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Considerate Design for Personalised Fashion: towards sustainable fashion design and consumption

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Abstract The inbuilt obsolescence of the fashion system and its ever faster cycles creates large volumes of waste, as clothing is discarded long before its useful life is over, with 60% of what is thrown away recoverable. The Size UK survey of 2001-2 found that the average female was size 16, yet the fashion clothing choices available do not meet the needs of a wide sector of the market. The fact that many items of clothing do not fit well contributes to the landfill problem. Considerate Design for Personalised Fashion Products seeks to develop personalised fashion and accessories to meet consumer needs for individual fit and comfort. The intention is, through personalisation, to increase consumer engagement and use of garments, whilst providing support for designers in the fashion industry by developing a sustainable design methodology for designers and a tool that enables them to access the relative environmental impact of design options. The project draws on three practice-led sub-projects situated at different sectors of the market: the mass market through ‘Knit to Fit’, radical innovation in the fashion industry through rapid prototyping techniques and the bespoke market through the work of innovative designer makers.

Keywords: personalised fashion; considerate design, sustainability, knitwear, rapid prototyping, bespoke

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Introduction

The consumer of fashion products is caught in a dichotomy between the desire to conform to current fashion (and to afford fashionability), and the desire to stand out and be recognised as an individual. The personalisation of fashion is a means of combining these two conflicting goals. At the same time, in a changing demographic which now includes a sizeable aging population who still wish to be fashionable, personalisation is also driven by the need for clothes to fit better and meet individual preferences. The technology to support personalisation is beginning to reach maturity: accessible body scanning technology can provide body measurements in a fairly unobtrusive way and increasing automation in design and production tools can create the appropriate means. The Considerate Design for Personalised Fashion Products (CDPFP) project combines personalisation with sustainability to enable consumers to meet their needs and wants in the most sustainable way possible. This paper discusses the three design subprojects within CDPFP, which investigated these issues using three product scenarios at very different positions in both the market and innovation spectrum, all using body scanning for personalised shape and measurements. After outlining the particular challenges of the fashion industry, the concept of Considerate Design is introduced with an explanation of the project methodology. The three subprojects are described before conclusions are drawn in the final section.

Background to the project

The inbuilt obsolescence of the fashion system and its ever faster cycles creates large volumes of waste, as clothing is discarded long before its useful life is over, with 42% of textiles thrown away in the UK being reusable clothing (Morley et al 2009: 14). The Size UK survey of 2001-2 (Treleavan 2003) found that the average female was size 16, yet the fashion clothing choices available fail to meet the needs of a wide sector of the market. A significant contributory factor to the landfill problem is that many items of clothing do not fit well. Fit is more than a matter of linear measurement: a three-dimensional profiling of bodyshape reveals large differences across similar measurements. Size information, is interpreted by manufacturers according to their own production and economic values and constraints, with a bewildering array of brand-specific fit and sizing still leaving a great many individuals unable to find clothing which meets their needs. Addressing both these problems, Considerate Design for Personalised Fashion Products seeks to develop personalised fashion and accessories to meet consumer needs for individual fit and comfort. The intention is, through personalisation, to increase consumer engagement and extend their use of garments whilst providing support for designers in the fashion industry: the project is developing a sustainable design methodology for designers and a tool that enables them to access the relative environmental impact of design options. The CDPFP project was developed as a
collaboration between the London College of Fashion and Cambridge Engineering Design Centre (EDC), and now involves the Open University Department for Design, Development, Environment and Materials. A previous paper ‘Developing Considerate Design: meeting individual fashion and clothing needs within a framework of sustainability’ was presented at the MCP07 conference and has subsequently been published in the book Making Customer Centricity Work: Advances in Mass Customisation and Personalisation.(Piller and Tseng 2009) This outlined the rationale, context and concept for the Considerate Design project and its proposed methods, including a method for costing the design effort of personalisation. The present paper reports on the results of the practical sub-projects which were used as case studies and outlines directions for further work. The intervening period has witnessed an ever increasing awareness of sustainability issues throughout the manufacturing, transport and retail sectors, growing particularly strongly in the fashion industry at production, retail, media and consumer levels.

