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Designer/Makers are Key to Sustainable Textile Development

Abstract

The opportunities emerging from the practical and conceptual application of sustainable materials and eco-efficient processes are presenting designer/makers with new problems to solve, resulting in new design possibilities. This paper explores the emerging culture of sustainable fashion and textiles and some of the creative strategies and holistic approaches being developed within the context of designer/maker practice. The paper explores how a growing understanding of sustainability issues combined with material advances, is resulting in designer/makers being ideally placed to take a leading role in realising opportunities to create innovative, aesthetic, desirable, and ultimately eco-efficient textiles and products.

Keywords
Bio-based materials; Biomimetics; Closed-loop technology**;** Holism; Sustainable textiles.

Introduction

This paper acknowledges the unprecedented advances that have been made in fibres, materials and processes in the last decade. Previously, innovations came from advancements for military use. Medical and cosmetics industries are now leading that development and designers are increasingly working in collaboratively with materials scientists to explore commercial applications. Particular reference is made to the design responsibility that has fallen to designer/makers, including the difficulties experienced in acquiring knowledge of new and emerging materials and processes. This is an exciting and challenging time, with many new opportunities underpinned by complex ethical considerations. Advances in polymer technology have resulted in the availability of sustainable natural fibres, from protein sources which biodegrade naturally in time. These fibres present designer/makers with exciting alternatives to synthetics, as well as possessing improved environmental credentials.

The nature of materials application is observed, and the framework for commercial success is highlighted as a need for greater knowledge and understanding of sustainable materials and processes, especially in design education. The paper argues for increased support to be offered to designers, through greater access to resources, to enable stronger awareness of design responsibility and increased understanding of how to accommodate ethical considerations without compromising design objectives.

The central theme explores the dual role that designer/makers and researchers are striving to fulfil; to extend their own exploration of materials and objects whilst remaining conscious of the new expectations of a more environmentally focused culture. Designer/makers are expected to design and make with a conscience, whilst keeping in step with emerging technologies. Their ability to realise the potential application of technical advancements now requires the conviction to make ecologically sound, user friendly, aesthetic products. New values need to be placed on the resources and objects that we already possess.

Recent discussions have identified a need to change the current cycle of use, and to achieve this we will need to bring about a paradigm shift to our social culture, designer/makers are the critical mass in delivery of sustainable futures.

Why Design Makers are Key

The complex world of fashion and textiles is undergoing a radical rethink, but our grasp of sustainability and its implications for our future activities presents designer/makers with an enormous challenge. 'Business as usual' is no longer an ethical option and design integrity is essential, not only for designers, but for consumers and everyone involved in the textiles sector today. 'The environmental and social impacts of producing textiles are many and varied and expose a mosaic of interconnected resource flows that underpin even our simplest design choices' (Fletcher 2007).

Some ground has already been made in addressing fashion and textile production from a more global, ethically orientated perspective by large manufacturers, supported by Government initiatives and dissemination through conferences. In 2007 and 2009, the RITE Group presented strategies dedicated to 'Reducing the Impact of Textiles on the Environment'. These include initiatives adopted by Marks and Spencer, Timberland and Levi Straus which could lead to social innovation. However, as reinforced by Braungart in his keynote at the RITE conference 2007, switching to ethical production is difficult for large manufacturers to enforce expediently and it is often smaller concerns and independent designers/researchers who offer the most creative and practical solutions for a 'cradle to cradle' approach towards 'remaking the way we make things' (McDonough and Braungart 2002).

Legislation from the UNEP (United Nations Environment Programme), the European Commission and through the ENDS (Environment Data Services Report) Reports in the UK has influenced sustainability innovation in the fashion and textiles sector. Legal boundaries and consumer pressure from NGOs like the Soil Association and Oxfam continue to be important catalysts for change and provide support to smaller design companies. For example, Oxfam Waste Saver centre provides the fashion company Amoosi with the recycled garments that form the basis of their design collections.

