A Study on the Sustainable Fashion Design in the Process of Use

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Abstract

Sustainable design is becoming increasingly important in the fashion world. Though consensus exists within the design world that sustainability is a vital topic to explore, little has been studied about the apparel design on the use matters. Sustainable practices are growing in some areas of the apparel industry. However, use is very important; it is a vastly under-explored area of innovation in sustainable fashion. This study discussed several approaches of sustainable design during the course of washing and drying were discussed. Therefore, the purpose of this study was to explore how we can minimize the impact on environment in the process of use through apparel design.

Keywords: Sustainable fashion, apparel design, garment, clothes, textile

1 Introduction

Sustainable design is becoming increasingly important in the fashion world. The apparel industry has created many environmental problems, including large quantities of harmful waste that are generated at every stage of the apparel manufacturing process. But research shows that most of its environmental impact comes from laundering and not from growing processing and producing it or disposing of it at the end of its life. Though consensus exists within the design world that sustainability is a vital topic to explore, little has been studied about the apparel design in the use phase.

Along with increasing global awareness of environmental problems, consumers' awareness of sustainability has risen as well. Consumers are seeking environmentally friendly clothing, and producers are exploring ways to meet these demands. In the past, apparel designers and merchandisers have emphasized a product's functional, aesthetic, and economic aspects during the design process (LaBat & Sokolowski, 1999). With increased consumer interest in the environmental implications of apparel production, many companies have introduced sustainable practices. For instance, companies such as Coop Switzerland, Levi Strauss & Co, Marks & Spencer, Nike, and Noir use organic cotton (Black & Anderson, 2010; DeLong, 2009; Organic Exchange, 2007). Other companies, such as Patagonia, offer products made from recycled polyethylene terephthalate (PET) bottles (Rupp, 2008). Manufacturers are also offering fabrics made from recycled or regenerated fibers. Martex's ''eco2cotton,'' a fabric made from apparel yardage waste, is one such example (Marks, 2007).

Sustainable practices are growing in some areas of the apparel industry. However, use is very important; it is a vastly under-explored area of innovation in sustainable fashion. There are very few examples of fashion and textile designers getting to grips with cleanliness, hygiene and the environmental consequences of laundering their products. What is more, there is little information about the scope and potential of designing

to reduce the impact of the use phase for fashion. Therefore, the purpose of this study was to explore how we can minimize the impact on environment in the process of use through apparel design.

In this study, three approaches of design idea to promote low-impact laundering, considering the factors of washing temperature, washing frequency, size of load, are suggested. Then a new idea of design clean clothes is proposed to eliminate the impact on environment to the greatest extent in the process of use through fashion design.

2 The use phase of apparel is more important

The majority of studies on sustainable fashion design focused on the phases of production and disposal before. While a research from the Netherlands shows that the average piece of clothing stays in a Dutch person's wardrobe for 3 years 5 months is on the body for 44 days during this time and is worn for between 2.4 and 3.1 days between washings [1]. Yet even though the typical garment is only washed and dried around 20 times in its life, most of its environmental impact comes from laundering and not from growing, processing and producing the fabric or disposing of it at the end of its life. The washing and drying of polyester blouse, for example, uses around 6 times as much energy as that needed to make it in the first place [2]. Just by washing the blouse half as often, the product's overall energy consumption can be cut by almost 50 %, with similar savings for air pollution and production of solid waste. The point here is that the biggest gains in environmental performance for many fashion pieces can be made by tackling the impact arising from their washing and drying.

Material choices, production efficiency issues and waste also matter, but for frequently washed items, they do not deliver resource savings on the same scale as influencing laundry practices. Yet while use is very important, it is a vastly under-explored area of innovation in sustainable fashion. There are very few examples of fashion designers getting to grips with cleanliness and the environmental consequences of laundering their products. What is more, there is little information about the scope and potential of designing to reduce the impact of the use phase for fashion.