The Fashion Industry Context

The clothing, footwear and textile sector is economically significant, the fifth largest industry sector, employing up to 40 million worldwide, of which up to 19 million are employed in China, 2.7million in the EU and 400,000 in the UK, (excluding retail), where it is the same as the aerospace and automotive sectors combined. Over recent decades, the fashion life cycle has become an increasingly global manufacturing phenomenon: raw materials and garments travel around the world due to production taking place in low wage countries for consumption in developed countries, where many clothes end up in landfill or re-exported after a short use period. Fashion consumption in the UK has grown significantly in recent years: there was a 37% increase in the amount of clothes purchased per capita between 2001 and 2005 (Allwood et al 2006:12). At the same time, globalisation of production, increased competition and consumer demand have resulted in accelerated fashion cycles which in turn have led to a culture of ‘fast’ and disposable fashions. The result is also a decrease in prices- clothing is relatively far cheaper than in previous decades (whereas housing, transport and cost of living have risen) - but at what ethical and environmental cost? As fashion has become cheaper and more disposable, careless overconsumption means a significant proportion of garments are hardly worn before being thrown away - they have become expendable. Many don’t fit well enough, are poor quality, or simply don’t suit people’s tastes. 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 – a contradiction at the heart of contemporary fashion consumption which Black has termed “The Fashion Paradox” (Black 2006, 2007, 2008). To increase the acceptance and longevity of clothes, one response is to personalise garments, so that they fit people better and meet their individual needs and tastes. However, personalisation of clothing poses particular challenges compared to other product
sectors, because fashion production consists of small batches over a large product range, sold at low profit margins. Therefore fashion designers need tools and processes to help them incorporate environmental assessment into their daily work practice in order to create more sustainably designed products which will also engage the individual consumer for longer. The CDPFP project is researching the relevant issues for sustainability and developing tools based on this concept.

Historically, both the consumers of fashion and the fashion industry have largely sidestepped these problematic issues. However, in the wider context of climate change and improved global communications, a strong momentum has developed within the industry in the last few years, although sustainable clothing production is still a small fraction of the overall market.

Only very recently have initiatives such as the UK Government’s Sustainable Clothing Action Plan (Defra 2008) and publications such as Sustainable Fashion and Textiles (Fletcher 2008) or Eco Chic: the Fashion Paradox (Black 2008), raised awareness of environmental and ethical issues for fashion and textile industry designers. Compared with other sectors such as the built environment, product design or food, awareness and action for sustainability in fashion has been slow to develop in both the industry and the consumer - the fast moving and constantly changing nature of fashion appears fundamentally contrary to the spirit of sustainability, time and price sensitivities mitigating strongly against it.

Fashion offers a huge potential for personalisation and the sustainability benefits resulting from it: consumers in the UK spend about £780 per head per year, purchasing around 2.15 million tonnes of clothing, (35 kg per person) of which one eighth is sent for re-use through charities and the rest is discarded. (Allwood et al 2006:2) In 2006, this consumption was worth more than £13 billion by value (Morley et al 2009 Technical Report:17). According to Ecologist magazine, the average woman now buys fourteen items a year that she never wears (Ethical Fashion Special, February 2007)

The Considerate Design Concept

The Considerate Design concept (Black and Eckert 2007, 2009) aims to address the complex issues within fashion and sustainability in an accessible manner by considering all aspects of the fashion life cycle – from materials, design and manufacturing to consumption and end-of-life scenarios, and considering the needs of the user through personalisation and co-design. Considerate Design makes new links between personalization, sustainability, and cost. It aims to support designers in making sustainable decisions about the design and production of garments and accessories to maintain profitability, whilst meeting the personal needs of consumers and evaluating the costs of these activities. The economic importance of the fashion industry is kept in constant view, but it is contended that the endemic wastefulness within the fashion system can be mitigated by greater knowledge and understanding, whilst maintaining the important social, economic and cultural functions of fashion in society.
With comparatively low unit costs and small runs, it is critical that personalization can be achieved in a cost effective way. The ability to address sustainability issues such as waste, traceability and transport miles in addition to design factors adds a burden which many fashion designers, already working under great time pressures, are currently unwilling or unable to take on. The concept of Considerate Design has been developed in response to the particular challenges of the highly competitive fashion industry, to assist designers who are working under strong commercial constraints, and often subject to management decisions where price points are paramount, determined by marketing and buying teams. The aim is to empower fashion designers to think about sustainability issues, their design role and decision making processes within their sphere of influence and responsibility, and balance the often conflicting priorities and issues for personalisation within the design process and the nature of fashion itself.

