DESIGNING SUSTAINABLE CLOTHING SYSTEMS

The design for environmentally sustainable textile clothes and its Product-Service Systems

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DESIGN INTERNATIONAL

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1. Clothing system design for sustainability: background knowledge

1.1. Behind the sustainable clothing system

Today the demand for a sustainable clothing care system is higher than ever due to the continuous environmental impact caused by this system. When it comes to the environment (*The State of Fashion 2020*, 2020), the fashion industry record is well documented. Fashion accounts for 20 to 35 percent of microplastic flows into the ocean and outweighs the combined carbon footprint of international flights and shopping. It is no wonder, then, that campaigners who target the industry as part of the Extinction Rebellion describe the industry's potential future impact as "catastrophic". The current generations are more careful about our planet, the scarcity of resources, and the total impacts related to the clothing care system. They care about what they wear and how and where their clothes are made.

In the critical research book on sustainability in the fashion sector, Sandy Black (Black, 2012) affirms that "the business of fashion is a complex mix of personal, cultural, economic, and social factors. The words 'fashion' and 'clothing' donate different aspects of our relationship with what we wear. 'Clothing' can be understood as our everyday basic garments, commodities purchased out of necessity; 'fashion', on the other hand, represents consumers' discretionary choices, which can be driven by all manner of personal and symbolic motivations: desire, aesthetics, novelty, conformity. […] Whether involved in the creation, production, communication, or representation of fashion or simply as its consumers, everyone is implicated in the destructive aspects of this endemically unsustainable system, where obsolescence is inbuilt. As public awareness of issues and demand for product transparency have grown, there is now an urgent imperative for change. Still, the question remains: can fashion

ever really be sustainable, or is the very term 'sustainable fashion' an oxymoron?".

Many studies affirm (Ellen MacArthur Foundation, 2013) that approximately sixty-five/seventy percent of the consumers under thirty-five worldwide affirmed that they select where and what to buy based on the ethical actions and believers the companies and fashion retailers.

They are more prepared than the previous generations about the environmental impact of what they wear. As consumers' demand for ethical and sustainable fashion products gets higher, many new brands are trying to propose solutions to avoid environmental impacts by producing and using clothes. At the same time, many historical companies and retailers have been encouraged by the request of the markets to innovate their offices, creating one specifically dedicated to the research for new sustainable strategies to be implemented in their collections.

By the expression "economically responsible behaviour", we mean an increasingly widespread tendency for consumers, and partly also for companies, to consider the consequences of their behaviour on the market, especially consumption-related behaviour, which nowadays goes beyond being just the outcome of and the reward for a given working process. It is important to note how, although in theory individuals should always act functionally to optimize costs and benefits, in practice, people buy and utilize items according to criteria that are not altogether rational, both in meeting primary needs for material survival and when satisfying other requirements. In so many everyday life situations, rationality is systematically left out of the equation: one would expect the consumer always to opt for the most economical alternative but, inexplicably, it does not always do so.

One explanation can be advanced from the observation that choosing and using commodities is not only a way of satisfying physical or psychological necessities. It also involves other dimensions, among which communication particularly stands out. Consumption is a communication device that we habitually use when building relations with other people, on par with physical appearance and language. So, consumers make a cultural move when choosing commodities, a move by which in practice they manage to define their vital world and at the same time to express both their individual and social ethos. As individuals (Corner, 2012), we consume with a personal style that clarifies our individuality. Still, this style is nevertheless linked to the group or section of society we aspire to be part of. Our garments interact with us, as individuals and as a broader society, what we need to operate on a physical level. Clothing conventions allow us to attend a party or go for a job interview.

In consumption, we measure two fundamental human needs: the desire to be accepted and the aspiration to make our uniqueness acknowledged, dynamics that are not always easy to combine. Already at the end of the nineteenth century, Georg Simmel recognized in them the recurring forms of social living and identified in fashion a fertile terrain for their combination.

It is not by chance then that clothing and its associated consumption patterns can help us understand some of the orientations emerging in contemporary society. Consumption goods increasingly represent a symbolic and communicative value and can therefore express who we are and what we want. The emergence of responsible consumption reinforces the concept of multiple criteria spurring consumers in their purchasing options, driven not only by their need for material satisfaction but also for effective and value gratification.

Responsibility in consumption can be interpreted in three possible macro directions corresponding to three different types of commodity:

- towards oneself: items for psychophysical wellbeing and personal happiness;
- towards others: fair trade products that respect worker rights and exclude child labor;
- towards the environment: low environmental impact clothes in all their life cycle phases, from material production to clothes manufacturing, distribution, wear and care, and disposal.

In responsible consumption dynamics generally, a virtuous circle is established between producer and purchaser, capable of conferring values like justice and solidarity to certain products. This synergy also allows for a particular subversion of current market logic, which is devoted to the blind pursuit of individual profit and unbridled wealth, creating a more sustainable lifestyle from a social and environmental point of view by offering environmentally sustainable clothing Products-Services Systems. This implies rendering all the transactions in the value production chain visible.

The main issue at stake here is cultural: responsible consumption seeks not only to produce economically essential facts but also to influence societies' values. It is no longer a question of selling responsible goods to a growing number of consumers but of making the consumer's ethical choice not only a necessity but much more a preferable choice. As designers, we need to rethink what we design and put on the market, removing the embedded obsolescence that comes from adopting a model made up of products focused on current trends, doing that as a responsible business but also driven by consumer demand.

Examples of responsible production and consumption have been mushrooming, making the sector particularly effervescent and suggesting that the fashion world is not insensitive to responsibility (Lunghi & Montagnini, 2007) as an expression of what is most peculiar in the human soul: respect and care for one's fellows, values which can also be expressed through the garments we wear every day. In this perspective, the expression "responsible fashion" is far from being a contradiction in terms; it acquires depth and seems to point to a new frontier in contemporary culture building. Today, sustainable fashion (*Seven Forms of Sustainable Fashion*, 2012) is a highly debated and increasingly covered topic in media and at seminars worldwide. More and more clothing companies are transforming their business models and improving their supply chains to reduce overall environmental impacts, improve social conditions in factories, and human and earth wellbeing in general. We also see a growing awareness among consumers, especially younger generations.

