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Teaching Sustainable Design to Textile and Fashion Students

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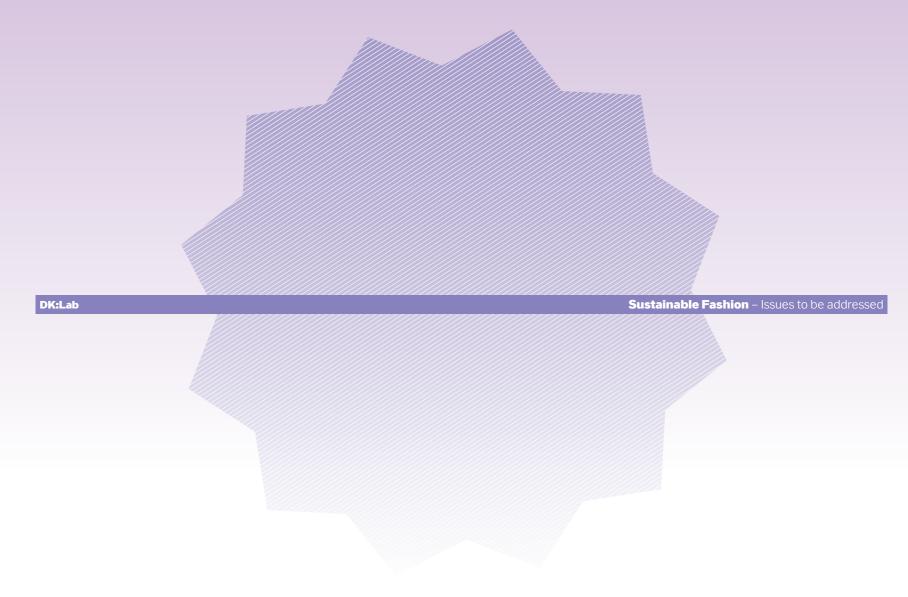












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Sustainable Fashion

- Issues to be addressed

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We kindly thank

Ms. Reiko Sudo, textile designer, Director of NUNO, Mr. Ikeda and Ms. Nakajima of TEIJIN. Without their support and inspiration the project 100 % Polyester would not have been possible.



DK:Lab Sustainable Fashion – Issues to be addressed

Sustainable Fashion - Sustainability as a Mindset

By Mette Strømgaard Dalby, Head of Development, Kolding School of Design



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- from a micro and macro perspective By Vibeke Riisberg



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Sustainable = Fashionable

By Lene Hald



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By Line Hangaard Nielsen

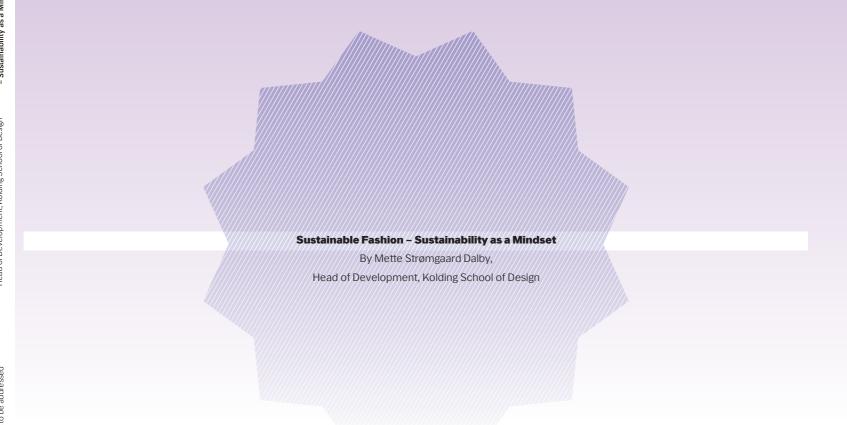


100% Polyester - the TEIJIN ECO CIRCLE PROJECT

- Student designs











wonderful thing.

Hove fashion, darling! A lot of us appreciate the way ers do not doubt the significance of these aspects fashion enables us to play with identities. One day in relation to the creation of a modern identity and we wear a 1950s inspired dress looking like somecommunication of that identity. However, it is hardone from the TV show "Mad Men", the next day we ly vital, and not many would permanently trade their access to food with the possibility to acquire a fashhave on a pair of jeans, a small black dress or something completely different. The point is that I recogionable garment - although I too have read the efnise the fact that fashion is important and essential. ficient self-branding of the fashion people telling Fashion reflects our time, gives the user the opporstories of how, back in the day, one would eat oattunity to play with different identities and in some meal for three weeks just to be able to purchase this cases, although few, fashion can be equated with an season's must-have bag.

artistic experience. However, the majority of fash-

ion – and the various fashion brands – is primarily

commercial; that is to say a business that someone

has to live and make money on. When everything

comes together in an artistic vision, a craftsman

prowess or a technical skill, fashion is definitely a

However, at the risk of being lynched by all the

world's fashion editors, I will state that fashion is not

vital. When looking at Maslow's hierarchy of needs,

where the physiological needs for obvious reasons

(survival) form the basis, there is quite a long way to

self-realisation and the need for free, individual ex-

pression through clothes, accessories and gadgets.

20th and 21st century sociologists and consum-

Where am I going with this? Well, if fashion is not outright vital, we should carefully consider the way the fashion industry impacts our already damaged planet. In other words, we must take action and a closer look at one of the most polluting industries worldwide. We must innovate the way the fashion industry conducts its business, both when it comes to production, choice of materials and disposal. Kate Fletcher, author of the trendsetting book 'Sustainable Fashion and Textiles - Design Journeys', puts it this way: "Business as usual or, more to the point, fashion as usual is not an option".

In general, there are two kinds of innovation: incremental and radical. The first kind can be identified as

the small steps that, when put together, can create large changes through streamlining, rationalisation and minimising of resources. Radical innovation, on the other hand, is something entirely different. Here, one creates a completely new foundation for speaking about and doing things; one example could be the Internet's influence on our ability to communicate globally; or the Cradle-To-Cradle mindset, which consciously focuses on not creating waste and instead, having everything enter an eternal cycle of recirculation. This is a vision of considerable proportions: wanting to eliminate the concept of waste and instead, refer to industrial and natural recycling, respectively. In the industrial cycle, the materials have to be able to be disassembled into individual components, whereas the natural cycle can easily create a decorative abundance of material and then disintegrate into harmless individual parts that re-enter the cycle of nature. For instance, the flowering cherry tree, which for a short period of time produces many beautiful flowers, only to have them wither away - but this "waste" is merely a natural element in an eco-system. The point is that one solution is not better than another. The intention is not to commune with nature like we did in

pre-industrial times. Indeed, what is appealing about

the Cradle-to-Cradle mindset is that traditional dogma about "good" and "bad" is abandoned. In other words, natural cotton is not necessarily the most eco-friendly material, and polyester is not by definition eco-hostile just because it is synthetically produced. In order to produce 1 kilo of cotton one uses an average of 8000 litres of water, whereas one is able to produce 1 kilo of polyester using hardly any water. On the other hand, polyester fibres are made from oil, and particularly the petrochemical industry is known for its huge global impact politically, socially and environmentally.

My reference to cotton and polyester is not coincidental: From the world's total textile fibre consumption of 59.5 million tonnes in 2005, cotton makes up 24.4 and polyester 24.7 million tonnes. Thus, these two textile materials comprise the vast majority of the world's total textile production, and another sustainable way forward could be to begin contemplating more diversity and hence less vulnerability in relation to exploitation of the soil, crop failure, etc. in the case of cotton, and less dependency on fossil fuels in the case of polyester. With reference to the H.C. Andersen tale The Woman with the Eggs, it is never wise to put all one's eggs in one basket!



cycle of the product, not just from cradle to grave but from cradle to cradle. In this respect, polyester is an interesting material in that all polyester has the potential to be recycled. Because polyester, like many other synthetic materials, has been perceived as a replacement and second-rate material, it also presents an interesting challenge design-wise.

This material and aesthetic challenge was presented to a number of fashion and textile design students at

Kolding School of Design during a course in autumn

CIRCLE concept by the Japanese company TEIJIN,

the students were asked to develop a complete de-

2009. Based on the new polyester recycling ECO

Discussing sustainability and textile production is

indeed a complicated matter, which requires re-

search in order to be able to understand the com-

plexity. The Cradle-to-Cradle mindset can help us

understand that one has to consider the entire life

sign concept, which encourages consumers to return used clothes for recycling. At the same time, they were to work with laser cutting, transfer print and direct print onto the material. The assignment for the future designers was to adopt sustainability as a mindset and focus on making aesthetics and sustainability come together naturally.

The results are presented in this publication, and we hope they speak for themselves – also in relation to the exciting and challenging design problems within the entire area of sustainability. It is a far cry from the "long-haired" eco-clothes made from hemp that we saw in the 1970s to the modern versions of sexy, sustainable fashion. We hope that in the long run, sustainability will become an integral part of a designer's mindset, so we will no longer have to address the issue of sustainability as something quite unique.

Apart from the student suggestions for sustainable fashion items, the publication includes a number of articles by experts of sustainability from Denmark and abroad, practitioners as well as theoreticians. Kolding School of Design and the Laboratory for Design, Innovation and Sustainability – which is also part of the Danish Fashion Zone – hope that this book will help attract attention to the important issue of Sustainable Fashion – because in the end it is indeed a question of design.

Finally, I would like to give a warm thank you to the writers, teachers and students.

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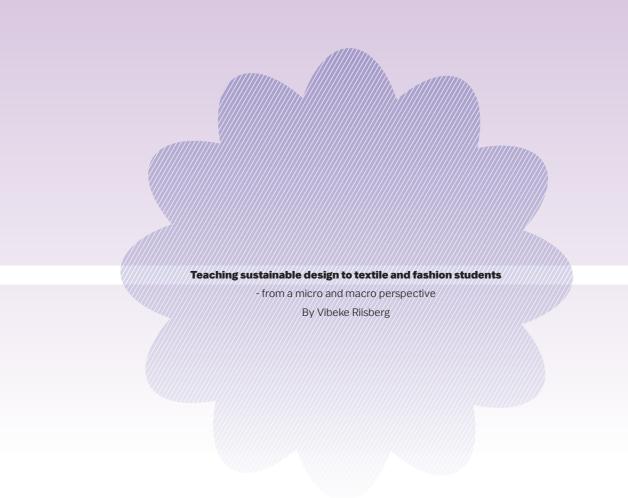
Kate Fletcher Sustainable Fashion & Textiles

- Design Journeys - Earthscan, 2008

William McDonough & Michael Braungart Cradle-to-Cradle.

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Introduction

Teaching sustainable design is a complex subject with no definitive answers. It demands the teacher's reflection of the didactic approach in order to find ways to engage students in an enthusiastic and pleasurable learning process. In 1992, Textile Engineer Joy Boutrup and I set out on this task initiating our first course in sustainable textile design. Since then, we have developed and adjusted the course in collaboration with colleagues, mainly Annette Andresen who joined us in 2002. During the years, we have also established valuable knowledge exchange through our international network.

The initial course was to a great extent informed by a macro perspective looking at the design system: the manufacturers, the production line, the use of resources, pollution etc. However, it soon became clear that these types of facts worked counterproductive to the creativity of our students. Thus, we changed perspective and decided to emphasise upcoming and new, available technology that might bring about a more sustainable future. We also made stronger efforts to present the dawning effects of design networks like O2 and to find examples of manufactures striving to develop sustainable products and services. In this way, focus was shifted, and we acknowledged that design students are better off learning about sustainable issues in bodily ways than through negative facts and abstract models. In a recent article, co-authored by Malene Leerberg, the progression of our pedagogical efforts are

described this way: "Designers often understand an intellectual problem through acting and/or creating, which can be described as a micro perspective with origins in the arts and craft tradition. Today, the course is offered to second-year fashion and textile students and is approached from a micro perspective but also introduces elements of a macro perspective. Starting simultaneously with a material based design process and lectures on material science, environmental issues are presented gradually during the course introducing the principles of Cradle-to-Cradle thinking and ways for making a simplified Life Cycle Assessment. This holistic way of working seems to give life to creativity and also to prevent a loss of perspective in the overwhelming amount of information and challenges" (Leerberg, Riisberg, Boutrup, 2010).

We believe that the course provides the students with embodied experience and knowledge that gradually opens up to an understanding of the more abstract macro perspectives of sustainability. During the last few years, we have noticed that more and more students continue to work with methods and ideas generated during the course. E.g. during one semester, several students used their spare time to elaborate on projects from the sustainable design course in order to be able to participate in the competition 'Innovating Sustainable Fashion' arranged in connection with the COP 15 meeting in Copenhagen 2009.

Kolding School of Design has upgraded its general curricula to focus more intensively on sustainability, and the students' own commitment to working with sustainable design solutions in BA and MA projects has significantly increased over the past ten years.

This is good news because more than ever we need to address the problems of how to create a more sustainable future. Design is key to this process, because its inherent nature is to create visions for the future. Designers also have an ethical responsibility, since many of the products we create function as the driving force of consumption in Western societies, which often act as role models to the rest of the world. As Graedel et al. already pointed out in 1995, designers can help save valuable resources: But at the same time it is important to focus on how to change our current ways of consumption in order to avoid ending up leading an ascetic lifestyle with no aesthetic products to enjoy. In our teaching we emphasise that a product which nobody wants to buy cannot be sustainable. Any production, however ecological, consumes resources, which are wasted if the product is taken directly from production to disposal. The end consumer, cultural aspects, price, etc. must be taken into account, as well as sustainability, functionality and the product fulfilment of consumer needs and wants.



Waterproof cape, biodegradable – the first prototype and one of the final outfits at the COP15 fashion show. 'The Rain Protection Project' was created by Camilla Skøtt Christensen, Lea Parkins Benjaminsen and Randi Samsonsen.





'The singing cicada's final song' – a summer collection of compostable textiles created by Nora Olafsdatter Krogh, MA graduation project 2009.





"We will have to be more sensitive to the effect of things on us and to be aware of the implications that come with possessions"

Anni Albers, textile designer, Bauhaus teacher

"We touch things to assure ourselves of reality"

Anni Albers

Extending curricula

In 2008, Kolding School of Design set up a 'Laboratory for Design, Innovation and Sustainability' with the objective of bringing together the dynamics of education, innovation, research and the business world. Soon after, it was decided to extend the curricula in sustainable design, and among other initiatives we introduced a new course offered to third-year fashion and textiles students. Our intention was to give the students a broader global perspective on the design profession by connecting a design assignment in sustainable fashion with knowledge of Corporate Social Responsibility (CSR) and global production.

out to describe a four-week project with the Danish company Eurotex Apparel as partner. Eurotex has its headquarters in Kolding, production facilities in China, India, Bangladesh and sales offices in Denmark, the UK and South Africa. Eurotex does not have its own brand but provides ready-to-wear fash-

I was happy to accept this challenge, and together

with my colleague, Fashion Designer Ulla Ræbild, set

ion items to a great number of international fashion companies. Eurotex has a production of organic cotton in India, and one element in the assignment was to work on how organic cotton might acquire 'added value' through design. During the course, the students worked in groups, each creating a collection of 1:1 outfits based on a common idea for a more sustainable fashion concept.

The outcome was first presented to Eurotex and since to a wider audience at an international seminar on sustainable fashion at Trapholt Art Museum. On both occasions, the students received positive responses to their projects, but during the following internal evaluation, it became clear that too many complex issues had been presented in too short a period of time, thus leaving both the students and teachers frustrated. Therefore, we decided to reinvent the course and split it in two modules – one focusing on CSR and global production, the other restricted to design for recycling working with only one material: polyester.