Considerate Design addresses the questions: can emerging technology and digital processes within fashion help to address the fashion paradox of transience and sustainability, and reduce fashion consumption by enhanced personalisation of fashion products? Can user engagement with the creation of clothing, knitwear and accessories create a different and longer lasting relationship with clothes?

**Approaches and Methods**

The Considerate Design for Personalised Fashion Products project has been exploring the concept of Considerate Design across three separate designer-led collaborative sub-projects, each reflecting different parts of the fashion spectrum, from potential mass market to cutting edge innovation and traditional craft-based processes. All projects make use of body scan data to explore personalization and custom fit, and two used rapid prototyping technology to create 3D forms from scan data. The team comprised six core researchers, and a research associate from a textile design background: five design practitioner/researchers from London College of Fashion including the PI; a specialist researcher in process modeling for design as Co-I from Cambridge EDC and later the Open University; and external design consultants and software collaborators from industry. The three subprojects were carried out by the team’s designers, who developed innovative products and at the same time reflected on their processes. They were regularly interviewed and visited by the RA and the investigators. Each sub-project took about 6 person months over the two-year period as follows:

a) **Knit to Fit**, led by Sandy Black and Penelope Watkins, on 3D made-to-measure seamless knitwear using Stoll industrial knitting machinery and quality wool yarns.

b) **Evolving Textiles**, led by Philip Delamore, on the use of rapid prototyping technology for body conforming textile-like products, in collaboration with external partners including Dutch design company Freedom of Creation (FOC).
c) **Bespoke Bags** designed to conform to the body, made by Steven Harkin in collaboration with Frances Geesin using her experimental metal-plated materials.

The Considerate Design concept was developed in parallel as a meta-project to which the individual design projects contributed as case studies. Two separate tools have been investigated. The first is a simple visual tool for designers to assess the environmental impact of a particular design on several dimensions, developed through a series of workshops with fashion designers and experts. The second is a process modeling tool, which uses the P3 software (Wynn et al 2006)\(^1\) developed in the Cambridge EDC for engineering projects, here used to simulate the design process involved in customizing a garment or bag in order to assess the financial viability of personalization.

Product designer Jonathan Chapman (2005: 51) writes in *Emotionally Durable Design* on the failure of our relationships with consumer products:

> Most products are capable of creating even a small amount of empathy at the point of purchase; from this point on, however, product longevity is soberly dependent upon the sustainability of that empathy. … Waste, therefore, is a symptom of expired empathy, a kind of failed relationship that leads to the dumping of one by the other.

Personalisation is one means to create engagement or empathy and reduce product replacement and consumption. The dimensions of Considerate Design (See Figure 5) were developed through the project designers’ prior knowledge, and a detailed literature study, validated in 3 workshops with external designers and design educators, to arrive at an intuitively understandable terminology and grouping of important issues.

### The Design Sub-projects

The selection of the three case studies was to some extent opportunistic, however they distinctively represent different sectors of the fashion industry, one of the ‘creative industries’ which are currently flourishing in the UK. The development of highly innovative fashion and accessories by designer makers combines craft based processes with technology, whereas the knitting project builds on the long tradition of knitwear industry in the UK, even though knitwear and fashion manufacturing has largely moved off shore, driven by cheaper labor costs. The automation of the manufacturing process through 3D knitting produces integral (seamless) garments in one piece directly from the knitting machine, almost entirely removing the need to make up garments manually. This creates an opportunity to bring high value service-based production back to the UK.

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1 See [www.cam.Eng.ac.uk/p3/](http://www.cam.Eng.ac.uk/p3/)
Knit to Fit

The Knit to Fit concept explores the application of state of the art 3D knitting technology to individual body measurements. The project has developed a palette of simple seamless sweater styles customised to an individual’s body shape and style preferences, (comprising 5 different necklines and 3 types of edge trims, and wide colour choice, see example in Figure 1), and will compare costings for different production routes and design choices. This project is positioned in the commercial spectrum of knitwear production using the latest Stoll Knit and Wear® industrial knitting technology, and combines expertise in knitwear design and technology (Black 2002, 2005) with stretch pattern profiling (Watkins 2005). The contribution to Considerate Design is therefore in personalized garments to give enhanced comfort and fit and localised individual production made to order.