Fashion is nowadays subject to constant changes; every day people come into contact with a large number of textiles and clothes. It is therefore easy to understand how each consumer establishes a relationship with these objects, which offer comfort and protection and which in many cases allow people to express their individuality. It is an industry that constitutes an important sector within the global economy.

Today more than ever, it is essential to know and study the negative aspects hidden behind the design, fibre and textile production, clothes manufacturing, distribution, use & care, and disposal of clothes. And if this is true for any object, so forth is for the textile-fashion sector, also due to the large number of items that everyone keeps in closets and periodically disposes of. The downside is represented by numbers: according to the Ellen MacArthur Foundation (Ellen MacArthur Foundation, 2017), the clothing industry employs over 300 million people worldwide, and cotton production alone employs about 7% of the workers in low-income contexts.

Clothing accounts for over 60% of the total textiles produced, and the forecasts do not bring any clues to a possible turnaround. It is estimated that in the years from 2000 to 2015[1], the production of clothes doubled, thanks to the increase of people belonging to the middle class in low- and middle-income contexts. This increase in production is the consequence of a constantly growing demand, which in the last two decades has certainly been favored and facilitated by the birth of a phenomenon that has spread

1. Euromonitor International Apparel & Footwear 2016 Edition (volume sales trends 2005-2015); World Bank, World development indicators – GD (2017), in Aa.Vv. (2017), *A new textiles economy: redesigning fashion's future.*

rapidly on a global scale: fast fashion. Fast fashion immediately accustomed consumers to an ever-increasing number of collections, boasting affordable prices compared to the traditional market. To make possible what in the eyes of less attentive consumers is a simple "miracle", commercial and economic strategies such as the delocalization of production sites and the externalization of costs have been adopted. We can see in the graph in Fig. 1.1 how this growth in production goes together with a strong decrease in the use of each garment. This means that in the last two decades, more and more has been purchased and, at the same time, as a logical consequence, much less has been used of the items purchased.

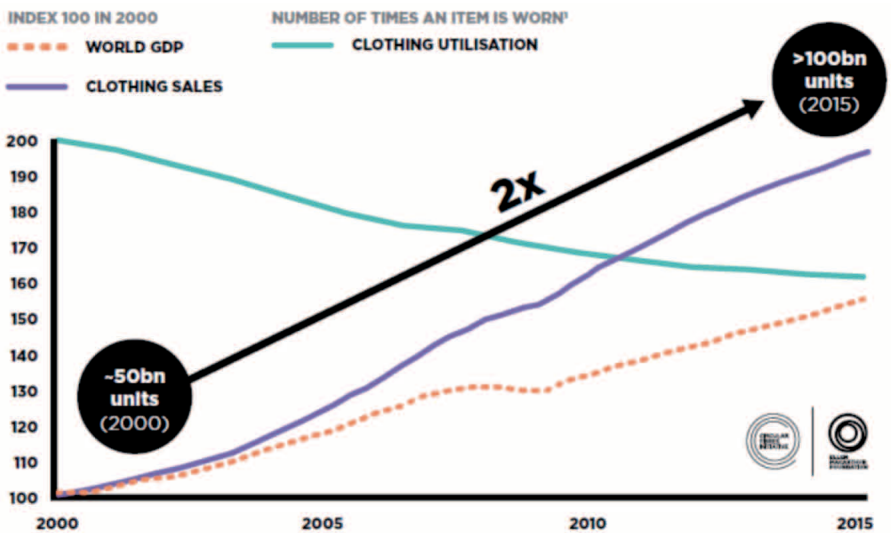

Fig. 1.1 - Growth in clothing sales and decline in usage rate, source: Euromonitor International Apparel & Footwear 2016 Edition (volume sales trends 2005-2015); World Bank, World development indicators – GD (2017)

According to Sophie Benson (Benson, 2011) we own more and more things and less and less time to enjoy them. A recent article published in the New York Times describes how some generation Z kids (born between 1995 and 2010) feel the need to continually buy new items to post new content on social media without reusing the same outfit more than once or twice. To the question: "why (do you wear the clothes) only once?" they answer: "because they are usually in the photos when I wear them and then they are posted on social media. I really don't want anyone to see me

in a dress more than once. People might think it is not stylish always to wear the same thing. The style is to change for whatever situation you are in and for different events".

Fast fashion is undoubtedly an innovation of the fashion industry and would not be possible without technological and infrastructural progress. This consumption model was induced thanks to various commercial strategies, first of all the perceived obsolescence. Going from the main collections, spring/summer and autumn/winter, to a weekly proposal for new looks has led consumers to a state of frenzy and fear that forces them to visit the shops with an ever-closer frequency. According to Lucy Siegle (Siegle, 2011) and Elizabeth Cline (Cline, 2013), if it is true that fashion has always counted on change, what is surprising today is its schizophrenic speed: the consumers who want to be fashionable must constantly update their wardrobe. However, they are no longer willing to spend this because they know that the following season, if not the following month, they will buy other items. This vicious circle has forced companies to lower the quality and the checks of products to further lower prices and continue to sell large quantities of clothes. The average final consumer does not realize the poor quality of these garments: the younger ones may have never owned a high-quality one; more generally, consumers today do not have time to realize if a garment is of quality or not since they will not use it for more than a few months.

As we know, mass production arrived at the beginning of the twentieth century with the industrial revolution, powered looms, sewing machines, and cutting machines (partly due to the need for uniforms) together with the first signs of fashion democratization.

More practical yet still fashionable, clothes became available thanks above all to the American ready-to-wear industry. In the 1940s and 1950s, the American designer Clare McCardell introduced a new informal look under the name of "sportswear". Industrial clothes became increasingly popular and reached a growing number of working people. The habit of making clothes at home gradually disappeared from the second half of the century, when the youth revolution overturned the traditional social order (top downwards) and young designers like Pierre Cardin, André Courrèges, and Mary Quant looked to a new future.

