a different kind of price. I think things like pre-destroyed denim or a 5 dollar t-shirt will look like our moment of madness, and I think we will return to a completely different approach.

I think in 20 years there is not going to be eco fashion and fashion, it's going to be fashion and non ethical fashion. I am not opposing the fact that fashion is super democratic at the moment. I am not opposing the fact that there has to be cheap clothing available for people who struggle to put food on the table. I am not saying that. I feel that it is about rebalancing; we have lost the sense of balance. We have to find new solutions and this is where fashion steps in, because fashion talks: you wear it, everybody sees it – you are talking. Ethical fashion is also a consumer-led movement, where more and more people are saying: Hallo, I'm against these low prices; I'm against this social exploitation. I know I'm an eternal optimist, but I feel so confident because I have seen things happen so fast over the past 14 years, as well as over the past 5 years.

A.

Addendum 6

Waste management questionnaire

The questionnaire was put together by Ann Rosenthal in 2011 as part of her master thesis. The aim of the questionnaire was to analyze the nature, drivers, impacts and barriers of eco-innovation in textile industry. Part of the questionnaire was used to gather waste data into the database available at www.reuse.ee (part of it can be seen in Addendum 7). The waste mapping project and the creation of the website was financed by Estonian Environmental Investment Fund.

1. Describe what kind of waste your company creates. Focus on such waste that has not found a good solution yet or could be used in a better way. Describe the following parameters:
   type of waste; average volumes in a month/quarter; chemical composition of the material colour; patterns, etc.
2. What solutions are or have been used for the waste until now? Any charity?
3. What kind of criteria are being considered while purchasing input materials?
4. What kind of external aid would help your company find new solutions for reducing your environmental impact?
5. What do you consider to be the biggest environmental impact of your company, inside the production cycle as well as during the whole product life cycle?
6. Which innovations/changes have been made in recent years (or are being planned) which also help decrease your environmental impact?
   Management system: certificates, calculation of parameters, training, feedback, changes in responsibilities, new goals, improvement, etc.;
   Production and sales; Decreasing pollution vs. optimising processes vs. innovation in design; Technological vs. non-technological;
   Main processes vs. auxiliary processes; Innovations in input: water, energy, material use, choice of materials, choice of methods.
7. What has been the most important impact of these innovations for the company?
   Reducing costs; Success of the product/service, quality increase; Increase in capacity, process speed, flexibility, productivity;
   Employer satisfaction, improvement in working conditions;

Influence from other companies or interest groups.

8. How is the impact calculated? Any method, indicators, measuring tools? Do you calculate environmental costs? Which indicators could be used for presenting the environmental improvements of your company to interest groups outside the company?
9. How big (magnitude, % of turnover) was the investment in reducing environmental impacts in the last 2 years (including investments where the environmental impact was a side-effect)?
10. Do you have a person or team (e.g., development team) who deals with environmental issues or design? In Estonia or on a corporate level?
11. Are the abovementioned changes innovative internally for the company, innovative on the Estonian market, or innovative on the global market? Any patents?
12. What are the main drives for making such changes?
    Law, regulations, standards; Client interests; Market conditions; Competitive advantage; Owners' interests; Trends and unwritten agreements inside the industry.
13. Are the changes mainly internal developments (in an Estonian company); on a corporate level; based on cooperation with a research organisation, consultation company, etc. or a bought-in solution? Are you satisfied with the cooperation?
14. What has been or could be the best support for you, what could be improved?
    Cooperation possibilities; Positive examples, benchmarking; Databases, information; Consultation, training; Financial support; Infrastructure; Eco labels, consumer campaigns.
15. Have you done or ordered any research for innovation? Is there a good possibility to do that (potential partners) and enough information?
16. Where do you gather information about new developments, market possibilities, market changes, etc. (e.g., cooperation partners, fairs, research, industry union, media, internet, etc.)?
17. What kind of information is lacking, e.g., material-specific, technological, marketing information, cooperation possibilities, environmental issues?
18. What are the main barriers for implementing changes (slowing it down, plan has been dropped, etc.)?
    Internal vs. external; Regulations; Financial issues; Lack of knowledge; Lack of motivation; Lack of possibilities (employment, suppliers, partners).
19. Have you reached your expected goals while implementing a change or innovation?

A.

Addendum 7

Waste Data

Uuskasutuskeskus

Field of activity: Enabling circulation and reuse of post-consumer products

Type of problematic waste: Clothing and home textiles recollected from Estonian consumers; main materials are cotton, denim, synthetics, outdoor clothing materials

Terms of transfer and use of waste, cooperation possibilities: Free to claim, materials can be collected and sorted by type if necessary

How and where is production waste currently used? Mainly donated for charity and given to craftsmen

Coats Estonia

Field of activity: Production of zippers, sales of sewing and handcraft supplies

Type of problematic waste: Scrap zippers; plastic granules (leftovers from zipper teeth)

Terms of transfer and use of waste, cooperation possibilities: We are interested in giving away all or nothing. The material will not be sorted. EXW terms of delivery: containers are ready for take-away with new clean containers left in exchange. Delivery should be with agreed regularity. Resale of material is not permitted; the purpose should be reuse.