The ECO CIRCLE project

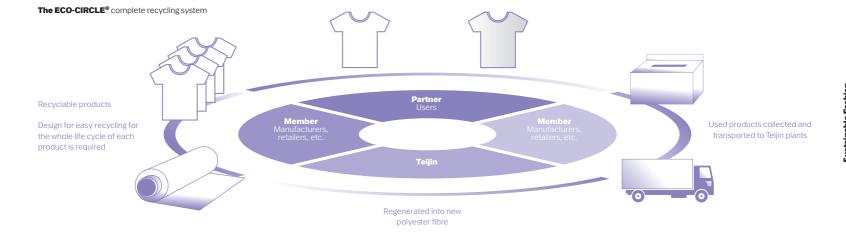
Why did we choose to focus on polyester and recycling? First of all, we did so because polyester accounts for the largest share of fibre consumption in the world, namely about 40%. Second of all, it is made from oil – a limited non-renewable resource. Thus, the sustainable perspective of recycling is evident given that the process does not consume more energy or pollute more than virgin materials. Finally, polyester offers the designer a great number of aesthetic possibilities to create beautiful garments – just think of Issey Miyake's 'Pleats Please' collections and other Japanese designers like Yoshiko Hishinuma and Reiko Sudo. 1

Today, hardly any of the garments we find in the shops are made from only one material; most are constructed of several fabrics in different fibres or

fibre blends. Add to that waterproof coatings, trimmings, zippers, buttons etc. made in other materials (e.g. metal), and you end up with a complex product that is impossible or very difficult to recycle.

If you manage to recycle part of the garment, the resulting material is of a much lower quality than virgin materials and thus makes recycling less attractive from an economical point of view. But it is possible to change this situation – at least for some types of garments – if the designer chooses a single material for the whole garment, e.g. polyester. We wanted to make this perspective tangible to our students by applying TEIJIN's ECO CIRCLE concept as a framework for the new sustainable design module offered to our third-year fashion and textile students.

The Japanese company TEIJIN has developed a new method for recycling PET, which is environmentally attractive because it reduces oil consumption and CO2 remarkably compared to the production of virgin polyester.2 TEIJIN has also set up a closed loop system called ECO CIRCLE based on membership by companies who are committed to returning the polyester garments for recycling at TEIJIN's plant in Japan. In 2009, there were about 110 members worldwide, one of the most well known being the sportswear company Patagonia. In the future, more recycling plants will be constructed on other continents minimising the transportation distance. But since there are no laws that command recycling of polyester, the TEIJIN initiative needs the support of companies, designers and consumers alike in order to expand.



"... more than ever we need to address the problems of how to oreate a more sustainable future. Design is key to this process, because its inherent nature is to create visions for the future."

Vibeke Riisberg















The Square Project – a collection of unisex and transformable garments, which can be worn in several ways.

The project was created by Anna Ebbesen, Benedicte Holmboe, Elin Sjøgren, Ruth Enoksen, Siff Nielsen,

Tina Gabrijelcic and Mette Gliemann.



The assignment

For the ECO CIRCLE project we collaborated with Silvio Vujicic, a talented young fashion designer living in Zagreb, Croatia. Silvio has visited Kolding School of Design many times as a most appreciated guest lecturer always eager to educate the students and himself, especially regarding new textile techniques. Together, we planned the course taking advantage of our different fields of expertise.

We agreed on one core issue for the assignment, stated as a simple "Dogma rule": Make garments that are 100% polyester. This also included sewing thread, linings, trimmings, buttons, zippers, press studs etc. so the garment could be easily recycled. In addition, we asked the students to come up with a concept to stimulate the collection of used garments.

The first day of the course we dedicated to lectures on sustainability and recycling, perspectives on polyester, its history and properties, including inspiring examples of fashion designers using polyester in different textile techniques and TEIJIN's ECO CIRCLE concept. During the next three weeks, the 30 students worked in small teams, and the teaching took place most of the time in the workshops and at the students' desks.

To inspire the students, Reiko Sudo most kindly sent us a number of poetic statements. She also helped establish the contact to TEIJIN, so the students could actually work with a fabric made of recycled polyester. This ECO CIRCLE fabric, also used for the pleated NUNO bag designed by Reiko Sudo, is constructed as a plain weave that can be used for many purposes because of its medium weight.

The fabric has a crisp hand, which is well suited for shibori, pleating and laser cutting and turned out to react well with our range of disperse dyes. Since we had a limited amount of the ECO CIRCLE fabric available, the students also used other fabrics made of 100% polyester.

Coda

When evaluating the course it became clear that three weeks is a very limited time for this assignment. Nevertheless, all the groups managed to formulate short statements for stimulating the users to return the garment for recycling and produced outfits in 1:1 scale. In addition, all students made a fabric sample library of the different textile techniques introduced during the course.

Thus, we may conclude that by introducing TEIJIN's ECO CIRCLE concept to our students, they gained new knowledge of sustainable system thinking – the macro perspective – and through their design projects learned new exiting techniques to manipulate and decorate polyester along with draping and shaping different polyester fabrics into 3D form – the micro perspective. The students worked with great enthusiasm and produced a wide range of spectacular garment expressions – all included in this book. We would like to thank our students; we are proud of them. Their projects show how polyester garments designed for recycling can be both beautiful and fun.

We also hope this project has inspired TEIJIN and would like to express our gratitude to Mr. Yuichiro lkeda and Mrs. Reiko Sudo. Without their support and inspiration this project would not have been possible, and we look forward to continuing the collaboration when we begin the next course in September 2010.

- 1 Reiko Sudo, Textile Designer, Director of the Japanese company NUNO was the key note speaker at the international seminar 'Textiles, Ornament, Light and Interior Space', Kolding School of Design, spring 2009. During Mrs. Sudo's visit, our idea for the ECO CIRCLE project became realistic, since she offered to help establish the contact to TEIJIN.
- 2 For more details, please refer to Joy Boutrup's article.
- 3 Silvio always experiments in unexpected ways and the results are stunning, beautiful garments that thoroughly combine textile techniques and 3D form to a coherent whole. See: http://www.silviovujicic.com/english/main.html



Vibeke Riisberg is an Associate Professor at Kolding School of Design. She is trained as a textile designer and holds a PhD in design from Aarhus School of Architecture. She has worked with issues of sustainable textile design for many years. Her recent research deals with developing new solutions for adjusting daylight in office buildings and user centered design in order to create better "healing" environments in hospitals

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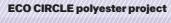
http://www.nunoworks.com/

TEIJIN ECO CIRCLE: www.ecocircle.jp/en

http://www.teijinfiber.com/english/products/specifics/eco-circle.html







Fashion and textile design project with recycled and recyclable polyester By Joy Boutrup





Introduction

The following article contains the background and basis knowledge introduced in the course '100% Polyester'. In order to understand the aim and impact of the ECO CIRCLE concept, several facts regarding polyester have to be understood, and the different methods available for the designer in order to obtain colours, structures and surface features have to be trained and mastered.

Definition, history and production

Within the textile field, "polyester" is the general term applied for synthetic fibres of PET, an abbreviation of polyethylene terephthalate. This material is also widely used in other objects outside the textile field such as bottles for beverages, fibre reinforced composite materials, transparent sheets, buttons, zippers etc.

The material was first synthesised in 1941, and the first fibres were developed by a joint enterprise by I.C.I in Britain and Dupont de Nemours & Co. in the USA. The market share of polyester fibres has grown steadily since it was first introduced, and since 1999, polyester fibres have had the largest market share in the world's total textile consumption. Its share today (2010), is more than 40% of the total consumption of around 52 million metric tonnes of textiles.

An ester is a condensation product between an alcohol and an acid. PET polyester is made from an alcohol called ethylene glycol and an acid called terephthalic acid. Both components are derived from mineral oil and thus not from a renewable re-

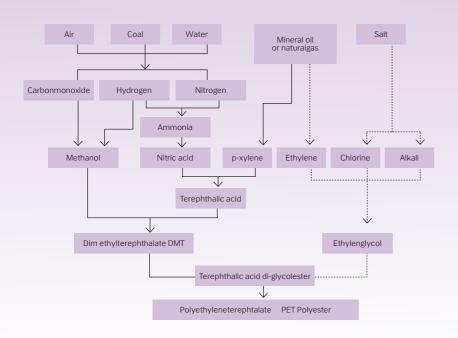
source. Since the production of polyester started in the mid 20th century, the production methods have undergone several changes towards less waste of resources, better catalysts and fewer by-products. The two schematic flow charts show the older method of polyester production (DMT method) and the newer, more economical and less polluting method (PTA method), respectively. Both methods are still in use.

As can be seen from the flow charts, the recent method consists of fewer steps and has fewer sources of raw material. The energy and resource demands are also much lower. In the meantime, other types of terephthalates have been introduced in the plastics industry as well as in the textile field. These new types, called PTT and PBT, are softer and more elastic than PET. As of yet, they only hold a small share of the market: the main bulk is still PET. These newer types of polyester are made by using alcohols that are partly produced by fermentation of sugar or starch, thus making the fibres halfway bio-synthetic. In view of the high market share of PET in textiles feasible methods for recycling the material will have a high environmental impact. This impact will be especially important in relation to the consumption of non-renewable resources during production of PET from mineral oil.

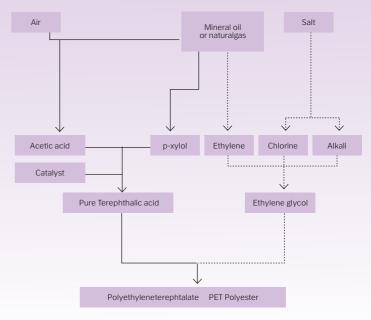
Recycling of PET

The first attempts at recycling PET fibres were to reuse them for filling blankets e.g. by collecting used textiles, opening them and separating them into fibres. In that context, there were no high demands regarding purity or strength of the material.

DMT line of production:



PTA line of production:





Shibori process,

Maria Rokkedahl Nørholm & Anna Kristine Borg

The next method was to collect, clean and melt used beverage bottles and extrude the melted polvester as fibres. The bottles have often been used several times before being collected for recycling, which means that the polyester is often damaged, i.e. reduced in strength. The cleaning and melting process is energy demanding, and the final fibres are less durable and not as strong as new polyester. In textile production these fibres have to be mixed with new polyester in order to obtain an acceptable quality. The main applications for these fibres are in knitted fleece materials for insulating jackets.

"No aspect of our lives seems untouched by textiles" Kathryn L. Hatch

In 2001, the Japanese company TEIJIN introduced a new method for recycling PET polyester. The details of the method are not published but it includes decomposing polyester into two main components: ethylene glycol and terephthalic acid. Dye and other contamination are then cleansed from the two components, and they are conclusively combined into PET polyester, which has the same quality as new polyester.

This new method, called "ECO CIRCLE", reduces the energy demand by 84% and the CO2 emission by 77% compared to the production of polyester from mineral oil. It requires and involves a network of companies from all over the world to sign up for and send back garments of TEIJIN polyester for re-

cycling. Until now, the project only comprises TEIJIN polyester, but one can hope that more companies will follow suit in near future.

Properties and techniques

Polyester is a thermoplastic material, which means that it can be shaped by means of heat. It has no uptake of moisture or water, the material is not hygroscopic and the surface is hydrophobic. This attribute is an advantage in regards to some purposes, but for others the almost non-existing moisture uptake in garments can cause problems with proper transportation of body evaporation if insufficient air is enclosed in the textile structure. Some companies have developed combinations of polyester with hygroscopic materials in order to regulate the moisture uptake, and some have even developed fibres with special properties regarding shape and ventilation for sportswear e.g. TEIJIN in cooperation with Nike1.

On the other hand, polyester textiles possess good shape retention, are easy to wash and dry due to the low absorption of water, do not crinkle or shrink and are not in need of ironing after washing. The hydrophobic nature of the fibre can, however, cause the textile to absorb fatty substances and make soil and smells difficult to remove. A saponification of the surface with strong alkali can counteract the problem.

The popularity of polyester in the textile industry - and with the consumers as well - is especially due to the strength, durability and versatility of the material. Polyester fibres are strong, have very good abrasion properties and high tenacity.

Transfer print,

Laura Locher & Anne Woidemann Christiansen

Polyester fibres are available in a wide range of thicknesses, cross sections and levels of gloss.

The properties can be adapted to most textile appli-

cations in home furnishing, apparel and transportation. For instance, the extremely fine fibres in micro fibre polyester produce a textile with a softness and drape similar to silk, while the thicker fibres can provide the strength and durability demanded in protective wear.

A whole range of different techniques for changing surface, colour, structure or drape are available for the textile and fashion designers. They are all based on the special properties of polyester. The thermo plasticity makes it possible to shape the textiles in pleats, folds and spikes with a hot press or with steam. The melting properties of the material makes it suitable for laser cutting as the heat of the laser will melt a narrow zone on both sides of the cut and thus seal the edges. Slits and holes can be cut into the fabric, and shapes can be cut out of the fabric with edges which will not fray in use.

Dyeing and printing

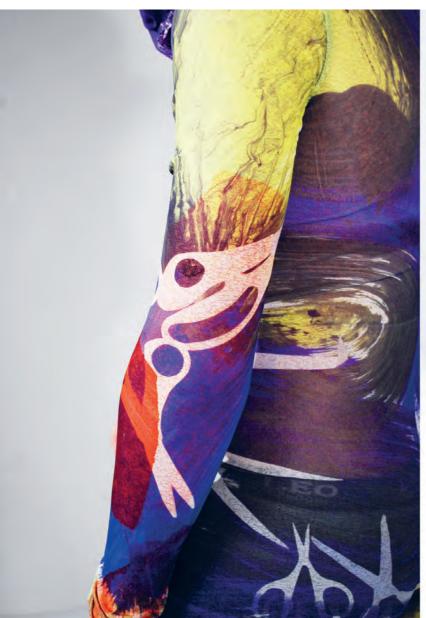
Polyester can only be dyed and printed with disperse dyes. Disperse dyes were originally developed for cellulose acetate fibres but have since been adapted to polyester and other synthetic material. The dyes are insoluble in water and have to be finely dispersed in the dye bath or print paste when used. The name of the dyestuff class is derived from this. The dyes normally come with a dispersing agent included, so that an even distribution of the dyes is made easy for the user.

The dye can only penetrate into the fibre when the fibre is softened by high temperatures. The temperature needed for dyeing polyester is above 130° C which is not possible without high pressure. Polyester can also be dyed at temperatures around 100° C if a so called "carrier" is used. Both dyeing methods are not suitable under simple conditions as carriers are poisonous and environmentally very damaging (the use of carriers should be banned in near future), and the high temperatures cannot be reached except under pressure.

There is the possibility, though, to dye and print polyester by using brands developed for transfer printing. Disperse dyes have special fastness properties; some are very sensitive to exhaust gases and air pollution, and some have the ability to sublime when heated. Subliming is the transition from solid state to gaseous state without any intermediate state as a liquid. The gas state can move rapidly into other materials, and dyed or printed material will stain when for example ironed.

The ability to sublime has been used commercially for transfer printing. The dyes are printed onto paper, and the dye is transferred by means of contact and heat onto textiles. This is considered to cause a low environmental impact as there is no use of water after the papers have been printed. The textile needs no washing after the transfer process as only pure dyestuff has been transferred. Residues of dyes are on the paper and can easily be incinerated.







