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Waste, dirt and desire: Fashioning narratives of material regeneration

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Abstract

The consumption of clothing fashioned from recycled textile fibre waste poses a challenge for buyers not simply due to fears of a loss of quality, but also to fears of 'dirt' and contagion. These concerns appear to reside in cast-off clothing's intimate links with unknown bodies, and cultural perceptions of the recycling system's ability to properly 'clean' these materials and transform them back again into textile fibres that can be worn again on the body. The fashion industry currently recycles less than 1% of its own cast-offs back into clothing, despite mainstream economists' claims that keeping fibres in circulation for longer is not only environmentally sustainable but also economically advantageous: closed-loop business models secure resources in an increasingly competitive market still focused upon growth. Here it is argued that the drive towards a more circular fashion system in Europe brings competing frameworks of purity into the same field, where cultural values ascribed to clothing hygiene and cleanliness are confronted with the goals of sustainability and resource effectiveness. In their attempts to re-make post-consumer clothing fibres back into desirable fashion, manufacturers and retailers are trying to negotiate these complex value systems, with variable results. This article explores three, very different, contexts where manufacturers and retailers experiment with adding value to fashion made from mechanically-recycled wool: an ethical fashion trade fair in Berlin, textile specialists working with a British high street retailer, and a yarn wholesaler in Prato, Italy. The examples reveal the current precarity of the symbolic re-ordering of recycled textile materials as 'clean and green' rather than 'old and dirty', and how corporate actors struggle to re-shape their narratives of material sustainability at this increasingly visible frontier.

Keywords

circular economy, recycled wool, sustainable fashion consumption, sustainable fashion production, textile recycling, textile waste

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Accumulation of wastes or abundance of materials?

At a sustainable fashion fair in Berlin in January 2018, a hip Basque brand displays a woollen jumper under the banner 'Clothes made from Clothes'. On an adjacent rail, their tunic dress woven from similarly recycled wool is framed only by images of Japanese chrysanthemums heralding spring – no mention is made of the tunic's recycled origins. In 2016, the fashion press heralded Gucci's 'recycled' cashmere scarves, but the yarn manufacturer is still careful to point out that no post-consumer waste is used – implying that they only recycle manufacturing leftovers that have never been 'worn' on a body. In a blaze of publicity in 2012, Marks & Spencer launched a coat recycled from their customer's jumpers, but the next season it was no longer in the spotlight. Meanwhile, in warehouses in the Italian city of Prato, cones of identical recycled woollen yarn are packed for shipping to weaving mills to be made up into fashion, some in boxes labelled 'recycled yarn … help the world', some left unmarked, depending on whether the buyer has paid for an eco-certification that adds value to the recycled material or intends to substitute it for more expensive new wool.

These conflicting commercial strategies highlight a deep cultural uncertainty about the perceived 'cleanliness' of recycled clothing and fibres amongst European consumers. The fashion industry, like many others, faces a potential crisis in resource security, as well as increasing calls for it to take responsibility for the waste it generates throughout the production process and supply chain through to end of use. Circular economy thinking is proving to be an attractive approach for the fashion industry, but it requires a fundamental revision of the hierarchies of value based upon 'clean' and 'new' fibres. In the wool sector described in this article, the fashion industry has a history of promoting pure, virgin animal fibres as highly desirable, while making cheaper products using recycled wool, a material which has sometimes been concealed as an adulterant at the lower ends of the market. Claims are now being made as to the high quality that can be achieved by recycling wool fibre, if a market can be developed for it. Cultural acceptance is arguably the most important challenge facing the revaluing of recycled textile materials as fashionable fibres in mainstream markets.

The mainstream fashion industry's engagement with sustainability is partly driven by the scarcity of material resources to meet the demands of continued economic growth and rising consumption of fast fashion (Global Fashion Agenda, 2017) but it is only beginning to address the related proliferation of waste clothing. This waste is still an externalised economic and social problem for which public bodies have to find solutions, although France has introduced an Extended Producer Responsibility scheme to push the cost of waste management back onto clothing suppliers, and the UK government is currently investigating similar schemes. However, these accumulations of waste are now being reconfigured as an abundance of materials, a concept that underpins much of circular economy thinking today (Webster, 2017).

Recycling post-consumer wool fibres back into woollen cloth is an old technology developed as a cost-cutting strategy that end consumers are often not aware of, and even trade buyers may not be able to detect. This research reveals how the woollen cloth industry in Europe is now beginning to consider the reincorporation of recycled wool back into its production lines as a 'sustainable strategy', aiming to improve the quality

that can be produced in order to introduce it at the higher end of the market. Manufacturers and brands are uncertain as to how to communicate this to the public, whether to prominently label recycled fibres as an environmentally sustainable resource or continue to improve their ability to close the materials loop 'quietly' through improving quality. These re-circulated fibres destabilise previous conceptual categories of 'virgin' and 'recycled', 'clean' and 'dirty', 'manmade' and 'natural', and the cultural values associated with these categories. To be successful as sustainable fashion fibre, these wastes must be presented to us as something we can consume that allows us to feel connected to the world and which fits into new ways of thinking (Hawkins, 2006). This may involve greater transparency around the production, regulation, certification and narration of material cycles to reconfigure conceptual boundaries. Or it may involve more subtle strategies of mimicry and substitution that work to reduce the visibility of the recycled origin of fibres, but relying on a brand's reputation for doing the right thing to allow the re-assembled materials to fit into pre-existing cultural categories of value, indirectly re-framing the end products through their inclusion in the broader narrative of a brand's sustainability policy.

