

ReDress: Reducing Textile waste through Component Reuse

Kim FRASER

Auckland University of Technology, New Zealand

Textile products are everywhere, from covering our bodies to populating our homes and workplaces. Is it unsurprising then that millions of tons of textiles are ending up in waste? This paper critically reflects on a 2009 Refashion case study. It discusses the current process of reuse in the fashion industry, drawing attention to the further potential of design for reuse.

Reusing and remaking used clothing was a long-standing practice that began as a way of extending the life of valuable resources. This sensitivity and respect for textile products changed in the 20th century with the growth of mass produced clothing and low cost off-shore manufacturing. Buyers, exploiting the low cost, capitalised on their economic strength, through larger orders in excess of their needs. This overproduction and excess stock directly fed the habits of a consumerist society demanding more for less. Current patterns of fashion consumerism have resulted in overproduction and overconsumption. This coupled with lower quality product and fast changing trends, has stimulated a 'throwaway' culture. Equally the inferior quality of mass produced clothing has limited its desire as a reuse option. The ubiquity of textile is its downfall, this devaluation has permeated all textile product and consequently millions of tons of textiles are consigned to landfill globally.

Refashion is an intervention in the 'take, make, waste' lifecycle of a garment. It is a slow growing, upcycling movement that reuses discarded clothing to produce new items for return to the fashion stream. This paper examines the perceived barriers of the Refashion process that currently limits the scale of the manufacturing operation. Findings in the Refashion case study support the feasibility of the process as a manufacturing method. Therefore the potential for Refashion, if it were more commonly practiced, is to divert large volumes of textile waste from landfill and reduce the demand on the environment: Refashion reuses the textile, maintains the original value added and delivers a new fashion item without the environmental problems required by virgin textile. This paper specifically focuses on component reuse: as a way of extending the life of the textile prior to recycling the fibre; and elucidates the process. The author identifies the benefits of a component reuse process built into the lifecycle of a fashion product and highlights the need for fashion designers and manufacturers to design for reuse.

Keywords: Refashion, Textile Waste, Fast Fashion, Component Reuse, Sustainability

The Textile Context

Accelerating consumerism in the fashion industry results in overproduction, overconsumption and waste. This combined with contemporary fashion's constant 'engagement with the new', makes premature product replacement imminent (Farrer and Fraser 2011). The fast changing trends have led to the morally questionable practice of disposing of garments that have only been 'worn' a few times (Birtwistle and Moore 2007). Lack of awareness and confusion as to the intrinsic value of textiles is emphasised in this 'throwaway' culture. This paper provides an overview of the traditions of reuse and secondary system within clothing textiles, together with our changing values through industrialisation. The author discusses the perceived barriers to reuse in the fashion industry through examination of a recent study. The process of *component reuse* (Fraser 2011), as a way for reducing textile waste through Refashion, is scrutinized and strategies for successful implementation are identified.

The Long Tradition of Reuse

Reusing and remaking used clothing is a long-standing practice that began as a way of making the most of valuable resources. Prior to the industrial revolution, creating textiles was a labour intensive process that required specialist knowledge and technique: textiles were both treasured and inherited. Patchwork quilts for example, provided an esteemed avenue for recycling precious fabrics that would be passed through generations. This perceived value in clothing textiles can be traced as late as the 18th and 19th centuries when, Ginsburg (1980) asserted, the frequent loss and theft of clothes and textiles as reported within court cases and newspapers was confirmation of their value. Second-hand clothes were vitally important in providing "relatively cheap and respectable clothing" to the working classes (Worth 2007, 18). Similarly outgrown clothes were passed down and adults' garments cut down and remade for children or renovated for reuse.

With industrialisation textiles became abundant and the Shoddy industry developed to meet the demands of yarn supply. This recycling process recovered shoddy fibre from rags which was then spun into yarn and re-used by local mills in 'shoddy' cloths. At the same time ready-made clothing was evolving, and according to Worth (2007, 18) the shoddy cloth became the "staple of the growing ready-to-wear clothing industry". However although readily affordable, ready-made clothing became synonymous with poor quality, deemed inferior through the use of lesser quality fabric combined with a poor 'fit'. This perception thus endorsed the *reusing* of quality used clothing and emphasized the regard held by textile. Hence during times when textile was considered a valuable resource, we developed enduring habits that prolonged its usefulness.