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The disperse dyes have been separated into groups with different tendency to sublime. Some have very high subliming fastness and cannot be used for transfer printing; other brands have the ability and are sold especially for transfer printing. These dyes have permanently low subliming fastness, and this must be taken into consideration in the further treatment of the material and in the end use and maintenance of the product. The dye will continue to have the property to move from one material to another when heated.

Experiments have shown that it is possible to dye with transfer brands as well. The dyes will give an acceptable colour yield at boiling temperature; very dark colours are not obtainable, though. No further additions than the dyestuff are needed for the dyeing process if the water is not alkaline; acetic acid can be used for neutralising the water if necessary.

The dye bath can be used again until exhausted, which also helps encourage sustainability.

The historical perspective on polyester and knowledge of textile material science is presented in lectures; it is rather abstract and presents a macro level of sustainable issues. Much of the information is later connected to practice during the conversations in the workshop, when the students make samples at the drawing table reflecting on form, draping 3D shapes and considering which technique to choose for surface interest, colour and decoration. Thus, it becomes part of the design process in an organic way as textile science is repeated and explained in relation to the design process at a micro level.

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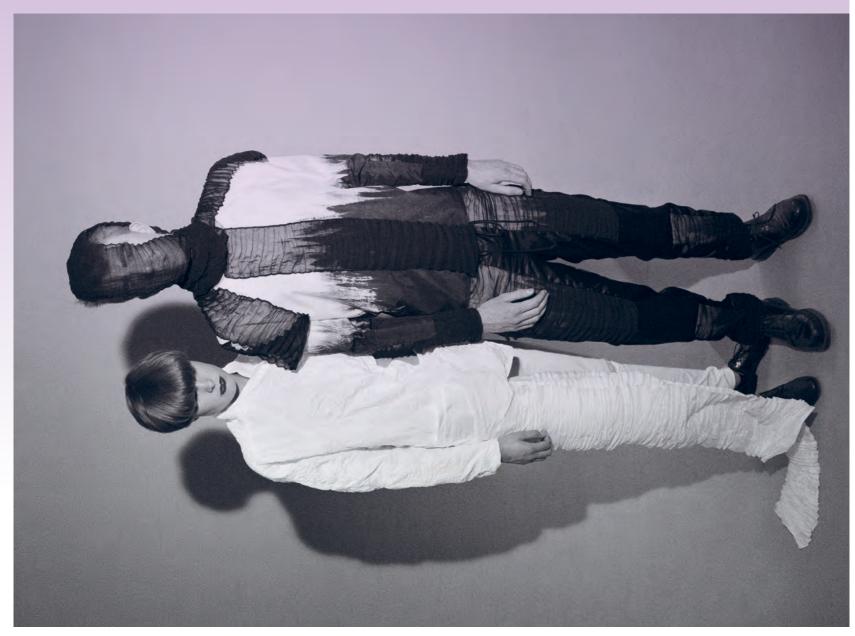








By Kate Fletcher



Most of us know what fashion is. Many of us know what sustainability is. But when it comes to exploring the relationship between the two, we can very quickly find ourselves on new ground. For the relationship between fashion and sustainability is active and complex and each time we look at the key ideas or issues at stake, different aspects seem to come to light. Sometimes what is emphasized is technical information about toxic chemicals or working conditions in mills and factories on the other side of the world. At other times, the fashion and sustainability relationship seems best understood by looking at what goes on locally: networks of handcrafters; dyes made from species of plant found only in local hedgerows; our individual laundering practices.

cal hedgerows; our individual laundering practices.
The truth is, of course, that sustainable fashion is all of these and more. It is a celebration of ingenuity, vitality, care, resourcefulness and strong relationships between us and our world, expressed in garment form.

These sustainability values will help shape the future of fashion and give us a mental picture and sen-

sory way markers about the direction in which we should head. Part of this "shaping" involves reducing the impact of the fashion sector as it exists today - and it is a massive job. For the production and consumption of fashion impacts hard on ecosystems, communities, workers and consumers in a variety of challenging and sometimes surprising ways. Producing fashion clothes, and the textiles they are made from, is one of the longest and most complicated industrial chains in manufacturing industry. It starts in fields with the cultivation of fibre crops like cotton and wool or in chemical plants where fibres like

polyester are extracted; and ends up in homes, on our bodies and in landfill sites continents away from where they started out. The journey in between involves the use of lots of labour, water, energy and processing chemicals and produces waste and pollution. Indeed in a recent pollution risk assessment by the UK's Environment Agency, the fashion and textile industry was rated worst.

Thus it makes sense that sustainable fashion activity is underpinned by a deep awareness of the use of resources and how these resources are organized to meet people's needs. Central to this is "lifecycle thinking", an approach that sees garments as a mosaic of inter-connected flows of materials, labour and as potential satisfiers of needs that move through phases of a garment's life from fibre cultivation, to processing and transportation and into garment use, reuse and eventual disposal. Such lifecycle thinking is inspired principally from the study of ecology, where each part of a system influences every other, and where overall system effectiveness is prioritised over the individual parts. When fashion is looked at from a lifecycle perspective, what is revealed are "hotspots" of harmful impact and opportunities for the greatest whole system improvement.

For some (though certainly not all) fashion clothes, these hotspots of harm are linked to material choices. Traditional views of sustainable fashion focus their attention almost exclusively on materials and their provenance; on whether fibre is organically grown and fairly traded, or whether materials are from rapidly renewable sources or from recycled yarn. Today for example over 20 major brands and 1200

smaller ones now sell organic fibre products. Yet for many other fashion clothes, choice of materials has only limited effect on overall product sustainability. In the case of frequently laundered clothes for instance, the overwhelming hotspot of harm is the use phase of a garment's life. Here it is our laundering choices, washing, drying and ironing behaviour and perceptions of cleanliness that have most influence over our clothes' sustainability.

Yet these flows of resources are only part of the story. Fashion clothes are much more than the fibre and chemicals needed to make them. They are signs and symbols, expressions of culture, newness and tradition. They link us to time and space and deal with our emotional needs, manifesting us as social beings, as individuals. Thus sustainability issues in fashion are as much about cultural, economic and social phenomena as material and manufacturing ones. They are also about decadence, consumerism, expression and identity and if sustainability is to become a real possibility in fashion, then the sector has to work with these big issues and their difficult implications as well as the more bounded fibre-specific or production focused ones. For in order to make sustainability happen in the fashion sector, there needs to be change at many levels: we need both root and branch reform.

Making such sustainability-inspired reform to fashion brings to the fore the sector's key issues, these include:

Damaging agricultural practices where some natural fibres - most notably cotton - are cultivated with very large quantities of pesticides and synthetic fertilisers, water and energy in large farms with no crop variety. The effect is to reduce the fertility of the soil; create water pollution; damage the diversity of plant and animal species; develop pesticide resistance, leading to ever higher levels of pesticides being applied in order to control pests; and damage to workers' health through exposure to acutely toxic pesticides.

Resource intensive fibre, fabric and garment manufacturing including significant use of energy and petrochemical resources for synthetic fibres like polyester; pollution to air and water from production of synthetic and cellulose-based fibres (like viscose); and for all fibres large water consumption, use of toxic chemicals and waste generation.

Exploitation of garment workers who experience labour abuses including poverty wages, excessive working hours, forced overtime, lack of job security and denial of trade union rights. In recent years, working conditions in factories have been forced ever lower in what is called a "race to the bottom" as manufacturers compete on price for a place in the supply chain of big brands.

Damaging effects of fashion trends and

imagery where the drive to constantly "renew" ourselves in the light of changing trends helps feed short-term thinking, psychological insecurity and rising levels of mental illness; while fashion imagery is linked to body issues and serious medical conditions like anorexia, which is now reaching record levels in young men as well as women.





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Kate Fletcher









"... in order to make sustainability happen in the fashion sector, there needs to be change at many levels: we need both root and branch reform."

Kate Fletcher





Kate Fletcher has worked with sustainable fashion since the early 1990s. She is an internationally popular lecturer and teacher in sustainable fashion and a leading researcher in the field. She is trained as a fashion designer, holds a PhD in sustainable fashion and works as consultant for large retail chains, designers, NGOs and other through her company Slow Fashion. She is the author of the acclaimed book: 'Sustainable Fashion and Textiles - Design Journeys'.

Passive consumers who "follow" the trends prescribed by industry, who are ill informed about, and distanced from, the creative practices surrounding their clothes and who lack the practical skills to do anything about it.

Excess and wastefulness linked to consumerism and fashion consumption where we meet our desire for pleasure, new experiences, status, and identity formation through buying far more products than we need - many of them clothes. Global brands and high street retailers profit from this relationship and for them, challenging consumerism remains a taboo subject. Indeed the trend for consumption of fashion continues upwards (in the UK, it increased by one third in the last four years) and is linked to an increase in speed: high street chains can turn around collections in as little as three weeks; and fashion seasons are now not only biannual, but each of the two main seasons contains three mini collections, opening up new opportunities to consume.

There is no denying it: fashion and sustainability issues are large in scale and tricky to navigate and it is all too easy to feel overwhelmed and see them as too global and too deep-rooted to influence.

Yet contrary to common expectations, big change doesn't just flow from decisions made at high-level international meetings or in the boardrooms of company directors; for single, small actions can have big effects. Nabeel Hamdi in his delightful book Small Change puts it like this: "in order to do something big... one starts with something small and one starts with where it counts".

Acting "small" and "where it counts" brings change towards sustainability in fashion within the grasp of each and every one of us. It starts with us asking questions of companies and suppliers and by challenging them to respond to key issues, like the ones raised above. It involves us looking at garments not just as items of beauty, or as something to wear, but in their totality – as resources, processes, symbols and values. For it is in these dynamics that sustainability will emerge in fashion. Sustainability also starts closer to home as we question our own behaviour. As we look at what we buy and why we buy it. As we consider how we wear clothes and how we care for them. And as we reach into our sewing baskets and with needle, thread and a large measure of thoughtfulness, begin the process of re-skilling ourselves in the art and practice of creating and caring for things and not just consuming them.

















Sustainable fashion is a concept riddled with complexity. Although eco-fashion is one of contemporary fashion's most compelling practices, the notion of fashion has traditionally been exclusively concerned with the rapid change of trends and the constant developing of new product ranges; in many ways, the complete opposites of what drives a sustainable approach to product manufacturing.

At first glance, sustainable fashion may appear to be an ill-matched marriage between short lasting trends and durability. However, most trendsetters seem to agree: Fashion is entering the Green Age. Fashion may be rooted in change and novelty, but it cannot be reduced to a flippant and superficial industry of excessive style.

Fashion also embodies a much deeper, more insightful engagement with clothing that is seen across all times and all cultures. And now the industry – both commercial and design-driven – seems to be making a fashion forward change towards a "green" vision.

Fa - Fa - Fast Fashion

Let us start out with the Slow versus the Fast Fashion paradox. If one takes a look at the fashion history of the past thirty years, it would be fair to say that fashion and environmental awareness have not been two concerns that have comfortably been sitting side by side.

During this time span, technological, social and economic changes – and their impacts on every aspect of life – have set a hasty pace. Stylistic reinvention

has been an imperative when the goal has been to lift a fashion brand onto a bigger stage, and the rapid changing culture has become an integrated part of what constitutes the concept of fashion. Being up to date on the latest fashion trends and ideas seems to have been required in order to grab the attention of consumers. Fashion has become increasingly more affordable and disposable, and the equation of "The New" and "The Improved" has been constantly made. As a result, high street and global brands such as Zara and H&M have hollered for greater market shares.

This flowing, fleeting progression of looks and products seems to have been essential and fundamental; as if nurturing some in-built drive and desire to adjust to changing fashions. Eco-clothing, on the other hand, has been reduced to the hemp pants, tie-dye and nostalgic Hippie subculture. Why now – all of a sudden – does sustainability and fashion form an alliance?

Eco-Gen

To keep it short: A new generation is rewriting the principles of fashion. It is a generation still seeking to adjust to changing cultural conditions, and – as generations before them – still yearning to know the current way of doing things. But instead of finding the answer in Fast Fashion, they turn to sustainability, addressing issues concerning biofuels, climate change and global warming. Upcoming designers and young consumers alike are focusing on how to live their lives with an ethical, social and ecoaware conscience. A growing number of designers are even going one step further and embracing



Cradle-to-Cradle principles, which consider a product's lifespan from beginning to end. This offers a heartfelt approach for a more sustainable future.

The relevance of the Cradle-to-Cradle movement is overt, as the industry looks for ways to produce goods that leave minimal trace. Cradle-to-Cradle production is based on natural methods that eradicate waste. All materials are viewed as endlessly valuable, circulated in closed loops of production, use and recycling. Cradle-to-Cradle is a growing movement with the potential of becoming the benchmark in sustainable design. Designers and brands attracted by the Cradle-to-Cradle philosophy work in various ways. Some create products made with single materials unblemished by gloss or paint, others ensure that packaging is entirely biodegradable or engage in well thought-out design that envisions a second life for products once their primary use has been fulfilled.

The movement is tightly linked to another trend: Slow Fashion, conceptually deriving from the Slow Food movement, which originated in Italy twenty years ago. The movement promotes a framework for a more sustainable and mindful way of designing, questioning the notion that fashion be concerned exclusively with "the new", focusing rather on transseasonal products intended for keeping and all materials being organic, recycled or fair-trade.

D.I.Y.

These trends are based on a conscious consumer behavior and recognition of the fact that increased consumption does not boost our happiness.

Instead, positive and important acts do. We all have a need to engage in meaningful and stress-reducing activities as counter-weight to the up-tempo culture, which has dominated the 21st century. We want to be brought into contact with things that we experience as being genuine and less processed.

Fashion, lifestyle and consumerism are to an increasing extent being determined at the individual level, resulting in a greater demand for a far more activist and personal approach. A widespread D.I.Y. (Do It Yourself) culture focuses on people creating objects themselves instead of paying professionals to do it. These acts spring from the desire to abandon traditional rules and give everyone the ability to become a creator.

It is a consumer behavior based on personal and autonomous access to fashion and design. A way of living, which can be traced back to the first Homo sapiens, who used the skills they had and the tools that were available to make their own clothes. The unschooled expression, the imperfect look and its distinct non-mainstream style is part of the attraction and offers a concept, which is a far cry from today's mass produced and homogeneous products.

The D.I.Y. culture is critical of explicit consumerism and the attitude that solutions to our problems lie in the purchase of things, and instead encourage people to take technology into their own hands. In this culture, there is no dichotomy between blogging, 3D printing, using ubiquitous computing and at the same time being passionate about environmental issues.









"Fashion is entering the Green Age. Fashion may be rooted in change and novelty, but it cannot be reduced to a flippant and superficial industry of excessive style."

Lene Hald

Nature-chic

One thing is certain: Saving Mother Nature is no longer perceived as a profession for the hemp wearing vegan task force. The green tidal wave is not just another strategy from marketing bureaucrats who want us to believe that organic cotton grown by fashion capitalists can save our souls and let us consume without guilt. It is grounded in the fact that disappearing seasons are making more and more of us think about the future beyond the next three months and grounded in a growing knowledge among people in industrialised countries that wealth and plain consumption do not make us happier. The new green consumerism is filling a political void in people's lives, and non-green consumption is being looked upon as anti-social and disruptive. There is a growing interest in the environment within all areas of life; from sorting the garbage, riding the bike to work, and buying Weleda products to choosing nonpolluting laundry detergents.