Figure 1 Designing seamless shoulder, sleeve and neckline configuration. Photo S Black

The research is evolving a new method of creating personalised knitwear starting with individual measurement data derived from bodyscans, imported into the proprietary software. The Stoll Knit and Wear® pattern creation software includes a library of style patterns, which simulate traditional fully-fashioned knit garments using essentially 2D chart (pattern) construction to produce a 3D knitted garment. However, there is no provision for the digital application of ease allowance for fit preferences in relation to direct body shape measurements. Traditional pattern profiling relies on the aesthetics of a drape fit irrespective of body shape; Knit to Fit addresses these fit and shape preferences, allowing the wearer to choose how tight or loose fitting their garment will be. Three key stages are required to create a true digital ‘custom fit’ for 3D knitted garment designs:

- 3D body scanning- defining the measurement data set for automatic extraction;
- the ‘Form Fit’ 2D pattern generation procedure (Watkins 2005) and the application of ease allowance, according to customer preference.
• compatibility with the knitting machine to interpret the pattern profiles to produce a seamless 3D garment via a technical programmer/operator, to meet customer’s fit and style parameters. Comparisons between bodyscan data and extended manual measurements highlighted discrepancies and a poor match with the inbuilt knitting software. Comparison between traditional fully fashioned knitting and the 3D knitting technology formed part of the study, which also aims to cost the design development effort for a personalised knitwear service, taking into account programming and prototyping time. The digital creation and programming of each design is a significant element of the production process, and full exploitation of this complex technology depends on communication and flexible interpretation between the designer and technical operator, which has already been very problematic in traditional knitting and co-located designers (Eckert, 2001; Sayer et al 2004). Thus the technology has been slow in uptake by mainstream industry due to cost and complexity.

There are both benefits and drawbacks to the production of seamless garments. Although reducing the time from concept to product, any faults or damage render the entire garment unviable, potentially creating more waste. The complexity of the programming and number of simultaneous production operations mean that on average, more sample iterations are required, perhaps 33% (three or four rather than two or three). In mitigation, once optimized, the technology offers great opportunity for added value through personalised design content and better fitting garments for increased comfort and satisfaction, which could reduce the number of garments consigned to landfill due to bad fit or poor choice. Similar to bespoke fashion, design and production costs for complete garment knitting are high per individual garment, but can be traded off against reduction in labour costs for making up, efficient yarn usage once optimized, and greater customer satisfaction. Costs balanced against potential savings therefore need to be carefully calculated. Eckert (1997) modelled the processes by which simple design changes may impact the range of customisation options in fully fashioned knitwear. Future work will address the cost comparisons arising from the new paradigm of seamless complete garment knitting.

Three-dimensional knitting technology can therefore provide one means to achieve a ‘fashion on demand’ business utilising a ‘neo cottage industry’ model, evidenced in trial boutiques set up in Japan by leading knitting machine builder Shima Seiki (Shima 2005).

Evolving Textiles

This exploratory project investigates the use of additive layered manufacturing, in particular laser sintering of PA12 evolved from rapid prototyping (RP) technologies developed for engineering and product design, and applies it to a new form of textile-like construction to explore the making of bespoke items which conform to the body, such as shoes (Delamore 2005), accessories, and eventually garments. The collaborative team, led by a textile designer who learned the technical processes, comprises fashion/textile and industrial product designers,
software developers, and RP experts and materials suppliers. During the project a flexible glove was generated consisting of separate three-dimensional links similar to medieval chain mail. In 1999 designers Freedom of Creation (FOC) demonstrated proof of concept for these textile-like linked structures, which have long term potential for clothing applications. The project aimed to create a design solution which links the laser sintered textile (2D sheet) proposed by FOC to generative software capable of producing a continuous 3D surface textile which conforms to a 3D bodyscan shape. The glove (Figure 2) was created as proof of concept, to develop the tactile qualities and flexibility of the original FOC concept.

![Image](https://example.com/image.jpg)

**Figure 2** Fourth iteration of flexible glove produced by laser sintering technology. Image David Sweeney/Digital Fashion Studio

Discussion on the topic of sustainability applied to the digital manufacturing process of laser sintering raised several interesting questions, some of which remain unanswered. Does the environmental impact of the materials and power consumption outweigh the benefits over conventional production, assuming that machines and raw materials still have to be transported. Could localized production include the development of self-build machines and local materials? This would enable designs to be uploaded to the internet and accessed globally.