OverConsumption and Devaluation of Textile

Textile products are now everywhere, from covering our bodies to populating our homes and workplaces. But following 250 years of industrialisation the perceived value of textile has drastically changed. Take patchwork for example, whereby economising became associated with the practice and relegated it to the resourcefulness of the less affluent and therefore socially undesirable. This attitude arose in the 20th Century when business focused on maximising profit through increasing production and reducing costs. The availability of mass produced clothing escalated with the advent of low cost off-shore manufacturing. Buyers exploiting the low cost capitalised on their economic

strength through larger orders in excess of their needs (Farrer and Fraser 2011). The ubiquity of textile was its downfall, this devaluation has permeated all textile product.

When Fast Fashion² developed in the globalised 90's, widespread overconsumption was already the norm. New high-end trends are delivered into store in short regular intervals, at the cheapest possible price-point. This constant newness expands the consumer's wardrobe until, logically, removing the 'old' is necessary. But the quality of this mass produced clothing has further deteriorated (in terms of fabric quality and fit) and consequently reuse of these garments is now an unlikely option (Fraser 2013). Textile Impact

Mass consumption of mass-produced clothing at very low cost provides the consumer with a false understanding of the labour involved (Fraser 2013). Consequently, without a better understanding of further recycling options, 'throwaway' fashion now consigns millions of tons of clothing to landfill. Although the percentage of textile waste by comparison to total waste is small (approx 4% in most countries), textile products present particular environmental hazards for landfill that has an adverse effect on humans: pooling water stagnates, decaying fibre produce toxic gases and leachate which contaminates groundwater sources (Birtwistle and Moore 2007; WasteOnline 2004). Paradoxically the process required to produce virgin fibres is generally considered more alarming. For example the two most prolific fibres in common use are cotton and polyester. Every kilogram of cotton fibre requires 20,000 litres of water³ and it requires a kilogram of hazardous pesticide (per hectare) to reach successful harvest. Similarly hazardous for the environment, virgin polyester is extracted from non-renewable crude oil through chemical reaction⁴. If we were to consider that all fibre comes at a cost to people and the environment, then all reclaimed fibre reduces the need for this cost and therefore has value. There is no doubt that reuse and recycling of textiles would reduce the environmental burden (Oakdene Hollins 2006; Fletcher 2008).

At first glance textile 'recycling' appears to offer a commercial alternative for dealing with textile waste, because it produces a 'bulk product'. Unfortunately the process is now considered a downcycling process that produces an inferior and less expensive cloth. According to Oakdene Hollins (2006) this is due to the heterogeneous mixture of different fibre types and colours extracted from the original discard source. Together with this, recycling reduces the garment to its elemental value of fibre, destroying the value added through developing the yarn, weaving/knitting the textile and any intricate construction detail. The author posits that textile recycling should be considered the last step in the lifecycle of a textile product (Finn and Fraser 2013).

² Fast Fashion delivers a cheaper source of trend clothing on the high street (Barnes and Lea-Greenwood 2006).

³ <http://www.worldwildlife.org/industries/cotton>

⁴ <http://www.chemguide.co.uk/organicprops/esters/polyesters.html>

The ReDress Case and Refashion



Figure 1: ReDress x 5 on rack (Fraser 2010)

The 2009 case study: *ReDress - ReFashion as a solution for clothing (un)sustainability*, explored the possibilities of Refashion as a solution to wasteful fashion consumption in New Zealand. This paper critically reflects on the aspects of reuse within the case study, specifically looking at extending the life of the textile component prior to recycling the fibre. The project facilitated the remanufacture of discarded items of clothing that still had structural textile integrity, into 'new' standardised ready-to-wear garments (refer Figure 1). The purpose of the original case was to investigate the barriers for larger scale production of refashioned product, through remanufacturing multiples of the ReDress prototype from discarded men's trousers.