This new type of consumption is based on principled and sustainable products, and the rising ecoawareness is affecting the fashion industry. Both wholesalers and retailers are on their toes and paying attention to these green aspirations, remembering the one vital aspect which is often overlooked when discussing fashion and sustainability: the business aspect.

The rules are the same for sustainable fashion as it is for less ethical brands: In order to continue production, they need to make money. In order to do so, green fashion fairs are emerging and they seem to be finding an audience. In Denmark, the fashion fair

Gallery is lit up by energy-efficient lighting, and all the interior and decoration are used over and over again for different exhibitions. The fashion fair CPH Vision & Terminal-2 has launched an official iPhone application containing general info about the activities during Copenhagen Fashion Week as well as brand lists and floor plans in the long run hoping this will reduce printed matters at the fair. These are baby steps but moving in the right direction.

Furthermore, today's sustainable design has stepped up, and the aesthetics are as high as the morals. The Danish deluxe brand Noir is among those that have turned global concern and corporate social responsibility sexy through designs characterised by luxurious charm and sensual simplicity. Noir has created its own organic and fair- trade cotton fabric brand "Illuminati II" made from raw ingredients sourced in Uganda.

Danish fashion in the green age

It only makes sense for more to go along. Denmark is renowned for an extensive welfare system and high standards for social responsibility and in line with this, Danish fashion is often characterised by its accessibility, functionality and democratic quality. It seems obvious to make environmental, ethical and corporate social responsibility part of Danish fashion's unique selling point.

Danish brands and designers are becoming increasingly conscious of the social situation of the countries in which they choose to manufacture, how to avoid the use of pesticides and polluting dyes, as



well as focusing on transparent production systems. Both due to an obvious need for action led on by climate problems, but also grounded in a rising consumer demand to know where their clothes are coming from and under what conditions they are being made.

Fashion is more than just appearance. It is supposed to make you feel great. Nobody feels great wearing a pair of sneakers one knows has been produced by underpaid and unhealthy children; or feels "fashion fabulous" when discovering that their best jeans have been treated with polluting dyes.

The sourcing of materials and the manufacture and distribution of clothes have traditionally been nontransparent to the public, but a consumer demand to be informed is rising. We all want to be made aware, and there is a need for clarity and transparency in all areas of the business in order to maintain the customers' trust in the fashion industry.

Staying True

British designer Katharine Hamnett is famous for fighting the good cause. Since her first collection in the 1970s, she has been known as a tireless ecowarrior, struggling for a better world. Her original slogan T-shirts ("education not missiles", "worldwide nuclear ban now", "preserve the rain forest" and

"choose life") never lost their credibility and are today more fashionable than ever. In 2004, she relaunched her collection now using only organic cotton, linen and natural fibres because their production, treatment and recycling have the least possible impact on the environment. The collection carries the name 'Katharine E. Hamnett; E for ethical and environmental.'

In autumn 2007, Katherine Hamnett announced that she was to end her contract with the Tesco supermarket chain to distribute her 'Choose Love' range of ethical clothing stating that:"... I've come to the conclusion that it (Tesco) simply wants to appear ethical rather than make a full commitment to the range." This shows the importance of practicing what one preaches. The ethical concerns of any company need to be genuine. There is not room for companies that merely attach themselves to the eco-fashion "zeitgeist" in the hope of attracting short-term media hype. All opinion leaders and important media will be very quick to desert any ecofashion brand that does not stick to their promise.

Transparent Shades of Green

Failing to follow codes of conduct can be devastating for the brand image, as seen in the extreme example of former Nike CEO Phil Knight who was

denounced by Michael Moore in the film 'The Big One' for making money by selling shoes made with the labor of children and pregnant women.

The need for clarity and social responsibility is less a passing trend than an economic reality. An increasing number of commercial companies are realising that the general public demands authenticity and transparency.

The Danish fashion brand Jackpot goes to the extent of making the story of their products visible to the consumer. This is done through a transparent supply chain called track and trace. Using a track code in the garment, it becomes possible to track products from where the cotton was grown, to the factory where it was manufactured and finally to the specific garment in one's local store.

Jackpot is part of an organisation called MADE-BY that helps fashion brands manufacture in a sustainable way. Other brands in MADE-BY include the fashion brand Edun created by U2 celebrity Bono. Each pair of Edun jeans is inscribed with: "We carry the story of the people who make our clothes around with us."

A Danish eco-fashion newcomer is the socially responsible T-shirt brand A question of, which produces all T-shirts from GOTS certified African organic cotton abiding by fair-trade working conditions in Tanzania. A question of's products are developed in collaboration with talented designers, photographers, fashion bloggers and artists. "These are a mix of established as well as upcoming designers, which enhances our social responsible business strategy, as we are promoting new talent. Sustainability is not just a choice. It is an obligation," says founder Mads Ulrik Greenfort, supporting the statement that those players who genuinely change for the better will be ready for a market that is more aware and better balanced.



Lene Hald has degree in Fashion and Visual Communication from The Danish Design School and Rhode Island School of Design and is currently completing a Master's degree in Visual Sociology at Goldsmiths University of London. Since 2003, she has worked as a trend researcher and consultant at a number of Danish and international companies, including Peclers-Paris and Sign of the Times. She also works as a freelance writer and editor.

Sustainable Prospects

At the end of the day, the continuation of ethical fashion lies with the people engaged in it. Educational initiatives such as the establishment of the Laboratory for Design, Innovation and Sustainability by Kolding School of Design aims to ensure that future generations of fashion professionals and decision makers learn to recognise the social and ecological aspects of fashion and learn to deal with eco-technology and new, sustainable materials, ultimately, leading to a prolonged passion for sustainable fashion to project into the industry. After all, today's students hold the key to securing sustainability in the fashion world by acting and designing with the Planet's best future in mind.

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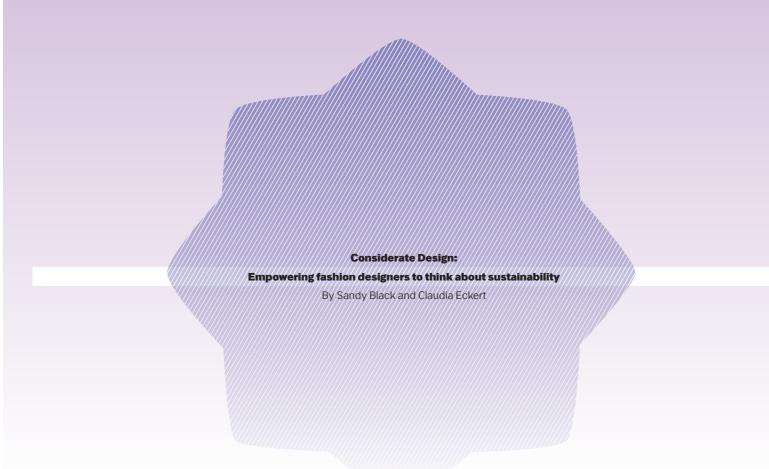
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Introduction

The Considerate Design project aims to develop a considerate design toolkit for fashion designers, and test new design and production methods for creating personalised fashion products. It is a collaboration between London College of Fashion (LCF), The Open University and The Engineering Design Centre at Cambridge University. The project is led by Professor Sandy Black (LCF) in cooperation with Dr. Claudia Eckert (The Open University). It identifies a set of factors for consideration and the extent to which they influence the environmental impact of fashion products. As many factors, such as materials and transport, are themselves far from simple, they can be broken down hierarchically, so that designers can visualise and comparatively assess them individually to aid design decision making.

This article will present a simple tool to assess the environmental impact of fashion products. It represents the impact of individual factors on a scale of low to high and thereby draws impact profiles of design alternatives. The designers can thus compare the "footprint" of alternative design scenarios and target their efforts to reduce the impact of certain factors. At present designers put their own estimates into the tool so that it provides a visualisation of the connectivity of many complex factors. However, in the longer term the tool can be populated with quantitative assessments to reach a comparative overall measure.

The Fashion Industry Context

Fashion consumption in the UK has grown significantly in recent years: between 2001 and 2005

there was a 37% increase in the amount of clothes purchased per capita (Allwood et al., 2006, p. 12). Globalisation and fast fashion has pushed the price of fashion products down, while increasing their environmental impact across the globe. Fashion industry products here encompass manufactured clothing and accessories comprising textiles and other materials such as leather. Both raw materials and garments travel around the world in unsustainable ways, factors which may not be taken into account when designing. At the same time, as supply chains become longer and physical distance between production and consumption in fashion has increased, the rate of production and consumption has also increased. Now that the vast majority of apparel production takes place in locations remote from European markets, designers can no longer respond quickly to changing trends or negative customer feedback. Previously, locally situated production runs were flexible and tailored to the requirements of customers, to produce more or fewer products in response to demand. In contrast, when products offered are not what customers really want, stock is unsold, and more goods end up marked down in sales and feeding the waste stream.

Compared with other sectors such as architecture, product design or food, action for sustainability in fashion has been slow to develop in both the industry and the consumer, because the nature of fashion itself appears contrary to the spirit of sustainability. However, in the wider context of climate change and improved global communications, a momentum has developed very strongly in the last few years. Pioneer sustainable fashion designers such as

"Globalisation and fast fashion has pushed the price of fashion products down, while increasing their environmental impact across the globe."

Sandy Black and Claudia Eckert

Katharine Hamnett have raised the profile of organic and ethically produced clothing through meticulously sourced collections, which have been widely publicised. As an independent designer, Hamnett has been able to invest the time and resources to make sure that every element of her collection is fully organic and produced as locally as possible under fair wage conditions. However, this is not possible for most designers who are working under great commercial pressure and subject to management deci-

sions.

The complexity of the fashion supply chain has made the concept of environmentally and economically sustainable, ethically sound clothing extremely difficult for the mainstream industry to address. Only very recently have publications such as 'Sustainable Fashion and Textiles - Design Jorneys (Fletcher, 2008) or Eco Chic - The Fashion Paradox (Black, 2008), raised awareness of environmental and ethical issues for fashion and textile designers. There is a contradiction at the heart of the fashion industry, in what Black (2006, 2007) terms the "fashion paradox": fashion's inbuilt obsolescence is intrinsically unsustainable, but the desire for fashionable renewal is an inherent cultural construct; fashion is also a powerful economic driver, sustaining global industry and employment.

Fashion products have in many cases become cheap disposable products, which customers pick up without thinking where they have come from or how they were made. Fashion purchases are optional – people rarely need a particular item at any one time, rather they purchase for pleasure. While

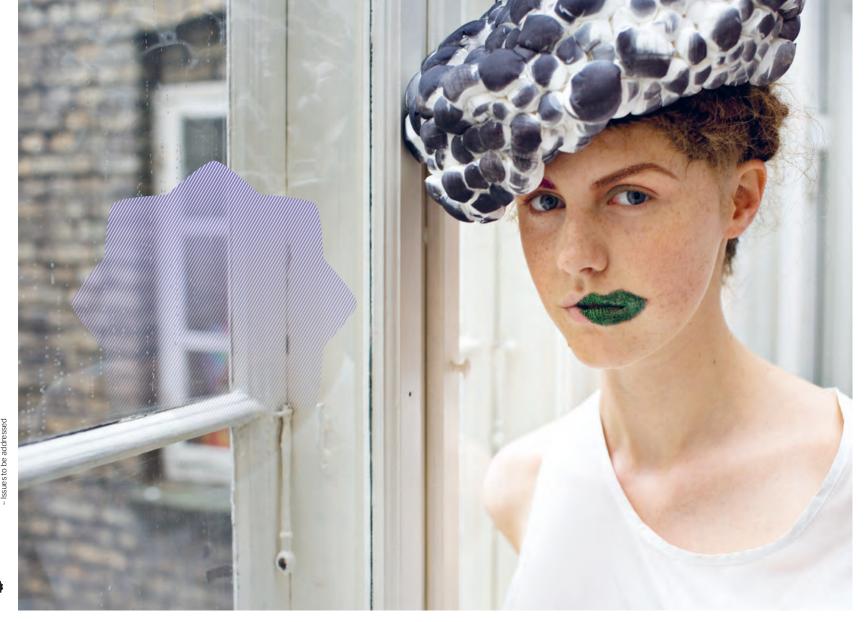
the type of offering remains fairly constant – trousers, shirts, suits etc. – the style, colour and materials of these items themselves change very rapidly. Many purchases are made on impulse and a great deal of clothing is never worn before being thrown away. Considerate Design is aiming to create more sustainably designed products which will also engage the individual consumer for longer.

Supply chain issues

With the exception of a small number of staple clothing products, such as basic T-shirts or underwear, fashion garments are produced by ever-changing supply chains, in batches of relatively small production runs (typically in the order of a few thousand, often much less). Therefore the time invested in designing a product is a significant part of its costs. Tracing a garment's ethical and environmental supply chain adds to this cost and thus increases designers' and company management's reluctance to do so. Typically, fashion designers create a large number of designs which are launched simultaneously, so that whilst each individual design might be simple it is extremely difficult to follow up all garments at once.

The clothing supply chain is highly complex and time sensitive, involving many components and subcontractors in different locations. The range of variables in the production of both basic clothing and seasonal fashion is still relatively high compared to mass production in other industries. Through small batch sizes purchasing power in much of the fashion and textile supply chain is limited, as typically, small quantities are sourced from numerous suppliers.





Volume is broadly related to price and market level: supermarkets and high street brands manufacture perhaps a thousand per style variation; a designer label hundreds or even dozens; a start-up design company works in very small batch production, whereas bespoke services a market of one.

Due to this fragmentation, SMEs (small and medium sized companies) in the fashion industry have had little influence on the large chemical suppliers at the start of the production chain of fibres, dyes and finishes, although recent government legislation in Europe addresses the environmental impact of chemicals. The fashion supply chain has largely been based on trust, with few suppliers being certified to guarantee ecological or ethical production. Designers' ability to check up on their suppliers is limited by the very tight time schedules of seasonal fashion production, which are pivotal for commercial success.

Fashion Customers

The ethical dimension of garment production has an increasing public profile, although cost is still of paramount importance. A survey by consultants GfK found that 54% of consumers would rather buy clothing that is ethically made as long as they are not paying more. Consumers now expect clothing retailers and manufacturers to demonstrate greater responsibility and transparency about their suppliers at all levels of the value chain, from fibre to garment. Accountability for the sustainability of clothing and fashion is thus distributed between consumers, retailers, designers and suppliers, in the absence of established legislation.

At any one time hundreds of thousands of different fashion designs are on sale, making it impossible to trace and evaluate all competitor designs, so that direct product comparison has not been a driver of ecological or sustainable fashions as it has, for example, in the automotive industry. Here, it is possible to assess the final product to understand its environmental impact, as many of the production processes are similar across companies and heavily legislated. In fashion there is an enormous variability in the impact from both resources and production processes.