The influential stylists remained the domain of the most privileged, but high fashion became less and less influential, to such an extent that the great French Fashion Houses started to launch their first prêt-a-porter lines. The consumer society began to emerge.

In the Seventies and Eighties, fashion moved in the opposite direction, appearing as a rebellion against fashion, in the guise of youth trends like

punk and rock. These styles inspired great designers like Versace, Jean-Paul Gaultier, and Zandra Rhodes. Since the Sixties, the mass production of casual clothes (jeans, T-shirts, and baseball caps) based on the casual American look has become a sort of uniform for youth culture.

The rigid seasonal diktats from magazines like Vogue and Tatler had to leave their place to emerging publications guided by this new look. Fashion was fragmenting: the rules were overturned, and the barriers between high fashion and popular trends, great designers and everyday styles began to disappear.

In the Eighties, when consumerism reached its heights, fashion parades became the symbol of an aspirational status. A second luxury-democratizing wave spread this imprint during the Nineties, when aggressive marketing and massive expansion made brands accessible to more consumers.

Over the last 15 years, fashion has become increasingly faster and cheaper. As well as increasing competition and industrial growth, global communication and marketing have fuelled demand and consumer expectations, constantly speeding up fashion cycles. However, this position is unsustainable for fashion, both in the medium and long term. Fashion production and consumption are the ends of an extremely long, complex, fragmented chain that transforms fibres and fabrics, which in turn are mediated by designers, industries, and buyers into the clothing on sale in shops. There are problems to deal with at every stage of the process, long before the end-user chooses, wears, washes, and finally throws away the product. As Catherine Hamnett says, the way (Black, 2012) we consume "the future of the planet".

The recent interest in the relationship between fashion and sustainability is associated with the convergence of many different environmental and commercial factors, together with changing social and cultural norms. Fashion has always been a global affair, a quest for the unusual or exotic for its rarity and prestige.

The recent increase in goods arriving from abroad, especially China and India, is a direct result of the change in international trade agreements, altered in 2005, when the MFA (Multi-fibre Arrangement) and GATT (General Agreements on Trade and Tariffs) regulations, already in force, were integrated with an adjustment in international import-export quotas. Closed markets like the UK were previously protected against competition from very cheap imports (like those from China). However, now these goods can invade the market, destroying the previous equilibrium. Consequently, many low-income countries, like Bangladesh or Cambodia, have moved into the clothing market. Although some regulatory quotas are still in use concerning exportation, the new trade relations could prove

difficult. For example, the so-called "Bra war" broke out in 2005: millions of garments made in China were blocked at European Customs until China agreed not to export more pullovers, bras, and trousers that year and to include half the blocked items in the quotas for the following year. In contemporary times (*US Consumer Sentiment Survey 2019: Consumers Are Ready to Spend – but Wisely | McKinsey*, n.d.), demand for change is led by the young. Activists such as Greta Thunberg attract global headlines, bringing forward a call to action to address environmental sustainability, adding to the lexicon on the subject by using "crisis" and "emergency" over "change" and "warming". Thunberg says, "it's 2019. Can we all now call it what it is: climate breakdown, climate crisis, climate emergency, ecological breakdown, ecological crisis, and ecological emergency? […]". These activist movements are making consumers increasingly interested in the environmental impact of fashion. Some 66% of respondents to a McKinsey US cohort survey (and 75% of millennial respondents) say they consider sustainability when making a luxury purchase. Still, consumers do not always back words with actions. Only a minority is willing to pay more for sustainable products – only 31 percent of Gen-Z and 12 percent of baby boomers (*US Consumer Sentiment Survey 2019: Consumers Are Ready to Spend – but Wisely | McKinsey*, n.d.).

The global fashion industry is highly energy-consuming, polluting, and wasteful. Despite some modest progress, fashion has not yet taken its environmental responsibilities seriously enough. Next year, fashion players need to swap platitudes and promotional noise for meaningful action and regulatory compliance while facing consumer demand for transformational change.

The clothing textile sector is a highly significant economic player; as far as earnings are concerned, clothes are much cheaper now than they were a few decades ago. Clothing sales have risen by about 60% over the past ten years. According to research by McKinsey Apparel CPO Survey 2019 (Berg *et al.*, 2019), today we consume a third as many clothes again as we did four years ago and throw them away after wearing them very little, even only once. There has been an increase in the way garments and fashion are sold, with the advent of "value fashion" available in supermarkets, alongside food, and in high street chain stores, clothes that sell because of their low prices rather than for their potential to last. Cheap fashion means accessible fashion and encourages greater consumption, creating a vicious circle. More importantly, fast fashion puts pressure on the textile industries and their suppliers to raise their output, impacting those at the bottom of the production chain and those who actually make the clothes. Sustainable fashion (Berg *et al.*, 2019), is

picking up rapidly among consumers and becoming a fundamental driver of purchasing decisions and is likely to be critical for competitive success in the near future. As an indicator of growing public concern about the topic, internet searches for "sustainable fashion" tripled between 2016 and 2019. Hits on the Instagram hashtag #sustainablefashion quintupled between 2016 and 2019 in both the US and Europe. That is an indicator that sustainable fashion is becoming part of a broader movement, driven, in part, by the concern, activism, and rising spending power of Generation Z consumers.

In this context, many are the questions raised about sustainable fashion since many are the elements involved and complex the sequence of events inherent in the life cycle of our clothes and the fabrics that go to make them. According to *The Sustainable Fashion Handbook* by Sandy Black (Black, 2012), we will continue this work in the same interdisciplinary spirit, making it accessible not only to seasoned players in the industry but also to students, fashion lovers who are just embarking on the journey towards sustainability awareness.

Possible futures' strategies are needed, seeking answers to the key questions surrounding sustainable fashion:

- How can fashion become more environmentally and ethically positive?
- How can we slow down fashion?
- How can consumers make a difference?
- Can conflicting interests be reconciled in such a fast industry as fashion?
- What environmentally sustainable opportunities are available among textiles?
- What would the impact on the market be if everybody kept their clothes longer?
- Is it possible to resolve the paradox between transitoriness and sustainability?
- How can designers make a difference?