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2 Refer to website FOC www.freedomofcreation.com

3 Online platform Shapeways enables anyone to create 3D designs online and have them manufactured in a number of materials using RP technology, and shipped directly. ([www.shapeways.com](http://www.shapeways.com) accessed 10.06.09).
Successful iteration of the software through three stages of design prototyping has enabled a continuous 3D textile to be automatically generated over a scanned surface. This implementation has been modeled to give a map of the product development process which shows the potential to give an excellent result for highly adaptive and customisable products with low logistical impact, where integrated components can be digitally stored and shipped for localised manufacture.

Future research will identify modifications to existing techniques to allow a flexible end product to be produced to meet specific needs in terms of shape and conformability. The long term goal is to send the instruction for production to local rapid prototyping machines, similar to current desk-top printers, enabling on-demand manufacturing with minimal waste, together with the development of appropriate new and sustainable materials (Delamore 2004).

Bespoke Bags Case Study

Bespoke handmade bags represent traditional craft techniques and materials such as leather, here combined with experimental metallised materials to produce a luxury range of customisable bags and cases. During the project many of the challenges small businesses face in attempting to produce personalized sustainable products were highlighted. The Considerate Design project has developed personalised bespoke bags using body scanning to create component parts fitted to an individual’s body shape, using RP technology. For example, a made-to-measure shoulder bag was created using a cast of the client’s shoulder (Figure 3) produced on an RP machine from body scan data. The cast became a mould for the final component part fashioned in leather. The personalized craft production process is described here.

Figure 3 Moulded leather shoulder panel modeled over 3D form generated from body scan
Steven Harkin is a designer maker of high quality handbags in distinctive designs with high aesthetic values, which last for many years. A range of 40 different basic bag designs are offered, made to order in small batches by himself and an assistant. When placing an order, the customer selects colours from a range of 16 vegetable tanned leathers. While most orders are standard shapes and sizes, some bags are customised to individual customer measurements. As a small business, Harkin works with a number of suppliers, but he cannot test their sustainability assertions nor can he influence their colour schemes. Harkin responds to evolving fashion trends with different bag designs each season, however the ideas for his most successful designs are often those that he works on for long periods of time. The design of a new bag typically starts with an idea and sketches, but quickly moves on to making a physical prototype. Having over 20 years experience in designing and making handbags, Harkin can switch smoothly between sketches, 2D cutting and a 3D prototype. While he can visualise a bag before he begins to make it, a physical prototype using the right materials is necessary to see that the components can be reliably assembled. There are often several rounds of iteration and experiments with new materials and techniques to get the details just right, following which, samples are made in several colour combinations. The collection is therefore a combination of slowly evolving designs and new pieces for particular seasons. For a design maker, customisation is fairly straightforward, but still has a price. If the shape is same and the material is in stock, costs are very similar, as each bag is hand made anyway; differences in shape require different cutting patterns, although being very experienced this does not take long. However customisation increases the scope for mistakes and reduces the economy of scale. Steven Harkin’s design process has been modelled as a P3 model, Fig 4.

Through the CDPFP project, Harkin is collaborating with Frances Geesin, Reader in Materials and Textiles at LCF, incorporating her engineered fabrics into bags and accessories to create new work, based on their respective approaches to materials, aesthetics and form. Geesin’s research practice is a continuous investigation into textile, fibre and process, often adapting or combining materials from industrial applications such as water filtration, or protection from electromagnetic radiation. She has developed the electroplating of fabrics over many years – a process of producing a metal surface or object by controlling the electrodeposition of metal passing through an electrolytic solution onto a metal or metalized form. Harkin’s practice incorporates unusual materials such as aluminum, perspex and wood into the leather bags. Their collaborative work has been based on an experimental approach where aesthetics and durability are major considerations. The project has developed truly customized bespoke bags using the body scanner to build special components to ensure that a bag worn on the body can follow the curvature and unique form of the individual’s shape. The costs of this personalization process will be used as a case for the P3 modelling tool.

The successful integration of unique metallised fabrics into bespoke bags which conform to individual body shapes has combined aesthetics, materials, function and form in distinctive designs. Therefore an investment accessory can become a practical luxury, justifying its costs as a handmade item by its longevity and both the physical and emotional durability of its design (Chapman, 2005), demonstrated by the desirable patina of usage gained over time with materials such
as leather. The contribution to Considerate Design is therefore enhanced durability and longevity, through user engagement a highly personalised bespoke process.