How and where is production waste currently used? Ungraded scrap product goes to landfills, as no better solution has been found. Plastic granules are sold for reuse but the company is interested in a more cost-effective solution.

Available: Scrap zippers

Category: textile fittings

Material: polyester

Packaging: container

Source: post-industrial waste

Quantity: 2-2.5 tons per month

Description: Mainly polyester, small metal details (carriages/fastenings and material called ZAMAK) are attached. It would be possible to sort the material into four groups

(see the photos):

1. spiral zippers S40 and S43 e.g. polyester ribbon with plastic spiral;

2. spiral zippers S60 and S80;

3. plastic zippers P45, P60 and P80, which is made of polyester ribbon to which melted plastic granules are poured as zipper teeth

4. plastic zippers RT25, which consist of 19 mm wide polyester ribbon and 10mm wide spiral

Contract period: termless

Contract terms: fixed regularity of delivery, ungraded material, containers are provided by receiver, material is not for resale

Price: according to the agreement

Time left: until a cooperation partner is found

Ilves Extra

Field of activity: Production of sports and leisure clothing and hats

Type of problematic waste:

1. Fabric scraps from cutting;

2. cardboard tubes, leftovers from fabric rolls

Material description: Mainly polyamide, polyester, polyurethane; material is ungraded and mixed with plastic film and paper. About 10–15% of textile used in the factory goes to waste.

Terms of transfer and use of waste, cooperation possibilities: The company is willing to give away ungraded material packed in bags.

How and where is production waste currently used? Scrap products and larger textile leftovers are sold in a factory outlet with negotiated prices. Cotton batting leftovers have a big demand and are mainly used as cushion filling material. Some material is sorted by a waste handling company and resold, but some also reaches landfills. Some cooperation is done with educational institutions as well to reuse waste.

Other comments: The company is interested in finding a partner that could provide cotton or flannel leftovers to be used for cleaning machines.

Baltika

Field of activity: Creation, production and retail sales of clothing collections

Type of waste:

1. Pre-consumer scrap products;

2. fabric scraps from cutting, post-industrial waste

Terms of transfer and use of waste, cooperation possibilities: Cooperation terms have to be discussed and agreed upon. Baltika is interested in offering materials for reuse projects but the company is not ready to take on organizational responsibilities (measuring volumes, providing an overview of leftover materials, etc.)

How and where is production waste currently used? The realisation of fabric scraps is organized by production department. Pre-consumer scrap products are collected and redirected to different reuse and donation projects. Currently most cooperation is being done with Hula designers, who redesign the products and sell these with their own trademark at Fashion Street. At Fashion Street it is possible for everybody to give away old clothes (all brands of Baltika), which are then reused by Hula.

Wendre

Field of activity: Production of home textiles (blankets, cushions, mattresses, etc.)

Type of waste:

1. Greasy polyester fiber;
2. foam leftovers;
3. cardboard tubes from fabric rolls

Terms of transfer and use of waste, cooperation possibilities: Wendre is interested in finding any solution that is better than sending waste to landfills (which involves paying a waste tax).

How and where is production waste currently used? Most of the production waste is reused in-house or sold to other companies for reuse. About 5% of all production waste needs a better disposal solution.

Available: Greasy polyester fiber

Category: fiber

Material: polyester

Source: post-industrial waste

Quantity: 30-40kg per day

Description: Leftovers from cushion filling material that became greasy during the production process.

Contract period: termless

Price: free to claim

Time left: until a cooperation partner is found

Qualitex

Field of activity: Production of tricot fabric, sewing factory

Type of waste:

1. Fabric leftovers from cutting;
2. fabric leftovers from joining fabric rolls;
3. fiber from fabric tearing;
4. test-pieces of fabric of different materials and sizes used for laboratory tests
5. ungraded bulk of thread roll ends and plastic film, cardboard and carton packaging

Description: Cotton, synthetics, wool. Materials are ungraded; only those materials which can be sold for reuse are gathered separately. The most problematic material is wool.

Terms of transfer and use of waste, cooperation possibilities: Qualitex is not interested in giving away materials for free.

How and where is production waste currently used? Some waste is sold for reuse (e.g. fabric ribbons which can be used for making rag carpets). The quantity of problematic waste is low. It is gathered in containers and stored at the site until a good solution is found or the material needs to be sent to landfill.

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