The Fashion Lifecycle

Although a widely accepted theory in product design is that 80% of a product's environmental impact is determined by the materials choice (Graedel & Allenby, 1995), this breaks down with staple clothing items such as T-shirts, underwear and jeans, which are frequently laundered, or outerwear which is often dry cleaned. Consumer use and after care is a major part of the lifecycle and environmental impact of clothing, before its end-of-life disposal stage. Behaviour patterns regarding washing, ironing, tumble drying and dry cleaning clothing vary dramatically, dependent on individual decisions, contexts and preferences. Studies have found that in some types of clothing the use phase can cause the vast majority of the impact. A frequently cited study, the life cycle analysis of a polyester blouse by Franklin Associates found that over 82% of energy requirements, 66% of solid waste and 83% of carbon dioxide emissions derive from the consumer use phase (cited in Fletcher, 2008, p. 78, Kelday, 2006). Similarly, the report Well Dressed? analysed the energy profile of a T-shirt



when washed, ironed and tumble dried 25 times, and found 65% of the total energy used due to laundry, compared with 7% from transport (Allwood et al., 2006, p. 27). Fletcher and Tham's Lifetimes project in 2004 examined variations in consumer behaviour and use across different types of clothes including jeans, underwear, outerwear and party clothes (Fletcher, 2008, p. 175-183). Considerate Design will assist in considering lifecycle issues at the design

User centred fashion: Bespoke fashion and customised fashion products

stage, where informed trade-offs are possible.

Mass customisation in fashion is becoming technologically feasible and can enable production to return close to the place of consumption. Online and physical retail systems are used in a growing number of product areas such as footwear, jeans and shirts, with the ability to respond to individual consumer choice whilst maintaining the benefits of mass production. For example, in 2006 Nike introduced the Nike ID online system of customisation for trainers, enabling colours and fabrics to be chosen and lettering to be added, and most significantly, for each foot to be specified differently. By better satisfying customer needs it may be possible to reduce the rate at which fashion products are replaced. We are developing methods to assess the cost of the design effort required in customisation to make customisation economically viable for new and existing business models.

"By better satisfying customer needs it may be possible to reduce the rate at which fashion products are replaced."

Sandy Black and Claudia Eckert

The Considerate Design Concept

Considerate Design is both a concept and a process which aims to reduce the environmental impact of fashion consumption in two ways: (a) by giving customers what they want through customised products and (b) by helping designers to assess the environmental impact of the designs they are producing. Few fashion designers realise the environmental impact of their design decisions.

Moreover in a fast-moving industry such as fashion, sustainability is a vast concept for designers to contemplate, one that paralyses rather than motivates. Considerate Design aims to break down design for sustainability into elements relevant to fashion: it considers the environmental impact of the clothing production supply chain; considers the end user, and considers the lifecycle of the product. This is intended to be applicable to the economic framework

and constraints within which the designer is working, whether bespoke, small batch production or mass manufacturing.

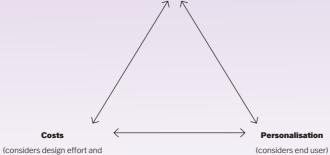
The Considerate Design concept makes new links between sustainability, personalisation and costs within the fashion design and production process (see Figure 1). A two-fold approach is adopted to assist at different scales within the fashion industry:

- 1) for large scale manufacturing to compare costs and tasks, process modelling, using the P3 software tools developed by the Engineering Design Centre at Cambridge University⁴, is adapted to the fashion industry;
- environmental impact analysis using a simple accessible tool to identify and assist decision making is aimed at designers in small or larger companies, which is discussed here.

Figure 1 Triangle of relationships

Sustainability

(considers the environmental impact through life cycle)



economics of production)

"... action for sustainability in fashion has been slow to develop in both the industry and the consumer, because the nature of fashion itself appears contrary to the spirit of sustainability."

Sandy Black and Claudia Eckert

Existing literature on eco design or green product design outlines both theoretical models and, more recently, practical tools for product designers to develop more sustainable approaches in response to previous critiques (see for example Papanek (1995), McKenzie (1997), Whitely (1993), Brezet and von Hempel (1997), Jones et al. (2001) and Walker (2006)).

As it is extremely difficult for fashion designers to assess the environmental impact of a design, they do not know how to target potential improvements, and so make choices on aesthetic or financial criteria. In trying to assess environmental impact, designers have to trade off very diverse factors, such as the costs of transporting the garment and its raw materials versus the impact that the disposal of the garment would have, as illustrated in Figure 2. In this context, a concept similar to the eco strategy wheel is used. It was originally developed by Brezet and van Hemel (1997) and adapted by others. ⁵

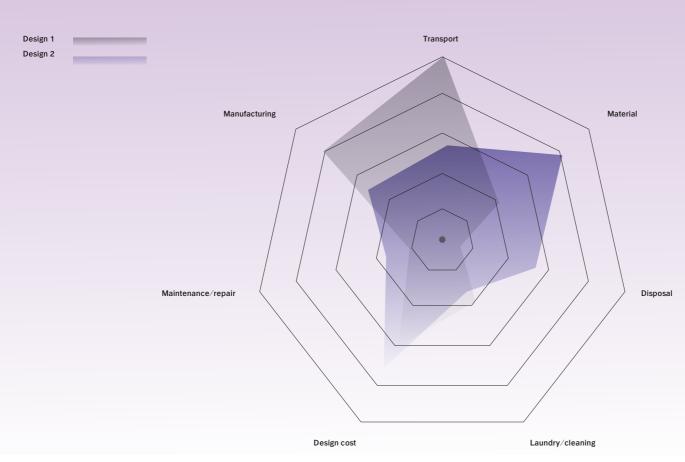
The Considerate Design project works on identifying a set of factors which contribute to the environmental impact of fashion products. As many of these

factors are themselves far from simple, they can be broken down further hierarchically, so that designers can visualise and assess individual factors.

The spider diagram (Figure 2) represents the impact of individual factors on a scale of low to high and thereby draws impact profiles of design alternatives. Designers can thus assess and compare the "footprint" of alternative design scenarios and target their efforts to reduce the impact of certain factors, comparing production routes or materials depending on costs. In the first instance designers can provide their own estimates, so that the spider diagram provides a visualisation of the connectivity of many complex factors. However, the assessments of individual factors will later be automated in order to reach a comparative overall measure.

Considerate Design spider diagrams can be accessed at different levels of complexity and on different aspects of the supply chain. They particularly identify any additional costs of personalisation against other factors contributing to the design, costs which are often hidden.

Figure 2 Trading off different factors of fashion designs



Example of considerate design decision making: personalised knitwear

Due to global shifts in sourcing, the majority of commercial knitwear designed in the UK is manufactured overseas, entailing transportation of samples, design staff and bulk production. In contrast, individually made pieces using 3D garment technology enables knitwear manufacturing to be responsive to demand, localised and personalised.

Yarn sourcing

Yarn is sourced from an Italian manufacturer – but the designer has no information about the yarn dyeing or where the wool is grown. Best quality merino wool comes from Australia and New Zealand (no comparable quality wool exists in the UK), therefore hidden transport miles are contained in the yarn specification. The designer must depend on the yarn supplier's integrity to have factories which produce no harmful effluents and use non-toxic dyes, and for ethical conduct throughout its own supply chain. Figure 3 illustrates the selection of two different yarns.

In the selection of the material, the designer needs to consider aftercare and disposal. Wool can be washed and dry cleaned and, if thrown into landfill, it is biodegradable. Due to its high material value, compared to cotton and acrylic for example, wool garments can also be mechanically recycled into lower quality fibre or filling material, provided no significant quantities of other fibres are used in the yarn or garment, including threads and labels.

Choice of knitwear manufacturing technology

This determines the amount of yarn wastage and the programming and manufacturing costs, which vary according to the skilled labour needed and the technology involved. Choices are:

- Cut to shape from knitted fabric lengths and sewn up by a production line of workers. This wastes yarn, but minimises programming time, and is fast and low cost when used for bulk production.
- 2. Garment pieces knitted to shape and "linked" together by highly skilled workers. This process is labour intensive, of premium quality, with minimal yarn wastage and standard programming time but high make up costs. It is flexible for small batch production, within a wide range of fabric possibilities, but less cost effective for individual items which require additional set up.
- 3. 3D knitted as a one-piece garment with minimal make up and yarn wastage. Subsequent garments can be made easily without setting up a production line, but their customisation requires additional programming. Simple changes in size are easily accomplished, but textural or design innovations may require significant programming and sampling time to adjust standard patterns and apply choice of colour, yarn, texture or other design motifs.

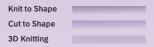
As Figure 4 illustrates, for 3D knitting, design and production costs are high per individual garment, but traded off against reduced labour costs for making up and minimal yarn wastage, together with enhanced comfort and personalised fit for customer satisfaction.

Although detailed environmental impacts are beyond the feasible responsibility of many fashion designers, the enhanced traceability information emerging from the textile industry together with increased availability of more sustainable materials enable designers to be better informed to make more sustainable decisions around material choices. Added to this the potential of 3D knitting technology for personalised knitwear enables new business models to be envisaged.

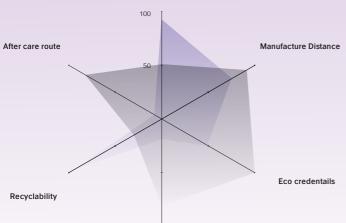
Figure 3 Factors for consideration in yarn sourcing



Figure 4 Comparison between knitwear manufacturing routes









Making up cost Knitting time

Yarn cost

Programming time

Yarn Sourcing

Design time

Conclusions

Design decision-making in the fashion clothing sector operates under a number of key constraints, notably high time pressures, remote manufacturing, saturated markets and increase competition. Dynamic supply chains create severe difficulties in achieving sustainable design, and responsibility is dissipated throughout the chain, with players at different points completely unconnected. Key decision makers are retail buyers, whose focus is on the right product at the right time and price, and designers whose focus is on the balance of style, aesthetics and cost. Communication between these interests determines economic success. As communication throughout the entire supply chain becomes more transparent, the influence of informed design decisions can grow accordingly. In a saturated market, the desire for greater individuality has

increased, and Considerate Design can assist in harnessing sustainable benefits for personalised fashion products, countering the tendency for fast and throwaway fashion through increased satisfaction, meeting consumer needs more accurately and perhaps disrupting established wasteful systems. Considerate Design helps assess the viability of these personalised products and compare costs of the design effort in the specific context of sustainable fashion, supporting this concept to become a reality and not to remain an oxymoron.

Acknowledgement

The Considerate Design for Personalised Fashion project is funded by the AHRC and EPSRC research councils under the Designing for the 21st Century Initiative.

- 1 S. Black, personal interview, July 2007.
- 2 EU legislation in the mid 1990s banned the use of 22 azo dyes as potential carcinogens when broken down. The Registration, Evaluation and Authorisation of Chemicals (REACH) EU legislation, aimed at protection of health and the environment and implemented in 2007, requires companies to register the manufacture and use of all chemicals above a threshold volume.
- 3 GfK Consultants, 2008, Organic Exchange Symposium, 13th June, London College of Fashion.
- 4 www.eng.cam.ac.uk/p3/
- 5 See for example the Eco Design Web tool available at www.informationinspiration.org.uk/ developed by Lofthouse and Bhamra; Elvins & Bassett (2005): Financial + Social + Environmental + Personal = Sustainable.
 An introductory guide to sustainability for designers.



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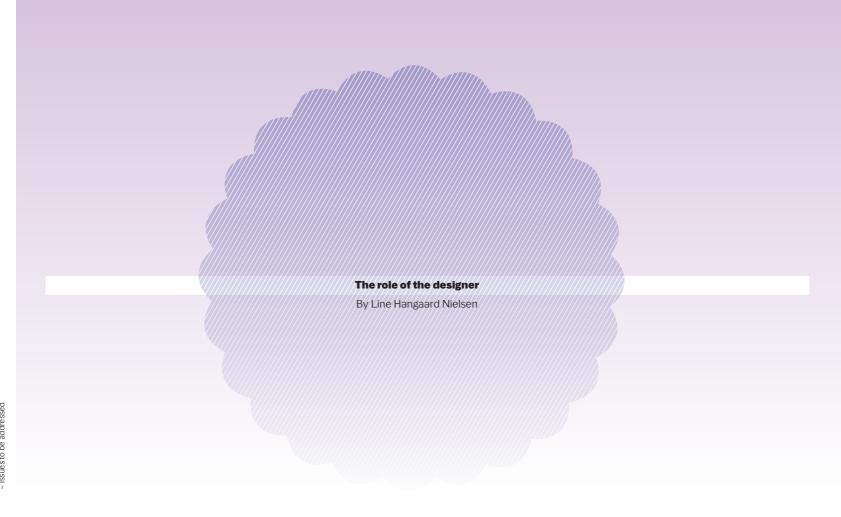
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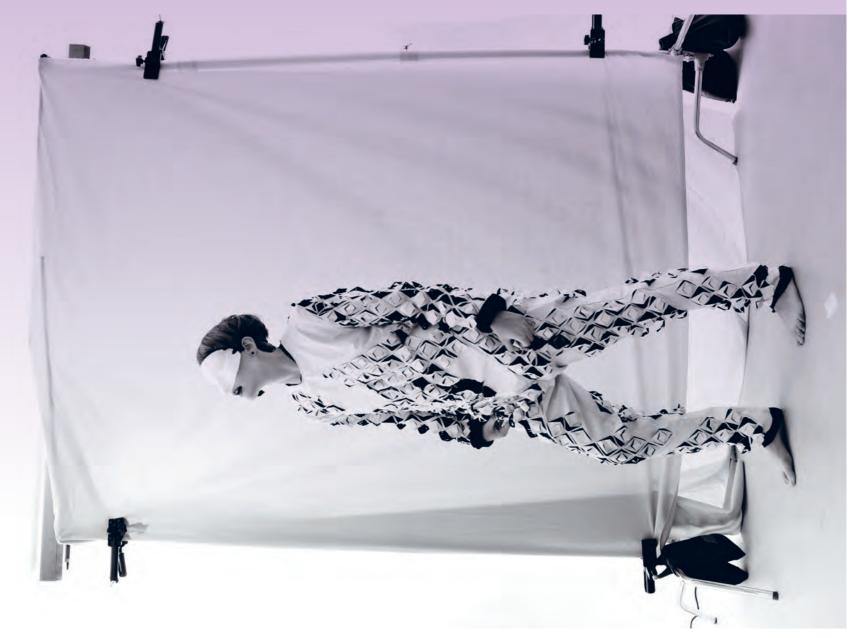
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Introduction

Literature describing the connection between sustainability and design particularly emphasises issues concerning materials, production methods and pollution in relation to industry, since these have a massive impact on the environment and cause large waste problems (Braungart & McDonough, 2002, p. 27-56). An issue that is not often addressed, though, is the issue of sustainability in the creative process of the designer. This includes e.g. the possibility of using techniques developed to optimise the materials, shaping, functionality, reutilisation, aesthetics and the general life cycle of the product. You could for instance create sustainable fashion by taking a new approach to shaping where technologies create new construction methods, bring a new aesthetics to fashion and give the designer new possibilities for design development.

This article deals with the margin between sustainability and fashion based on the role of the designer. The article sheds light on issues and perspectives concerning the role of the designer in relation to product development, production and industry, business strategy, technologies and materials as well as their application, shaping, the consumer and dissemination of information. The article will define fashion in relation to market strategies and product development methods, since these are the areas in which the designer has to navigate when the objective is sustainable design. Sustainability and the role of the designer have to do with market strategies that involve quality, price and creativity, all creating a profit for the individual company. But not all strategies are consistent with sustainable production, industry and business strategy.

Sustainable fashion achieves real value in the interplay with a consumer. The role of the designer in relation to the consumer is developing, because the Internet gives the consumer the possibility to influence the market consumption and the design process. Thus, the consumer, the product value, location and position in society are inseparable parameters of a sustainable design development.

