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DRESSING ROOMS: CURRENT PERSPECTIVES ON FASHION AND TEXTILES

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Digital Tools and Textile Printing

Resumé

Digital inkjet printing on fabric is the latest invention in the textile industry and a major technological shift, because it does not use templates. At present inkjet is slow compared to conventional printing, but it has other advantages e.g huge flexibility. Digital printing opens a range of new possibilities in manufacturing and aesthetic expressions to industry, fashion and textile designers. This paper shortly describes, the historical and technical development of textile printing, and outlines the principle differences between analogue and digital technology. Examples of production and experimental design projects are presented and discussed. Finally I argue that digital media and inkjet could be used to further more sustainable textile products.

Introduction

Printing is the most prevalent method of decorating fabrics, because it is fast, cheap and offers a great variety of expressions. With the invention of mechanized roller printing in 1783, printed fabrics became some of the first mass produced goods. And during the 19th century they played an important economic role and became a pivotal point in the discourse of ornament in the UK. Printed fabrics also introduced fashion to the lower classes, and affected the reversal to modern industrialized consumer societies (Forty 1986).

Machine printing increased speed and reduced price considerably, but it also limited the size of motifs, number of colours and repeat patterns became the dominant form of decoration. These industrial standards intervened deeply in the designers artistic freedom and provoked a strong reaction. Most well known are the writings of William Morris (1834-96), who objected to the general low quality of fabrics, their poor colour fastness, bad technical execution and the reduction of aesthetic possibilities for the designer. Further more he was concerned about the severe consequences the textile industry had on society and the environment (MacCarthy 1994).

Today the textile and garment industry is one of the largest in the world, and fashion shifts more rapidly than ever. This increases consumption of resources and environmental problems. China and other countries are adopting western

consumer patterns, therefore it is important to promote more sustainable production and look for alternative ways of consumption. In this paper it is not my intention to argue for a new utopia or the abolition of fashion, but it is my humble ambition to point out some of the possibilities that digital media provide in solving some of the problems.

CAD/CAM was developed in the 1960s in conjunction with analogue printing (Bunce 1999). Ever since software and hardware have improved and today CAD/CAM are standard tools. During the last few years digital printing on fabrics has been implemented, but only 1% of the total global quantity of printed textiles was produced by this method in 2004 (Mheidle 2004). Therefore, analogue printing is in no way obsolete, and hence a discussion of inkjet technology must be seen in relation to high-speed conventional production.

Analogue printing

All analogue printing is based on a reproduction process, where templates 'carry' the motif and colour, which are transferred to the fabric by direct contact. The making of templates is a considerable investment in mass production. Therefore the technological development has been driven by a search for more rational and economic ways of manufacturing them. Another aspect has been the demand for higher production speed, but this factor has in the last few decades been pushed in the background in line with the markets request for lesser quantities of the same design. Never the less speed is still a relevant parameter for comparing analogue and digital printing, because the price of fabrication drops remarkable after the cost of the templates has been paid for.

During the second half of the 20th century the textile and garment industry has developed into a complex global business with a supply chain consisting of many split processes. The system demands holding of stocks at many levels, and this is the most risky and costly in the whole production chain (Ross 2001).

Global mass production makes it impossible to complement stocks within the short interval of a fashion season. Therefore most of the garment industry takes precaution by manufacturing plentiful of supplies. This leads to overproduction, and a considerable part of the goods are sold at reduced price by the end of the season. One aspect, which contributes to the uncertain calculations of goods, is the difficulty to predict, what the consumers want. As we all know stereotype target groups, which follow a clearly defined fashion, do not exist any longer. In stead the consumer seeks individual products, which requires a flexible production chain and a pluralistic fashion system. For these reasons conventional mass production has become less profitable and new strategies, like *quick response* and *mass customization*, adopted by part of the trade.¹ It is

¹ Professor Rajan Suri: "Quick Response Manufacturing (QRM) is a companywide strategy to cut lead times in all phases of manufacturing and office operations"

(d.9.2.07) <http://www.engr.wisc.edu/centers/cqrm/whatisqrm.htm>

Frank Piller: "Mass customization refers to a *customer co-design process* of products and services which meet the *needs of each individual customer with regard to certain product features*. All operations are performed within a *fixed solution space*, characterized by stable but still flexible and

on this background the development and big investments in inkjet technology should be seen.

