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ABSTRACT

The unbridled consumption of clothing threatens the environment. A discussion is developing around the adoption of new materials and economic models to reduce the impacts of clothing production and use. We discuss these emergent technologies in the wider historical setting of the Anthropocene. The history of human-environmental interactions is interwoven with the development of international garment economies. This article provides an account of how changes in clothing manufacturing and consumption patterns have affected environmental systems, focusing on laundry practices in Britain. We draw on closed-loop recycling to discuss how ideas from clothing businesses privilege the status quo and technological change. Optimistic solutions to fashion and sustainability challenges are an example of mechanisms that are responding to a utopian eco-modernist argument that human systems can adapt and prosper in a changing world. Such flawed solutions hide from view more radical visions to transform the relationships among fashion, technology, and the environment.

KEYWORDS: *Anthropocene, environment, fashion, sustainability, laundry*

The unbridled consumption of clothing threatens the environment. In fashion communities, a discussion is developing around the adoption of new materials and economic models to reduce the impacts of clothing production and use. We discuss these emergent technologies in the wider historical setting of the Anthropocene, a geologic term that denotes the global-scale environmental changes brought about by agricultural and industrial activity. The long history of human-environmental interactions is interwoven with the development of international garment economies that have shaped biological and physical systems. This article provides an account of how changes in clothing manufacturing and consumption patterns have affected environmental systems over time, with a particular focus on laundry practices in Britain. We draw on one technical solution that has recently emerged—closed-loop recycling—to discuss how the forward-looking ideas from leading clothing businesses privilege the status quo and technological change. Optimistic solutions to fashion and sustainability challenges are a signal example of mechanisms that are responding to a “good Anthropocene,” a utopian eco-modernist argument that human systems can adapt and prosper in a changing world. Such flawed solutions hide from view more radical visions to transform the relationships among fashion, technology, and the environment.

Introduction: Nature and the Anthropocene

To be concerned about the future is to be preoccupied by environmental change. In response to fears about the environmental impacts of clothing production and consumption, a new approach—closed-loop recycling—has gained prominence among forward-looking industry leaders. Rather than a discrete chain of clothing manufacturing, retail, use, and disposal, proponents envisage that unwanted garments can provide the raw materials for subsequent cycles of production and consumption. Clothes are to be remade from the same matter in a perpetual series of commodified social relations: “Circular principles will be at the heart of the new textiles system, with the ultimate goal of generating growth that benefits citizens and businesses while phasing out negative impacts such as waste and pollution.”¹ C&A, H&M, and Nike, among other fashion labels, are popularizing a “Circular Fibres Initiative.”² Whether such a system is technically feasible and business will choose to implement the technology is uncertain, but examining the logic that

underpins such models can shed light on how societies are grappling with environmental change in this new age defined as the Anthropocene.³

Global environmental change is ongoing and unavoidable.⁴ Human-induced transformations of ecosystems are widely recognized but poorly understood, and the Anthropocene has arisen as a concept for contextualizing both the extent and severity of contemporary environmental change. Fears over irreversible damage have spawned a generation of environmentalists. While concerns surrounding biological and physical processes are discussed by influential voices, including John Bellamy Foster, Naomi Klein, Jason W. Moore, and Nicholas Stern, the idea of the Anthropocene is contested and debated.⁵ The notion of an Anthropocene challenges what type of world we want to live in and is molding the production of new technological and social futures, with some highlighting the opportunities that the age represents and calling for a “good Anthropocene.”⁶ In the second half of this article the role of sustainable approaches to fashion in the age of the Anthropocene is explored, with particular reference to the challenges of synthetic fiber production and microfiber pollution in marine environments and the proposed solution of closed-loop recycling. To understand the utopian concepts embedded within the Anthropocene first requires an appreciation of the social construction of *nature*.

