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Conditional garment design for longevity

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Abstract
In the clothing sector, approaches to design for longevity can provide the "…single largest opportunity to reduce the carbon, water and waste footprints of the clothing in the UK" (WRAP, 2013a). Although an emphasis lies on slowing consumption, the types of design-led approaches that can be used to achieve this goal are considerably varied yet sparingly used by the mainstream fashion industry. In light of the growth of a circular economy, the challenge facing the fashion industry is to adapt the existing product design and development model and explore a fashion system where other, more diverse design approaches can prosper. Thus, this paper attempts to contribute to this debate and further highlight factors that need to be considered by fashion companies when developing garments designed for longevity.
Through a range of novel design principles/methods, underpinning modularity and incremental garment design/construction in this paper we demonstrate how designers may begin to envisage garments as items designed for longevity. The experimental work carried out here is part of a larger initiative, Re:Textile in Sweden (Retextile, 2017). In the experiments conducted we demonstrate the power of various garment design conditions intended to synthesize a change towards garment longevity. Together with highlights of the key processes and basic design principles underpinning these design-led approaches, the experimental work also specifies how and where they contribute in achieving the aims of designing in a circular economy. The findings also highlight the opportunities for improving the redesignability of the garment in its active use life as set by the original design conditions laid in light of design for longevity.

Introduction

In the fashion industry, garments are developed for a variety of markets, for consumers with specific requirements, needs, and values. The characteristics of garments developed for these markets differ greatly; their aesthetic, material and production characteristics are selected to suit a given function, purpose and price point. High street fashion garments are primarily designed for aesthetic appeal and are frequently constructed from inexpensive materials that keep the items affordable and (easily) replaceable, while at the same time demand shorter lead time to market. Once purchased, all garments go through a cycle of wearing, laundering, storing, and perhaps repair and alteration, before a final disposal (Bras-Klapwijk and Knot, 2001). Typically, at the point of disposal many consumers believe that garments have no further purpose or use value, and so items are often placed in a waste bin (WRAP, 2012).

Of the 350,000 tonnes of discarded clothing that is sent to UK landfills each year (WRAP 2012), much of this waste could be reduced if designers employed strategies to extend the life of garments and support consumers to engage with maintenance practices. In many cases the lifetime for clothing can be extended from 3 to 5 years if designers consider longevity factors during the design process used to develop fashion products (Claxton et al. 2015). It is commonly understood that the decisions made during the garment design process are known to potentially lengthen or shorten the lifetime of the product during its use. If poor quality materials and inexpensive construction processes are employed, then the physical durability of a garment is compromised. At the same time aesthetic design decisions can make a garment appear 'outdated' when new seasonal trends emerge (Walker 2006). Moreover, some design decisions can confuse consumers because they confront preconceived ideas about the relationship between price and brand: one where the durability of a garment is seen to correlate with a high price and brand (Gwilt et al., 2015).

In maximizing garment longevity, 'durability' could be considered in terms of both its physical and empathetic qualities. However, this point needs to be considered in relation to the context of use, and consumer behavior. Typically, consumers are satisfied if a garment retains its function during use, and they are unconcerned whether the item should last for any longer than this (Cox et al., 2013). To designers there is then a significant opportunity; to not only extend the physical life of garments for as long

as possible to keep materials in circulation, but also to change the perceptions and expectations that consumers have towards clothing lifetimes.

Considering design for longevity

For designers in the fashion industry it is possible to reduce textile waste if strategies are employed to ensure garments are 'fit for purpose', desirable to consumers and developed for longevity (Claxton et al., 2015). Through a circular economy lens it is apparent that a wide variety of design-led approaches can be used in new product development to achieve this goal. Moreover, in considering the extension of the life expectancy of garments we propose that designing for longevity could be a mechanism for increasing the active use period and thus delaying the disposal of garments. However, design for longevity in terms of clothing products can be explored from different perspectives.

WRAP (2013a), Laitala, Boks and Klepp (2015) and others argue that the disposal of clothing can be delayed, "…through improved design, consequently increasing the active use period." In ensuring that garments have a long and active life it is necessary to consider the development of clothing products in relation to their empathetic and aesthetic qualities alongside effective physical and technical attributes (Laitala, Boks and Klepp 2015). At the same time the meaning of the term design goes beyond the direct creation of clothing in production, to include the creation of services or systems that sit in consumption (Laitala, Boks and Klepp 2015).