Principle differences between analogue and digital printing

Conventional printing machines run 450-9000 meters pr. hour in full width, while digital printers at present produce between 10-300 square meters pr. hour.

Analogue printing uses one template for each colour [*spot colour*], and in the process of separating the colours, half tones can be obtained by raster points. Production price pr. meter increase with each template, and for this reason designs in many colours require a form of stylization. This is not needed in digital printing, where the price pr. meter is the same no matter how many colours. Here the motif is transferred directly from a software to the print heads, which have no contact to the surface of the fabric. An electric impulse ejects the ink through the microscopic nozzles of the print head, and tiny dots of different colours mix on the white fabric generating millions of shades. This method is called *process colour* and different printers run with 4, 6, 7, 8 or 12 standard colours. More colours extend the gamut, but in spite of millions of shades, there are nuances which cannot be reproduced. Spot colour printing has a larger gamut, because each colour is mixed in regard to the original design from a wide range of dyes. Digital printers require special inks, which are more expensive and exist only in a limited range.

Analogue and digital printing can be carried out with pigments or different groups of water based dyestuff for cellulose- animal and synthetic fibers. After printing water based dyes must be fixed by steam or dry heat, washed and dried. Pigments only need a dry heat process, and can be printed on all different fibers. Hence they are the most economic and widely used in analogue printing. In digital printing pigments still pose problems, because they easily block the print heads. Colour management between digital sample printing and analogue mass production also generate problems, but new software solutions like STORK U SEE seems promising.

As of now inkjet printing is the most clean technology, because the inks are utilized to a high degree, and thereby minimizing water and energy consumption in the after treatment. Digital printers can switch design on the fly - without stopping the machine. This is a major advantage compared to conventional printing, where each new design requires the making of templates, tuning of the machine, adjustment of the pattern, sample printing and cleaning before each new design and colour way. These processes are costly, time consuming and impact the environment through a considerable amount of dyestuff generated as waste (Cahill 1998). The making of templates is also a burden to the environment since a great number are discarded after sampling, because the pattern did not please the customers taste. In 1997 the number of discarded

responsive processes. As a result, the *costs associated with customization* allow for a price level that *does not imply a switch in an upper market segment*.

(d.9.2.07) <http://www.mass-customization.de/glossary.htm#pers>

templates was as high as 42%.² But digital sample printing must have brought down the number.

A short history of inkjet

The earliest experiments with electrostatic ink drops on paper was done by Nollet in 1749, and in 1876 the first inkjet device was connected to the telegraph (Jürgens 1999). During the 1960s and -70s inkjet printers were developed first for typewriters and later computers (Bunce 1999). At the same time experiments were taken up by the textile industry, and in 1975 the american company Milliken started mass production of carpets with inkjet technology (Dawson 1992). Japanese Seiren Co. Ltd. established fabric production with inkjet in 1989 as part of their *Supply Chain Management* concept.³ In 1991 STORK marketed the first inkjet printer for sampling fabrics, and Canon/Kanebo presented a production printer in 1995. This machine never sold, because of its price [700.000 USD], high operating costs and unreliability in production (Cahill 1998).