Knowing nature helps us understand the Anthropocene. *Nature* is one of the most complex words in the English language, used differently in varied contexts.⁷ Beyond the immediate purview of environmental studies, it may refer to the essential character or quality of something or an inherent force that directs action. In contrast, here we are concerned with “traditional” arguments that treat nature as the “biophysical” world outside of human control. When *nature* is used in this way, it is held to be a “pure” biological and physical domain that exists independent of the influence of society, modernity, and industry.⁸ Researchers from both the physical and social sciences have long depended upon this idea of “nature.” Pioneers of ecology and environmental science posited that there was a “default setting” for the biophysical world. The influential ecologist Frederic Clements argued in the early twentieth century that ecosystems reached a natural “climax” community in a given climatic region, an inevitable trajectory of change that would continue once anthropogenic stressors were removed.⁹ This conceptualization of nature became an appealing concept beyond science, especially for conservation movements that wanted to restore “pristine nature”; but nature is a concept

that is as ahistorical as it is inaccurate.¹⁰ The binary cleavage between a natural world and a human-made world neglects the socioecologically mediated hybrid landscapes that have been developed through millennia of human-environmental interactions. All landscapes are co-produced by social activity and environmental processes. Humans are part of the natural world, not separate from it. The emerging concept of the Anthropocene can help to destabilize the false dichotomy between humans and nature, and the idea can frame an understanding of both how industrial society shapes ecosystems and how best to respond to environmental concerns.

The Anthropocene arrived as a way of conceiving of the ecological predicament of the twenty-first century. It emerged from the geosciences but had been cautiously embraced by critical social science and humanities as a rallying point for a politics to confront the problem of environmental crisis.¹¹ Initially, the concept of the Anthropocene came in response to observed, documented, and proven human-induced climatic change.¹² Since the onset of the Industrial Revolution the global environment has been undergoing tremendous change as a result of human activity. Landscapes, ecosystem processes, and species distributions are transformed by anthropogenic forces, sometimes irrevocably.¹³ The extent of human-led change varies between places, but few, if any, environmental systems have escaped the impacts of modernity. Cumulatively the effect of humankind is so great that it will leave an indelible signature in the fossil record. This was recognized by the International Geological Congress in 2016, which officially designated the Anthropocene as a geologic epoch that began in the mid-twentieth century. Leading geoscientists argued that humans have become a powerful and permanent geologic force significant in the history of the Earth.

Arguments that popularize the notion of the Anthropocene coalesce around the dominant issue of climate change. Emerging and unpredictable patterns of global warming, fueled largely by hydrocarbon emissions, affect the whole planet. The chemistry of the very atmosphere in which life is encompassed has been reformulated by human hands, demonstrating that there is no natural world outside of social influence. Yet the Anthropocene concept envelops more than a new mixture of climatic gases. Rather, it is the full spectrum of environmental changes led by anthropogenic action, many of which are disrupting environmental systems and crossing thresholds of dramatic and irreversible planetary harm.¹⁴ Synthetic fertilizers have altered the nitrogen cycle, nuclear energy and weapons have produced

radionucleotides changing the radioactivity of soils, and species extinction rates are around a thousand times greater than they would be without human activity.¹⁵ Relentless material hyperconsumption, which goes beyond functional use, has produced an abundance of waste. Aluminum, alloys, and plastics are found in trace concentrations of sediments, forming man-made “technofossils” that will stain the geologic record.¹⁶

The mass use of synthetic materials presents a particular threat to marine environments. A swirling flotsam of plastics is accumulating in the oceans. The Great Pacific Garbage Patch has become a cause célèbre. This place, with no fixed coordinates but extending almost across the width of the North Pacific, has gone from being a hidden phenomenon to a vortex of trash and a visible relic of global environmental change.¹⁷ The uncertain eddies of the oceans and society’s insatiable consumption of plastics have co-produced a novel waterscape, but as with climate change it is the as yet obscure, hidden, and invisible disruptions to ecosystems that are among the most far-reaching and fearsome for many who anticipate a future global crisis. One such change is the micro-scale pollution that is harming life in rivers and oceans. Fish and other aquatic species are ingesting tiny plastic fragments, which include artificial microfibers released when polyester garments are laundered.¹⁸ Though the fibers themselves—smaller in diameter than a human hair—are all but invisible, the potential impacts upon sea life are substantial. Organisms of all sizes have been found to consume fibers and other microplastics that can take up space in the digestive system yet are unpassable, reducing both survival and reproduction, as well as increasing the uptake of chemical pollutants that bind to the fibers.¹⁹ Such impacts can bioaccumulate through the food chain, including to humans through the consumption of freshwater and marine organisms.