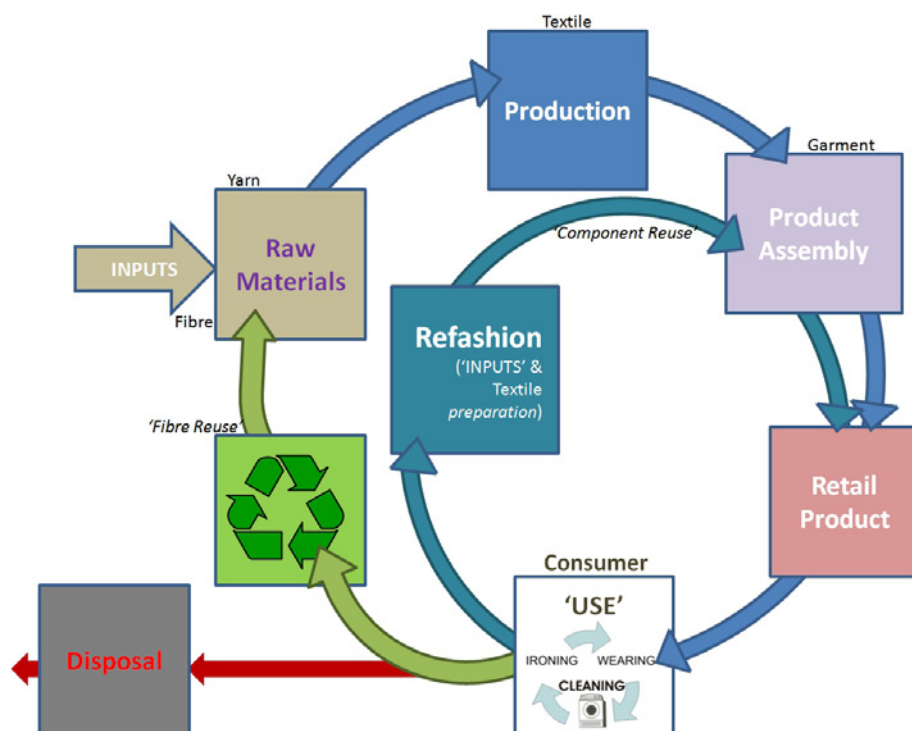


Figure 2: Refashion as an Intervention in the Lifecycle of a Garment - adapted by Kim Fraser 2015

Refashion is an intervention in the 'take, make, waste' lifecycle of a garment (refer Figure 2). It is a slow growing, upcycling movement that reuses the textile, maintains the original value added and delivers a new fashion item without the environmental problems required by virgin textile. However there remains a question around commercialisation and scale of production. Through examining the process required for manufacturing multiples of the ReDress prototype, it became apparent that perceived barriers for the Refashion process primarily concern the *input* stock. This is not a new revelation, the ReFashion process is generally perceived as a *one-off* domestic mode. The perceived *singular* nature is the critical issue because the business model for fashion has a commercial reliance upon multiplicity of product (*bulk product*). The singularity arises due to the diverse nature of stock within the secondary industry: *input stock* is irregular and quantities are unpredictable.

Men's Dress Trouser

Primarily men's dress trousers were selected to test the process of refashioning multiples because they met the criteria of being an appropriate *input stock*: consistency of style; perceived quality of 'textile'; semi-standard shape; similar construction across brands; and limited variation in colour. Beneficially men's dress trousers also featured high quality tailored details that could be reused (fly, pockets, waistband). Additionally the availability of large quantities of trouser within the secondary system, satisfied the 'bulk' requirement to manufacture 'multiples' and potentially commercialise the process. The trouser stock was sourced from several second-hand clothing vendors around New Zealand. Poor quality textile was considered a significant impediment to the success of the refashioned product, accordingly trousers were selected because of their perceived 'textile' quality.

Disassembly

The difficulty of disassembling a garment to produce an homogeneous product for further use is considered a barrier to effective recycling (SATCol 2007). The ReDress case trialed a variety of approaches to the disassembly process. In traditional Remanufacture⁵ a blanket approach to disassembly is used, whereby the original discarded product is broken up into its individual components, then (exactly) like components are grouped as 'stock' items, bundled and stored. This works in cases where specific componentry/units have a limited variety within the 'usual' componentry (eg vehicles, lawn mowers, computers). However in the case of clothing, the immense variation of style/product (fibre, textile, texture, colour, pattern, gender, style, size, shape, combined with continual variations in design and construction detailing: collars, cuffs, plackets, linings, facings, fastenings etc) decreases the likelihood of gathering random discards together that have exactly the same components. The ReDress case revealed that to facilitate productivity and maximize the *input stock*, complete disassembly of clothing stock was impractical until specified.