An important prerequisite for creating a sustainable development is communication. To be able to explain the potential and qualities of a given product influences the sentimental value of the product to the consumer; a value and relation that can promote a long-term use of sustainable design adjusted to different forms of utilisation and reutilisation.

Bigger focus on the role of the designer in a sustainable fashion industry could advance research, debate and discussions with educational institutions and professional organisations and lead to a larger development of shaping, textile materials, technologies, standards and recycling systems within the field.

Market strategies in the fashion industry

Often, market strategies in the fashion industry are left to marketing. Visually, marketing can make a brand present itself as a quality product creating profit for the company. The excess value for the consumer comes from the physical and sensuous experience of the product and the experience imparted to it by marketing, while less attention is directed towards the development, the manufacturing, and the quality of the product.



The market strategies of the fashion industry are about quality and price but also about creativity that enhances the aesthetic value of the products. During the creative work, the designer is present, and therefore, the role of the designer becomes of importance to the marketing process.

In the fashion industry, the division between price, quality and creativity is clear. Price and quality are carefully calculated by the companies to support the market strategy and the consumer group. The division of price range and quality has, however, become less transparent for the consumer. This is partly due to the fact that the discount brands have improved their market strategies, and partly to the fact that companies have improved their possibilities to improve the qualities compared to the production scale – the bigger the production, the cheaper the product.

Another kind of market strategy in the fashion industry concerns designers and fashion houses who emphasise recognisability compared to signature, silhouette and innovation within cutting and design. For instance, Azzedine Alaïa has pioneered in the field of synthetic stretch material such as Lycra. Alaïas' design may appear simple but its production is complex using the qualities of the material to create shape (Hodge et al., 2006, p. 50). The designers attach importance to exclusive materials and high standards during production that can support the design of the product (Black, 2008, p. 171-176). Exclusivity is also due to the limited production which enables the consumer to acquire an individual look. This can be an important parameter to some

customers and a reason for buying the products at a higher price.

A third kind of market strategy used by the upper part of the high street chains are the so-called retailers who produce brands for their own chain stores. These companies develop products that are supplied in large numbers, where the design is based on basic shapes with variations corresponding to the current fashion trends. Examples are Zara, H&M and Bestseller (Black, 2008, p.171-176).

The middle price range is for instance represented in department stores typically divided into brand sections selling products from selected domestic and international companies. The department stores have certain common features with the above mentioned chain stores that create their own. mass-produced products for the mainstream market. In other words, the department stores aim to be spot on regarding fashion trends and attempt to launch the products at the exact right time, meaning when the trend is peaking. The chain stores produce large lots of styles, which means that they can sell the products at a lower price. In addition, the design of the products is directly inspired by the trendsetting fashion houses that put a lot of effort into the creative process and in the making of their products. Because of this direct inspiration, the chain stores save money on the creative process and thus generate a profit.

The trendsetting fashion houses have observed this trend of how the chain stores build their business with negative implications. However, within the last

few years, the smaller fashion houses have benefitted from the branding offered by the chain stores, which has enabled the fashion houses to save money on costly marketing. One way of branding takes place when a fashion house makes a small line of clothing and sells it under its own name in the chain stores. The chain stores market the collaboration and present the aesthetics of the fashion house to the consumers. This has resulted in larger sales for the fashion houses, since more customers are introduced to the aesthetics of the fashion house and subsequently pursues the exclusivity. Examples of such collaborations are Karl Lagerfeld for H&M and Yohji Yamamoto for Adidas (Black, 2008, p. 176).

The newest addition to the fashion industry is the sale of fashion items by discount stores. The discount stores generally have a limited product range because they sell easily saleable goods in order to increase turnover and minimise storage costs. In addition, the stores try to increase their profit by minimising costs on decoration, and sometimes even sell goods directly from pallets and cardboard boxes (Black, 2008, p. 171-176). The products of the discount stores are intended for mass production, the driving factor being profit. In other words, they try to offer good quality at the absolutely lowest price on the market. Thus, "discount fashion" is a significant competitor in the fashion industry.

Another recent market strategy is the development of online shopping on the Internet. Customers are able to order goods directly from the supplier online. Internet shopping enables customers to buy the same products as if they were shopping in a physi-

cal store but they do not depend on the geographic location of the store/supplier, which means they have easy access to more products. This creates major competition in the fashion industry. Internet shopping is able to offer a wide product range but the sensuousness of the physical contact is obviously lacking. 1

The above mentioned market strategies are the general strategies, which the fashion industry applies when it markets new products. However, once the product arrives at the consumer a new development occurs making the sentimental value of the product a significant parameter. If you succeed in creating great, sentimental value in a product, you will automatically get the consumer to keep the product for a longer time. Therefore, when working with sustainable design, you have to investigate and focus on the emotional bond that the consumer develops with the product. On the Internet, the consumers are able to discuss and "review" products on different chat and consumer sites. This enables the designers and companies to include consumer opinions in their further marketing and product development. The latter includes contemplating the placement, value and position of the product in society. The designer influences the role of the product in society, and this influences the way the consumer perceives it.

Sustainable design process

When sustainability becomes the basis for a design, it is important to regard the design process as divided into different decision areas, more specifically the design process, the product development and the subsequent processing.

"If you succeed in creating great, sentimental value in a product, you will automatically get the consumer to keep the product for a longer time. Therefore, when working with sustainable design, you have to investigate and focus on the emotional bond that the consumer develops with the product."

Line Hangaard Nielsen



"It is some paradox that the fashion trends demand styles with an old and worn look. The consumer can create this look by simply using the product, but the consumer demands and/or is lured into buying – new, "old" clothes, e.g. jeans, which cause great damage to the environment during production."

Line Hangaard Nielsen



Materials and fibres have a great impact on the environment and cause major waste problems. In a sustainable design process, you will typically focus on selecting fibres and materials and they way you combine them. This makes it possible to use intelligent and new materials created to support the values of functionality, aesthetics, reutilisation and minimum waste.

In their book "Cradle to Cradle", Michael Braungart and William McDonough (2002) define sustainability as a life cycle process. This cycle takes place via a "cradle-to-cradle" principle in which products are part of a recycling system without loss of value. The Japanese textile company TEIJIN creates materials that enter such a life cycle; e.g. their ECO CIRCLE polyester which is completely recyclable.²

"Cradle to Cradle" also focuses on the diversity of a product. One should not only consider how a product is produced but also how it is used and who is to use it (Braungart & McDonough, 2002, p. 136-177). The optimum solution is long-term use of products adjusted to various uses that thus contribute to a sustainable design – either in a form where the product becomes part of a reutilisation process which constantly works to improve the product, or as a product with great sentimental value and therefore long life cycle.

In a sustainable design process, the designer has to ask questions and think of new links in relation to aesthetics and the environment. In a sustainable context there may be a tendency to place less importance on the aesthetic value and durability of a design.

For example, it is difficult to combine sustainable, eco-friendly solutions with trend and fashion because the consumer is so used to seeing fashion as a constantly changing industry with eight annual collections and prices that enable people of even low income to buy clothes on a regular basis. The question whether all these items of clothes are really necessary is rarely asked.

The designer plays an important role in integrating the concept of sustainability in fashion. Fashion is a river with multiple ramifications. If a good, functional and sustainable design is introduced, it can potentially affect the fashion world on several levels. Repetitions or copies of the product and designs imitating the principles or even creating improvements of the product will most likely be introduced on the market. Attention will be directed at the product in question and through the Internet or other communication channels, a trend can develop based on the product that may centre on a new fashion or a new way of applying the product.

Sustainable product development

Energy and pollution are important factors in the product development of a design. Waste problems are often seen in connection with material use and faulty manufacture. Product development consumes large amounts of energy, both during the processing of textiles when the product is made and in connection with products that need subsequent processing such as bleaching and other forms of washing. If one wants a sustainable approach during this phase, it requires reducing the amount of waste and the environmental impact meaning colour pol-



lution, water and energy consumption (Fletcher, 2008, p. 46-57). The designer should attempt to optimise the textile, minimise the sewing process, utilise cloth remnants and develop the shape. For instance, one could imagine a sustainable design with a completely different shape where technologies

stance, one could imagine a sustainable design with a completely different shape where technologies create new cutting principles that support a design without waste and with reduced energy consumption. By emphasising a difference in shape between "conventional" design and sustainable design, fashion companies will be able to market their sustainable products more clearly making it easier for the consumer to choose. Moreover, the designer must consider the sentimental value, the life and the reutilisation possibilities of the product. By creating a design that can potentially be reused, one comes closer to achieving a sustainable life cycle in the form of a "Slow fashion" culture including designs that are "long-term" in use and function (Fletcher, 2008, p. 173-175).

The role of the designer in the sustainable production

The biggest environmental challenge in sustainable fashion is the manufacturing process along with the right supply and selection of materials, since these processes involve chemical spill, transport, water consumption and waste issues. More knowledge of production methods and technological development will help improve the environmental impact during the manufacturing of clothes.

In order to minimise energy consumption, the designer may consider ways of redefining or optimising the design, e.g. by eliminating the production of waste

materials (Braungart & McDonough, 2002, p. 108-135). A design choice could also involve eco-friendly fibres; not only the material of the fibres but also the amount of fibres influence the eco-friendly production. Materials with a single type of fibre can result in fewer obstacles during the reutilisation process.

During regular cotton production the energy consumption is particularly visible during the washing process and in the use of chemicals during the cultivation process. When manufacturing viscose, the energy consumption dominates the production, since these fibres are regenerated from chemically treated cellulose (Allwood et al., 2002, p. 44). The designer can try to prolong the life of the product or reuse materials in order to reduce the total energy consumption.

Since the environmental impact is worst during manufacturing, alternative manufacturing methods must be developed. Shifting from regular to ecological cotton cultivation will reduce poison and chemical spill but may also result in increased economic costs for the cotton farmers. An important economic issue is the fact that conventionally cultivated agricultural land that is converted to ecological production is not accepted as ecological the first three years. Only after three years is the farmer able to receive the added cost of ecological cotton. Meanwhile, he has to struggle with a lower yield - which is the result of having an ecological production – that can only be sold at a "conventional" price. Thus, to the poor cotton farmer, shifting from conventional to ecological production is not a question of unwillingness but rather a question of economy and pure survival.









A company such as Gossypium is aware of this issue and therefore uses cotton from the transition period in an attempt to support the ecological cot-

ton production in India (Black, 2008, p. 122-123). Gossypium refers to the products as "pure and fair"

and "Fair-trade", because the term ecology would be misleading. The "Fair-trade" standardisation with-

in the cotton industry only refers to the production of cotton fibre (Fletcher, 2008, p. 23). The standardisation does not state anything on the manufacturing of the final cotton product. This means that the con-

sumers have to check what the standardisations actually comprise when choosing a product.

The designer can further reduce the environmental impact of the production by avoiding chemical

subsequent processing such as dyeing and washing for the sole purpose of making the clothes look older and worn (Fletcher, 2008, p. 49-57). Rather than

chemical ageing, the expression should come from wear. It is some paradox that the fashion trends demand styles with an old and worn look. The consum-

er can create this look by simply using the product, but the consumer demands – and/or is lured into buying – new "old" clothes e g leans which cause

buying – new, "old" clothes, e.g. jeans, which cause great damage to the environment during production.

In relation to industrial manufacturing, processes of subsequent processing focusing on reutilisation or degradation will still have to be created. In terms of

the environment, the recreation of design objects can support significant improvements to the waste issues. By reusing product materials that would other-

wise be thrown out or by using reproduced waste materials, the designer approaches the wish – or the

demand – for creating a life-long design (Braungart & McDonough, 2002, p. 108-135).

However, it is important that the objective for a design created from reproduced materials or waste materials is a product of the same or better quality so sustainability does not come to mean a decline in quality. If sustainable products do not remain true to the requirements and values disseminated by the sustainable business strategy, such as products with long durability and reduced wastage, the consumers will lose their faith in the products. This would be devastating to the growing sustainable industry. Location of production sites also influences the environment, for instance when goods from developing countries have to be transported from the production plants to the Western market. However, relocating the production to the Western market is a long-term and unrealistic measure that would cause vast economic

and societal problems in the developing countries.

Instead, Kate Fletcher's idea about "Slow fashion",

as well as a general strategy to produce less, might

be a solution (Fletcher, 2008, p. 173-175). Moreover, much points to the fact that the competition from the developing countries will intensify. The developing countries will continue to offer low wages to the production staff, while the demand for the productions increases in relation to the quality of the products as well as the use of technological developments that might lead to the implementation of robots (Allwood et al., 2002, p. 33-37). This will mean an entirely new production structure. Thus, the starting point of a sustainable production must be to produce less and to improve the products so they are able to form part of reutilisation processes.

The role of the designer in the sustainable industry

Within the sustainable industry the designer needs to focus on minimising waste and using biodegradable materials. The fashion industry solves many waste problems by incineration. Therefore, the use of artificial fibres, meaning synthetically manufactured fibres, should be minimised, since these produce hazardous fumes during combustion (Allwood et al., 2002, p. 50-53). However, for certain techniques, such as welding, pleating and laser cutting, the qualities of the artificial fibres are necessary. The techniques support innovative solutions and enable new approaches to clothes bringing together new technologies, materials and processes in one design. However, it is important to apply and develop technology that has the additional objective of supporting a sustainable development in order to be able to solve issues concerning materials, production methods and pollution in relation to the industry (Fletcher, 2008, p. 43-44).

The sustainable sector is growing, but there is still a need to promote sustainable growth and develop sustainable products that will help define the fashion industry now and in the future. If a company introduces sustainable products, it will result in changed working processes in affiliated industries, and a new development in technology and production methods will follow. Influencing the industry on all levels is crucial in order for sustainable products not to become niche products (Fletcher, 2008, p. 108-114).

A piece of clothing such as a T-shirt can be both a cheap product in a discount store and an exclusive

design item. The production costs related to the exclusive T-shirt are bigger because better quality materials and more aesthetic design values are used. The two types of clothing are products of two very different creation processes, which of course generates a price difference. If, in both instances, the T-shirt were to be transformed to a sustainable product, it would create changes in the choice of material and production costs. The choice could concern local production or the use of materials manufactured without the use of chemicals. The changes would not be directly visible in the product but would result in a price increase due to the processes being more costly. Companies do not wish to see the prices of their products go up, which is a barrier when it comes to creating sustainable products. Sustainable products do not create value for a company unless they are defined as business opportunities and business strategies that unite ethical and environmental objectives (Allwood et al., 2002, p. 26-27).

When the link between sustainability and business strategy becomes unclear, so does the level of the designer's involvement in a sustainable development. The role of the designer in a sustainable development is to be found partly, in the demands the designer can place on the products used in the design process and partly, in the demands that the designer can place on the formulation of the business strategy.



Sustainable business strategy

Defining a sustainable business strategy is hard. It can take on various forms and lead to different improvements of sustainability. It is hard to say exactly when a company can be defined as sustainable since the mere existence of a company implicates the environment. In that respect, is it better to wait for the development of the "right" sustainable business strategy? Or is it about working for a slower

process where each new measure in the company

is a step towards more sustainability?

Implementing a sustainable business strategy can be difficult if the company does not develop the product from beginning to end product. It will be harder for the company to track the process and control the entire production chain. However, keeping a sense of perspective is important, because the consumer can demand an explanation and a description of the cycle of the product from which to form his or her own opinion of the sustainable business strategy of the company.