Traditionally the mainstream fashion industry has not exploited the opportunity to manufacture highly durable garments or to provide/support maintenance initiatives. In part this began with the rise in popularity of mass manufactured, ready-to-wear clothing in the 1940s/50s, when fashion became accessible and affordable for consumers. Prior to these new garments were either constructed within the home or custom-made by local tailors or dressmakers (Tarrant 1996) and consumers understood the construction process and valued the resources and inputs required to produce a garment. This appreciation extended through to garment maintenance where in the home consumers routinely repaired, altered and remanufactured garments. In contemporary society, it seems that fashion consumers are predominantly situated outside of the industrial system, often unaware of the methods and materials used to produce garments or approaches to maintain garment lifetimes. Simultaneously fashion producers are still largely comprised of a variety of profit driven businesses, which operate a traditional production model dependent on a seasonal cycle of producing, selling and discarding large quantities of clothing to meet economic returns.

In a circular economy, the fashion industry has the opportunity to influence a change in consumer behavior whilst employing different models for business. According to WRAP (2013a) one approach would be for brands and producers to see longevity integrated within the company strategy, which would provide a clear aim for teams involved with product development during manufacturing and retail.

Existing approaches

If the fashion system was viewed through the lens of 'designing garments and designing supporting services and systems', there are, according to WRAP (2013a) and Laitala, Boks and Klepp (2015), several factors to consider when designing for garment longevity. Notably these areas include:

- Considering the role of design and production in addressing design aesthetics; size and fit concerns; and providing greater durability.
- Supporting consumers through communication and after sales services.

Significantly, in moving towards designing garments for a longer life it may be possible to foreground 'longevity' as a valuable clothing attribute. Disposable garments may then become undesirable; however, this will require, "... a cultural shift, driven by consumer re-education, corresponding marketing promotion and, perhaps, new business models" (WRAP 2013a). There have been a number of initiatives advocated by NGOs and campaign groups, and products developed by brands and fashion companies that demonstrate how design for longevity can be considered and applied in the fashion industry.

The Welsh clothing company, Howies, developed the 'Hand-Me-Down' collection with the intention of creating products with longer lifetimes. During product development the design process involved identifing and correcting the potential weak points that arise in a garment during use. The garments, which were created to last for ten years, were then manufactured using high quality materials and durable construction methods, and the company offered to repair or replace damaged components arising from wear and tear. In 2014 Tom Cridland began his sustainable fashion brand with an aim to develop products supported with a thirty year guarantee. Cridland's range of T-shirts, jackets and trousers for the menswear market are intentionally aesthetically classic, not unlike the products found in the Howies Hand-Me-Down collection. Both brands strived to ensure the physical durability of a garment through select materials and construction methods, but in both cases the opportunity to improve consumer attitudes and practices towards garment maintenance has been missed. This is where campaign groups have been highly active. The 'Love Your Clothes' campaign founded by the NGO Waste and Resources Action Programme (WRAP), UK was developed to influence behavioural change amongst consumers. With the support of industry and academic partners the web resource provides consumers with advice on garment care and repair, remanufacturing methods, and recycling / reuse ideas. Notably the

campaign encourages consumers to get involved by posting quick tips, video clips, and blog posts. But it is apparent that there is an ongoing disconnection between 'producers' and 'consumers' although efforts to bridge this divide are emerging. Swedish brand, Nudie jeans, is commited to providing both a product and a service for its consumers. Through the Nudie Jeans Repair shops jeans can be purchased as new, repaired for free, resold as second-hand, or donated to the store for recycling (Nudie Jeans n.d.). At the same time, through the blog the brand encourages consumers to get involved by posting images of loved-yet-damaged garments, or by learning specific care techniques. These approaches signpost the ways in which brands can reach-out and connect with their consumers.

Whilst the examples discussed demonstrate how designers and users can engage with and promote design for longevity, implementation of these types of approaches across the sector remains small. Working in line with design for longevity, in this paper we explore the notion that fashion designers and consumers can visualize fashion garments as living products, which are designed to evolve, transform and grow for a long life.

Demonstrative case

Although design for longevity can be achieved in many ways, it is a combination of the design-led approaches that helps extend the lifetime of a garment. Using appropriate and considered materials and construction techniques in the garment, manufacturing plays an important role in enhancing durability through use. We, in this study, categorized these approaches into two primary design conditions.

1. Modular garment design: refers to the development of a range of detachable parts for fashion garments that can facilitate replacement, repair or even adaptation, by creating novel attachment system. Such modularity can be devised in the method of construction by making the garment components (sleeves, front and back panels, collars and cuffs, etc.) detachable either manually or via automatic separation technologies. More creative forms of modularization can be achieved by making the garment ornamentation, embroideries, and silhouettes modular, i.e. can be easily separated from the garment. Advanced technologies, such as laser-cutting, ultrasonic bonding, 3D printing etc. can be used to enable such garment modularity.

2. Incremental garment design: in terms of designing for longevity informs designers to consider the key attributes or micro design elements, such as garment form, features, garment proportion, color and print, themed references, and genres in fashion (Seivewright, 2007), to be incrementally updated leading to garment life extension. Here it could be suggested that in terms of design for longevity it is important to reflect on the key attributes in terms of the contribution to extending the lifetime of the garment. The garment without these incremental design features is ready-to-wear but with low user appeal for its long life.