Obviously, it is a difficult process, at least as long as the clothing textile industries continue to sidestep sustainability-related issues. However, the wave of criticism from more watchful consumers and the reporting on environmental problems and ethical practices within the production chain have created a certain pressure, which has now speeded up reparatory action in many ready-to-wear companies such as the Sustainable Apparel Coalition[2].

2. Launched in 2011, it involves some of the largest global brands and retailers, including Nike, Gap Inc., H&M, Levi Strauss, Marks&Spencer, Patagonia, and Walmart, together with government agencies, NGOs, and academic institutions. The Sustainable

There has been a fundamental behavior change spurred by ethical consumption, by which consumers request more information about how, where, and in what conditions their clothes are made. Dramatically passing the buck of company social responsibility, companies that were previously seen as the primary cause of the environmental problem, as far as textile production, dyeing and manufacturing is concerned, should urgently become part of the solution. The pressure exerted by small companies and the propaganda from some organizations have taken hold, and a new way of thinking is emerging at higher and higher levels, impacting the whole value production chain. Mass media interest in working conditions in the clothing industry has grown. Numerous interviews have been published about industries in the fashion sector, and various covers have been dedicated to the problem of exploitation at work. Almost all economics magazines and newspapers, from Vanity Fair to Business Week, have been publishing a green column since 2005.

But what steers fashion? We know that fashion is full of contradictions: it is ephemeral yet runs in cycles; it looks back to the past but constantly embraces novelty; it is an expression of personal identity but also group membership; it can both be a way of drawing attention to ourselves and a collective experience, it exists for the few as a unique piece of tailoring, for the many as a mass product. On the other hand, making one's clothes or making them unique, imitating the hippie trend of the seventies, with its handmade garments, has recently captured the attention of younger generations and is steadily gaining in popularity. The desire to be fashionable, continually changing and renewing one's look, is expressed in every area of contemporary lifestyles, increasing obsolescence so forth resources consumption and environmentally impacting emissions. This paradoxically fuels the industry on which millions of people depend, in high/middle/low-income contexts: cotton farmers, textile workers, shop keepers, and many other categories. For those who live below the poverty line, working in the clothing industry is often a better alternative to subsistence agriculture, even though wages may be no greater than the local minimum. High-income contexts consumers must realize that there are serious, complex problems behind all our fashion purchases.

In the present context of growing debate on the problems of environmental protection, social equity-inclusion, and economic prosperity, there is a new sensitivity according to which this unbridled consumption

Apparel Coalition was founded with thirty-three members to focus on developing universal tools for measuring sustainability in the apparel and footwear life cycle and driving best practice and innovation through collaboration (Black, 2012, p. 324).

of faster fashion must slow down. We must remember that in any case, companies in the clothing textile sector are fundamental economic players; they have to respond to one in six of the world's workforce, from fields to factories. The desire for novelty and a credible fashion status is deep-rooted in our psyche. The constantly changing fashion cycles that steer demand and fuel the market will never disappear, and neither could they. It is, therefore, necessary to develop alternatives. Pioneer sustainable-fashion designers (Black & Eckert, 2012) such as Katharine Hammett[3] have raised the profile of organic and ethically produced clothing through meticulously sourced collections that have been widely publicized. As an independent designer, Hamnett could invest the necessary commitment and resources to ensure that every element of her collection is fully sustainable and produced as locally as possible under fair wage conditions. Buying things that have been made with more significant consideration is a choice we are preparing to embrace. However, other problems arise when entrepreneurs have to face the impact of a drop in sales and find win-win beneficial solutions.

Against this background and the numerous meanings and interpretations of fashion as a cultural, economic, and social phenomenon, the concept of sustainable fashion may look self-contradictory, in itself an oxymoron. We come to the concept of the 'fashion paradox' (Black, 2012) to encapsulate this complex web of contractionary perceptions and practices – comprising economics and employment, trade, design and manufacturing, buying and marketing, and cultural identity that collectively make up the global fashion industry.

The pioneering but brief wave of sustainable fashion in the early Nineties associated its natural and healthy image with organic products, "natural clothing" that respect the environment. Today's sustainable fashion is based on a combination of environmental protection and social inclusion principles, innovation, and a high level of aesthetic content. The clothing supply chain (Black & Eckert, 2012) is highly complex and time-sensitive, involving many components and subcontractors in different locations. Except for a few staple clothing products, fashion garments are produced by ever-changing suppliers in relatively small production runs compared to engineered products. The time invested in designing a product is, therefore, a significant part of the cost. Today the demand for clothing is changing: the clothes are designed in a different way, can be produced

3. Unofficially crowned 'queen of sustainable fashion', designer and campaigner, Katharine Hamnett was made a CBE in January 2011. Hamnett's collections span four decades, and have been sold in over 700 stores in forty countries. Her influence – from slogan T-shirts to new stonewashing – is widespread (Black, 2012).

totally with organic fibres, there are recycled fabric collections or products designed for a long life and less waste, and all this contributes to a new wave of design that is changing the way of perceiving clothes made with sustainable resources. The popularity (Morley, 2012) of approaches such as Cradle-to-Cradle and closed-loop fibre-to-fibre recycling instead of down-cycling fibres to industrial products indicates a desire in the industry for a more circular approach to design. Designing and making a more sustainable item of clothing can be both conceptually simple and frustratingly complex in practice. Life Cycle thinking tells us that extending the product's lifetime will bring substantial environmental benefits for reasonably durable products that do not consume energy (including clothes). Hence, a body of evidence supports the sustainability credentials of vintage and second-hand clothing, be it sold in domestic markets. So longer-lasting clothes, and those with multiple lives, are definitely preferable.

Recently, for the fashion industry (*The State of Fashion 2021*, 2021), 2020 was the year in which everything changed. As the coronavirus pandemic sent shockwaves worldwide, the industry suffered its worst year on record, with almost three-quarters of listed companies losing money. Consumer behavior shifted, supply chains were disrupted, and the year approached its end with many regions in the grip of the second wave of infections. A turbulent and worrying year has left us all looking for silver linings – both in life and in business – knowing full well that we will need to make the most of them in the year ahead.