There are a limited, but growing number of studies that give detailed Lifecycle Assessments (LCA) for textiles and clothing and there confirm the high relative impact of the use phase for frequently laundered clothing. The study most commonly referred to by companies and the literature alike is that of a polyester blouse performed by consultants Franklin Associates [3] for the American Fiber Manufacturers Association (AFMA), the trade association for US companies that manufacture synthetic and cellulosic fibers. The study uses an established LCA methodology and its results show unequivocally that the major part of environmental impact in the lifecycle of a blouse arises from the consumer use phase (see Figure 1). It concludes that as much as 82% of energy use, 66% of solid waste, 'over half' of the emission to air (for carbon dioxide specifically the figure is 83%) and 'large quantities' of waterborne effluents (96% if measured by Biological Oxygen Demand alone) are amassed during washing and drying.

LCAs have a long history of being used by companies to defend themselves against environmental requirements by demonstrating that problems are more complex than initially believed [4]. While as a report's executive summary states: 'it was demonstrated that the manufacture of a particular reusable product was not the most significant consequence for an energy and environmental analysis; instead improvement measures should be aimed at the efficiency of home laundering devices. It may also be possible to develop 'easy care' fabrics requiring lower consumer maintenance. These improvements would have much greater potential benefit than improving the product manufacturing process.'[5]

So the study addresses the imbalance and explores multiple and emerging sustainability issues associated with the use phase of fabric and garments. It touches on opportunities to choose fabrics and design garments

with lower impact in use, community laundries, service design and the socially and culturally determined need to keep clean.
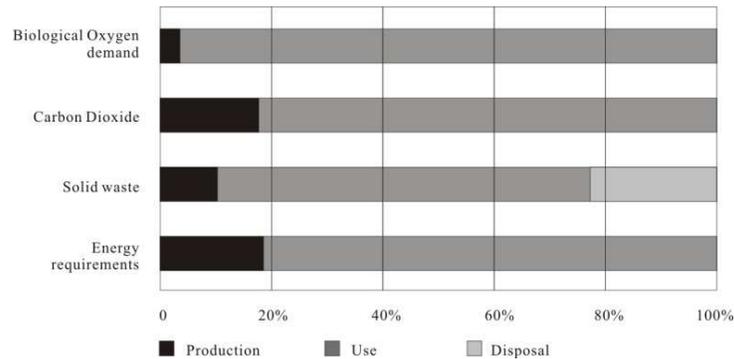

Fig. 1. Lifecycle impacts for a women's polyester blouse (percentage of total impact)

3 How to design garments that cause less impact as they are laundered?

As was proved above, the phase of use is important for sustainable fashion. So there comes up an ideal of design by altering the structure and composition of garments to promote low-impact laundering, considering the factors of washing temperature, washing frequency, size of load, etc. Making changes to any or all of these factors should have potential to reduce impact.

3.1 Washing Temperature

In the case of wash temperature, studies reveal that different fiber type types are laundered on different temperatures. Cotton items are commonly washed on warm temperatures (50°C or 60°C) whereas synthetics are washed cooler (30°C or 40°C). This means that by designing with 'synthetic' fibers instead of 'cotton', impact associated with the use phase of the lifecycle could be reduced, although this has complex resource implications in other areas of the lifecycle and takes little account of widely held cultural preferences for natural fibers. The more general point, however, is that selecting fibers that wash well on cool temperatures and dry quickly (without tumble drying) could bring major benefits. This gives a tentative green light to fibers like polyester and nylon on the basis of their low-impact laundering profile. So we should, at the first place, use synthetic fabrics as much as possible in the practice of sustainable fashion design.

Yet the benefits of substituting one fiber for another to reduce the impact of laundering are dependent on consumers correctly differentiating between fiber types and washing them accordingly. Evidence indicates, however, that this is not the case; most people struggle to tell the difference between fibers, resulting in most textiles being laundered on cotton cycles regardless of their actual fiber content. Further complicating matters, when studies of how people sort their laundry are taken into account, it is clear that in the majority of cases, and clothes are sorted by color and not fiber type. These loads are then laundered at hotter temperatures if they are white or light colored than if they are made up of dark shades. The implication here is that careful specification of color is an effective means of reducing the impact of consumer care.