There is a diversity of physical markers of the new geologic epoch defined by human activity, but while there is some consensus around the signals of the Anthropocene, the start date of the age is disputed.²⁰ Laying out the different arguments from the physical sciences for the onset of the Anthropocene falls outside the scope of this article. Rather, in the next section we explore how microfiber pollution is the latest in a sequence of Anthropocene moments associated with the evolving economy of garment production, consumption, and laundry, both globally and in Britain, which became an epicenter of garment manufacturing. The long history of clothing is briefly summarized in tandem with key moments in human-led biophysical

change. The changing relationship between garment economies and the environment epitomizes the dual advance of social progress and environmental degradation. Following on from this we discuss how sociotechnical closed-loop solutions to the problem of synthetic fiber consumption and pollution are being proposed within the utopian but technocentric framework of a “good Anthropocene.”

The Co-development of Modern Clothing Economies and the Anthropocene

The last ice age ended 11,700 years ago, and this heralded the start of the Holocene, the geologic era that preceded the Anthropocene. However, scholars who favor an early starting point for the Anthropocene overlay the concept onto the Holocene and in effect replace that term in the geologic record, arguing that human activity began to irreversibly alter planet Earth twelve millennia ago.²¹ Farming started after the last ice age, setting in motion global change. Along with growing food, farmers developed textile agriculture. Early farming cultures grew flax for linen in the Middle East and southwest Asia, hemp in China, and cotton in the Andes, Amazonia, India, Mesoamerica, West Africa, and the Sahel.²² Plants were selectively bred to produce new varieties, and animal husbandry promoted favorable hides and wools. Domesticated livestock and plant species flourished, but agriculture simplified and destabilized existing environmental systems. Forests were cleared to make way for fields. River management was at the forefront of human transformation of the biophysical world. Waterways were canalized, dammed, and fished, and floodplains were actively shaped by farmers. In the preindustrial era, rivers beside settlements served as outlets for rubbish and sewage as well as vital routes for navigation and shipping. Laundry was another service provided by streams and other sources of running water, although the impacts of clothes washing on ecosystem processes was relatively minimal.

The next proposed starting point for the Anthropocene draws a line between the Holocene and the current epoch at 1492. European colonialism transformed the world.²³ The transatlantic voyages of Christopher Columbus connected different ecological systems, enabling species of animals and plants and diseases that had evolved on divergent land masses to be exchanged between distant territories. Hundreds and thousands of new species were

found in places where they were not endemic. Crops transplanted across the Atlantic included sugar, coffee, and wheat carried from the Old World to the New and potatoes, tomatoes, and peanuts in reverse. One of the most prized commodities traded from the Americas to Europe was cochineal, a beetle from which the rich red textile dye carmine is derived. Flora and fauna traveling in either direction often flourished because they were released from the presence of pests and parasites with which they had co-evolved in their native ecosystem. Ecology was globalized after 1492. This Columbian exchange led to a massive transformation of what we think of as the “natural environment,” and the extent and impacts of ongoing species translocations are only now being understood.²⁴ In tandem with a changing ecology European colonialism transported eight million enslaved Africans to the Americas, many of whom labored on tyrannical cotton plantations.²⁵ The fibers they produced provided raw materials for European mercantilism and enabled the next key moment in defining the history of the Anthropocene.

Britain's clothing and textile factories were at the forefront of the Industrial Revolution. The spinning jennies of northern England, which depended on imported cotton, pump primed cycles of clothing production and consumption that accelerated across the next two and a half centuries. James Watt's innovations in steam engineering helped launch a fossil fuel economy, which began with the first commercial use of coal steam power in a cotton mill in Nottinghamshire in 1786. This event provides another potential candidate for the start date of the Anthropocene. The “great acceleration” in economic activity and population growth of the eighteenth century set in motion the transformation of the global economy and ecology. The evolution of industrial capitalism, with its appetite for burning coal, oil, and gas, which discharge carbon dioxide, sulfur, and other emissions into the atmosphere, led to a logarithmic escalation in global environmental change. Industrial capitalism did not just bring factories but, in fact, produced new regimes of consumption, facilitated technological innovation, and drew different communities into a single world market economy. Clothes laundry offers a vivid example.