The Considerate Design Tools

Process modelling tool to assess the cost of personalization processes

Automated mass customization is currently being offered for products such as jeans or trainers, where adaptations to specific body measurements or personal preferences can be automated with minimal design input. However, except in the simplest cases, a certain amount of redesign needs to be carried out by the designer. As the unit cost is relatively low for fashion items, design time is a considerable proportion of final costs and design costs may easily be underestimated. The P3 process modeling technique (Wynn et al. 2006) developed in the EDC in Cambridge for complex engineering process, was applied to the fashion case to assess the risk of customization and investigate the question: how much design work is viable for a customizable range? A discussion related to pattern customisation for fully fashioned knitwear can be found in Eckert et al (2008), Black and Eckert (2009).

The scenarios examined through a simple problem a fundamental question of mass customization, the design and selection of the choices offered to customers based on the expected sales figures. Through a process simulation it offered the following choices a) a small number of standard designs with variable factors such as colour or material, which don’t require additional design effort, b) a wide variety of initial designs, which could be adapted with minor alterations to individual measurements or c) to redesign each garment individually. Future work will apply the P3 modelling tool to the personalized Knit to Fit project seamless knitwear process.

Simple visual footprinting tool

As the notion of a visual foot print is intuitive to a fashion designer, the project team decided to develop a simple version of an eco footprinting tool specifically for fashion designers. Through the project’s structure and methods such as workshops, the different factors affecting the production, consumption and disposal of fashion products were identified. Some of these are outside the control of the designer, such as customers’ previous education and understanding, or the legislative framework they are working under. However, the dimensions over which a designer has some control, such as materials, transport or design concept were confirmed as dimensions of the footprinting tool, seven in all [Figure 5] in which the impact of each is indicated on a scale of 0 to 10. As many of the dimensions are themselves complex, a further level of analysis can be similarly applied to each dimension with its own footprinting diagram.[Figure 6]
Figure 4: Model of bespoke bag process including time spent per task.
As a result of the project workshops, in which garments designed by participants, the case study products and commercial garments such as knitwear and jeans were analysed using the tool, further refinements have taken place. Two key challenges for resolution emerged: how a designer mentally calibrated the tool based on prior knowledge, and the issue of trading off between parameters in order to make informed decisions for the design and life cycle of the garment. Finally, feedback was sought from individual designers in industry, working as designer/makers, design managers or within larger teams. The final design and development of a software tool are planned for a further related project.

Conclusions.

The CDPFP project portfolio structure, incorporating process modelling and concept definition as meta projects, has tested real problems and provided a foundation for further development towards a toolkit for the benefit of fashion/accessories designers in small and large companies. Both Knit to Fit and Evolving Textiles design projects have developed and tested the integration of bodyscanning measurement data with industrial manufacturing systems in order to offer a ‘seamless’ integration of data, each requiring the development or adaptation of software, enabling new models for personalised services to be constructed. The Bespoke Bags project has demonstrated the flexibility for personalisation inherent in the bespoke service, utilising a new integration of body scanning technology with traditional craft process. All projects provided case studies for the
overarching Considerate Design concept, linking personalisation with sustainability and providing data to evaluate costs.

The knowledge generated has helped to establish the parameters and requirements for an accessible Considerate Design process tool for the fashion industry sector, not previously addressed in sustainable design research. An additional benefit is the two-way exchange of knowledge and understanding between fashion and engineering. As fashion processes are far simpler than engineering processes, this context enables the rapid exploration and evaluation of the process modeling environment. Using real examples, learning generated from the fast-moving fashion industry can quickly be applied to the engineering sector, for which product cycles span a much longer timescale; at the same time, the more systematic evaluation of decision making processes and design effort can contribute data for further research into realistic costings of personalised and co-designed fashion products.

As commercial retail systems continue to offer consumers more individual choice and mass customisation becomes increasingly feasible, a future can be envisaged in which a greater proportion of fashion products are made on demand or short order to personal preference, by combining technology with the craft skills of fashion in service oriented systems, providing alternatives to the current stock only system. Enhanced customer satisfaction due to improved fit, meeting personal requirements, and the consequent emotional engagement with the final products, may also contribute sustainability benefits through longer use leading to less waste. The personalised fashion systems explored in the CDPFP project contributing to new fashion manufacturing processes and encourage local production, thereby reducing overall environmental footprint.

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