The breakthrough for inkjet printers came in 1999 at the ITMA machine fair in Paris. Since then technology has constantly improved, and the use of inkjet has increased world wide. In Europe Italian Mantero and Swiss Jacob Schlaepfer have been pioneers in digital printing of high-end fashion fabrics. Mantero started in 1999 and in 2005 10% of the production was done by digital printing (Mantero 2005). Since 2001 Jacob Schlaepfer has utilized inkjet on paper - followed by a dry heat process transferring the decoration to polyester fabrics. Also designers like Issey Miyake, Jean Paul Gaultier, Pia Myrvold and J. R. Campbell have embraced the technology at an early stage – all starting in the late -90s, followed by Prada, Jonathan Saunders, Hussein Chalayan og Antonio Cuitto. Also for the middle market inkjet technology has proven profitable – some good examples are the american print service Beta Management [BMT] and Japanese Seiren Viscotec.

Beta Management Team [BMT]

Like Jacob Schlaepfer BMT make use of inkjet and transfer printing on polyester fabrics. The company offers engineered motifs fitted the cutting or repeat patterns on piece goods. BMT have developped a buisness concept, which they call Zero Inventory Production [ZIP]. With ZIP there is no investment in inventories, because goods are printed only on demand (BMT). The client signs a contract for a minimum periode of six months, and during this period he is committed to buy "X" amount of fabrics at 8.50 \$ pr. yard. If the client is buying more than 10.000 yards pr. month, BMT offer to install an inkjet print system on leasing terms at his site. BMT provide training of staff, deliver software,

² Bert van Agen from STORK lecture at the FESPA conference Manchester 28.11.97, source Textile Engineer Joy Boutrup – a participant.

³ "SCM has three primary goals: Reduce inventory, increase the transaction speed by exchanging data in real-time, and increase sales by implementing customer requirements more efficiently" (POET).

materials and maintain the print system. In this way the price pr. yard is reduced to 6.50 \$ (Ross 2001).



Inkjet printing on transfer paper at BMT



Heat transfer of motif to fabric

One of BMT's clients is Coolware - a manufacturer of swim wear, sarongs, shirts and pants. The design team at Coolware create all patterns and motifs in graphic computer programs like Photoshop, Illustrator or Freehand. The digital files are sent to a server on the Internet, where BMT can download and prepare the documents for production. First samples are printed and sent by post to Coolware for approval. To keep the shortest possible production time of one week - the orders must be on BMT's server Monday morning, approved by Tuesday, fabrics printed and sent on Wednesday. Coolware starts to cut and sew Thursday and new goods arrive in the shops each Monday.

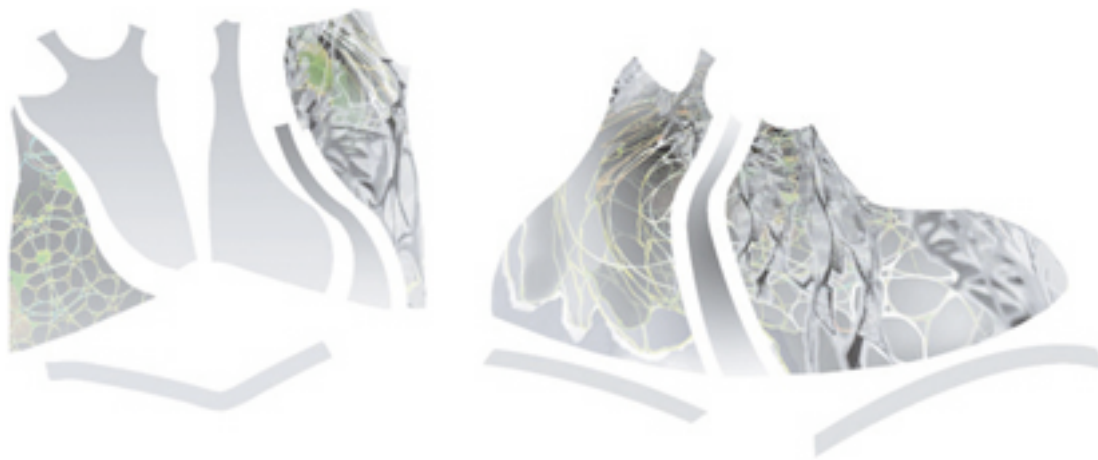
Coolware is not obligated to a specific minimum of each design, but can order from a few to several hundred yards in one or more colourways. 80% of the fabrics are manufactured as digital print, while the last 20% are printed on conventional rotary machines. The reorganization to digital production has given the company extra work capital - previously bound in inventories and a production time of 2-3 months. The combination of injected capital and an increase in sales have resulted in a 25% augmentation in Coolware's turnover (Ross 2001). This case makes it clear that digital printing can be a reliable production technology and also cost-effective. But neither BMT nor Coolware seem to be interested in, what inkjet can offer in regard to new aesthetic expressions - however, this is investigated by many designers.