The mechanization of the laundry industry began gradually but accelerated rapidly at the turn of the nineteenth century. As the number of independent laundrywomen went into steady decline, an increasing number of entrepreneurs set up laundry businesses as the steam and mechanized laundry trade flourished. The shift from manual to mechanical power not only

changed the way laundry was done but also altered the skills and know-how required to do it and introduced standardized norms of what appropriately clean and pressed clothing should look like, which radically transformed the domestic life of many families as laundry was moved from the home to the factory.²⁶ With the infrastructure provided by industrial capitalism, laundry could be done in larger quantities and at faster speeds than ever before, both helping to reinforce standards and expectations for cleanliness and radically changing the way in which resources were consumed for clothes cleaning. The power of capitalism to transform the environment is so strong that authors such as Jason W. Moore have argued that the term *Capitalocene* is more accurate than *Anthropocene* because the watershed when humanity's modern relation with the rest of the environment began was with the dawn of the age of capital.²⁷

The merits of a Capitalocene heuristic framework and its interrelationship with the Anthropocene have been picked over elsewhere.²⁸ Where there is consensus among writers using new sociogeologic terminology is that by 1850 the Industrial Revolution in Europe and North America, financed by capitalism, fueled by coal, and often resourced by the outputs of slave and colonial labor, was changing the world. The modern factory system, and particularly clothing industries, were at the center of nineteenth-century society; in 1870 textile manufacturers operated more steam engines than any other sector of the economy.²⁹ In lockstep with an expansion in standard manufacturing techniques and retail came a new culture of garment use and fresh standards and regimes of bodily and clothing cleanliness.

Soap is a relatively new addition to laundry practices, as its widespread production and use have been historically restricted by monopoly and taxation. It was not until the mid-nineteenth century (1853) that Britain's soap tax was lifted. In 1884, W. H. Lever developed the first branded and packaged laundry soap, called "Sunlight."³⁰ By the latter half of the nineteenth century nearly all laundry workers used soap, helping to remove stains from soiled clothing more easily and reducing the number of soaks required—and at the same time further reproducing social and cultural expectations for clothing and cleanliness. Clean clothes usefully facilitated public health, although laundering evolved into a preoccupation with using technology and detergents to work against entropy and reproduce wardrobe items as "like-new" garments. These changes led to the evolution of new laundry routines, which were far more resource-intensive, to combat what Alan Warde describes as "new

structural anxieties” around normal levels of cleanliness.³¹ These emerged as a result of the co-evolution of the meanings associated with appropriate levels of cleanliness, developments in technology, and the learning of new skills needed to operate modern devices.³²

As well as scrubbing away some of the grubby marks and patina of social life, when the new soaps dissolved, the outflow of solvents and suspended materials polluted watercourses. A new cocktail of man-made chemicals—also including industrial outputs alongside household rubbish and effluence, as well as laundry wastewater—choked rivers. In Britain legislation followed, cleaning up the more visible and odoriferous pollution, infamously following London’s Great Stink of 1858. Further technological transformations catalyzed the advance of modernity and helped produce new laundry practices and clothing materials. Gender roles were also reproduced as industrial laundry became coded as a feminine task. Commercial steam laundries were inherently allied to Victorian class structures, and the industry functioned on the dynamics between classes and genders.³³ Later, Fordist patterns of production, consumption, and social reproduction reinforced class and gender divides.

The year 1945 was chosen by the International Geological Congress as the start date for the Anthropocene. The final year of World War II saw the first detonation of nuclear weapons, in a test in New Mexico and later in action with horrific effects in Hiroshima and Nagasaki. Humankind’s mastery of nuclear physics demonstrated a step change in our capability to devastate environmental systems; however, it was the more mundane, yet rapid progression in hydrocarbon use after 1945 that had far-reaching impacts on the global environment. Burning fossil fuels for transport and energy generation has underpinned the escalating anthropogenic transformation of the environment. Historians identify a second phase of great acceleration associated with the oil-fueled boom in global economic activity and phenomenal growth in population.³⁴ Global production of oil and natural gas began around 1850 with the first commercial refining in Europe and North America, and global oil consumption rose to 523 million metric tons in 1950 and increased to 4,185 million metric tons in 2013.³⁵ The exhaust from these emissions contributed to carbon dioxide levels rising dramatically, from 285 parts per million (PPM) in 1850 to 311 PPM in 1950³⁶—and making headline news when they passed 400 PPM in 2013.³⁷ This systemic shock announced the Anthropocene.