Cheap clothes are often comparable to single-use products. The products are mass produced to keep

prices low and attract consumers. They are sold

in stores that change their product range approximately every third week. Such a business strategy generates great losses, but the store regains its loss because the strategy tempts the consumer to buy on impulse, since the product is only available for a limited period of time. This sustains a system of consumption which increases consumer expectations and competition allowing the short-lived nature of

fashion to grow and develop; a short-lived fashion

which results in more waste but also contributes to economic growth and is an important source of income in Denmark and abroad (Black, 2008, p. 88).

The speed of the development will increase due to the commitment of the consumers. Thus, it is central that the consumers continue to demand further improvements in order for the pace that we see in "single-use" fashion to translate into sustainable business development. However, to influence the development in fashion to become long-term and sustainable will interfere with the business strategy of a lot of companies. The designer will therefore have to consider whether it is realistic to slow down the pace of the fashion industry, and whether it is in fact a prerequisite for sustainable fashion. Although, this would require an analysis of all principles, production processes, design methods and marketing strategies within fashion (Fletcher, 2008, p. 161-166).

There are many ways of approaching a sustainable business strategy. To slow down the pace of the fashion industry could be one approach, but it would encounter resistance from the global industry. Another approach could be to focus on second-hand clothes: The recycling sector is already used as a solution to the vast surfeit of clothes. Promoting this development would encourage more people to recycle their clothes and enable an increase in the amount of material to be reused in other products.

A large problem connected to the trade of second-hand clothes is that new clothes have become con-









siderably cheaper. This means that second-hand clothes lose a significant share of their value and thus are not worth sorting for recycling. In addition, the quality of second-hand clothes has deteriorated, since most of the clothes donated to thrift shops are cheap clothes of poor quality (Fletcher, 2008, p. 100-101).

A structure of society where people of few means find status in donating for thrift shops rather than buying from them adds to this problem. In addition, many consumers sell their clothes through the Internet, which also leads to reduced business for the thrift shops, but on the other hand this reduces the consumption of new clothes. Today, distinguishing between vintage and second-hand clothes has become relevant: as opposed to second-hand, old vintage clothes are still very much in demand.

The idea of creating new products from already existing products is obvious to pursue in the recycling sector. However, reusing second-hand clothes as a solution for sustainable design gives rise to a number of issues, since the product is already processed and often is not designed for reuse. Therefore, a lot of second-hand clothes have limited use and serve as decoration for new garments (Fletcher, 2008, p. 101-103). Moreover, a lot of the clothes are of poor quality and therefore not suited to form part of a recycling process.

A sustainable business strategy could include the materials being selected based on their almost infinite possibilities of reuse and long period of application. Environmentally, the designer has to focus on creating improvements in relation to energy and chemical consumption during material production as well as contemplate how to produce the products - locally or globally – and how to dispose of them.

In order to comply with a sustainable business strategy, companies have to reduce the production of primitive products. A problematic objective since primitive products are attractive due to the fact that they are affordable and work long enough to satisfy the expectations of the consumers and the market in general (Braungart & McDonough, 2002, p. 49). Hence, companies have to look upon sustainable products as an objective and as a challenge that will help the company grow and make a profit. If the sustainable business strategy is pushed towards an industry reserved for products of high quality with the potential to be reused, a bigger demand for repair services might develop. By offering repair and adjustment services, the companies provide the consumer with the possibility of individualising the product, thereby increasing its sentimental value. This is why repair and remodelling are significant aspects of the sustainable business strategy. The service must be about redesigning already existing design concepts and must be carried on in their branding (Black, 2008, p. 83).

Renting clothes

Another way of prolonging the life of clothes is to develop a system for renting, sharing and borrowing clothes and exclusive fashion objects.3 The benefit of such a system will increase the amount of times the clothes are used (Allwood et al., 2002, p. 41). A lot of consumers want to follow the fashion trend but many brands sell expensive products. If the consumer could rent these products instead, he/she would have access to high quality clothes and accessories and at the same time follow the newest fashion trends.

However, the idea of renting clothes can seem strange to many consumers; especially if the clothes are for regular wear. In order to make rented clothes an attractive alternative, they must satisfy the needs of the consumer; for instance the need to create an identity through certain brands or labels and/or the need to shop frequently. The challenge is to brand the idea efficiently and attractively and thereby create a change of attitude.

As already mentioned, a sustainable business strategy can point in many directions and support various improvements. It is not necessarily the designer who defines the values of a sustainable business strategy. But it is important that the designer is critical and mindful - for instance by focusing on sustainability and place demands on the products and materials that the company uses in the design process.



The role of the designer in the application of sustainable technologies and materials

When the application of technologies becomes the starting point for the development of a design, the processes can be divided into three stages: 1) Technologies applied in the product development

- 2) Technologies applied in the product
- 3) Technologies applied in the enhancement of the product.

Technologies in the product development

Technologies applied in the product development can benefit smaller productions, and prevent the price of the product to be determined by the size of the production. One will thus produce less and sell the products at the same price as mass produced products. If the products are not produced prior to ordering, the stock costs and need for clearance sales will be minimised, just as the amount of clothes produced will correlate with the actual amount of clothes in demand (Black, 2008, p. 84). Moreover, requirements concerning placement, sales outlet, prepayment as well as obligation to order large lots, which might result in product waste, will also be reduced.

In the manufacturing of clothing, technologies that are able to create clothes by using a single machine would be preferred. Current clothing manufacturing generates a lot of production waste, since a lot of material is cut off and thrown away. This waste would be greatly reduced if the fibres were inserted directly into a machine that is able to transform them into clothing. Another factor has to do with a more accurate use of dyeing and use of robots in

the production. This is an expanding technology. One example is seamless clothes in which almost all sewing processes are eliminated due to 3D knitting and laser welding (Allwood et al., 2002, p. 30-37). Already existing products include machine knitted gloves and socks from the groundbreaking A-POC - A Piece Of Cloth - by Issey Miyake. A-POC applies 3D knitting and 3D weaving whereby structure and texture are joined into finished knit parts of an allwoven piece of clothing – in one simple process. A-POC thus consists of seamless items of clothing that the consumer can cut out according to need (Miyake et al., 2001).

Applying new production techniques will enable a relocation of the production, since seamless knitting, stitch-free seams, 3D weaving and 3D sewing do not require additional sewing. Such technologies would also alter the payment structure of the production, since you would be able to use robots for the product manufacturing (Allwood et al., 2002, p. 13).

Digital technology and virtual technology are also developing. These technologies will enable 3D visualisation and activation of clothing design that will make it possible to create these in individual sizes and preferences by using a body scanner. The Selfridges department store in London has a virtual fitting room installed - a so-called "Bodymetrics" which helps the consumer find the right pair of jeans to fit his/her body type.4 The customer is scanned in the fitting room where subsequently, he/she can try on the jeans styles that the department store offers and select the best fit. This revolutionary technique will help reduce wrong purchases and enhance the

sentimental value of the jeans and so prolong their life: the perfect fit will potentially make the jeans the "favourite pair" that will be worn for a long time.

Body scanning can help companies create better fits for their mass produced clothes. Previously, measurements of the body have been based on a survey of the population conducted in 1941 (O'Brien et al., 1941). However, this measurement no longer corresponds with current body shapes. Today, a lot of decisions regarding bodily dimensions are therefore based on experiments and subsequent feedback from customers. The body scanning technology will provide a better understanding of the present sizes and shapes of the human body and thus enable the development of size sorting systems that fit the majority of the population.5

Another example of how body scanning technology is able to create a new shape is a T-shirt design by fashion designer Mashallah. 6 Mashallah scanned a number of people and translated their 3D data into 2D patterns with a multitude of points and changes of direction that do not concur with only one thread direction. This way of creating patterns alters the aesthetics of traditional cutting. Contrary to regular pattern construction, this kind of cutting is not based on traditional guidelines such as "middle front", "middle back", or "armhole". This gives the designer more freedom, opens up new ways of designing and enables more dialogue between designers and consumers. Thus, it is relevant to direct attention to the way we produce piece goods. Is there a better way of producing piece goods when technologies that enable new construction methods exist?

Technologies applied in the product

Clothes proofed with perfume, lotion, anti-UV qualities etc. are already on the market. In the future, we might be able to create multi-functional materials and clothing, for instance by applying textiles that change colour or pattern according to need. Such technologies will make the consumer less inclined to buy new clothes because each item can take on various forms. If the consumer is also able to change the shape of the clothes, we will have a complete recycling of products (Allwood et al., 2002, p. 46).

Nano-coating can help create a dirt-repelling surface. Such a surface can help reduce the need for washing, which will reduce energy consumption and prolong the life cycle of the garment. However, this is to be balanced by the fact that products created by nano-technology are so complex that the product is rarely suited for reuse. Moreover, there are not sufficient data on nano-coating's impact on the skin (Black, 2008, p. 98-103). Longer durability and less maintenance change the relationship we have with our clothes. We are used to washing our clothes regularly. If we are to become accustomed to clothes that do not need as much washing, we will need alternative cleaning methods that will compensate and help change our habits.

Technologies applied in the enhancement of the product

If the design of a product focuses on the use of one specific type of fibre as opposed to mixes of fibres – or it is easy to separate – the fibres of the product can be reused in another product, which will save energy. Each type of fibre has its own process of decay.

Using multiple types of fibres thus complicates the possibility of recycling (Fletcher, 2008, p. 103-105). In the recycling process, materials are categorised according to whether they are technologically or biologically manufactured and are intended to return to the same technological or biological recycling system after end-use (Braungart & McDonough, 2002, p. 120-133).

One company that applies the development within fibre recycling is Patagonia. Patagonia has created a system where the customers return their used clothes upon which they are reused in "new" cotton or polyester clothes (Fletcher, 2008, p. 95-96). Patagonia also collaborates with the companies Calamai and TEIJIN on fibre recycling. Calamai has upgraded fibres for the last hundred years and is known for its recycled cotton and polyester fleece. TEIJIN has developed a new method for reusing polyester; the so-called "ECO CIRCLE" concept where the polyester fibres can be shape fixated, laser cut and dyed but are still able to return to the original "basis fibre".

Whether the choice is ecological cotton or TEIJIN's "ECO CIRCLE" polyester, it is important for the designer to be able to explain his/her choice and to have considered other options for how to create a sustainable product. To ensure development in the field of sustainable design, the designer must apply the technology and intelligent materials available. The designer must connect the materials, the technology and the processes to make new products and make the various disciplines work together.

"In the future, we might be able to create multi-functional materials and clothing, for instance by applying textiles that change colour or pattern according to need. Such technologies will make the consumer less inclined to buy new clothes because each item can take on various forms."

Line Hangaard Nielsen



By Line Hangaard Nielsen





The significance of shaping to a sustainable design

Technological possibilities can influence a new shaping within the clothing industry. Currently, the majority of sustainable fashion has a shaping similar to that of the general fashion industry. You could, however, imagine that new technology applied in the shaping of sustainable products could result in less waste and reduced energy consumption.

In order to be able to understand the significance of shaping within clothing, you have to understand the development of the cutting methods, which, during modern times, have had a fundamental impact on fashion. The French fashion designer Madeleine Vionnet (1876-1975) is regarded as one of the most influential designers of the 20th century. She is described as the inventor of the "bias cut" and as a master among tailors. The bias cut is a technique where you work across the direction of the thread in a piece of woven fabric. Such a piece of fabric would normally have two thread directions perpendicular to each other and perpendicular to the body. Working diagonally to these directions makes the fabric more flexible. This makes the shape more flexible and can make the shaping appear lighter. Using the technique of bias cut makes it possible to stretch the fabric and enhance the lines and curves of the body. This approach to couture became groundbreaking to the designing of fashion. It opened up to new possibilities and has had a huge impact on today's designers. You still see the principle applied directly but also further developed in the work of contemporary designers such as Comme des Garçons, Azzedine Alaïa, Martin Margiela and Issey Miyake (Demornex et al., 1991).

The role of the designer in relation to the consumer

The fashion that is available to the consumers in stores is generally ordered and paid in advance prior to the season. The buyers predict which products to offer in the stores. In other words, it is their job to understand and predict the wishes and needs of the consumers for the coming season. Less focus is, however, on the role and responsibility of the consumer. In order to change this, you could inform the consumer and focus on sustainability early on in the fashion cycle. If you could persuade the fashion industry - and in particular fashion magazines, fashion journalists and fashion bloggers - to emphasise the benefits and necessity of having a sustainable mindset, you could influence the consumers to buy sustainable products. Buyers are consumers as well, though; therefore, you cannot avoid their subjective opinions, experiences and knowledge influencing their choices (Black, 2008, p. 180).

The Internet makes it possible for consumers to influence the market of consumption, for instance through personal blogs where they can present, debate, assess and recommend products.

This way, the personal blogs also come to work as staged "image disseminators" enabling the consumers to express themselves and their personal taste and style. The same thing goes on when the consumers have the opportunity to (semi)design their own products. For instance, NikeiD gives the consumer the possibility to put together and individualise selected items of clothes and shoes. 10



When the consumer is involved in the design process, it becomes more difficult to assess the role of the designer in relation to the consumer. The designer initiates the process but is no longer in charge of the final design. The many possibilities of the Internet are constantly developing challenging the business strategies of the companies and influencing the relationship between the designer and the consumer (Fletcher, 2008, p. 192-195): Is it the designer who makes the final design choices and thereby creates an area for the consumer to choose from? Do the designer and the consumer make the design choices together? Or is it the consumer who makes design choices, and the designer who has to operate within the area and select products for the consumer? In other words, is it up to the consumers to change their perceptions of (sustainable) consumption, or should the companies change their products to match the consumption of the consumers?

Literature on sustainable design disagrees on whether the objective is to change the perception of the consumer or not. Michael Braungart believes that we have to work closely together with the consumers and not try to change their perception but rather discover solutions that interact with the behavioural patterns of the consumers (Braungart & McDonough, 2002, p. 82-107). In contemporary society, clean clothes, new clothes for new events and the desire for frequent shopping are important needs for the consumer. In addition, the consumer is tempted by trends and new design products where part of the business strategy is that the products are used as a source of social acceptance in society (Fletcher, 2008, p. 117-124).

"Once the product is in the hands of the consumer, the relationship to the customers must be preserved in order to promote the recycling process."

Line Hangaard Nielsen

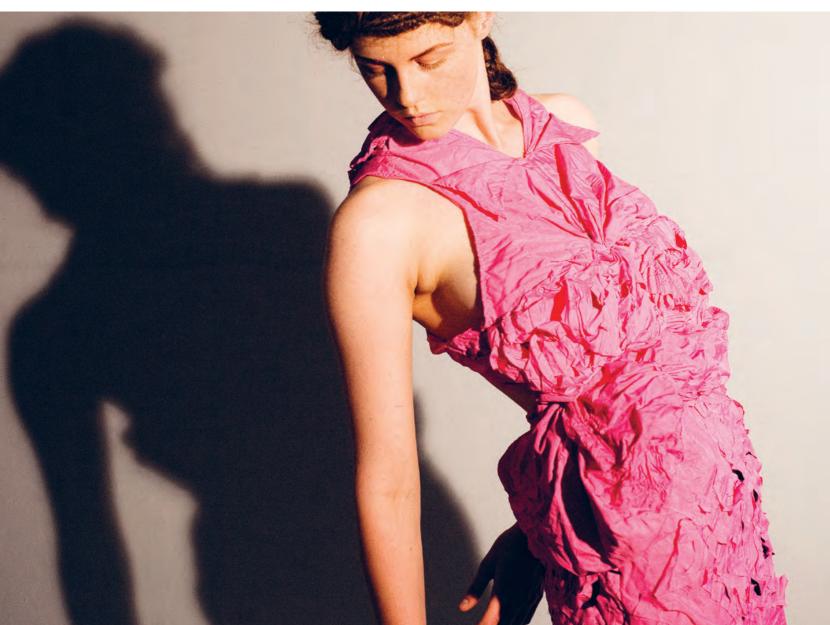
Linking the needs of the consumer with sustainability must occur in interplay between everyone involved: the designer, the company, the buyer and the consumer. The consumer still has a need to buy, and a sustainable development does not necessarily involve bringing down the level of consumption. By developing new consumption methods the consumption society will reasonably attach importance to recycling systems, buying second-hand clothes and developing the consumer's attitude towards recycling. As already mentioned, repairing and "customising" clothes can prolong the life of the clothes, while renting clothes and accessories can give access to a larger and more exclusive supply, which would minimise the production need while ensuring that each item of clothing would be used more intensively. Kate Fletcher's "slow fashion" concept has the same objective of keeping the clothes on the market and with the consumers for a longer period of time - the latter due to the sentimental value that the clothes have to the consumers.