New aesthetic possibilities

Since there are no templates to be made, designers can, at a reasonable price, test ideas and manufacture short runs, either at a print service or by investing in a digital printer.

Quite a few design schools now teach digital printing, and in the following a few examples from Designskolen Kolding are presented. The school began to implement digital printing in 2001, and since then the students have experimented with new visual expressions in samples, garments and interior fabrics. Also different ways of design thinking has taken form e.g. the combination of digital print and user oriented design, ideas for customization, collaborative projects, Internet concepts and the merging of hand and digital printing.

The collaborative project - *Interruption on the Edge* - took place in 2003, and involved three fashion and three textile students in 4th year. The aim was to merge cutting to size with three-dimensional form and decoration in three different garments. The group chose the theme 'distortion', and started out by gathering inspiration from texts and pictures of mirroring in water, reflections from glass facades and other shiny surfaces. In the following process of sketching the group split in two focusing respectively on cutting and decoration. Each group agreed on a rotation procedure, where digital files were exchanged. In this way they broke up the individual sketching in order to create new and unexpected expressions, and at the same time overriding the personal 'ownership' to a design. The whole group met regularly and at the end collectively decided which designs should be carried out.



Interruption on the Edge. Cutting to size and decoration

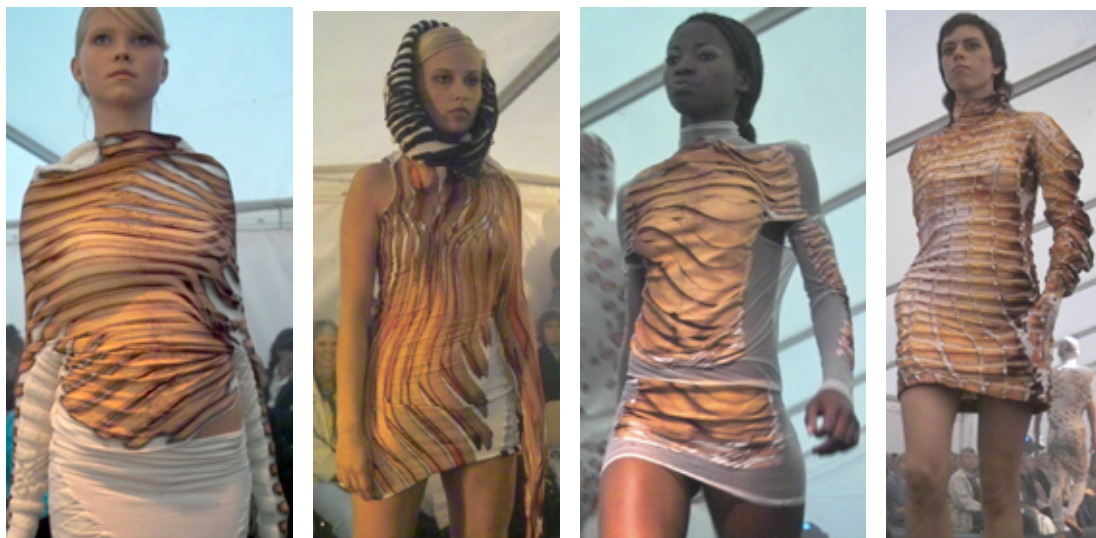


Interruption on the Edge. Dress - digital print on silk satin

In all three garments both decoration and cut is asymmetrical. This furthers a dynamic expression, emphasizes the sensation of movement and challenges the eye to wander and explore. The shiny silk satin, composition of colour and amorphous forms support the mirror and distortion theme. The decoration is subordinated the proportions of the body, and appears restrained in many transparent layers of grey tones. This gathers the composition to a coherent whole – yet bringing about a feeling of depth. In the example, shown here, a discrete tension is created by adding fine lines in green and red. The decoration

can be seen as a continuation of the textile tradition for moiré effect in woven fabrics - the so called 'watered silks' – and their imitation in print. But other associations come to mind e.g. the anamorphic motifs of paintings from the renaissance and contemporary blur effect of computer graphic.

In his graduation project '*Spare parts for future humans*' Kambiz Kavkani comments the increasing possibilities of medical science to re-design and replace parts of the human body. He is fascinated by the relationship between the artificial and the natural, and questions if the ideals of beauty will be transformed, when we rebuild the body. As a first step Kavkani took a series of digital photographs of his own naked body. Next he transferred the images to the computer and manipulated them in Photoshop to rhythmical compositions of wavy stripes and squares.



Kambiz Kavkani, Designskolen Kolding graduation show 2004