Oil did not just beget economic growth and emissions; when liquid hydrocarbons were refined, polymers were produced that enabled the manufacture of plastics and synthetic fibers. New textile materials such as acrylic, polyester, and nylon were first synthesized in the 1920s, as was rayon (a regenerated cellulose fiber, sometimes called a “half synthetic” due to the “natural” origins of its wood pulp feedstock). The emergence of such materials was interconnected to the expansion of the oil-based global economy. From the perspective of the parallel evolution of both global environmental change and an unsustainable international clothing economy, the growth in the use of oil-derived synthetic fibers represented a fundamental shift in the relationship between fashion, humans, and the environment. The development of synthetic fibers allowed clothes to be washed and dried more quickly at home, while the change in fashion and move away from heavy starching and other fastidious finishing processes meant that specialist services offered by laundries were no longer in demand. As Britain was becoming wealthier after World War II, clothes were also becoming cheaper, and more people could afford to buy the latest fashions. Post-1945, after the electrical standardization of Britain and increase in the availability of consumer credit, households began using electric laundry appliances. The new materials now being worn were easier and quicker to wash than ever before, further increasing the amounts of laundry that were done and the energy and water demands of garment cleaning. This also led to another upward shift in perceived levels of acceptable cleanliness.

During this period there were many other transformations in the fashion industry, including the global shift in production away from the West to East Asia, the proliferation of manufactured obsolescence, the declining quality of garment construction, an acceleration in cycles of clothing consumption and a breakdown in the spring-summer and autumn-winter seasons, the spread of branding, and the increasing sexualization of body types. Critical work on fashion and environmental sustainability has focused on a plethora of challenges such as water usage and water resource pollution in the production phases. This includes the unsustainable extraction of water to enable cotton growing in water-scarce environments such as around the Aral Sea region. Critical scholars have tried to budget the true “virtual water” footprint of clothing production.³⁸ Environmentalists have focused attention on the ecosystem degradation associated with garment manufacturing and have attempted, with limited success, to sway the opinions of consumers to

consume less and consume differently. Interventions have had only partial success, because fundamentally changing consumption patterns represents a threat to one of the logics that underpins capitalism: the need for the market to grow and economic activity to ever expand or face crisis.³⁹

Microfiber Pollution and Closed-Loop Recycling

Ecological systems are impacted throughout the life cycle of clothing products. This includes all *natural* and *synthetic* fiber garments. As discussed above, nothing is truly “natural”; rather, “naturalness” is socially constructed. Cotton, linen, and wool are all the product of generations of selective breeding, intensive farming, and in many cases industrial and chemical processing; yet plant- and animal-derived fibers are objectively different from synthetics, significantly because of the ability of plant and animal fibers to be broken down by micro-organisms, light, air, or water, and the nomenclature of “natural fibers” is used in our argument. The difference is illustrated in the laundry. Domestic machine laundry involves a physical process that agitates as well as cleans fabrics. As heat, movement, detergents, and water dissolve stains, they also weaken textiles. When clothes are laundered, fibers from the fabric surface are abraded, break off, and are released into the laundry water; they are then discharged from the washing machine, enter the sewerage network, and can accumulate in waterways. Biodegradable natural fibers pose few problems in comparison with artificial fibers.⁴⁰ Tiny strands and coils of polyester and acrylic are flushed into aquatic and marine systems, contributing to the escalating problem of plastic pollution in seas and oceans. In addition to ecological impacts through ingestion, deposition in river sediments has as yet poorly understood effects on aquatic ecosystems and the geochemistry of river, lake, and ocean sediments but is likely to increase the chemical contamination of such locations at the very least.

The problem of artificial microfiber pollution is a signature example of the challenges of the Anthropocene. Its history is embedded within the co-development of agriculture, ecological globalization, capitalism, and the post-1945 hydrocarbon economy. Modern life is underpinned by unsustainable patterns of resource use and consumption that are dictated by norms and values, such as the social desire for new and fashionable garments and the cultural necessity to dress in fresh-smelling and unstained garments.⁴¹

Furthermore, the effects are changing the immediate biophysical environment of rivers and seas and are leaving an impression upon geology that may be present in the Earth's record alongside other markers of past and future epochs. The depositing of man-made microfibers, plastics, and pollutants in sediments has the potential to leave a permanent mark in the geologic record. This could in the future become what geologists refer to as an epoch-defining "golden spike": a specific event marked in rock, sediment, or glacier ice that denotes the onset of the Anthropocene.⁴²