TED (Textile Environment Design) exhibited a range of garments and textile products made from recycled, up-cycled and ethically sourced materials. TED was set up in 1996 as a research cluster involving design practitioners at Chelsea College of Art and Design, London. Staff and students work collaboratively and on individual projects. The main aim of TED is to look at the role that the designer can play in creating textiles that have a reduced impact on the environment and to provide a toolbox of designer-centred solutions. TED has developed a series of possible strategic solutions to assist designers in their decisions. Some are materials and process based including; low toxicity/organics, new technologies, design for recycling and biomimicry. Others consider more conceptual approaches such as: lifecycle thinking, fair-trade and ethical production, short life/long life textiles, design for low launder and systems and services design. TED is the first research project to apply these types of eco design concepts to textile design in such an innovative way (www.tedresearch.net).

Knowledge of the various lifecycles of textile fibres and resulting products is becoming a priority for contemporary designer/makers. There is a need for research into material diversity, ethical production, best practice models and

innovative, sustainable manufacturing processes. Canadian furnishings company LoooLo know that the textile industry is one of the largest known environmental polluter and seeks to address this issue in order to affect global change:

> 'We are driven by the belief that good design is sustainable design. So we go to great lengths to ensure that all the raw materials that go into making our textiles have as little (if any) negative environmental impact as possible. This ensures that our products are fully biodegradable. At the end of their useful life, LoooLo textiles can be safely put into a composter and, within one year, be reabsorbed by the earth (Notkin 2009).'

Concern about where textile items originate and the development of products based on a sustainable ecosystem lies firmly with the philosophy of the designer. Textile production methods and lifecycles of products result in a highly complex situation for designers to negotiate. Rebecca Early and Kate Fletcher's project '5 Ways**'** encompassed approaches to fashion textile design:

> 'The 5 Ways projects explore…things made round the corner from where you live, things which you never want to launder, things which work with human needs, things which have multiple lives pre-ordained, and things which require you to roll up your sleeves and get involved (www.5ways.info).'

The ethical sourcing of textiles is important for designers. Clothing and interior textile designer, Gudrun Sjöden, sources a grower to supply her with sufficient organic cotton. She uses her own labelling system to identify the materials used to inform her customers of the quality and authenticity of her products. This is indicative of the interconnectedness of textile production. This is also the case with the Mull Weavers, who seek a harmonious link between the land, the products, and the consumer; customers not only benefit from a unique and beautiful product, but also become more connected with the environment in which it has been created (www.isleofmullweavers.com).

Changing Patterns of Consumption

Lack of choice erodes our individual identity and restricts our ability to express cultural identity. This is a direct result of mass-production and mass availability in the high street. Consumer focus on quantity over quality is slowly being redressed by the global recession and negative publicity about offshore manufacture in the media. For design students and educators, there is support from organisations such as Fashioning and Ethical Industry (FEI) who promote 'Labour Behind the Label' projects through workshops and have just published A Handbook for Educators (Parker 2009).

The customisation of products (up-cycling) of vintage or unfashionable clothing is a growing trend, underpinned by the ethos of sustainability engendered by independent and emerging designer/makers. Multi-media networks are used by designers to share their passion for DIY fashion and crafting with each other (www.threadbanger.com). Consumer involvement is central to identifying sustainable design solutions, underpinning the need to move from *wants to needs*, from *global to local*, from *fast to slow* and from *consuming to making*. These ideas are not new; in the 1970s the cultural critic Ivan Illich's ideas of a 'life of action' highlighted many implications for sustainability and the relationship people have with fashion and textiles today.

Top Shop recently ran free craft workshops in some stores to promote customisation or crafting of clothing using haberdashery. The feminist magazine Bust regularly features reworking clothing projects. It has also produced a book called Stitch 'n Bitch, which has led to network groups of knitters meeting to share their favourite knitting patterns and ideas in the culture of craft for all. Social networking references to www.crochetville, evidences the trend in *making* as a social activity and how it is interwoven into how we access and communicate about craft and design. As Richard Sennet observes in The Craftsman (Sennett 2009) 'the *Enlightenment* showed the belief that everyone possesses the ability to do good work, that there is an intelligent craftsman in most of us'. These activities are minor revolutions by creative activists, who play an influential role in society, encouraging enthusiastic amateurs to pursue craft practice to professional standards. Such knowledge can improve satisfaction with material consumption:

> 'Designers in the future could take a leading role in integrating environmental criteria into a product's overall marketing and communication strategy. The designer is the central connection to the marketplace, acting as the bridge between the manufacturer who produces the goods and the consumer who desires them (Green Design- www.co.design.co.uk).'