Social science interest in materials, their 'social lives' and material agency is an expanding field (Bennett, 2010; Drazin & Küchler, 2015; Hodder, 2014; Ingold, 2007, 2012). Barry's work on material politics details the 'way in which the production of information about materials enables the activity of materials to be managed and monitored, while also generating the conditions within which controversies can proliferate over the quality and sources of the information produced' (Barry, 2013, p. 5). Barry has called for a chemical geography, and claims that we need accounts of the production of information about materials, and an acknowledgement that the question of what the properties and behaviour of given materials are, or what they might become, can be the focus of what is in dispute (Barry, 2013, p. 13). He points out that by assessing the performance of certain materials, and producing, circulating and publicising information about them, other materials are rendered less visible. Below I focus on the problems faced by brands trying to introduce *mechanically* recycled post-consumer wool as a sustainable fibre where it has traditionally been seen as dirty and inferior, and in an emerging field where, above all, *chemical* recycling is now promoted as the new, clean technology.

Re-consuming textile waste

The cycling of clothing's constituent *materials*, such as cotton, wool or polyester, through multiple phases of wear is a concept that is only beginning to have wider purchase in the global fashion industry, which has hitherto focused on the reuse of garments and textiles. Estimates for the global flow of clothing materials suggest that over 97% of inputs are 'virgin' materials (63% plastic, 26% cotton, 11% other), 2% are recycled materials from other industries and $< 1\%$ from closed-loop recycling in the textile industry itself (Ellen MacArthur Foundation [EMF], 2017). Of the 53 million tonnes of clothing materials produced globally every year, 73% is eventually land-filled or incinerated, and 27% lost during manufacturing, down-cycled or leaked as microfibres. Recycling plastic bottles into synthetic clothing is not new, but it is having unexpected effects down the line.

During use, it has been recently estimated that half a million tonnes of plastic microfibres shed during washing end up in the ocean and ultimately enter the food chain (EMF, 2017, pp. 66–70) . In other words, we may end up eating our own clothes.

Greenpeace suggests that the fashion industry is still looking to alternative material wastestreams to secure resources, rather than attending to the wastes of the fashion industry itself:

> 'Circularity' is being promoted as the latest solution to the environmental problems of our wasteful society, particularly by the fashion industry and policy makers. However, it is mostly being tackled from the downstream up, pushing short term waste management approaches, such as the recycling of problematic plastic waste from other industries as the main solution and betting against the odds that a technological fix will provide an easy solution. (Cobbing & Vicaire, 2017, p. 6)

Discarded clothing that ends up in a textile recycling warehouse has been categorised as 'dirt' in Douglas's sense of matter out of place (1966), but that dirt is itself a productive category that underpins sorting systems for reuse markets based upon degrees of relative dirtiness (Botticello, 2012). The clothing that is sorted for textile recycling rather than reuse (Norris, 2012b) is the 'dirtiest' in this schema, and until now it has been largely down-cycled into wadding and insulation, hidden underneath more attractive surfaces. Prototyped chemical recycling technologies for re-processing mixed fibre and cotton textile waste back into fibre are now emerging as a potential driving force in re-shaping global fashion production, along with developing the incipient social and economic system change required to turn end consumers into sources of recyclable materials (see discussion in Norris, 2017; Rhoades, 2014).

In the trade press, fashion fairs and industry events, discarded fashion itself is now being re-presented to us as new *materials* rather than recycled *objects*. This moves us beyond studying the spaces of second-hand consumption (Gregson & Crewe, 2003; Hansen, 2010; Le Zotte, 2017; Norris, 2012b; Palmer & Clark, 2004) or creative upcycling strategies (Brown, 2013). Two categories of recycling technology can now be contrasted: established *mechanical* recycling where waste fibres are processed into reusable fibres through tearing and recombining, and *chemical* recycling. Synthetic oil-based fibres have been routinely chemically recycled, but with the latest technologies, cellulose can now also be dissolved before being re-extruded as bio-synthetic fibres. These new socio-technical systems are starting to re-structure material flows and the politics of waste, with chemical recycling technologies potentially perceived as 'cleaner' than traditional mechanical technologies.

Having fallen to less than 3% of the fashion market, wool is today experiencing a revival as a natural, renewable, biodegradable sustainable material. To tackle concerns about animal welfare and the over-grazing of land, the Responsible Wool Standard is one way in which codes of conduct and certification are being introduced along the global supply chain for new wool. At the same time, technologies to bring cast-off woollens back into the fashion system are also being refined and certified, especially where these are able to identify high-quality fibres and 'close the loop'. But the reintroduction of these high-value fibres appears to face much greater consumer resistance than chemically recycled oil-based and bio-synthetic textile materials.

Second skins and the threat of bodily contamination

It is rarely mentioned by those involved that as part of the processes of collecting, sorting and processing old clothes, the garments themselves accumulate dirt: stained with food and bodily excretions from previous use, gathering dust from collection bins, transport and factory sorting, and piled high in stinking, hot mountains of textile waste awaiting recycling. The open fibres of old woollens especially absorb the stench and spills of use and abuse, material evidence of their abject status. But charities, recyclers, up-cyclers and sustainability campaigners avoid reference to the need for rubber gloves for handling, and face masks and odorisers to combat the smells of urine, food and faeces – textile collection bins are all too often treated as dustbins.

The fear of contagion from wearing someone else's old clothing includes the fear of disease-spreading germs, the belief in hygienic practices' ability to maintain the borders between clean and dirty, and uncertainty about the moral character of others in maintaining those practices (Stallybrass & White, 1986; Shove, 2003, cited in Pickering & Wiseman, this volume). One simply does not know whether old clothing of unknown origin has been appropriately 'cleaned'. Pickering and Wiseman draw on Latour's insights that germ theory gained acceptance since dirt management practices were similar to those associated with miasma-based theories of contagion (Latour, 1988). In the case of the exchange and circulation of old clothing, these fears can also overlap with the threat of ritual pollution conveyed by wearing garments from those lower down in social order, thereby failing to maintain the body boundary properly (Ginsberg, 1980; Lemire, 1988; Norris, 2010).