Fashion is one of the world's largest economic and cultural sectors. It has complex geographies, making it a difficult system to study.⁴³ The clothing industry has begun to respond to environmental crises, although the ideas emanating from business often offer flawed and partial solutions.⁴⁴ Here we are most interested in the problematic relationship between synthetic fibers, laundry, and water pollution because of the particularly utopian vision that is promoted via new closed-loop proposals, such as the Circular Fibres Initiative. This initiative proposes technological solutions to specific environmental problems, namely, to reduce material waste. The famous yachtswoman Dame Ellen MacArthur is a high-profile proponent of the circular economy who has previously lent her celebrity status to supporting campaigns on plastics pollution in the oceans. MacArthur discusses the initiative in utopian terms: "The Circular Fibres Initiative aims to catalyse change across the industry by creating an ambitious, fact-based vision for a new global textiles system."⁴⁵ Another advocate of a circular clothing economy is WRAP (the Waste and Resources Action Programme), which highlights the benefits that can be brought about by changes in laundry practice.⁴⁶ Closed-loop schemes recognize the damage caused by clothing manufacturing and laundry but do not threaten the social relations on which a capitalist market are predicated: namely, continuing and growing cycles of consumption. This is demonstrated by the headline objectives of WRAP's "Clothing Action Plan" of "cutting the environmental impact of clothing across the supply chain" while also "generating value for business through collaboration, measuring and sharing best practice."⁴⁷ What is not on the agenda is challenging commercial interests, questioning high-tempo fast-fashion models of production and consumption, or proposing alternative models of social relations that constrain the opportunities for market growth and profit accumulation. As of yet the technological solutions of producing a circular system are uncertain. Various fibers have been proposed as suitable for closed-loop recycling, such as polyester,

nylon, cotton, and wool. Incentivizing the public to return garments and putting widespread collection systems in place is one challenge. Other practical challenges include finding cost-effective methods to accurately identify and sort used garments. This is especially difficult when clothes tags are faded or missing, as the identification of any treatments or finishings on the garments (which can make recycling unfeasible) and the separation of blended-fiber garments pose substantial technical obstacles to recycling.⁴⁸

One of the features of closed-loop recycling that makes it particularly appealing to fashion manufacturers with a business model based on high-volume sales of low-price goods, such as H&M—the world's second-largest apparel retailer—is that it can enhance a rapid rhythm of purchase and disposal. Closed-loop models often forge a connection between throwing away unwanted items and buying new ones, as recycling bins are located in retail stores. Every time consumers want to get rid of an item of clothing at a disposal point located in an H&M shop, they have to first navigate the sales floor and its many incentives to buy a new outfit. H&M has initiated a garment collection scheme across thousands of stores worldwide, and “customers are encouraged to bring in unwanted garments of any brand and in any condition to H&M stores in all 53 markets to be given a new life.”⁴⁹ Cecilia Brannsten, project manager of the UK Sustainability Team outlines H&M's aim: “Basically, we want to change the mindset of the customer [so they] see their old clothes as a resource rather than throwing them into the garbage or letting them pile up at the back of their closet.”⁵⁰ When customers hand over unwanted garments they get a money-off voucher in return. In the United States, H&M offers a 15 percent discount voucher for every bag of used clothing, although it is worth noting that the company routinely posts a gross profit margin of around 60 percent and a net profit margin of 15 percent.⁵¹ Used clothing does not just go “away,” though it goes “somewhere.” Waste clothing enters the secondary economy, and H&M garments are sold to I:CO, a company that offers an international take-back system. Currently, second-hand garments are primarily exported to marketplaces in low-income countries as this provides the most profitable outlet.⁵² However, the model is set to change in the near future, because a new recycling model offers great potential for a future business model couched in the language of sustainability.

Businesses are working toward prioritizing the recycling of material. They imagine a future where “re-loved clothing and shoes would circulate in closed product and material cycles and be used continuously in the manufacturing

of new products. At I:CO, we are committed to this vision. Our innovative take back system is helping make it a reality and is used successfully by many companies around the world today.”³³ H&M and I:CO are companies driven by the underlying necessity to profit and expand their operations, therefore logic would dictate that they will want to maximize the throughput of materials, as this is where revenue is generated. Although it is not in their public business plans, it is conceivable that retailers such as H&M may become more of a subscription service akin to a Netflix or Uber for clothes. We can imagine a utopian future where customers might not own their garments but, rather, subscribe to the opportunity to wear them, returning items for remanufacturing once they are finished with them. Consumers become temporary custodians of new garments. In between the garments would get remade in a new design, refashioned to match changing trends and climatic seasons.