Hereby the naturalistic motifs were changed into abstract ornamental forms - but a close look reveals the photographic details of skin and hair. In this process of recognition the decoration appears surreal, and our perception of ornament, body and fashion is challenged. In some of the garments Kambiz Kavkani added a hand printed relief effect. In doing so, he merges digital [machine] and hand printing, and thus moves the previous boundaries of arts and crafts as limited to the work of hand.

Identity Play is the title of Birgitte Levin Hansen's graduate project from 2004. In collaboration with graphic designer Karen Kyed she designed an interactive web site presenting a virtual blouse collection. At the site customers can participate by combining decorative elements and answering a questionnaire, before the final product is manufactured. *Identity Play* also offers chat rooms, where the users can meet, exchange ideas and explore other womens life style universe. The collection has three different themes, and elements from each of them can be combined to a blouse in two layers. One layer is hidden, but can be revealed in a second - the idea beeing that the woman can shift identity accordig to her mood or change of situation.



Birgitte Levin Hansen *Identity Play*, web site in co-operation with graphic designer Karen Kyed 2004

Since the project has not been converted into reality, one cannot say if the user would find the web site stimulating, be willing to participate in the design process or buy the blouses. But Birgitte Levin Hansen's concept demonstrate how inkjet technology, print on demand, the Internet and dialog with the users can be combined.

Digital inkjet printing - a paradigm shift

As it appears inkjet gives new possibilities to both industry and designers. It is a great leap forward that unique specimens as well as replica can be produced equally, and that engineered motifs and patterns - without limitations in repeat size or number of colours - can be printed with no extra cost. Thus inkjet technology negates the standards and premises of industrialization as related to both production and ornament. Digital printing represents a major technological paradigm shift, and it should be explored from within its own specific possibilities. One person who has clearly realized this, is the Norwegian artist and fashion designer Pia Myrvold. But before looking at her *cybercouture* - allow me to return to William Morris and his reaction to the shift from hand to machine printing. The reason for this excursion are the similarities in his and Myrvold's objections to consumption, social concerns and pollution.



Pia Myrvold in collaboration with Phil Wood and Winka Dubbeldam

Morris was not against machines as such, but he was critical to their influence on people, the environment and society as a whole. But he believed, that every man should find joy in his work, and all things made beautifully in a good long lasting quality. William Morris knew, he was fighting for utopian ideals, but insisted on setting up an alternative to mass production, pollution and over-exploitation of resources. To Morris ornament was much more than fashion, to him it represented pleasure in life, personal memories and the link to history. In his time the only way to reach his ideals and obtain artistic freedom was manufacturing by hand. One can only guess if Morris would have embraced digital technology and perhaps reached his goals.