⁵ The term remanufacturing has been used to describe a disassembly/reassembly process adopted by several industries-more commonly associated with machinery and electrical appliances; http://www.reman.org/AboutReman_main.htm

Size Limitations

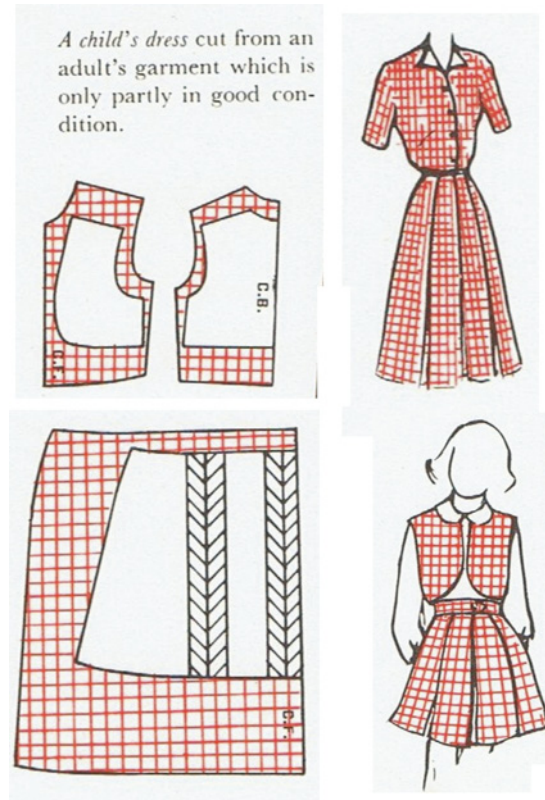


Figure 3: Child's dress recut from adult garment (Resek 1955, 172)

The resulting refashion design is also limited by the restriction of working within the shape of the components formed during first life construction. Historically large garments lend more readily to refashioning into 'smaller' garments for example children's clothes (refer Figure 3), the two dimensional area of the available cloth (*input stock*) is directly related to the size of the upcycled product. That is larger panel sizes offer more scope to be ReFashioned. Even disregarding that menswear garments tend to have larger panels than womenswear, the 'usable piece size' in men's trousers are somewhat limiting as evidenced in Figure 4.

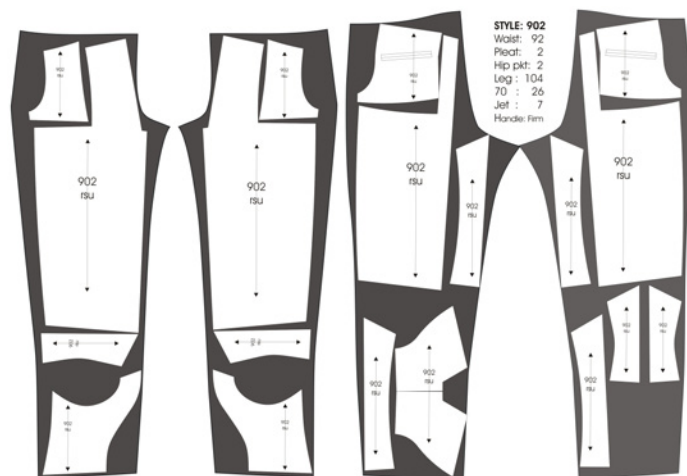


Figure 4: ReDress pattern layout on disassembled trouser (Fraser 2009)

Whilst all men's trouser do not each have exactly the same 2D area dimensions they are generally a predictable shape. For example men's dress trouser are constructed from 4 main pattern shapes: two front panels and two back panels. The 'back' is usually larger than the front through the seat area and the 'front' will be shorter in the crutch area. At the same time trouser styles will tend to vary in leg width, which will effect the refashion style. The ReDress case identified that although there is an expected direct relationship with size of original trouser to the smaller refashioned output, pattern placement for ReFashion is much more complex. Expert consideration must be given to the diversity of the original stock's panel size limitations. Exact placement of pattern pieces must consider the original 'grain' and can also be affected by the position of existing 'details'.

Component Reuse

A key discovery in the ReDress project was that *partial disassembly* can provide larger panels for re-cutting. This reinforced the notion that disassembly requirements may be specific to each refashioned style and the timing for disassembly is therefore determined by the specifications of the style. The author identified *component reuse* as the best terminology to describe the ReFashion process (Fraser 2011). The sizing restriction that necessitates *re-cutting down* to smaller garments is a perceived barrier for ReFashion. However through recognising the disassembly limitation alongside the *re-cutting down* restriction, a key difference was identified in the approaches; from the cutting process of the original trouser; to the approach in cutting the ReDress prototype.