Shortening the duration or phase of possession and making fashion consumption faster means that people keep and use clothes for less time. In such a short-life scenario it is conceivable to imagine that garments are returned and reenter the circuit before they need to be laundered. This is where closed-loop recycling intersects with the problem of microfiber pollution from laundry; the discharge of microfibers among household sewage could, theoretically, be halted. Clothing remanufacturing would be the domain of new clean remanufacturing plants run responsibly by companies like H&M and I:CO. While there is theoretical benefit from eliminating the domestic emission of microfibers, this could only be an ecologically sound system if the remanufacturing processes yielded little pollution—of microfibers and other emissions—and consumed limited energy. Given the huge environmental impacts of clothing production along with the complex physical and chemical processes and technical challenges associated with reusing textiles, this is an unrealistic proposal.

A closed-loop model would be a shift away from the current pattern of clothing reuse popularized by organizations such as Oxfam and Marks & Spencer to one of recycling. Within environmental management the maxim “reduce, reuse, recycle” is a neat turn of phrase that simply encapsulates how the best way to alleviate the impact of consumption is, first, to reduce purchases; second, to reuse objects in the manner for which they were first intended; and third, to make a new thing by recycling the material. The third option represents much greater use of energy and physical processes and so is less favorable than reusing, which in turn is inferior to not producing

and consuming the object in the first place. Reuse involves social change. In countries such as the United Kingdom this means changing attitudes toward purchasing and wearing preworn clothing. But this type of social change represents a challenge to profitability, and therefore business has become attracted to a technical solution that turns the potential for global environmental crisis into a business opportunity.

Utopia and the Good Anthropocene

A utopia is a non- or not-yet-existent society that is radically different from the present, has been described in considerable detail in literature, and is located in a particular time and space.⁵⁴ The particular place in which the Anthropocene is located is explicitly global, and although the temporal period of the Anthropocene in either the past or the present or the future is contested, proponents agree in proclaiming that it is irreversible. The concept of the Anthropocene is consonant with utopianism, as the “Anthropocene reimagines the history of the past and the present by reference to an unrealized future.”⁵⁵ Optimists foresee the unfolding Anthropocene as enabling new and improved societies. For example, Erle Ellis somewhat controversially asserts that “we must not see the Anthropocene as a crisis, but as the beginning of a new geological epoch ripe with human-directed opportunity” and therefore utopian promise.⁵⁶ Many businesses, scientists, policy makers, and other advocates of eco-modernization have become associated with the concept of a “good Anthropocene”—the idea that a changing planet produces opportunities for new commerce, innovation, and a flourishing of humanity. “Let’s not let a good crisis go to waste” might serve as an unofficial slogan, echoing Ellis’s assertion.

A strength and weakness of the Anthropocene concept is the way in which it can provoke audiences to think about what a future world will look like while also painting a picture of inevitable change and recognizing the “godlike agency” of humans. And yet, one of the most problematic issues with the Anthropocene is that it homogenizes humanity. Modern life is depoliticized, reducing the accountability of, for example, those in North America and Europe who have done the most to shape global environmental change through enjoying the benefits of hyperconsumption since 1945. While there is a growing consensus around the inevitability of global change, there is little

appetite to challenge the politics that underpin environmental crises. Instead policy makers and especially business leaders turn to modernization, science, and engineering for solutions. This was even the case in the Intergovernmental Panel on Climate Change 5th Assessment Report, where, out of the thousand emissions pathways considered, 87 percent of the scenarios consistent with limiting warming below 2°C required net negative emissions delivered by supply-side carbon sequestration technologies (i.e., technological rather than behavioral solutions).⁵⁷ A salient example of a technocentric “magic bullet” approach to the “classic” Anthropocene issue of climate change is geoengineering, which casts innovation as a panacea. Firms that can master new technology are set to reap the benefits of a good Anthropocene.