In the nineteenth century suspicions about the capacity of textiles to pollute both physically and morally were extended to reused fibres as recycling technologies developed on an industrial scale. The recycling of woollen fibres for reuse as clothing dates back to 1813, when the technology to 'pull' woollen garments, i.e. shred them to reclaim the fibres, was invented in Yorkshire. From the early nineteenth century, 'rags' were imported for recycling from Europe, the USA and across the British Empire, and sorted into dusty, stinking heaps in huge warehouses. Regenerated wool, known as 'shoddy', was an inferior substitute for new wool, and for the next hundred or so years, its use was linked to the availability and relative price of virgin wools (Malin, 1979). Due to the fact that re-processing shortened the fibre length, the quality, durability and feel of regenerated wool were significantly worse than pure new wool. Blending techniques could reduce costs for the lower end of the market, but also gave manufacturers the opportunity to conceal the inclusion of shoddy in products. Shoddy was the 'devil's dust cloth … manufactured for sale but not for use' (Engels, 1887). In Douglas's sense it was doubly 'out of place' since it also failed to fit properly into the functional category of cloth, and became a marker of the poor. Since the rags were never washed, unpleasant odours absorbed into the fibres were difficult to remove (see Norris, 2012a, for a discussion of odour in the Indian textile recycling industry). However, as Malin reports for the nineteenth and twentieth century:

> [I]t would seem remarkable that the aura surrounding 'shoddy' generated a persistency of criticism experienced by no other industrial raw material or product over such a long period. The rag and shoddy trade could not be accused of being alone in the use of a raw material with

> unpleasant associations – the paper, glue and leather industries were but three others… . Undoubtedly the opponents of shoddy could exploit fully the deep-seated psychological fear of wearing clothing manufactured from worn-out rags of unknown origin that existed to a far lesser degree in writing on paper made from cotton rags, using glue manufactured from old bones, or wearing leather gloves dressed with the products of Mayhew's 'pure finders'.[1] (Malin, 1979, pp. 553–554)

The use of regenerated wool declined between the first and second world wars due to 'changing consumer preferences, rising standards of living, and, most importantly, a marked erosion … of its price competitiveness with pure wool' (Malin, 1979, p. 556). The Wool Products Labelling Act of 1939 (USA), known as the 'truth in fabrics law', was the first attempt to label woollen goods with their fibre content. One of the targets of the law was the 'unrevealed presence of reworked wool, cotton and rayon in products which simulated wool in appearance' (Freer, 1946, p. 46), which amounted to nearly half of all the woollen products for sale. Three classifications of wools were defined: 'wool' fibres which have never been reclaimed from any woven or felted product; 'reprocessed wool' which has been reclaimed without ever having been used by a consumer; and 'reused' post-consumer wool. 'Wool' products continue to slip between these three categories and blur their boundaries today, in the effort to re-frame shoddy as an ethical and clean choice.

This fear of contamination from unknown bodies is therefore doubly heightened through the function of clothing as a second skin that has been unwrapped from one body and wrapped around another. As Turner puts it, 'the surface of the body, as the common frontier of society, the social self, and the psycho-biological individual, becomes the symbolic stage upon which the drama of socialization is enacted, and bodily adornment (in all its culturally multifarious forms, from body-painting to clothing and from feather head-dresses to cosmetics) becomes the language through which it is expressed' (Turner, 1980, p. 112). The skin, like clothing, is 'a surface upon which social identities and relations are made visible or erased' (Masquelier, 2005, p. 5). Masquelier points out that notions of transgression are often bound in categories of dirt and power (2005, p. 3), and 'in diverse colonial and civilizing contexts … the body surface was – and still can be – a central terrain on which battles for the salvation of souls and the fashioning of persons were waged through sartorial means' (Comoroff, in Masquelier, 2005, p. 2). Furthermore, in the social enforcement or transgression of boundaries through the treatment of the body's surface, it is women's bodies that have been important sites for 'contesting the porous boundaries of moral worlds' (Masquelier, 2005, p. 4). The body's surface is therefore a morally charged surface upon which alternative moral visions are performed, and upon which political action can be situated.

The sustainable fashion movement and evolving circular economy thinking is focused on addressing the loss of value, ineffective use of resources and waste at every stage in a garment's life cycle, from initial design through to materials recycling, and systems change is a key area of research. But as technology develops and resources become ever scarcer, it is, however, the challenge to change beliefs and behaviours that underpin cultural values that is increasingly seen as the main stumbling block. This must include the re-ordering of systems of symbolic classification to include recycled fibres that were

once considered dirty, contaminating and contagious, and re-frame the narratives about their transformation to persuade consumers that they have been properly processed. I argue here that this project is highly precarious, with prototypes still failing to convince consumers of their transformed status.

This article examines primary data from three different research contexts focused upon strategies to re-introduce recycled wool back into the fashion cycle, alongside the introduction of innovative new technologies and materials. The information was collected through a combination of observational field visits, interviews and follow-up conversations between April 2015 and January 2018. The first context examined here is the bi-annual Ethical Fashion Show (EFS) and Green Showroom (GS) in Berlin, a combined trade fair where youth-orientated sustainable fashion brands promote their products to trade buyers, and visitors can learn about the latest developments in sustainable textiles and recycled materials. I was able to conduct on-site interviews with participating brands followed up by email.

The second context is a small heritage wool industry in Yorkshire in 2016–2017, where experts in wool production have been working with Marks & Spencer (M&S) to keep materials in circulation and develop local circular economies. The project was to prove the concept of local closed-loop wool recycling by making a high-quality British coat, following on from their experiments with the highly-publicised 'Shwop coat' in 2012. I interviewed materials specialists and partners in the UK and Italy working on the project. This was followed up by site visits to the manufacturers to see the materials and processes first hand.

The final context is the textile manufacturing industry in Prato, Italy, a city well known for its recycled wool industry. I interviewed key figures in the local textile manufacturing and recycling industry, the Chamber of Commerce and the Textile Museum, and made site visits to local wool spinning and weaving mills, finishing units and packing warehouses in the local area.