Trouser: The pattern pieces are laid onto the textile within the length and selvedge boundaries. The garment panels are cut away from this allowance. This is a *reductive approach*: garment panels are cut away from the source.

ReDress Prototype: partially disassembled garment panels are maintained at a maximum surface size and built up where necessary. This is an *Additive approach*: garment panels are built up to accommodate the pattern, much like patchwork. For example in Figure 5 the long circular skirts of 1950's were cut from standard width fabrics with a small join at the selvedges to supply the extra length.

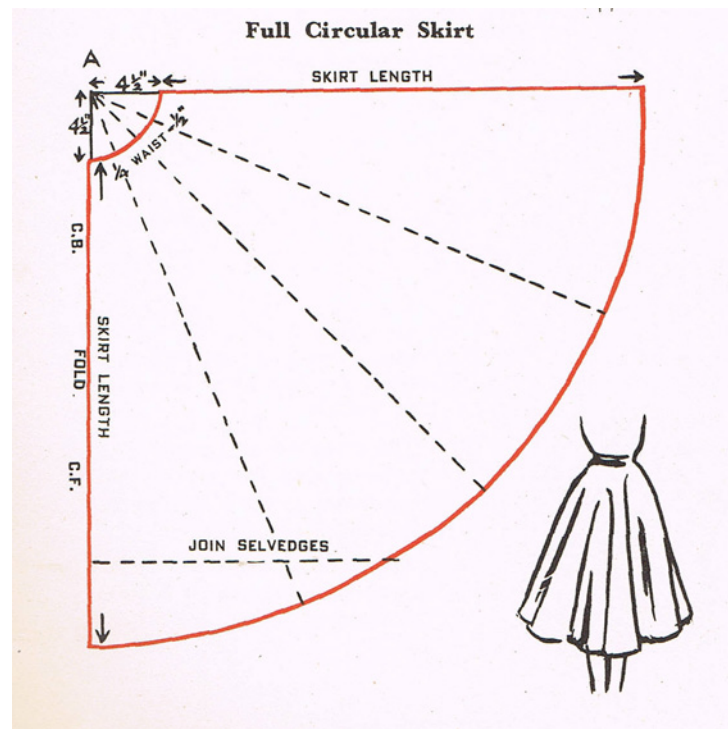


Figure 5: 1950's Full Circular Skirt Pattern (Resek 1955, 36)

The key finding was that *component reuse* for Refashion utilises both an *additive* and *reductive* approach. *Partial disassembly* affords the opportunity to use the *additive* approach. This approach advantageously allows for refined *details*, designed and constructed within the original manufacture, to be included in this new Refashion garment.

Planned Variations of style

Cutting ReFashion pattern shapes from disassembled garment panels also differs from conventional cutting in that cutting *1 pair* (the same shape mirrored) may not be possible. Panels within the original garment may retain a 'memory' of a previous body and become misshapen: consequently the distorted panel no longer mirrors the other side. Similarly positioning of targeted refined *details* will differ across input stock. During the development of the 'T' series prototype the only way to fit the new pattern piece on the disassembled panels was to disregard the *wisdom of the field* and adjust the direction to a diagonal grain. This caused a change to the angle of the pocket placement (refer Figure 6) and the 'Y' series was created. Highlighting the need for planned variations of style which can be adapted to best fit on the diverse dimensions of the disassembled panels - or '*planned variations of style*' to allow for inconsistency in first life stock.

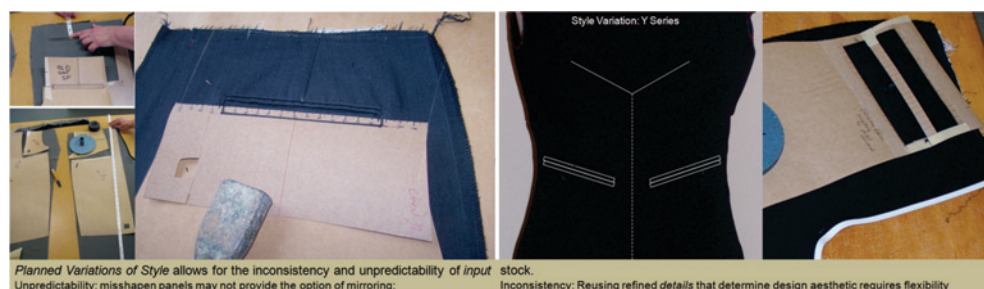


Figure 6: Plan for variations of style (Fraser 2009)