One factor that can contribute to creating this development of interplay is communication. If the message is to render visible the sustainable values of a design, this must be conveyed and communicated to the consumer. Once the product is in the hands of the consumer, the relationship to the customers must be preserved in order to promote the recycling process. It is hard for the consumer to know which

materials and production methods are the better and more sustainable ones. Thus, a clear communication of the concept of sustainability, the sustainable products and sustainable use and handling is required; for instance communicating to the consumer that less frequent washing and washing at lower temperatures will reduce energy consumption and thus pollution. In addition, concepts of ecology, green design and fair-trade will have to be explained in more detail for the consumer to be able to make qualified choices (Fletcher, 2008, p. 75-92). In regards to this, information concerning the origin of fibres, subsequent processing and production location would be relevant to convey to the consumer, for instance on the washing label of the garment. Michael Flanagan of Clothesource believes that in a few years, we will be able to inform about the chemical waste as well, and it will be as common as the nutritional information you see on food labels. Before this can become reality, though, it will require laws on fibre production, textile dyeing, development of recycling technologies and reduction of energy and resource waste on a global level (Black, 2008, p. 124).

Communication and sustainable business strategies can indeed support the consumers in making the right choices, so they buy fewer and durable textiles and clothes, products where sustainability is part of the design and products made with minimum energy and chemical consumption.





"...it is important to realise that sustainable design cannot be created from traditional construction and production methods alone, but that it is complex and has many directions and effects that all need to be understood, processed and addressed. The moment it becomes interesting is when you are able to abandon the basic shape and see designing anew."

Line Hangaard Nielsen

Conclusion

Sustainability is about life cycle. For now, though, the overall focus is limited to the material use and production of sustainable products. The designer creates products and thereby consumption. This is why the role of the designer in relation to sustainable design is so important to investigate.

However, there are areas where the designer has no space or possibility to make choices that can affect the fashion industry; for instance in the encounter between the consumer and the product where the consumer holds responsibility for making sure that the product enters a recycling system after end-use.

When the fashion industry demands cheap products it can be hard for the designer to meet the demand without compromising the product manufacture and choice of materials. In such cases, an

external pressure, for instance legal pressure, has to push the industry in a sustainable direction. Likewise, efforts to enhance the development of shaping, textile materials, standardisations, chemicals and requirements for improving recycling systems should be intensified. Therefore, it is also important for the design educations to focus on sustainability. The educational institutions must emphasise research, debate and discussions about sustainability and expand the knowledge of this area while also contributing to its development. At the same time, it is important to realise that sustainable design cannot be created from traditional construction and production methods alone, but that it is complex and has many directions and effects that all need to be understood, processed and addressed. The moment it becomes interesting is when you are able to abandon the basic shape and see designing anew.



Line Hangaard Nielsen is trained as a fashion designer. She graduated from Kolding School of Design in 2007 and has since worked with fashion and product design in Hamburg, Copenhagen and London. She has also been engaged as a project manager of the Fashion Zone within the Laboratory of Design, Innovation and Sustainability at Kolding School of Design.

- 1 www.wisegeek.com/what-is-web-shopping.htm
- 2 www.ecocircle.jp/en
- 3 www.bagborroworsteal.com rent e.g. clothing and accessories, whereas www.keepandshare.com enables you to share files and photos. A similar system could be developed for sharing clothes and accessories.
- 4 www.bodymetrics.com
- 5 www.bodyscan.human.cornell.edu/scene0037.html
- 6 www.mashallahdesign.lacaptas.com/public/ indexpage#THE%20T-SHIRT%20ISSUE
- 7 www.patagonia.com
- 8 www.calamai.it
- 9 www.teijin.co.jp
- 10 http://store.nike.com/dk/en_gb/

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By Line Hangaard Nielsen











Anna Katharina Thomsen // Anne Bretschneider

The fashion and textile industry is a polluting business. To call attention to this gloomy circumstance, Fashion Design students Anna Katharina Thomsen and Anne Bretschneider have named their ECO CIRCLE mini collection "The Dying Swan" as a reference to the struggling environment. The collection consists of two exclusive outfits that can be combined in different ways and be altered, since parts of the outfits can be replaced with new ECO CIRCLE pieces. This enables the consumer to continually customise and update her/his outfits and thus prolong their lifespan. In designing the clothes, the imagery of "the dying swan" served yet again as a sour-ce of motivation as the two design students took their inspiration from the classic ballet Swan Lake in which the beautiful swan Princess Odette jumps to her death for love.

To motivate the consumers to recycle their worn out ECO CIRCLE clothes Anna Katharina Thomsen and Anne Bretschneider have created a concept that revolves around charity: When the consumers hand in their worn out clothes or swop pieces at the store, a percentage of the recyclable value is donated to a nature protection organisation. A new organisation is chosen each time a new ECO CIRCLE collection is launched.

Angela Buur // Camilla Skøtt Christiansen // Randi Samsonsen // Rosa Tolnov Clausen

In creating their ECO CIRCLE design, the four Textile and Fashion Design students took their shape-related starting point in the simple Raglan shirt whose distinctive characteristic is its one-piece sleeves that extend to the neckline, leaving a diagonal seam from underarm to collarbone.

With this base as well as the range of colours - dark grey, black and purple - settled, each of the four design students began creating their individual pattern piece using a specific technique on each of the pieces, more specifically the techniques of pleating, Shibori shaping/decorating, laser cutting and shrinking.

To promote the ECO CIRCLE concept of recycling polyester and inform the consumers about the concept while also involving them, the students suggest engaging a well-known and easily accessible company such as H&M in a campaign that tells about and shows off the aesthetic and environmental advantages of polyester and in this way create demand among the consumers.

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Anne Woidemann Christensen // Laura Locher

In designing their costume, Fashion Design students Anne Woidemann Christensen and Laura Locher looked for inspiration within two different yet interconnected influences: African tribal body painting and the legendary Australian performer and fashion designer Leigh Bowery, whose dramatic and flamboyant art had a huge impact on British cultural life in the 1980's and 90's.

The costume came into existence by means of two processing techniques: Textile transfer printing and heat treatment with a heat gun and gum arabic, on the suit and mask respectively. The transfer printing allowed the future fashion designers to apply coarse brushstrokes to the fabric which creates an illusion of body painting, while the heat treatment with gum arabic gives the mask the appearance of old skin.

The vibrant decoration, the colourfulness of the suit and the rough, bumpy finish of the mask are direct references to the aesthetic and practical qualities of polyester and come to accentuate the many ways in which it can be aesthetically shaped and coloured yet still be recycled after each utilisation.

Niviag Binzer (White outfit)

In designing her ECO CIRCLE clothes, Fashion Design student Niviaq Binzer literally went in to microscopic detail as she studied the shapes and structure of bacterial culture. She then recreated these delicate and detailed patterns in the fabric by means of different polyester techniques.

The shape of the clothes itself is inspired by the classical suit jacket as the future fashion designer wanted to create an attention-grabbing meeting by combining a recognisable design with a different material.

Bruno Peter Heinrich Kleist // Kristoffer Guldager Kongshaug (Black outfit)

Adam Gefen (White dress)

Note: Due to the fact that guest students participated in the course '100 % Polyester', it has not been possible to gather information about all student designs.









In designing their ECO CIRCLE suit, Fashion Design student Anna Kirstine Borg and Textile Design student Maria Rokkedahl Nørholm sought inspiration in ice crystals and frost. These sources of inspiration are evident in the range of colours that the two students have incorporated in the suit as well as in the shape of it. The former include icy blue and gray colours which the students have created by means of transfer printing. The latter was obtained by means of steam fixation where glass beads were put into the fabric which was then wrapped. This technique resulted in the crystal-like look of the suit and also helped to it.

The suit can be worn in many different ways. By having multiple functions, the suit has potential to be used for a long time. However, when the customer gets tired of it, he/she can simply return it to the store where it was bought and receive a deposit which can be used for shopping new ECO CIRCLE clothes.







Katja Brüchle Knudsen // Marie Louise Udby Blicher

Inspired by the life of the nomads, Textile Design student Marie Louise Udby Blicher and Fashion Design student Katja Brüchle Knudsen ventured into a similar nomadic journey themselves, exploring and experimenting with textile shaping and dyeing techniques, more specifically the techniques of transfer printing, burning and shape fixation by means of steam and fabric wrapped around square wooden blocks. These experiments resulted in a rough, edgy look to which the lightness and delicacy of the polyester fabric added a sense of exclusiveness.

The nomadic inspiration is furthermore evident in the design of the final piece, which is intended to express the knowledge and experiences that a nomad gathers and goes through during his/her lifelong journey. Accordingly, the top of the piece sits quite heavily on the wearer's head.

Marie Louise Udby Blicher's and Katja Brüchle Knudsen's recycling concept is a deposit system of sorts that presupposes a widespread implementation of the ECO CIRCLE concept in grocery stores and supermarkets. When handing in the used ECO CIRCLE clothes, the customer receives an article that corresponds to the weight of the clothes. E.g. 2 kilos of clothes equals 2 kilos of flour.







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Lea Zaar Østergaard // Tanja Lund // Mette Löwén // Hellene Jørgensen

The bubbly ECO CIRCLE suit is called "Champagne Clouds" and is – as the name implies – inspired by champagne bubbles and the sky in its shapes and colours respectively. It consists of four items: leggings, top, vest and hat. In creating their design, the four students have used several shaping techniques, including digital knitting, laser cutting and shape fixation by the use of glass balls.

In order to encourage consumers to return their used ECO CIRCLE garments, the students have designed an envelope made out of 100% non-woven polyester, which the customers receive when purchasing a piece of ECO CIRCLE clothing. The envelope is labelled with the address of the TEIJIN Recycling Plant and marked with prepaid postage. At the end of the clothes' life cycle, all the customers need to do is fold the envelope to fit the size of the clothing piece and drop it in the mail box. At the TEIJIN Recycling Plant the clothes are then broken down and processed into new polyester fibre.

Katrine Terese Nielsen // Louise Raynløkke Munk Pedersen

Katrine Terese Nielsen and Louise Ravnløkke Munk Pedersen, students of Fashion and Textile Design respectively, have designed a bipartite costume intended for a show on the themes sustainability, use and decay. The suit will only be used once per performance as it will be torn during the show. An absolutely recyclable solution such as the ECO CIRCLE concept is therefore fundamental.

The costume consists of two parts: An outer side and an inner side. The latter is knitted in polyester yarn. The former is made of two layers of polyester fabric in black and white, the black fabric being the lining. These two layers are fused together by a laser cut pattern that also gives the performer great freedom to move due to its many slits. Furthermore, the pattern gives the fabric an interesting texture and creates an exciting play of colours that transforms concurrently with the performer's body movements.









Fashion Design student Mathilde-Louise Maalouf Christensen and Textile Design student Linea Lund Hjorhöy have collaborated on creating ECO CIRCLE clothes that are unisex and reversible. Having multiple ways to wear the clothes will motivate the consumer to keep and use the clothes longer and thus reduce the rapid consumption of fashion.

In order to encourage consumers to return their used ECO CIRCLE clothes and thereby prolong the clothes' life cycle, the two students have designed a discount based concept, which involves returning the clothes to the sustainable concept store where they were bought. When handing in the used clothes at the concept store - which only sells sustainable products - the customers receive a discount on their next ECO CIRCLE clothes purchase.

In the concept store and on its website the customers can also find so-called "Look books" that illustrate the many different ways in which the clothes can be worn and become inspired by the newsletters that the shop sends out to inform, inspire and keep in touch with its customers.





Sarah Mi Svendsen // Maja Lindstrøm Hansen

TEIJIN being a Japanese company, the two Fashion Design students Sarah Mi Svendsen and Maja Lindstrøm Hansen have naturally looked to the East for inspiration for their ECO CIRCLE design. Inspired by Japanese designers' way of changing and refashioning Western clothing, the two students took their starting point in a classic Western icon, the men's shirt, and launched themselves into a design journey of transforming and deconstructing this fashion classic, using Eastern – and especially Japanese – shaping and dying methods.

The result is four different shirts created with equally different techniques such as laser cutting, transfer dying, Shibori shaping and decorating, steam fixation and heat shrink with glue. In order to promote recycling of the ECO CIRCLE clothes, the students have designed a discount based concept that revolves around the special ECO CIRCLE Bonus Points that customers receive when purchasing and/or returning a piece of ECO CIRCLE clothing. When purchasing ECO CIRCLE clothes for the first time, the customer automatically becomes a member of the ECO CIRCLE Family. A personal account is set up to which the earned ECO CIRCLE Bonus Points are transferred. The "family member" will also receive newsletters and information about special offers etc.

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Pleasantly surprised by the excellent shape-related abilities of polyester, Textile Design student Carina Sveistrup Mikkelsen ventured into a number of shaping experiments to explore and promote exactly these abilities.

The result: A delicate and feminine ECO CIRCLE necklace that excites the curiosity of the observer and is a cause for wonder as to how it is created. The elaborate shape experiments are evident in the detailed necklace with its soft, crinkled features that interplay with sharp edges.

Carina Sveistrup Mikkelsen's recycling concept is based on the well-known deposit bottle system. When handing in the used textile at a store that sells ECO CIRCLE clothes, the fabric is weighed and the customer then gets a receipt with the equivalent amount which can be redeemed at the cash register and/or used for a new ECO CIRCLE purchase.









Kaja Lønnkvist Stumpf

In making her ECO CIRCLE dress, Fashion Design student Kaja Lønnkvist Stump went on a style shaping journey using all the techniques that were introduced during the ECO CIRCLE course, including laser cutting, dyeing, Shibori shaping, smock sewing and shrinking. This inclusive approach allowed the garment to shape itself as it was affected by the different dyeing and shaping processes.

As her inspiration Kaja Lønnkvist Stumpf used two notions presented by Reiko Sudo in the beginning of the ECO CIRCLE course, more specifically the terms "perceive" and "suspect". These terms motivated her to work with the idea of the hidden and the circumstance that what you see might not be what you get.

This idea was also sparked when Kaja Lønnkvist Stumpf was initially introduced to the ECO CIRCLE polyester. The fabric reminded her of candy wrap and inspired her to explore the ideas of what could be hiding beneath the outer layers. In order to encourage consumers to care for and recycle their ECO CIRCLE clothes - and thus prolong their life cycle - information about the correct treatment and where to send the clothes for recycling is noted on the care label.