Ethical fashion on show

In January 2018, the bi-annual Berlin Fashion Week took to the stage, hosting a number of trade fairs ('shows') in the German capital's glamorous and edgy venues. The Ethical Fashion Show (EFS) and the Green Showroom (GS) chose Kraftwerk as their location for the three-day event, a cavernous former power station built in the 1960s to power East Berlin. Shut down after reunification, then transformed into the techno club 'Tresor', Kraftwerk is now the epitome of urban cool; it promotes itself as 'a space resonating with energy', staging large-scale events right in the centre of town. The re-purposed industrial powerhouse has been described as 'Tate Modern Berlin style' with 'raw, ruinous beauty'.[2]

To fill this space is an extraordinary achievement for two sustainable fashion trade fairs, albeit Europe's largest: the EFS focuses upon the urban zeitgeist, the GS on the luxury sector. Grassroots sustainable fashion shows organised by small committed groups of Berlin designers, fashion start-ups and self-proclaimed 'disruptors' have been staged alongside Berlin Fashion Week for over a decade. However, it is the sponsorship of global trade fair giant Messe Frankfurt that has enabled them to scale up. Messe

Frankfurt own major yarn, textile and apparel trade fairs in Europe, North America and Asia, and the sustainable fashion shows give them a young consumer-facing platform for sustainable materials innovations in the pipeline.

Trade fairs 'provide a venue for the (re)enactment of institutional arrangements in a particular industry's field and for the negotiation and affirmation of the different values that underpin them' (Moeran & Pedersen, 2009, p. 4). Drawing on Goffman (1974), Moeran (2011, p. 3) shows how trade fairs are a framing mechanism that enables participants to perceive themselves as acting in a social field – trade fairs make markets possible (where markets are understood as real communities), and markets are frames. Over 170 labels from 26 countries took stands at the EFS and GS in 2018, with two-thirds coming from outside Germany. The smaller GS focuses on high-fashion garments, primarily made from ethically-sourced, virgin organic materials such as Cocoon's Indian 'peace silk' (extracted without the usual killing the of silkworms), and Edelzeige's fairly-traded Mongolian cashmere. These luxury brands depend upon high-quality materials, classic styles and product durability, but they rarely mention sustainability first in their marketing, instead appealing to lifestyles, comfort and style. Eco-credentials are left to the labels tucked away inside. As Skov notes, the size and location of a stand and its material attributes are indicative of the success and relative positioning strategy of the exhibitor (2006). The EFS, on the other hand, features a more diverse range of approaches, with more affordable labels often combining several strategies for sustainability into one product range and often communicating these loudly. While some of these fashion labels are start-ups that have sourced and developed their own material processes, many are working with new fibres and fabrics being brought onto the market by larger commercial entities. Fashion brands are the crucial intermediaries between material innovators and the end consumer, and their biggest challenge is how to tell a story about sustainability that engages the trade buyer and will sell to the public.[3]

Sustainable materials in the spotlight

Oil-based synthetic fibres, such as recycled PET (polyethylene terephthalate) derived from plastic bottles, are a significant area of development. Vaude's outdoor collection includes recycled polyester fibres, with some garments designed to be completely mono-material, making them easier to recycle in the future. Several brands use Econyl, a polyamide yarn recycled from abandoned fishing nets. Econyl is used for lingerie, sports clothing and swimwear featuring fishing nets and other self-referential images. It is also used in carpets, neatly allowing the fibre to be used both for two outfits worn at the Green Carpet Fashion Awards in 2017 (an eco-alternative to the red carpet fashion at the Oscars) and for the actual green carpet itself that the models stand on.[4] The manufacturer, Aquafil, describes how 'ghost nets' clog up the oceans, release dangerous toxins and entangle marine plant and animal life, and they have partnered with organisations such as the Zoological Society of London to support local communities in Cameroon and the Philippines to collect discarded nets through a programme called 'net-works'.[5] However, it is arguable that green fashion will not solve the myriad problems of marine waste nor provide sustainable incomes for poor communities living near the oceans. Similarly, while recycling PET bottles finds a use for plastic waste, using refillable flasks and

making drinking water publicly available avoids it altogether. The connections are a solution to existing problems rather than a forward-thinking plan to avoid them in the first place.

Bio-synthetic fibres are favoured for the strategy to transition to a bio-economy. These polymers are made wholly or partly from renewable sources, and can be classified as: first generation, derived from crops such as corn and sugar beet; second generation, derived from agricultural waste; and third generation, derived from alternative forms of bio-mass such as algae, fungi and bacteria. Fibres such as lyocell, made from renewable forests, are ubiquitous at the shows; those made from recycled waste sourced from a variety of other industries are now heavily promoted, while new materials such as Seacell made from naturally harvested seaweed are still niche products.

Biodegradable wastes that are being re-purposed to produce new fibres and materials include new 'vegan leathers' appealing to an expanding niche market (e.g. Piñatex made from pineapple fibre waste from the Philippines), or vegetable-tanned animal leathers that avoid the heavy metals associated with traditional tanning methods (e.g. Olivenleder's 'wet-green' process using discarded olive leaves). Orange Fibre, a Sicilian-based textile start-up, has developed cellulose yarns from citrus fruit by-products. Some of the 'new' materials being widely publicised at the show are redevelopments of much older technologies. Hannover-based QMilch makes fibre out of soured organic milk, a milk protein product that is hypoallergenic and anti-bacterial. Previous attempts to make regenerated casein fibres as substitutes for wool in the 1930s failed due to poor quality and the advent of the Second World War. QMilch's felted fabric has now been incorporated into the linings of walking boots and the inside straps of rucksacks by Vaude.