Making a Slow Revolution is a collaborative project with Craftspace and Helen Carnac to explore the identity of craft within the Slow Movement. It is a cultural shift towards slowing down the pace of everyday life. It is not controlled by a singular organisation. It is propounded, and its momentum maintained, by individuals that constitute the expanding community of Slow. Investigation of fast and slow fashion and fast and slow rhythms of use took place in Lifetimes, a project about the creative connections between fashion, clothes, time and sustainability and was carried out by Kate Fletcher and Mathilda Tham 2004: 'slow fashion is not just about responding to trends, it is a mentality that involves thinking about provenance and buying something that won't look unfashionable after one season.'

Adam Smith' co-founder and chief executive of Ascension, (formerly Adili), said, 'people are thinking pretty hard about what they spend their money on and if it will last. Slow fashion is very real - our customers believe in it.' Designer/makers stand to benefit from the present economic downturn. Consumers still need to buy products and give gifts and place a new-found value on their hard earned cash (not credit). They are looking for value for money, product longevity and a more carefully sourced, designed and crafted product from a designer/maker can match their needs more appropriately.

Innovative Sustainable Design Approaches

Holism is a concept or belief that all of the properties of a system cannot be explained by the component parts alone. Rather, the system as a unit determines how the parts behave. This idea offers a systems approach. The design process of experimenting with how all the parts can be balanced elegantly together is already in use. 'In the landscape of sustainability the system includes ecological aspects as well as economic and cultural aspects (Thorpe 2007).'

Kate Goldsworthy designs with reclaimed textiles focusing on the concept of life-cycle thinking and designing-in solutions as part of the creative process. Her Phd

project *Materials Re-creation,* explores these themes along with new manufacturing processes and digital technologies to 'Upcycle' synthetic materials. She was involved with 'Ever & Again; rethinking recycled textiles' (www.everandagain.info) with the TED research cluster, who continue to explores technologies that could potentially change the way we recycle our textile waste. Kate is Course Coordinator for MA Textile Futures at Central St Martins College of Art (www.textilefutures.co.uk) and a member of Textile Futures Research & Consultancy (www.tfrg.org.uk).

Orsola de Castro's company, 'From somewhere', is a clothing label that addresses the issue of pre-consumer waste and reproducibility in recycling for the fashion industry. With her partner Filippo Ricci she started Estethica, the sustainable fashion area at London Fashion Week.

Emmeline Child was employed by the DTI to look at the problems of waste textiles in landfill; she later launched her first range into TOPSHOP. In 2006 Emmeline won the DTI 'Business leader of tomorrow' award. She continues to highlight ethical issues in the fashion industry through her involvement in Further education and politics.

Amy Twigger Holroyd is the designer and owner of 'slow fashion' knitwear label Keep & Share, which seeks to reverse the effects of throwaway fashion by creating beautifully crafted pieces that will age gracefully and transcend short-lived trends. Her new business, Riot & Return will offer childrenswear via a library-style clothing scheme.

> 'As an ethical 'slow fashion' label, we seek to reverse the effects of throwaway fashion by creating 'best friend' pieces that will transcend short-lived trends and age gracefully. We manufacture on a craft scale and seek to minimise our environmental impact wherever possible (Twigger Holroyd 2009).'

Amy runs machine and hand knitting workshops for absolute beginners and more experienced knitters to share designer experience, signature techniques and infectious enthusiasm (www.keepandshare.co.uk).

Eco innovation specialist, Dr Jo Heely, has been working in eco-textiles since the early 1990's. She completed her Phd investigating eco-design and manufacturing in the UK textile industry and to establish the eco-forum TEN to raise awareness of environmental concerns related to textiles. She has collaborated on Government-funded projects in the UK.

Reiko Sudo is a conceptual textile designer who continues to inspire students, educators and practitioners through her challenging practice. Sudo breaks the established conventions of textile design through her unique application of processes and materials. She characteristically interrupts the manufacture of woven fabric to manually insert feathers, deliberately creates random rust marks on virgin cloth, plies threads with incompatible shrinkages allowing heat to then buckle the woven results, she bonds metallic films to traditionally 'valuable' silk fabric. Sudo is a sophisticated 'avant-garde' designer-craftsperson, challenging without difficulty the norms of materiality, process and technique (Harper in Millar, 2005).