Proponents of geoengineering argue that the environment can be remade through technical interventions that enable business to carry on as usual. A popular example of such a “magic bullet” is the idea of injecting aerosols into the stratosphere to reduce the amount of solar radiation that reaches the Earth. This is a geoengineering solution that would enable the fossil fuel economy to continue. While it seems unlikely that humans can escape the specter of climate change without adopting new technology in some way, what is socially problematic about the geoengineering response is that it follows a postpolitical narrative. Stefan Schäfer et al. argue that stratosphere injections constitute a “change-inhibiting project that prolongs an unsustainable and unjust status quo, or even intensifies existing inequalities and may hinder progress toward a de-carbonization of the economy.”⁵⁸ Mike Hulme supports this, noting that such geoengineering efforts have little co-societal benefits beyond the reduction of planetary heating and do nothing to address the main drivers of the problem.⁵⁹ Climate change, like all environmental change, is political, and technological innovations have become the default answer to managing problems rather than social change. There is a strong draw to eco-modernism, which sees the capitalist market and new technology as the solution rather than the most important driver of change in the Anthropocene. Technology has an especially fetishistic appeal that compels policy makers to look for magic bullets rather than questioning the validity of the current economic model and embracing new political ideas. A “good Anthropocene” response to the challenge of climate change represents a new horizon and opportunity for profit making and enables the continuation of the oil-based economy. Importantly, for the fashion industry this would have a knock-on effect of continuing the supply of petrochemical-derived synthetic

materials, providing little incentive for clothing businesses to adopt new approaches to material use in garment construction.

The history of the Anthropocene is intertwined with the development of the capitalist mode of production. As the global market economy has grown, ecosystems have become irreversibly damaged. Capitalism thrives on innovation and new opportunities for profit making; this includes past innovations such as cotton plantations worked by slaves, coal-powered textile mills, industrial steam laundries, and synthetically produced fibers, as well as ill-conceived eco-modern geoeengineering schemes to reflect sunlight in the stratosphere. In the realm of clothing the answers to problems such as synthetic fiber production and microfiber pollution are closer at hand than the problem of “fixing” climate change. However, proposed solutions such as closed-loop recycling follow the same flawed logic and do not acknowledge the problem of the underlying social relations of capitalism, principally the relentless profit logic, as well as the flawed epistemology of conventional geoeengineering approaches. Closed-loop recycling is a “magic bullet” response akin to injecting aerosols into the stratosphere. In this case the broader system and social relations that underpin fast-fashion consumption are not changed, so the larger impacts will remain. Closed-loop recycling places the utmost faith in modernization and businesses’ ability to draw upon technology to create new market opportunities while enabling the restoration of ecosystems.

The philosophical and natural sciences have long explored how humanity is different from other organisms, and we are the only species known to be aware of our ability to produce different natures. The world no longer has a stable Holocene, but this knowledge is only practical if it helps us politicize environmental change rather than scrubbing away the social relationships that are transforming biophysical systems. The Anthropocene concept can be useful, as it forces us to see how entangled the future of humanity is with the social production of a new biophysical environment or even a new *nature*. Further, it forges a view of humans actively engaged in nature, not standing apart from it, and with it an increasing openness to other species and appreciation of the intrinsic value of the environment that goes beyond its usefulness as a resource. Challenges to existing ecosystems that are biodiverse, dynamic, and enriching to social life require answers that acknowledge that what comes next will be socially produced, rather than an unrealistic aspiration to reset landscapes to an imagined prehuman “natural” state.

The utopian project of finding a different way of organizing society seems more vital than ever in the context of global environmental change, and yet the answer lies not only in technological innovation but also in transforming culture, economics, and politics and creating new sustainable ideas and propositions for living differently. Both technology and social change are part of the future. As this critique is embedded within the discussions that surround the Anthropocene and the global environmental challenges that are of an almost incomprehensible order of magnitude, the aspiration here is not to produce “solutions” to the worldwide problems of hydrocarbon-fueled regimes of synthetic textile production, high-energy laundry practices, and microfiber pollution; rather, our challenge is to think of a different future. Indeed the clothing industry has the potential to be an important test case, but not by following the technocentric, optimistic “good Anthropocene” approach. Rather, many of the “solutions” we could draw upon in this future may already be present in existing technologies, for example, a shift to wool clothing to avoid the hazards of microfiber release from polyester clothing such as fleece jackets, the development of sustainable design solutions to production problems, or the creative use of garments.⁶⁰ Social changes such as reducing the motivation and expectation to consume new synthetic clothing can also alleviate environmental degradation. What is imperative is to shift away from the mindset of a “business as usual” approach and to reject aspirations to restore a pristine nature and instead embrace the reality that future human agency will produce new cultural rather than natural landscapes. Radical visions of the future are required to help launch change, and progressive utopian ideas need to embrace different social futures and a revolutionary transformation of the relationships among fashion, consumption, technology, and the environment.

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Notes

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