Sustainable, scalable and systemic end-of-life solutions for fashion are still surprisingly hard to find at the trade fairs, though there was much talk of system change in the packed, parallel *FashionSustain* conference. According to cradle-to-cradle principles (Braungart & McDonough, 2002), materials should be either compostable or technically recycled without loss of quality. Ultrashoes from Portugal produce various models using recycled materials from local cork and leather industries, up-cycled pieces from production waste and recyclable materials, with one range being fully biodegradable. Composting is largely an untested means to effectively recycle textiles at volume, and attaining the toxic-free quality of material input required for human health is still a challenge (Greenpeace International, 2012) in order to create high-quality compost as an important next step in enriching the materials cycle. Swedish outdoor brand Houdini describe their ranges of biodegradable garments as 'edible clothing' and see their natural fibre products as moving beyond zero waste to becoming a 'regenerative life force'.

While brands do use sustainable new and/or recycled materials, it is still much less clear how recycl*able* they are and whether they will be turned back into clothing. Where they claim that the materials could be recycled, brands are frequently relying on third party initiatives to develop technologies for identifying different materials (e.g. infra-red fibre scanners and QR code readers), and commercial infrastructures for collecting, sorting and re-processing these materials (Norris, 2017; Palm et al., 2014; WRAP, 2013). Often brands still assemble organic and inorganic materials in such a way that it would be almost impossible to separate them out again without capital intensive machinery or cheap manual labour. Strategies that prolong the life of clothing make the material

resources used last longer, but they do not ultimately prevent the problem of vast amounts of textile wastes ending up in incinerators, landfill or illicit rubbish dumps in developing countries after they have been exported for reuse markets.

Scientific breakthroughs promise that there are new chemical recycling technologies in development which will close the loop on textile fibre production by returning cellulose-based clothing to a pulp and producing new fibres from it. This is of particular interest to Nordic countries whose material resources and technologies already feed into industries such as forestry, wood-pulping and paper-making, and crossovers between these. Swedish start-up Re:newcell is now able to take used cellulosic fibres such as cotton, dissolve them into a 'slurry' (*sic*) and re-extrude them as filament yarn through a process similar to that for making viscose.[6] Blend Re:Wind is another Swedish-funded technology able to separate out cotton from polyester in poly-cotton mixed fabrics, each then being chemically recycled separately.[7] Neither of these technologies is yet available at scale as fabrics for the fashion industry, but their promotional material, networking events and industry talks are striking in that graphics focus upon clean images of liquid solutions, glass chemical flasks, balls of fluffy white fibres and spools of silky white yarn, often set against green pine forests; a technology of enchantment reflecting the enchantment of technology (Gell, 1992). The difficulties of developing comprehensive collection systems and the dirtier reality of sorting used textiles (Botticello, 2012; Gregson, Crang, Botticello, Calestani, & Krzywoszynska, 2014), before extracting suitable materials for recycling and re-weaving is barely hinted at, and the systems level complexity is simplified by an arrow from a wardrobe to a factory, sometimes via a textile bin.

There is a proliferation of new, synthesised materials, derived from both organic and inorganic sources, that acquire sustainable credentials through their origin as wastes diverted from one arena of manufacture into another through chemical processing, dissolution and re-extrusion, thereby creating new categories of value. Similarly, new chemical technologies that promise to keep 'pure' textile materials cycling in closed loops are also purported to be clean and green solutions to resource management that ignore the wear, tear and dirt created through use and discarding practices. Material stories are dissolved at the same time, processes of identification and singularity are erased as materials are constantly re-commoditised (cf. Kopytoff, 1986), and new narratives can be drawn out. These innovations destroy the previous form of a discarded thing, the orange peel, fallen leaves, cotton fibre, empty bottle or watery ghost-net, and take it all the way back to its chemical constituents. There is, as yet, no equivalent process for wool.

Skunkfunk: Material strategies

Skunkfunk is one of the few labels to put the issue of used clothing going to waste right up front and literally in their customers' faces. With a large trade stand in the centre of Kraftwerk (Figure 1), banners greeted visitors with the message: 'we are Basque, we are designers, we are sustainable, we are Skunkfunk'. Information about the supply chain was prominent, and a corner of their stand was devoted to displaying their raw materials in glass jars, and explaining the advantages they offer in terms of reduced energy, water,

Figure 1. Skunkfunk, Ethical Fashion Show, Berlin, January 2018. ©Skunkfunk.

dyestuffs, fibres or recycled content. All are produced with particular manufacturers who share their philosophy and they work together to achieve certification and transparency. These materials included recycled polyester from PET, recycled leather cutting waste, linen, organic cotton, recycled organic cotton paper, lyocell, ramie, hemp, recycled cotton scraps and the most recent, recycled woollen thread. Sourcing used woollen knitwear from the charities Emmaus and Caritas, their partner manufacturer has apparently developed the technology for opening up the fibres so that they can now retain 95% of the fibre's original length, hence making it softer and stronger than previously possible.

A bright orange and beige pullover was displayed at the front of the stand, backed by an image of heaped used clothing, and with a large tag 'Clothes made from clothes' (Figure 2). A nearby graphic explained the principles of recycling woollen clothing into new yarns. During a conversation we had at the stand, Skunkfunk's Creative Director suggested that using only pre-consumer waste could be considered mere green-washing; recycling post-consumer waste back into desirable clothing is the real technological and cultural challenge for them, to create something 'fashionable, feminine and fluid'. She explained that the yarn was knitted up in Morocco (the brand states that they only work with trusted suppliers, but these are distributed worldwide). We both agreed that it was still slightly scratchier than virgin merino wool, but that apparently hadn't put off visitors so far, despite the company's initial concerns; Skunkfunk are waiting to see what happens when they go on sale in their shops. One or two visitors to the stand had asked about the jumpers' cleanliness, so she had explained that the used clothing is treated in an ozone chamber, which kills bacteria and removes odours. In contrast, she pointed out a dark grey tunic dress, also made out of recycled wool spun in France but woven in China,

Figure 2. 'Clothes made from clothes', Ethical Fashion Show, January 2018 ©Skunkfunk.

hung quietly amongst other garments on a rail in front of a poster of Japanese girl in a forest, with the text 'Kiku' ('chrysanthemum' in Japanese) and 'winter becomes spring in the chrysanthemum's hand'. Information about the materials was tucked away on the garment label inside, and poetic metaphors of regeneration provided the underlying message.