Quality of the Textile

All parts of a garment can be reused, if it is reclaimed before it reaches landfill. While there are a number of style factors that affect the reusability of an unwanted garment, the most prominent factor is the quality of the textile. If the textile has deteriorated the garment is no longer wearable and the textile is no longer useable. However it is still possible for the fibre within the textile to be recovered. Table 1 identifies the most probable lifecycle path for unwanted garments by their general condition in terms of the quality of textile, style and fit.

Table 1: General conditions for garment reuse (Fraser 2015)

Lifecycle	Condition of textile	Style / fit	Reused as:
Reuse	Good quality textile in good condition	Generally classic style - not trend driven, usually well made, good fit	Garment - <i>as is to be re-worn</i>
Component Reuse	Satisfactory to good quality textile over majority of garment	May be trend driven style, may require repairs, may be poor fitting style.	Textile - <i>partial deconstruction of garment</i>
Recycle	Poor quality textile, may be: shabby, pilled, matted, faded, holey, torn, stained, thread-bare	May be trend driven style, may require repairs, may be poor fitting style.	Fibre - <i>elemental or total deconstruction of garment</i>

The foundation for a reuse step already exists in the lifecycle of a garment. In New Zealand there are plentiful opportunities to donate unwanted clothing through a well established secondary system: reputable charity shops that accept clothing donations; vast network of clothing banks throughout even the smallest of rural communities; trustworthy online sales through TradeMe®; and good consignment opportunities through established recycle boutiques.

In 2012 Fletcher and Grose highlighted the need for garments to be made to the highest quality possible to ensure they hold their value and can be resold and reused. An unexpected finding from the ReDress case concerned the high percentage of mass produced brands in the main trouser stock sourced through the secondary system in New Zealand. But more significant, in terms of Refashion and Reuse, was the poor quality of the textile within the main trouser stock. The pervasion in New Zealand of low grade mass produced stock is a significant threat for *Reuse*: shabby stock is less likely to be sold for the purpose of wearing; and poor quality textile is no longer useful for *component reuse*. Downcycling becomes the only intervention available before landfill disposal.

Producer Responsibility

In a recent study of post-retail responsibility of garments, Kant Hvass (2014) discussed the responsibility of the producer through industry driven post-retail initiatives. In New Zealand carpet industry was one of the first industries in New Zealand to introduce a Product Stewardship Scheme as a method for diverting the large volumes of used carpet from landfill disposal. In 2012 Cavalier Bremworth launched a carpet recycling scheme in New Zealand, using wool carpet to produce a new nonwoven needle

punched carpet underlay made from 100% recycled wool⁶. The company offers commercial projects an end-of-life take-back for wool carpet and they have linked with The Waste Exchange⁷ and *Textile Products* in Auckland, to encourage residential carpet recycling. The intention is to reduce unwanted residential carpet from being disposed of in landfill and provide a targeted collection point for similar product stock to accumulate as *input stock*. However the provision of access to *links* does not guarantee that the consumer will follow this intervention.

Kant Hvass (2014) confirms a store/brand⁸ targeted approach, or in-store take-back scheme, makes it easier for the individual consumer to return no longer required garments. At the same time a targeted collection point provides some assurance regarding quantity and quality of garment *input stock* for the purposes of upcycling. Simultaneously a wider uptake of in-store take-back schemes may help to re-establish producer awareness of value and develop a more custodial relationship with garment products.

Conclusion

Garment *reuse* and *component reuse* both extend the life of the textile and they reduce the occurrence of textile waste in landfill. At the same time they replace the need for the production of virgin textile and therefore reduce the demand on the environment. Therefore the potential for Refashion, if it were more commonly practiced, is to divert large volumes of textile waste from landfill and reduce the demand on the environment.