Why don't we design sustainable fashion in a palette of white or light color? On the other hand, we can even apply a specific label indicating low temperature wash on each piece of clothes of sustainable at a prominent position(see Figure 2), such as beside the trademark, back of the neck, or bottom of the hem. Fortunately there were some efforts made on the practical sustainability at similar sense. For example, the key UK retailer Marks and Spencer has tried to circumvent laundering behavior complexity by introducing a standard 'thin climate-wash at 30°C' care label in 70% of its machine washable clothes. In recent years M&S has responded

by revising its clothes' recommended washing temperature from 50°C (pre-2000) to 40°C in 2001 [6] and recently to 30°C in 2007. While there is a lot need to be done in the future.
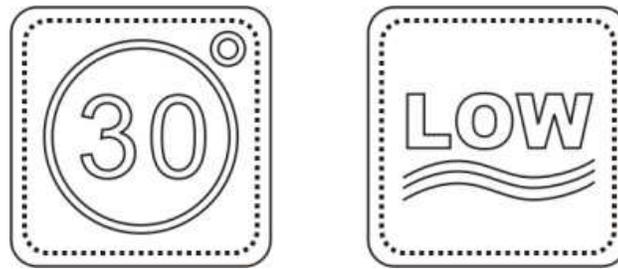

Fig. 2. Two kinds of special labels indicating low wash temperature designed by the writer.

3.2 Washing Frequency

In order to reduce the frequency of laundering, there are common ways of design include choosing fabrics that resist soil and odor, such as with stain-blocking coatings that form a barrier around the fiber. Durable stain-resistant coatings, like Scotchguard made by 3M, have been widely applied, particularly to dry-clean-only products like silk ties and suits, to provide resistance against oily stains and prevent the need for frequent cleaning. However, these coatings, based on perfluorinated chemicals, are known to have wide ranging human health impacts and are persistent in the environment, and face increasingly tight regulation in the future [7].

Other coatings give antimicrobial properties to fibers. The antimicrobial agent in longest use is silver, first used in Roman times, and now gaining importance in medical textiles, making antimicrobial dressings by incorporating silver ions into highly absorbent alginate fibers. More general antimicrobial textile applications using silver depend on limiting silver's highly oxidative properties that discolor host fibers, although in recent years, compounds have been developed that can be blended with fibers during extrusion to avoid this problem [8]. Antimicrobial protection can also be provided with organochlorines such as triclosan, the primary ingredient of the registered biocide Microban, suitable for polyester and nylon fibers and their blends with cotton and wool, or with coatings such as poly, suitable for cellulosic fibers.

Statistics suggest that it is the cultural or behavioral reasons that account for most of our laundry (as only 7.5% of laundry is thought to be 'heavily soiled'). More dependable gains come from altering the expectations people have about how often they need to change their clothes and from influencing inefficient laundering habits, like our tendency to wash everything that is not in the wardrobe, regardless of how dirty it is.

3.3 Size of Load

Different option for reducing the influence on the environmental impact is to reduce the volume of laundry created. Modular design can lead to less laundry, by making the parts of garments that get soiled most quickly detachable from the main body of the garment for separate washing. This is not a new idea, men's dress shirts with detachable collars were commonplace in Victorian and Edwardian times until mass production led to their phasing in the 1920s. While there are many contemporary takes on the modular design theme (such as Jun Takahashi's Dolls collection for the Undercover label in 2003), none have exploited its potential for sustainability.

There are a good number of split joint fashion styles of different materials prevailing in the market today. It is found that most of them could be changed into a modular design, with only a small device of bottoms for

detaching and attaching (see Figure 3). By this way, the collar, cuff and even hem, might be removed from the main body of any clothes for cleanness. Thus the size of load is minimized to extremely small, and the washing frequency lowed at the same time, as well as the drying efficiency. Of course, any device of detaching accessories can be used in the modular design.
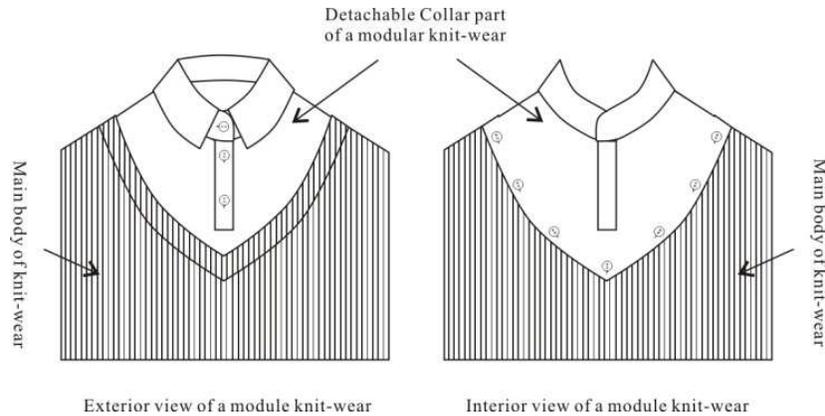