The brand's attempt to ritually purify these cast-offs draws on a complex mix of bio-chemical cleansing processes, various ethical, environmental and cultural values and the need for economic sustainability in global capitalist markets. Skunkfunk have made their new jumper part of a mixed collection of social and material experiments, each of which tries to tell a coherent narrative in different ways, and which is performed alongside community-based initiatives to reinforce their values, such as in-store swapping events

and used clothing collections. Their strategies can be understood as a means to negotiate multiple competing frameworks of purity within one brand narrative (Benthall, 2018).

Just as Skunkfunk strives to tell a coherent story across their multiple projects, so the EFS and GS try to bring together a wide range of competing material strategies and purification frameworks within the field of ethical fashion. But as Benthall (2018, p. 28) points out, 'purity is correlated with sterility. It goes with cleanliness, control, coherence, precision and asexuality, whose antonyms are all dangerous but essential to life and creativity.' This tension between pure and impure plays out in a number of ways within the field of sustainable fashion, no more so than between global capital investing in the continuous growth of fashion consumption, and the ethical agenda to support social justice and keep production within sustainable levels of material and energy use.

Doing the right thing?

In 2008, UK high street retailer Marks & Spencer (M&S) introduced their 'shwopping' campaign with Oxfam, encouraging people to bring back their used clothing in exchange for M&S store vouchers.[8] As of 2017, about 12% of returns were their own products. Unwanted clothing is either sold to the public through Oxfam's own shops, or sent to their own warehouses for sorting. Reusable clothing is exported to various markets, the remaining clothing is sent for recycling, mattress fillings and car insulation. Fronted by actor Joanna Lumley, the partnership aims to raise awareness around clothing waste and increase funds for charitable work. It is part of M&S's 'Plan A', the social and environmental plan launched in 2007 that aimed to put tackling climate change, waste, resources, fair partnerships and health at the centre of their business plan. The new goal is that 'by 2025 every one of [our] products will have Plan A attributes that address every single one of its material social and environmental impacts. For example, covering the key raw materials, factory, use and disposal stages in a product's lifecycle' (Marks & Spencer, 2017, p. 20).

In 2011, the first 'Shwop coat' was introduced, a limited edition of 500 double-breasted women's coats that were made from recycled wool and cashmere processed from shwopped garments (Figure 3). A highly publicised version was launched in 2012, costing half the price of a new wool coat at £89.[9] Yet production of the coat was never scaled up, and the range was not expanded. M&S's own internal retail buyers were not convinced that promoting this coat as a recycled product was the most appropriate strategy. Focus group research had apparently shown that customers expected M&S to be 'doing the right thing', and they supported the *idea* of recycling old clothing. But when customers physically encountered someone else's used clothing actually reincarnated into a new garment, some of them apparently physically recoiled.

The experiment revealed the hurdle faced by retailers on the high street such as M&S to market the value of sustainable initiatives effectively to their more conservative customers, and specifically to overcome negative perceptions around wearing recycled fibres. Furthermore, internal research suggested that there is more resistance amongst women to buying recycled fibres than men, and hence women's clothing is no longer a major focus of experimentation. Recycled fibre continues to be used successfully in

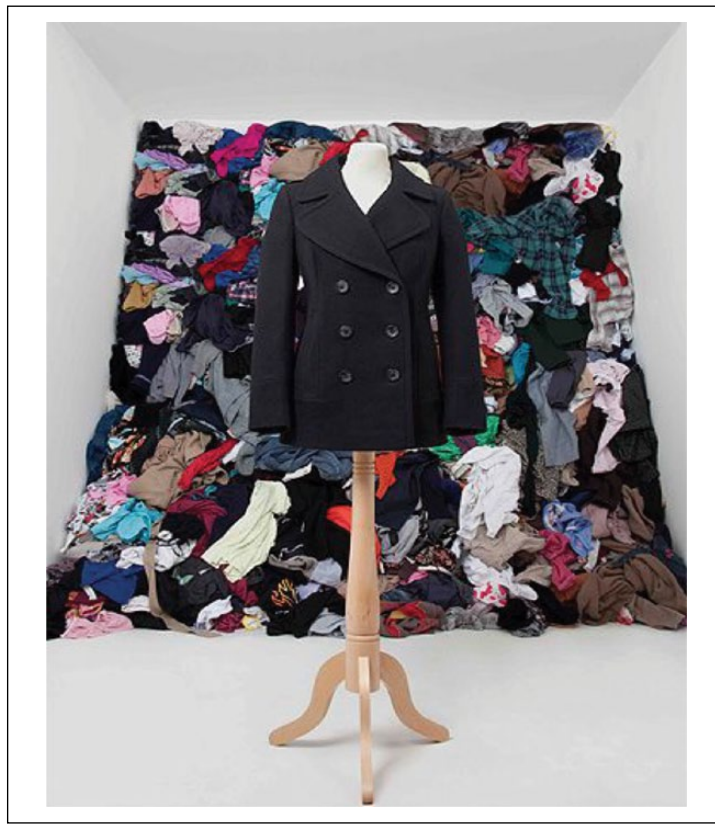

Figure 3. M&S's 'Shwop coat'.

men's outerwear, but without the campaigning around it. Internal marketing staff and end customers alike needed to be persuaded that it is possible to change negative public perceptions around the quality of recycling through effective story-telling.

It was striking how one expert became animated as he spoke of his admiration for wool, as an intrinsically sustainable and high-quality fibre, and for the producers with whom he had worked for many years throughout his career. He conveyed the weight of responsibility he felt in trying to achieve sustainable goals within a large organisation, and the burden he carried within him to push them through despite opposition or a lack of understanding in other areas of the business. Trying to improve traceability and transparency was an impossible task for one company alone, but collaborating with other retailers through joint platforms helps enormously, developing guidelines such as the new Responsible Wool Standard together with farmers. In 2012, M&S was the world's biggest retail buyer of British wool and cloth, and they are still the largest retailer of woollen clothing on the UK high street. But in the eyes of the materials experts I spoke to, wool has become an underutilised and devalued fibre, and their biggest problem is how to add that value back.