To demonstrate these two principle design conditions, an experimental work was conducted under the scope of a regional initiative in west Sweden called Re:Textile aimed at creating structures for circular flows in the fashion apparel industry through concrete projects to investigate the commercial viability of re-design practices.

Experiment 1 – Based on modular design/construction, reusable modules was used in different systems - a kind of qualitative semi-manufacture, enabling re-contextualization and a long and varied product life. Re:Textile created a modular fashion - clothing parts that can be added to and subtracted to create various kinds of garments, such as dresses, tops, skirts, with sleeves, without sleeves etc. The collection is based on interconnected modules, flexible in design, fit and construction and consisting of 18 scarves, designed into 5 different types of garments (Figure 1). Further the collection is made out of mono-material - 100% polyester, including stitching and thus possible to recycle at fiber level.

Based upon a standard estimation of production cost in Sweden of SEK 7 per minute and a mark-up factor of 4.5 for the potential price tag, the retail prices of the above products were calculated to be SEK 308, 416, 677, 735 and 758 respectively.

Experiment 2 – Based on the aspects of incremental design, examples of the existing products, or with some small alternations, is shown in Figure 2. The pant from a sustainable brand is made of a blend of polyester (20%), polyamide (70%) and Elastan (10%) and is reinforced with 100% Kevlar while the shoe cleaning area is 100% Polyester. It has therefore very limited recycling potential; however, the interesting part of this pant is its incremental features on the basis of its functionality. By changing pockets, several different functions can be added or removed as the user may wish. Similarly, the incremental design principle adopted in constructing the backpack incorporates loops for adding or removing functionality depending on activity.

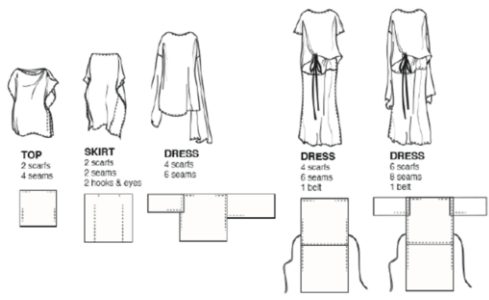

Figure 1. Modular design-led construction principle ©Re:Textile

Figure 2. Incremental design-led construction principle ©Re:Textile

The calculations in the examples are based on estimates of production costs, put in relation to the original price tag, using the generally accepted mark-up model. The production cost is approximately 20% of the original price tag. The garments in the examples are manufactured in the Baltic countries, so a minute price of SEK 2 per minute is used. The retail price of the pants is SEK 2300.

Analysis and concluding remarks

The paper attempts to outline some of the ways in which fashion brands and designers can envisage garments designed for longevity. Through experimental work that focused on two specific design-led approaches – modular garment design, and incremental garment design, the paper highlights how garment design conditions can be employed to meet the aims of designing in a circular economy. The findings highlight the opportunities for improving the redesignability of the garment in its active use life as set by the original design conditions laid in light of design for longevity (Figure 3).

	Principle	Contribution towards Design for Longevity
Modular	• Made of easily separable modules. • Preferred mono-material composition of each module	• Addresses both redesign (multi-purposing) and recycling requirements
Incremental (if Blends)	• Includes micro-design elements that can be incrementally updated	• Addresses multi-functionality. • Must be combined with modularity and mono-materiality to additionally improve recycling potential

Figure 3. Design conditions for longevity.

Design for longevity is often reported to increase garment costs by up to 5% for some products and add up to 2 weeks to garment lead times, thus confirming suggestions that improving garment construction to last for longer could increase costs (WRAP, 2013b). Given this lack of financial incentive for design for longevity, redefining the feasibility for design for longevity in terms of the power of the garment design process based upon certain radical product design conditions (mentioned in Figure 3) to synthesize a longer lifespan of the garment is critical. With modular garment design, it is possible to make garment parts detachable, which can be easily undertaken by the consumer before returning the components (at end-of-use) in separate bins. This will simplify the sorting process (thus lowering the average sorting cost by 50% from ~4 to ~2 SEK/kg). Further this will increase the fraction of redesignable garments rather than being sold "as they are". Incremental design potential will provide higher possibilities for value addition through re:coupling activities, e.g. cut, add, wash, stitch, or print. So, the redesignable fraction can substantially increase along with its yield. Basic requirement however is high design for durability (pilling resistance, color fastness and dimensional stability of the garment). Thus, whilst we have highlighted some of the challenges that need to be addressed when employing specific design-led approaches, we also show that brands have the opportunity to promote the value of 'longevity' in terms of commercial viability.

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