'Her habitation of the blurred territory between artisanal craft, high-end design, industrial manufacturing, and artistic creative intervention celebrated as a new hybridity, a contemporary interdisciplinary and modern expressive synthesis in textiles (Ibid, 2005).'

Sudo is the director of the Nuno Corporation, Japan who creates innovative textiles combining traditional aesthetics with the latest computer and synthetics technologies (www.nuno.com). The company founded a completely biodegradable new plastic made from maize that a manufacturer had made into yarn. Highly susceptible to changes in temperature, it enabled them to trace patterns with heat onto the fabric, which smelt like maize when roasted. 'Textiles are not just a pleasure to look at; they are a marvel to be experienced with all five senses (Sudo in Millar et al, 2005).' Sudo's work is a testament to the importance of exploration of new materials, experimentation with digital technologies and respect for traditional hand crafting techniques, as elaborated upon at the 'Textiles, Ornament, Light and Interior Space' symposiums' in London and Kolding, 2009 (wwkw.dcdr.dk).

Materials Advances in Sustainable Textile Design

There have been unprecedented advances in materials during the last decade. Technological advancements such as nanostructure led to research into innovative treatments and coatings of fibres and fabrics. The introduction of nano particles to fabric has been explored to present new functional capabilities of traditional textile materials. Designers and architects are also working in collaboration with materials scientists to explore commercial applications**.** Martin Ruiz de Azua's interest in textile shelters, is driven by his belief that we are destined to live with less. Basic House (1999) contains an extreme vision of the future and implies that textile technologies may provide the key for consumer culture to redeem itself.

Italian architect, Arturo Vittori has created an inflatable tent to be used in extreme conditions, Desert Seal (2005) The tent is cooled by its fabric, a polyurethane coated polyester, and by a solar film driven fan. American architect Sheila Kennedy's Portable Light Project (2005) was constructed within the 'Nomads and Nanomaterials' research programme. Two billion people worldwide are currently without access to electricity, the portable light project aimed to produce a textile solar cell light. Will Crawford and Peter Brewin developed 'Concrete Canvas' (2005) This is considered to be a major innovation in the design of disaster shelters. High-tech textiles membranes were used to create iconic structures like The Eden Project (2000) the Millennium Dome (2001) and the Water Cube in Beijing (2008).
Architects are constantly looking to nature for inspiration. Jorg Student's Emergency shelter (2004) is a polypropolene structure, modelled on the folds of a hornbeam leaf. (Colchester 2007). 'The idea of mimicking nature's cycles and structures is a useful starting point for design (Thorpe 2007).' To date, designers/maker's newly identified responsibility towards the extended life-cycle of the products they design, has generally been discrete, undetermined. However, it is becoming increasingly important that such critical awareness is articulated and publicised to the further advancement of design thinking.

Biomimetics

Biomimetics uses nature as a design philosophy in response to identified need. Janine Benyus' 'Biomimicry', (1997) defines it as the new science that studies nature's models and then imitates or takes inspiration from these designs and processes to solve human problems. Research has revealed this to be a firm foundation on which to base the theoretical and practical development of high performance textile products.

The Nobel Textile project 2008 provides evidence of the influence of biomimetic approaches and the crucial relationship between Science and Textile Design. The project teamed 5 Nobel Laureates with 5 textile designers/researchers from the Textile Futures Research Group (TFRG). 'Suicidal Textiles'; the work by Carole Collet and Sir John Sulston, uses biodegradable and synthetic materials, portions of furniture and textiles to slowly biodegrade to reveal different final forms. The design concept is inspired by the process of programmed cell death. Carole is pioneering textile inventions for the domestic market. As Course Director of the MA in Textile Futures at Central Saint Martins, she inspires future generations of designers by mapping out ways to redefine our intimate and emotional relationships within 'smart homes' using intelligent textiles and sustainable design (www.textilefutures.co.uk). At Understanding Complex Structures: Lace and Natural Objects (2009), Cecilia Heffer discussed her Residence with MA Textile Futures, and her 'hyperbolic lace' structures inspired by patterns of reproduction and cell regeneration in nature (http://www.ntu.ac.uk/science_heritage/).