One of the projects being prototyped in 2016 was a closed-loop woollen coat produced in Yorkshire, another step further on in terms of circular thinking. M&S have a sustainable sourcing policy for their wool and cashmere, and buyers say they have worked closely with suppliers in East Asia to make it achievable. Using their own stocks of used clothing collected in-house, returned faulty items and pre-consumer waste, they wanted to take M&S wool and cashmere jumpers and recycle them into new products within Britain. Given the fact that 95% of all returns in-house are less than a year old, this means that the fibres are quickly available to be put back in cycle. The advantage would be that they know exactly how the original fibres have been sourced, spun, woven and chemically treated, and can be confident that the recycled yarn is as sustainable as the original product. One of the problems with using recycled fibres from a variety of sources is that manufacturers can't claim that standards for animal welfare or land management have been adhered to, nor do they know how the fibres were originally processed so they can't exercise 'chemical due diligence' and avoid toxic contaminants (see also Norris, 2012a, p. 394). The goal of the new project is to experiment with 'opening up routes to recycling so that they are ready for when the market catches up'. This includes trying to induce customers to bring more clothing back; but stores are struggling to improve collection rates.

Keen to demonstrate the quality that could be achieved by local heritage industries, one of the M&S textile consultants invited me to visit the village of Saddleworth where the new coat fabric was being produced, east of Manchester and bordering the Pennines. Sitting by the river Tame at the top of a small valley was the Pingle spinning mill, founded in 1777 and now run by the Gledhill family. My host beamed with pleasure as he pointed out the sun shining weakly on a sprinkling of snow on the hilltops. This was a project very close to his heart, working with a firm he knew well, pushing themselves to prove a concept. The three Gledhill brothers inherited the mill from their father, and were born in the house on site. With pride, one of the brothers showed us samples of woven herringbone cloth in two colour ways, made from 70% recycled wool. A small run of the cloth had been woven a mile down the road, at Mallalieus, an internationally renowned woollen cloth manufacturer, established in 1863. The intention was to have the cloth made up into garments designed by a well-known British designer and manufactured by a high-quality garment maker in Manchester. The coats could potentially be sold in the 'Made in Britain' range, helping to keep the small heritage industry in business and prove the viability of the circular concept using local manufacturing rather than shipping it further afield. To date the project has not gone into production, but the team continue to work with recycled materials and routes to market, 'to be ready to scale it up when the time is right …'.

Prato: What the buyer doesn't know?

M&S has been working with specialist wool manufacturers in Italy for many years, and Oxfam were selling donated cashmere sweaters to a highly skilled recycling mill in Prato long before the 'shwopping' tie-up. The Italian city of Prato has had a flourishing wool industry since medieval times, competing with neighbouring Florence and Biella. In the early nineteenth century it began to industrialise by copying French textile technology that was years ahead of its rivals. The town boomed after adopting wool-recycling

technologies from Yorkshire in the mid-nineteenth century. However, today local people in the textile industry all pinpointed its huge success in the years after the Second World War, when the European market was flooded with military uniforms and used US clothing sent via the Marshall Plan. The town built up a comprehensive networked infrastructure for processing used clothing, from sorting vintage garments and specialist theatrical costumes, to second-hand clothing for reuse markets, all the way down to rags for regenerated yarn. The capacity of Prato's wool manufacturers to accumulate vast hoards of used woollens, and the haptic skill of sorters who can identify different wools, such as Shetland or merino, cashmere, camel and other noble fibres simply by touch are famous within the global industry. Prato firms were known for stockpiling material and sorting into 20 shades of each colour, thus able to produce recycled yarns in any wool fibre and any shade upon request.

At the same time, Prato's wool manufacturers are proud to have built up a reputation for fine fabrics and fancy yarns since the 1970s, and have worked hard to rid themselves of the lingering suspicion that they make inferior cloth from cast-offs. This may partially explain why no one talked about the historic pre-war recycling industry, and referred only to a post-war period of scarcity and necessity. Prato's Museo del Tessuto documents how the wool industry survived the First and Second World Wars by making regenerated winter textiles, but really took off when the 'Made in Italy' label was launched at the Palazzo Pitti in 1952, opening up the British and US markets. Swatch books on display reveal how Prato manufacturers visited trade shows by fashion houses such as Balmain, Hermes, Ricci, Laroche and Dormeuil in Paris in the 1970s, clandestinely snipping square inches of fabric from the inside seams of garments, and bringing them back to copy the designs.

About 80% of the town's wealth is based upon the textile industry. There is little vertical integration in Prato, textile manufacturers put out various stages of manufacture to thousands of small factories in the town, making it difficult to track which companies are using which materials and processes. During my visits in 2015, prominent local business people expressed visible anxiety about putting the recycling industry forward as an emerging green industry when asked, since it appeared to risk tainting their existing business. Textile firms are still run as family businesses, and older heads of families are resistant; a younger manager recounted a story of a French journalist, who visited the town in the late 1980s and accused it of poor quality copies of French designs in a national newspaper; his father is still angry about it. The danger of being too closely associated with impurity lingers over decades and generations when it comes to a town's reputation, and the museum presents a narrative that shows how it was technically proficient in recycling in the past but has now developed into new areas.