The pandemic has not only accelerated a pre-existing critique of consumerism but also the increased importance of sustainability in purchasing decisions and the rise of circular business models. Consumer attitudes (*The State of Fashion 2020*, 2020) are changing in the wake of the pandemic, as many embrace a "less is more" approach that coincides with industry changes in the fashion cycle. Some 65 percent of consumers in a McKinsey survey conducted during the Covid-19 crisis said they plan to purchase more long-lasting, high-quality items. Overall, consumers considered "newness" one of the least important factors in making purchases. One promising way for fashion to reduce its environmental impact is by scaling win-win business models, through which companies employ a range of strategies to make long-lasting clothes, make more efficient use of resources, being less toxic and more renewable, and valorize waste, as well as help their customers to do so. In 2021 (*The State of Fashion 2020*, 2020), we see circularity moving from the fashion fringes towards center stage.

The way in which value is created in environmentally sustainable systems is radically different from how it is created in traditional systems.

In essence, a single garment can create value repeatedly – through sale and resale, repeated rental, or being sold, maintained (washed, dried), repaired, returned, remanufactured, or recycled, and resold again to reduce the environmental impact. "Sustainability (*The State of Fashion 2020*, 2020) is obviously more important than ever, but it is also becoming the baseline requirement for all apparel companies", Dai Wear Chief Executive Joanna Dai said. "We find increased organic engagement and followers slightly outside of our core target niche who align with our values and buy into our brand. Environmental protection is likely to be one of the key business trends of the next decade. Instead, a collective effort is required in which fashion companies, customers, and all participants in the value production chain collaborate". To date (*The State of Fashion 2020*, 2020), players that feature sustainability in the centre of their branding have been at the forefront of environmental protection practices, as well as some established luxury brands owing. More so, perhaps, to the resale value of their stock rather than their eco aspirations. However, looking forward, we expect mass-market brands to scale their efforts. In addition, aggregators are well-placed to launch resale and repair programs, combined with an enhanced in-store experience. Marketplaces can build on their size and logistical capabilities. As consumers become more engaged with sustainability issues, environmental protection will be the key that unlocks the door to a more sustainable future.

1.2. Textile, Clothing, Fashion: discussing sustainability

Talking about sustainability requires different knowledge, especially in the clothing sector, defined as one of the most polluting sectors in the world. In the textile sector, the Fashion Pact, signed in 2019 by the biggest international fashion brands, represents an important document for producing with more responsibility, cooperating in the supply chain to find shared solutions.

A distinction (Tham, 2012) can be made between clothing and fashion: clothing can be described as answering material or physiological needs, as in a coat offering warmth, whereas fashion operates primarily at a symbolic level. As we have seen, sustainability is likely to be one of the predominant themes of the fashion industry in the years ahead, but the topic is complex and multifaceted. Frequently, articles titled "What is sustainable fashion?" are published in general-interest magazines. However, these typically focus on sustainable materials options without providing sustainability measures or covering the broader and systemic issues involved.

With Alberto Saccavini, expert of sustainability in fashion, member of Blumine/sustainability-lab.net and *Fa' la Cosa Giusta*, we talked about how it is possible to focus the discussion on sustainability in fashion in a sector that is indeed complex but increasingly close to this theme.

Give us your vision on fashion today.

Today the Fashion industry has, finally, I would say, decided that sustainability is an essential aspect for both their longevity and profit.

We can identify three main aspects.

The first one is the one that revolves around the circular economy, in other words, the one that looks to the productions, including textiles, as a closed cycle and not a straight line. All the buzz created around Circular Economy, starting from Cradle to Cradle, may be the soul from which the same circular economy comes. The Ellen MacArthur Foundation and the political effort of the European Union, are pushing the entire fashion value chain to take action in this direction. Of course, there are a lot of successful examples of circularity at a different level of implementation, some at a lab level some at a full scale one, but unfortunately the industrial reality is that very few products and material streams are fully circular. To make an example, the average quantity of recycled cotton used in a new fabric is rarely above 20%.

Nevertheless, I am sure that in 5 or 10 years, because I am an eternal optimist, we will see a huge step forward in this direction, especially when chemical recycling of cellulosic fibres, starting with cotton, and of synthetics will arrive at full industrial development. One of the most significant concerns when imagining Circular Fashion is the possibility of inputting in a closed-loop system all used garments. If technically we are slowly but steadily moving in the right direction, the direct involvement of the final consumer in this equation can be an imponderable variable. In other words, if the final consumer will not send her/his used garments towards recycling, it will be difficult or even impossible to intercept them.

A second aspect is responsible chemistry that is probably the single aspect in Sustainability in Fashion that made the greater steps ahead in this past decade. The foot on the throttle was set by Greenpeace back in 2011. They clearly pointed their finger towards the fashion supply chain as one of the major contributors to water pollution. Their campaign initially targeted international brands producing in South-East Asia, which responded positively and started to commit to eliminating toxic substances from the clothes they produce. This caused a domino effect that pushed the entire industry to reconsider their chemical approach more responsibly. Another reaction to the Greenpeace Detox Campaign was the creation

of the Zero Discharge of Hazardous Chemicals – ZDHC an organization initiated by several brands that today includes all actors of the supply chain from brands to chemical producers to manufacturers. The aim of ZDHC is to help, especially those companies using chemicals in their productions, mainly dye houses, tanneries, and ennoblers, to identify and substitute those hazardous chemicals with safer ones. Even though in this field major steps have been taken, the optimum is still far ahead.

The third and very important aspect is linked to transparency and traceability. These two interlinked and mutually essential qualities of a sustainability policy or program are crucial for environmental and social responsible sourcing and production. The entire fashion value chain is today pushed by civil society, media and all stakeholders to increase their level of transparency and implement credible traceability. Of course, this is a real challenge, especially when, for example, natural materials are produced in small farms or by nomadic people, namely I refer to cotton and cashmere. Nevertheless, essential projects at all levels are being developed involving different supply chains and steps within them.