New Textile Fibres

Textile fibre technology is a fast moving industry, with new materials and processes continually being developed to meet new needs and situations. Designer/makers have to regularly update their materials knowledge and understanding. To design products that meet changing market requirements. The introduction of sustainable textile fibres produced using the bio-polymer process from protein based sources like milk and soya, has resulted in new fibres that present sustainable alternatives.

Polymers and Bio-Fibres

Natural polymers exist as short fibres that need to be combed, lined up and twisted to make longer, more usable longer lengths. Most synthetic polymers are manufactured from petrochemicals using the process of polymerisation, but it is also used to produce sustainable fibres from natural and renewable sources like Bamboo.

Increased recognition of the need to make materials from renewable resources has been accepted as a new concept in material production thereby reducing our dependence on energy and resources. Newly developed 'bio-based polymers' are superior to conventional polymers in reducing the emission of carbon dioxide into the atmosphere. PLLA (PolyL-lactic acid) prepared from cornstarch, is just one of an increasing number of bio-polymers which will result in a new paradigm of materials science and technology and will impact considerably on the textile industry in this century (Kimura, 2008).'

Soya Bean and Milk Fibres

Fibres based on casein from milk have long been used in Japan. There are interesting associations with the concept of weaving or knitting with milk. There are many philosophical and psychological associations; we have with milk from our childhood for example, which could lead to interesting conceptual exploration of the different qualities and perceptions of milk as protein for health and well-being. It is one of the fibres that Pittman will be exploring in her ongoing practice-led PhD.

Bast Fibres

Newly devised processing techniques will lead to potential sustainable textile fibres obtained from the inner stem of the plant. Vegetable fibres can now be regenerated to supply local small textile industries. Nettles hold many associations which could be a source of inspiration for textile pieces. Project STING revealed that nettles can produce a high yield of fibre in comparison to similar bast fibres such as flax or hemp (Horne 2008)**.** Bamboo viscose, which is extracted using the new cellulose process, has recently produced a range yarns and fabrics which are now available in the commercial markets. This fibre has super anti-bacterial properties that could be applied to enhance factors of well-being.

Peat fibre is produced from the organic remains from peat bogs of Scandinavia. The clean, pollution free environment produced over hundreds of years preserves the fibre and keeps it bacteria free. The fibres have twice the thermal properties of wool. They are said to be able to mitigate the effects of radiation and can bring health benefits to rheumatism sufferers. Processing is slow and this is also a positive quality in a country like Japan where a fabric with ancient qualities, gives a consumer delight in wearing a fibre that is hundreds of years old. I would like to explore this 'slow' fibre which fits in with the philosophy of the slow fashion movement perfectly. It is also possible that the work of Carole Collet and Sir John Sulston could lead to further research to explore peat fibre; through growing products rather than fibres.

Tussah or wild silk is now being developed in sustainable projects in South Africa. Known as the 'memory cloth' which can capture the process of mark making in shibori techniques, where one is reliant upon serendipity to produce striking marks and structure onto fabric. This presents a natural challenge to designer/makers and usually results in unique designs. Tussah silk has featured in Pittman's textiles work for many years (figure.1). It is a versatile cloth that enables the processes of manipulation to be captured, which warrants further exploration as a sustainable textile.

Figure 1 Shibori process on tussah silk.

Figure 2 Shibori process on polyester

The use of digital technologies to augment and conserve hand generated crafting processes underpins the teaching of sustainable design at undergraduate and postgraduate level at Nottingham Trent University. On the MA Textile Design and Innovation programme, interdisciplinary approaches that permeate the boundaries of dedicated technologies, materials and associated disciplines are encouraged, leading to considered outcomes that explore highly functional, aesthetic applications (Jones and Townsend 2008).

Closed Loop Textile Technologies

Closed-loop production techniques challenge designer/makers by presenting new parameters to design within and by providing opportunities to explore flexible, innovative approaches and outcomes that engender longevity. Designer/makers awareness of consumer expectation and perception of products, which now have an extended, multi-functional role in everyday life, mean that they have to consider the lifecycle of the products that they design. The environmental impact of the application of newly developed textile products has positive lasting consequences that could help to redress the balance between recycling and landfill.