However, in acknowledgement of the recent commercial interest in making textile recycling more profitable in Europe and the problem of 'green-washing' in the textile industry, the Prato Camera di Commercio launched 'Cardato Regenerato', a sustainable certification for recycled wool. It is based on an assessment of the carbon footprint, water and energy requirements offset through the purchase of green credits (Figure 4). Only a couple of factories still 'pull' the old clothing to open up the fibres for reclamation, using water to retain fibre length, and fewer than 10 yarn makers are spinning it. One spinner confirmed that they buy up woollens from across Europe but also from India, where for

Figure 4. 'Cardato Regernerated', Prato 2015. ©Lucy Norris.

the past 10–15 years they have been partnering with dealers in Panipat, Kandla and Baroda. Woollen cast-offs are sorted in India, and zips, buttons and seams are removed by hand, and garments chopped into pieces (cf. Norris, 2012c). But once exported back to Prato, each bale (Figure 5) is again sorted by hand by four men to re-check fibre content and colour matching; one sorter laughed and said that the sorting in India was terrible. The owner claimed that while the technology and old machines had been sold to Turkey, Eastern Europe, Tunisia and India, no one else knew how to make regenerated yarn properly.

As we walked around the factory, we came to the stock room where cones of yarn are boxed up. In one half of the room, yarn was being packed into boxes labelled 'Cardato Regenerated: Help the World', in the other, into plain boxes. Our host explained that some customers were prepared to pay the higher fees for a certified carbon-neutral yarn, while others were simply happy to pay less for it in an unmarked box and feed it into their production line as a substitute material. This was the moment which revealed alternative constructions of the value of this fibre: it became clear that the quality of recycled yarn could be good enough to pass unnoticed in high street markets as it has done for decades, whereas a green certification could give it added value in smaller sustainable fashion markets.

Figure 5. Rags for recycling, Prato 2015. ©Lucy Norris.

Prato textile mills routinely use pre-consumer manufacturing waste from local woollen industries in their production, and it is an open question as to whether manufacturers can or should call such usual business practices 'recycling'. About 80% of all 'noils', the shorter fibres that fall out of worsted spinning, return to Prato mills. Re.Verso, a fabric made in Prato through a partnership with Gucci,[10] is widely advertised in the trade press as being made from recycled fibres, but expressly states that the pre-consumer clippings have never been 'used'.[11] In the 'Shwop coat' project, fibres had been tested extensively to make sure there were no harmful residues of dyeing and finishing processes, and the aim was to make a high-quality fabric that was as good as the original. The Prato manufacturer's materials are all finished in the same finishing unit, whether they contain recycled fibres or not. He is still supplying M&S with fabrics that include recycled fibres, along with many other high street retailers, but few of them draw attention to the fact. Although public perceptions of recycled textiles is that they are low quality, in fact often not even a lab test will reveal if fibres are recycled, and sometimes the only clue is the writing of 'mixed fibres' on the inside of a garment label.

Conclusion

The evidence from spaces where different attempts are being made for creating value around recycled wool is that it has precarious value, that contexts are unstable and brands are unsure how to develop narratives around them that ensure that they are perceived as being properly 'cleaned' and of high enough quality. In this era of transition, there are

clear differences between sectors of the market that take different approaches. Young brands such as Skunkfunk are using waste as a way of making a protest against the status quo of the fashion industry, both foregrounding a product in a way that might backfire, yet also quietly introducing recycled fibres as part of a mix of sustainable materials which have an overall narrative of collaboration with respected partners and of taking sustainability seriously. The more conservative-facing, and much larger, M&S brand has a far-reaching and radical commitment to shifting to a sustainable business model, but even Plan A is not communicated loudly to the public, and they prefer to do the arduous work of developing material supply chains and sustainable products quietly, reinforcing existing perceptions that they are a trusted company without making it explicit what this might really mean. Finally, the spinning mills of Prato are indeed able to construct high-quality woollen yarns at reasonable prices that their buyers can choose to go either way, claiming a more expensive carbon neutral green product or quietly saving money by substituting recycled fibres for virgin wool.

Chemical recycling is coming to the fore as the fashion industry's new hero technology; it stands in for the whole socio-technical apparatus of sustainable production and responsible capitalism, and has successfully managed to push the dirty, messy business of collecting, sorting and transforming people's worn clothing into more obscure territory. Investing in new technologies supports continued capital growth, but it also appears very likely that there are positive connotations of cleanliness attributed to technological processes that involve dissolving textiles in liquids to disassemble even natural materials such as cotton fibres into their smallest chemical constituents, and re-assemble them into new materials. These technologies of dissolution then lead to processes of re-ordering that construct new systems into which cellulosic compounds 'fit', they are matter 'in place' and have been properly 'cleaned'. Mechanical recycling is only really successful for fashion fibres when it manages to keep the wool fibre in as close a state to new wool as possible, limiting the destructive power of recycling technologies, but increasing the ritual work of purification that has to be done to make these fibres perceived to be 'clean' and culturally acceptable once more.

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Notes

1. A reference to the children who collected dog faeces to sell to tanners in nineteenth-century London (Mayhew, 1861).
2. See www.kraftwerkberlin.de/en/press.html

3. Products are often certified by one or multiple international bodies (e.g. GOTS: Global Organic Textile Standard, and Fairtrade) that are developing standards for sustainable materials, processing technologies and labour conditions across various stages of the supply chain. These certifying bodies also have stalls at the show, each explaining their systems to trade buyers.
4. See www.econyl.com/blog/cote-ai-green-carpet-fashion-awards-italiani-con-il-filo-econyl/
5. See www.econyl.com/blog/special-projects/net-works/
6. See https://renewcell.com/
7. See http://mistrafuturefashion.com/rewind-recycles-cotton-polyester/
8. Information in this section is either already in the public domain, or is drawn, with permission, from conversations with textile specialists working on the project to develop a prototype for a circular wool economy. The summary analysis here is my own.
9. See www.cosmopolitan.com/uk/fashion/news/a17617/Marks-and-Spencer-launch-first-fully-Shwopped-garment-the-Shwop-wool-winter-coat/
10. See www.classecohub.org/re-verso-eco-fabrics-made-in-italy/
11. See www.classecohub.org/re-verso-filatura-c4/

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