What does sustainability have to do with the macro trend of making, the makers, a phenomenon now exploded in the design scene in general?

lt surely is a popular theme because it is linked to geography and the call for shortening supply chains and protecting and passing on the know-how as an additional component of sustainability. Undoubtedly, the world of making and crafting are very interesting topics as well as the idea of going back to do things with our own hands, to regain those skills that until a couple of generations ago were typical household practices, but that we have lost in our society replacing them with consumption as a way of life. The attention to craftsmanship, the growth of makers, the tradition of 'artisanship' will help fashion and, therefore, the consumer to better understand the quality of products and push for a new awareness of garments quality. These traditional techniques, practices, and craft skills are a plus, especially in luxury production. In the textile world, there are unfortunately many cases of traditions that were being lost.

We are also witnessing the phenomenon in which many luxury brands open their own schools where they teach ways of traditional making and artisanal techniques. What do you think about it?

The luxury cannot live without the highest-level craftsmanship and its quality. Therefore, there is the need to preserve and often to internalize instead of outsourcing a certain type of work. This is another

symptom of how sustainability, in the broadest sense, has become an integral part of the structures, especially in big luxury groups. On the other hand, there is real craftsmanship, so the capacity, the need to keep alive the knowledge that these artisans have, and that can transmit to future generations.

What do you think about operations like the one H&M practices, promoting the return of the clothes to get a discount ticket? Can this practice sensitize the end customer at the moment of purchase or use?

I think there are good and bad aspects of this project simultaneously, not forgetting that the one of H&M is just one of many projects in this direction. There is real closed-loop exercise on one side, sousing those 'take back' clothes as source material for new production. As we know, this is a challenge, but actually, a certain amount of textile waste has not been used for landfilling but sent back into clothing production. Probably this is just a small percentage for now, but it exists, especially considering the huge investments H&M has made in several emerging recycling and sorting technologies essential to their project.

On the other hand, it is positive to push the consumer to consider the end of life of the clothes they own. However, the discount ticket system incentivizes overconsumption, which has been indicated by many as a major weakness in the entire fast fashion business model.

This raises many questions for the consumer: how much do we really need? Do we need a new garment that only resists a couple of washes? Or maybe we need something that will last much longer in time?

In order to let sustainability be that essential and mandatory path that big fashion brands are considering, I recall the words of Pinault, President of Kering Group, who claims that the only path to maintain the level of acceptance and interest from the consumer on their product is to focus on sustainability.

What can design do to make this aspect one of the levers young designers have in their "toolbox"?

Design is crucial for sustainability. In just a few years, arguments concerning sustainability that were only discussed among professionals today are taken for granted and are treated not as a novelty but as a fact already in the first years of design education. Nevertheless, educating the next generation of designers in all sustainability fields from environmental to social and economical, and in subjects like zero-waste design, upcycling, and disassembly, so that they can grow with the idea of designing not just one generation of products.

1.3. Designing sustainable clothing

Designers play a significant role in the development of new fashion products, and they can lead the selection of materials and services used within the production process (Gwilt & Rissanen, 2011). In the nowadays production system, designers do not directly connect with resources extraction and material production, making, distribution, and disposal of garments. They are thus unaware of all phases that a garment requires, from its design to disposal. That is because, conventionally, the design and the making of a product are separate. Design for sustainability has key challenges to face. Design (Black, 2012) has a big role in the industry because it is the stage where you have all the choices – specifying materials and shape. That is where to bring in sustainability aspects, at the beginning. All life cycle stages should be considered when designing; this would consider the overall environmental impact required. Each life cycle phase of a product should be addressed at the time of the design stage to evaluate each specific case with the aim to reduce environmental impacts.

Within this framework, overconsumption is a key problem to solve. Both referring to social inclusion and environmental protection, new design challenges are spreading, and studies address the necessity of a shift in the production and consumption system.

The fashion business is often totally unpredictable: months ahead of sales, designers and buyers must predict and interpret consumer trends. The traditional clothing textile chain includes many levels: transforming fibre and fabric (including dyeing and finishing), designing, acquiring raw materials, sample production, purchasing by buyers, production, shipping, marketing, and end sales.

Fashion buyers play a hidden but fundamental role in selecting and directing the styles that appear in the shops. Industrial products must be ordered in advance, and the very nature of fashion makes this operation speculative. Actual sales are uncertain, with massive fluctuations due to fashion cycles, trends' influence, and even the volatile seasonal factor. On top of this, buyers are subject to commercial pressures and try to keep their sales as near as possible to their seasonal needs while responding to last-minute trends.

The industry provides seasonal work, which may not be offered the following season because those dealing with supplies usually look around for the best price and delivery times for each order. In this way, it is not possible to guarantee workers continual employment from season to

season. Decisions made at high levels may also affect production, an issue now recognized by multinational sportswear brands.

Beyond this volatility, fashion lifecycles are intrinsically impacting the environment. For example, many items remain unsold even after being put into the sales at a cut-price. Waste is produced both before and after product consumption, and what remains in stock is sold through minor sales channels (outlets or discount stores), sold off in developing countries through charity organizations, burned, and taken to landfills. E.g., over a million tonnes of clothing and fabric (including furnishing material) are eliminated annually in Great Britain, 70% of which are thrown into landfills even though at least half of it could be reused.

A more sustainable approach to fashion design must consider the entire life cycle of clothes, including every stage from pre-production, to production, distribution, use, and disposal.

Over the past couple of decades, issues like green design, design for sustainability, design for the environment, eco-design, and product Life Cycle design have been discussed and investigated, focusing on the product dimension of fashion. We understood that design for sustainable fashion should consider even promising radical innovation and win-win new offer models that have been studied since the end of the ’90, namely Sustainable Product-Service System. Design (Black, 2012) is more than just creating a nice product, a fashionable product. Design involves responsibility: you can no longer just use a nice color, spot the right trend and make a new collection. […] designers today cannot only be designers; they have to be something of a philosopher: The consumer will be more educated in the future, so a designer has to convey a message that is true and authentic. By contrast, the aim must be to highlight the interdependence of the various aspects of the fashion sector that includes clothes, shoes, and accessories but also incorporates aesthetics, lifestyles, and the artificial environment.