In Pia Myrvold's writings there are many parallels to William Morris and she suddenly grasps the full potential of digital printing, customization and the environmental advantages of the technology. But unlike Morris - Myrvold does not seem to give any thoughts to the role of ornament - so after presenting Myrvold's *cybercouture* concept - I will close the paper with a few thoughts on this issue.

At the interactive web site *cybercouture* one can create a customized digital printed dress. The customer can place different motifs in premarked areas and decide a variation of dress length and neckline. There are currently four themes of decoration, two based on naturalistic photographs by Myrvold. A third is a mixture of abstract patterns designed by Karim Rachid, and the fourth is linked to a special designed computer program developed in collaboration with Phil

Wood and using images by Winka Dubbeldam. Here animated forms can be frozen at any given time and since printed on a dress.

Pia Myrvold tells the story of how cybercouture was conceived in the exhibition catalogue from *Clothes as Publishing* (Myrvold 2000). A group of women asked, if she would like to produce her garments in Kirkenes - a small village in Norway - in order to create new jobs. Myrvold accepted to make a proposal, and came up with an idea for a high technology workshop, which should manufacture garments ordered from a web site. The garments - all being one of a kind - could be shipped to customers all over the world. The workshop was to sign a contract on continuous information and ideas developed in Myrvold's 'design laboratory' in Paris. She thinks, that workshops like this could be a pivotal point for several culture and education centres where:

"...the products would create no waste, and no ecological threat, and where peoples natural abilities can be combined with a new purpose of media and technology."

Myrvold criticizes fashion editors and journalists whom, she says, gladly embrace garments produced in 'slave factories' in Asia if the goods have the right price, and she asks:

"how can we dream of cultural awareness when even the most privileged people show remarkable indifference to change or improvement?"

She also notice, that every day new opportunities arrive with the technological development:

"Is this reality not supposed to be used to better who we are, and are we not all responsible to change things for the better?"

The cybercouture project was never realized in Kirkenes, because the proposal was defeated by the local council of men, who preferred to build sheep farms instead. As a result Pia Myrvold made cybercouture part of her web site, and presented it at the exhibition *Clothes as Publishing* in Bergen 2000.

Myrvold's writings recall William Morris' concerns for the worker and the environment. An elaboration on these subjects are to be found in the writings of Victor Margolin - a contemporary design theorist. In his essay "The Experience of Products", he points at the importance of the relation between things, manufacturing and user experience. He argues that user satisfaction must be part of a discussion about sustainability and the lifetime of products. Victor Margolin urges the designer to identify with the users' experiences, their wants and needs in order to create sustainable products (Margolin 2002). But this might be contradictory to the designers' wish for artistic freedom and to new aesthetic experiments in digital printing, which necessarily leads to more or less avant-garde expressions. Experiments of this kind are essential to the renewal of the profession and to uncover the possibilities of the technology without commercial restraints. But the development of an avant-garde 'digital aesthetic' might be a paradox in developing more sustainable products for a mass market, where the

norms of convention change slowly. Neither new aesthetics nor utopian ideas can solve the environmental problems we are facing - hence there is a need for dialog between designer, producer and end user.

This paper have argued that the positive environmental advantages of inkjet combined with the Internet and other digital media can be part of developing a cleaner and more sustainable production of printed textiles. But in order to make radical changes of consumer patterns, we need more knowledge of the users reception of ornament and their relation to things in everyday life. Changing consumer patterns is a huge issue and cannot be carried out by designers or companies alone - much will depend on politics and us as consumers. Time will show if we choose to utilize digital inkjet printing as a means to accelerate or decelerate consumption, or if future technology can solve the environmental problems in ways, we cannot yet imagine.

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