Fig. 3. The exterior and interior view plan of a detachable collar knit-wear of modular design.

Yet there is a major caveat that limits how effective modular design can be in reducing the amount of laundry we do our laundry practices. Not only does modular design require consumers to get into the habit of detaching dirty parts of a garment for separate cleaning it also has to influence the frequency with which we wash. Modularity slows the frequency of washing if people wait for a full load to accumulate before doing their laundry. However if it is done in part loads, say when dirty items are needed, then the impact is less positive.

4 Design Clean Clothes
Functional innovation is concerned with delivering results with fewer resources. The core concept is that we seek the functionality or results that a product gives us and not the product itself. Much has been made of functional innovation in the sustainable design literature and its potential to save resources. The benefits are thought to flow from designers working in an increased design space, no longer limited by their traditional view of what they must deliver to the customer, and because these functions frequently require cooperation across industrial sectors. A shift from thinking about clothes to thinking about clean clothes is a major conceptual leap for designers and involves a high level of interaction with users over time, far beyond the point of sale.

One way to innovate around the function of clean clothes is to design products never to be washed. While it is culturally inappropriate to keep wearing some items (like underwear) without laundering them, there are other items that are more naturally suited to 'no wash' or at the very least 'low wash' design approaches. For example, we can design a garment with wipe-clean surfaces and extra underarm ventilation. Even with some bold 'decoration' of coffee spills and soap smells, it will act as a reminder of our garment's history as well as our responsibility to reduce the impact of use. Or we can pre-stain a dress with red wine in a semi-random splatter pattern. In this way any future stains add to the garment's design rather than cause it to be regularly laundered or discarded.

Of cause, those design ideas are prototypes and not in commercial production. Yet recent developments, such as a nano-technology-based self-cleaning coating for textiles [9] have potential to mainstream low wash

clothes. Ideas like designing low wash clothes fall between industries and involve forming relationships and connections where none existed before. It requires designers to look in new places for inspiration, to ad hoc projects, alternative lifestyles and different people.

The companion solution to durable no-wash products is disposable no wash ones. Less culturally contentious and more familiar to us, disposable textiles and clothing offer a means to reduce to zero environmental impact arising out of washing. Just as with durable no wash items, some garment types are likely to be particularly suited to overall lifecycle-impact reduction by designing them to be discarded before laundering. Yet they provide no immediate panacea, as while disposability side-steps environmental impacts linked to laundering, other impacts, like the cost of production and disposal, have to be included instead.

To make it past the drawing board, environmentally responsible, disposable, no wash garments would have to be produced super-efficiently, from low-impact materials, involving a non-polluting transportation system and an effective and economic cycle of materials reclamation and reuse. The capability of our current system of fashion production and reclamation to do this is untested, but major improvements across the supply chain are likely if disposable no wash products are to offer a more resource-efficient alternative across the lifecycle.

5 CONCLUSIONS

Through the research of the study, we now know that the use phase of clothes may do greater influence on environment of our living world than other phase of a garment life. And three approaches of design idea to promote low-impact laundering, considering the factors of washing temperature, washing frequency, size of load, are suggested. Then a new idea of design clean clothes is promoted to minimize the impact on environment to the greatest extent in the process of use through apparel design.

Although any changes to our laundering practices impact more on ritual and symbolic needs that on material ones. This makes the dominant social status and complex cultural significance of cleanliness the point to influence. Yet cultural norms change constantly and any change, however small, to cultural perceptions of cleanliness is likely to bring far-reaching sustainability benefits. What the study does is a certain practice from the view of fashion design to make it happen.

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