1.4. Redesigning fashion

Design (Black, 2012) has a huge role, and when we talk about design, we do not just think about the sketch artist, the pattern cutter, or the production machinist. Design is every decision made along the whole process, from the original concept right through to the way we are wearing them. The designers who create the original concepts play an important role because they impact everybody else further along with life. If we think about any product design, the initial decisions are the ones that indicate all of the other decisions. So it is a huge responsibility, but also an

incredible opportunity. Product design determines how everything around us works, appears, and seems, from the humblest of objects to highly engineered tools. Redesigning changes the relationship of an object with a person. In the fashion sector, the revolutionary concept of A Piece of Clothes (APOC), launched for the first time by Issey Miyake and Dai Fujiwara in 1999, creates clothes that are practically finished when they come off the loom or knitting machine. Designed to reduce fabric waste, the garments require minimal sewing and finishing. This process eliminates the need to use trial fabric, and clothes can be made to order, thus reducing warehouse space. This concept is unique in the fashion industry and represents a rethinking of fashion through the creative development of manufacturing technology. Moreover, it also represents a rethinking of the relationship between designer and consumer.

Over the past few decades, sustainable propositions (longer-lasting commodities, less energy wastage, recycled materials) have gradually become part of contemporary architecture and design. Despite this, the same approach has not yet been automatically and fully applied to the fashion field, which, though a form of product development, has to reckon with constant change. Generally, when we thought of clothes, we considered them functional, suitable for their market and purpose, available in a wide range of sizes, washable or dry cleanable, and must also remain in a cost range determined by the market. At the same time, the novelty and originality of fashion must continue to give pleasure and trigger desire. There is an infinite variety of styles, sizes, shapes, and fabrics and no absolute values, just a few timeless "classics" that remain constant despite the periodic stimuli that drive fashion ahead.

There is a distinct polarity between the more influential, radical fashion designers and the companies pioneering in sustainability. Avant-garde designers like Miyake, Comme des Garcons, Yamamoto, Margiela, and Hussein Chalayan create the main thrust towards rethinking fashion, inventing new body proportions, often using new materials, technologies, processes. On the other hand, small innovative companies are generally less interested in changing fashion and are keener on ecology or ethical production, especially using organic fibres. Many global labels and chain stores are now starting to propose ethical products for the mass market. However, numerous companies still do not yet see sustainability as a problem to be dealt with.

Given the convergence of environmental problems with those of social justice, it is no longer possible to ignore the need to completely rethink our relationship with clothes and how we can design fashion. Many companies are beginning to wonder what they could do. There are huge barriers

to overcome, especially the cost involved in setting up new plants and a supply chain for new materials, closer production chain monitoring, continuous updating and closer contact between all players in the chain. All this lays the base for new challenges in the fashion field and helps to resolve the paradox of fast fashion and sustainability. The role of design (Carbonaro, 2012) for a sustainable fashion system is similar to what we now call design thinking in other areas of design. It is a holistic approach to product development that is not only based on product lifecycle design but also focused on wider anthropological shifts, promoting new meanings and new styles of thought, not just a new sustainable lifestyle (Fletcher, 2014). In that sense, the real work of redesigning design.

1.5. The role of design and designers

In recent years (Manzini, 2015), the terms "design" and "designer" have been successfully applied to notions, activities, and people well beyond those found in the community traditionally acknowledged by these terms. The result is that an increasing number of people recognizes today design as a way of thinking and behaving that is applicable to many situations. On the other hand, for this very reason, its meaning has become less clear to those in the field than in the past. The capacity to turn out new ideas and better approaches to things is ultimately what increases productivity and, therefore, standards of living. We have (Carbonaro, 2012) come from a model of modern design that was mainly driven by the "form follows function" diktat, to postmodern design that seemed to be oriented around the slogan "form follows fiction", ad are now moving towards a new intellectually engaged "form follows sense" approach.

Many design theorists, whether innovative collaborators in design or responsible consumers, have proposed radical ideas about how we must rethink design with a more holistic approach, bearing in mind the entire context in which design works. Ezio Manzini supports the conception of an emerging design network in which "everybody designs"[4] including single individuals, businesses, non-profit organizations, and local and global institutions.

Today, both consumers and the new generation of designers will have to commit to being catalysts of new stimuli and implementing different

4. "This means putting their design capability into action: a way of thinking and doing things that entails reflection and strategic sense", in Manzini, 2015, p. 1.

design approaches. The crisis we find ourselves in is not simply a series of problems with a single answer. The circumstances are extremely complex, and many different strategies can simultaneously lead to a solution. Some of the ways fashion can do its part have already been put in motion, but this is only the beginning of what must become conventional behavior. This time, ecological fashion cannot merely be a transitory stage.

Production and economic processes have become essential for survival since they are fundamental drivers in consumer and designer behavior, though this could be a difficult path.

A new model of behavior means there is no going back. Emotional involvement may help: there are many advocates of new approaches to human progress, other than the capitalist-Fordist industrial growth economy, which holds happiness, personal satisfaction, and sustainability to be part of the final result of economic accounting.

Creative people also play an emerging role in recognizing new opportunities by looking at things from a new approach. Design is becoming increasingly important for business and has been significantly repositioned within organizations. Could a better design induce more consumers to buy ethical and ecological products? Can sustainable fashion be conciliated with the economic reality of the sector's traditional commerce, or is it destined to serve only a niche market, itself subject to the whimsies of fashion? People (Carbonaro, 2012) are pushing even the big corporations to change, and they are changing. This is happening in fashion, in food production, and in the construction of our built environment, and we see this reflected in the way that these and other fields are being taught.

I think that (Carbonaro, 2012) the breakthrough innovations will not emerge from inside the industrial mass-market production and retail system. The real transformation of the fashion industry will be wrought by the majority-minority and will arise out of the vast, diffuse creativity of the many individuals who are courageous enough to attempt to construct the future we thought we had lost. It is a cultural issue: designers can change the mental attitude of consumers and the market, which sees the economic problem as a limit rather than an opportunity.