The success of the refashioned product is largely dependent on the quality of the original discard garment (Fraser 2009). The ReDress case study highlights the benefits of a *component reuse* process built into the lifecycle of a fashion product. Trend based designs have a short life expectation. The lifecycle of a fast fashion or mass produced garment must become a consideration during the design process to enable reuse of the textile, if the style will likely no longer be reusable. Component reuse, as a way of extending the life of the textile and the inherent value of the laborious details, can only take place if the quality of textile is considered during the design process. Unfortunately while designers may have integrity and their design intention is to use a quality/durable textile, this may be subverted by those managing production to reduce costs. The author posits that both designers and manufacturers need to be aware of designing for reuse and these principles must be reinforced at the time of manufacture.

References

- Barnes, Liz, and Gaynor Lea-Greenwood. 2006. "Fast Fashioning the Supply Chain: Shaping the Research Agenda." *Journal of Fashion Marketing and Management* 103:259-71. Accessed July 5, 2010. doi:10.1108/13612020610679259
- Birtwistle, Grete and Christopher M. Moore. 2007. "Fashion Clothing - Where does it all end up?" *International Journal of Retail & Distribution Management* 353:210-16.
- Ginsburg, Madeleine. 1980. "Rages to Riches: The Second-Hand Clothes Trade 1700-1978." *Costume* 14:121-35.

⁶ <http://www.cavbrem.co.nz/environment/carpet-recycling.aspx>

⁷ <http://www.nothrow.co.nz/>

⁸ for example Patagoni, Marks and Spencer, Levis and H&M (as at <http://www.conecomm.com/hm-product-take-back-clothing>)

- Farrer, Joan, and Kim Fraser. 2011. "Sustainable 'V' unSustainable: Articulating Division in the Fashion Textiles Industry." *Anti-po-des Design Research Journal* 11:1-12. Accessed November 2, 2011. <http://www.anti-po-des-designjournal.org.nz/archive/volume-1-2011/abstracts-and-papers/farrer-rca-fraser/>
- Finn, Angie, and Kim Fraser. 2013. "Design for Redesign: Can Old Fashioned Strategies provide new opportunities for Sustainable Fashion?" Paper presented at Fashion and Social Responsibility Conference, Minnesota, April 19-21.
- Fletcher, Kate. 2008. *Sustainable fashion and textile: design journeys*. London: Earthscan.
- Fletcher, Kate. and Grose, Lynda. 2012. "Fashion and Sustainability: Design for Change" London, UK: Laurence King Publishers.
- Fraser, Kim. 2013. "Throwaway Fashion: The Real Cost of Cheap Fashion for New Zealand." Paper presented at OnSustainability 2013 Conference, Japan, January 23-25.
- Fraser, Kim. 2011. "ReFashioning New Zealand: A Practitioner's Reflection on Fast Fashion Implication." *International Journal of Environmental, Cultural, Economic & Social Sustainability* 73:275-88.
- Fraser, Kim. 2009. "ReDress: Refashion as a Solution for Clothing (un) Sustainability." Master's Thesis, AUT University, Auckland. Accessed November 2, 2010. <http://aut.researchgateway.ac.nz/handle/10292/817>
- Kant Hvass, Kerli. 2014. "Post-retail responsibility of garments—a fashion industry perspective." *Journal of Fashion Marketing and Management* 18 (4): 413-430.
- Oakdene Hollins Ltd., Salvation Army Trading Company Ltd., & Nonwovens Innovation and Research Institute Ltd. 2006. "Recycling of low grade clothing waste." Accessed April 27, 2009. <http://www.oakdenehollins.co.uk/pdf/Recycle-Low-Grade-Clothing.pdf>
- Resek, Ellen and Marietta Resek. 1955. *Successful Dressmaking*. Melbourne: Colorgravure Publications.
- (SATCol) Salvation Army Trading Co. Ltd. 2007. "Memorandum by Salvation Army Trading Co Ltd (SATCol) and the Nonwovens Innovation and Research Institute (NIRI) based at University of Leeds". Accessed October 21, 2010 from Department of the Environment Food and Rural Affairs website: <http://ww2.defra.gov.uk>
- WasteOnline. 2004. "Waste guide – Textiles." Accessed July 7, 2007. www.wasteonline.org.uk
- Worth, Rachel. 2007. *Fashion for the People: A History of Clothing at Marks & Spencer*. New York: Berg Publishing.

Kim Fraser is a Senior Lecturer and researcher in Design at AUT University. Her fashion design research is practice-led and focuses on sustainable design in relation to addressing post consumer textiles waste. She has presented her research at international conferences and has organized sustainable fashion workshops, seminars and events.