Cradle to Cradle

The architect William McDonough, and chemist Michael Braungart (2002), believe that a product should have multiple life cycles; the end of the first life becomes the first stage in the next and so on. To achieve this, the materials must be ecologically compatible; they must be designed to fit into the next life cycle. The loop is closed by returning products to nature through composting. In the case of non-degradable products, the loop must be closed by continually using and reusing the materials closing that loop too.

Japanese textile company Teijin have pioneered the idea of Closed-loop manufacturing, which has been developed by sportswear manufacturer Patagonia; their Synchilla fleece has prevented 86 million plastic bottles from going to landfill (www.patagonia.com). More recently they have taken this a stage further by introducing a new recycling system, Common Threads White Paper (2005) developed as Closed-Loop (fibre to fibre recycling), which has already made progress away from textile waste and the problem of landfill (www.teijin.co.jp).

It is now possible to recycle synthetic fibres chemically. Polyester, nylon and polypropylene can all be broken down at a molecular level, and then by re-polymerising the resulting pellets. Blends of fibres can also be treated with this method, to extract the synthetic fibres and reuse the natural ones. Eco-Annie's yarn is a successful example of this process. It uses organic fibres mixed with recycled and reclaimed fibres (www.anniesherburne.co.uk).

Industrial ecological networks that aim to develop products around ecosystems much like a natural ecosystem. Close consideration of materials cycles and improved energy efficiencies as well as strategic reduction of consumption, leads to clustered industries or dependent communities. The idea stems from principles of nature, co-operation, interconnectedness and symbiosis.

Designing out Waste

This concept requires further development, effective legislation and highly motivated designers with a sound knowledge of the 6 R's – Rethink, Refuse, Reduce, Reuse, Repair, and Recycle. Getting to this point will take time, but the first steps are already being made. Educational establishments must continue to be pro-active in supporting this shift. The Fashion and Textile Industry has made some progress in a relatively short time and now designer/makers must continue to lead the way by embracing the technological advancements in materials, identify firm manufacturing foundations and greater awareness of the social issues. Figure 3 and 4 show products that are designed to have multiple uses or

forms.Sustainable lecture programmes such as 'Preconceptions', in the School of Art and Design at (NTU 2007-2009) have featured many of the design concepts and design innovators referred to in this paper. First hand dissemination of ethical, 'no-waste' approaches helps to inform educators of current developments so they can continue to develop a curriculum that empowers future fashion and textile designers to make informed decisions, with a social and commercially sustainable conscience.

Figure 3 Neckpiece polyester

Figure 4 moulded polyester

Conclusion

Sustainable design is a challenging practice dependent upon a shift in consumer thinking and in the in power structures associated with design and manufacture. Designer/makers can step outside conventional commercial production methods, enabling greater creative freedom, quick response to change and short run, bespoke approaches. New values need to be placed on the resources and objects that we already possess. The sourcing of more ethical textile production methods and research into the lifecycles of textile products need to be addressed by design educators and practitioners.

Significant changes in consumer purchasing patterns will be achieved through holistic approaches to sustainability. Evidence of changes in consumer purchasing patterns can already be tracked in subtle transitions in the behaviour of consumers when they are *consuming*, and of designers when *designing*. Designer/makers could continue to benefit from the present economic downturn, by designing more strategically for consumers searching for value for money, product longevity and carefully sourced and crafted products.

Research into and experimentation with new and emerging, non-traditional textile materials is an essential element in the establishment of sustainable development. Stronger links between Science and Textiles need to continue to be developed through further practical research. The subversion and integration of traditional craft and 'digital crafting' techniques and interdisciplinary approaches are central to innovative design development.

Designers/maker's responsibility towards the extended life-cycle of the products they design is becoming increasingly important. It is crucial that such critical awareness is articulated and publicised to the further advancement of design thinking. Closed-loop production techniques challenge designer/makers by presenting new parameters to design within and by providing opportunities to explore flexible, innovative approaches and outcomes that engender longevity. The environmental impact of the application of newly developed textile products will have positive lasting consequences that could help to redress the balance between 'recycling and landfill'. Further dissemination of innovative 'no-waste' or 'recycled' approaches through live projects, events and design curriculums will

help prepare future designers to produce sustainable objects that future consumers' desire and value. Designer/makers are uniquely placed in realising this paradigm shift. Education and research are effective tools for communicating these changes.

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