1.6. An increasing role in designing a sustainable clothing system

Historically, the reaction of humankind to environmental degradation, especially since the second half of the last century, has moved from an end-of-pipe approach to actions increasingly aimed at prevention.

Essentially this has meant that actions and research focused exclusively on the de-pollution of systems have shifted towards research and innovation efforts to reduce the cause of pollution at source. In other words, the changes have been from: (a) intervention after process caused damages to (b) intervention in processes (e.g., so-called clean technologies), to (c) intervention in products and services (e.g., design of low environmental impact product and services), to (d) intervention in consumption patterns (e.g., so-called sustainable consumption).

Due to the characteristics of this progress, the role of design in this context has expanded over time. This increasing role is due to the fact that: the emphasis shifts from end-of-pipe controls and remedial actions to prevention; the emphasis expands from isolated parts of the product life cycle (i.e., only production) to a holistic life cycle perspective; the emphasis passes further into the sociocultural dimension, into territory where the designer becomes a "hinge" or link between the world of production and that of the user and the social/societal surroundings in which these processes take place; and the emphasis widens towards enabling users' alternative and more sustainable lifestyles.

Within this framework, the discipline of **Design for Sustainability** has emerged and enlarged its scope and field of action over time, as observed by various authors (*Seven Forms of Sustainable Fashion*, 2012). The focus has expanded from the *selection of* ***resources*** *with low environmental impact* to the *design of* ***products*** *for environmental sustainability*, to ***System*** *Design for Sustainability (aiming at environmental protection, social equity and inclusion, and economic prosperity).*

Moreover, Design for Sustainability has been recently recognized within the international institutional context as one of the key disciplines to foster sustainability, as reported within the "Circular Economy Action Plan" published by the European Community (European Commission, 2020):

> Up to 80% of products' environmental impacts are determined at the design phase. [The core of this legislative initiative will be to […] make the Ecodesign framework applicable to the broadest possible range of products. […] "Priority will be given to addressing product groups identified in the context of the value chains featuring in this Action Plan, such as electronics, ICT, and textiles but also furniture and high impact intermediary products such as steel, cement, and chemicals". […] "In the light of the complexity of the textile value chain, to respond to these challenges, the Commission will propose a comprehensive EU Strategy for Textiles, based on input from industry and other stakeholders. The strategy will aim to strengthen industrial competitiveness and innovation in the sector, boost the EU market for sustainable and circular textiles, including the textile reuse market, address fast fashion, and drive new business models".

In fact:

> This will be achieved by a comprehensive set of measures, including applying the new sustainable product framework, improving the business and regulatory environment for sustainable and circular textiles in the EU, providing guidance to achieve high levels of separate collection of textile waste, and boosting the sorting, reuse, and recycling of textiles (European Commission, 2020).

This is to say that even up to the top level of Political commitments, the fundamental role **of design is clear to promote a sustainable fashion System**.

Indeed, it is since the 90s that a new knowledge-base and know-how started to be developed to design products with low environmental impact. This attention was initially focused on redesigning specific qualities of individual products (e.g., reducing the amount of material used in a product, facilitating disassembly, etc.). It was in the second half of the 90s that this design approach broadened to systematically address the entire product life cycle to reduce the environmental impact, from the extraction of resources to the material production (pre-production), the distribution, the product manufacturing (production) and its disposal. This started to be referred to "as Product Life Cycle Design, Eco-design, or product Design for Environmental Sustainability and other approaches, including Cradle to Cradle design, biomimetics, emotionally durable design, and design for sustainable behavior, Circular design" (Vezzoli *et al.*, 2021). In those years, the environmental effects of the pre-production, production, distribution, use, and disposal of a product and how to assess them became clearer. New methods of assessing the environmental impact of products (the damaging effects of all input and output of all of the processes along the product Life Cycle) were developed; the most accepted is Life Cycle Assessment (LCA). In particular, two main approaches were introduced.

First, the concept of life cycle approach – from designing a product to designing the product life cycle stages, i.e., all the activities needed to produce the materials and then the product, to distribute it, to use it and finally to dispose of it – are considered with a system approach.

Second, the functional approach was reconceptualized from an environmental point of view, i.e., designing and evaluating a product's environmental sustainability, beginning from its function rather than from the physical embodiment of the product itself. It has been understood that environmental assessment, and therefore also design, must have as its reference the function provided by a given product. The design must thus consider the product less than the ‹service/result' procured by the product.

How this has been specified and articulated concerning the clothing system, it is described in chapter 5 "The clothes Life Cycle Design" in relation to the clothes design environmental requirements, the clothing product Life Cycle Design approaches and skills, and finally, the clothing product Life Cycle Design strategies, guidelines and examples. the method and tools for clothes life cycle design are described in chapter 7 "Methods and tools for sustainable product-service system design".

Again, the new EU action plan for the circular economy also mentions some models as win-win opportunities to enable the diffusion of design for sustainability (European Commission, 2020):

> Incentivising product-as-a-service or other models where producers keep the ownership of the product or the responsibility for its performance throughout its lifecycle.

This is indeed what, since the end of the 90s, has been defined as the Sustainable Product-Service System win-win offer model. In fact, from the end of the 90s, we started to realize that a more stringent interpretation of sustainability requires radical changes in production and consumption models. For this reason, attention has partially moved to design for Sustainable Product-Service Systems, a wider dimension than designing individual products alone. From among several converging definitions, the one given at that times by the United Nations Environment Programme (UNEP, 2002) states that a Product-Service System (PSS) is «the result of an innovative strategy that shifts the centre of business from the design and sale of (physical) products alone, to the offer a system of (ownerless) product and/or (all-inclusive life cycle) service, that are together able to satisfy a particular demand». In this context, it has therefore been argued that the design conceptualization process needs to expand from a purely functional approach to a satisfaction approach, in order to emphasise and to be more coherent with the enlargement of the design scope from a single product to a wider system, fulfilling a given demand related to needs and desires, i.e., a unit of satisfaction.

Other authors (Vezzoli *et al.*, 2021) more recently developed new knowledge about Sustainable Product-Service Systems (S.PSS) design coupling economic and environmental benefits with social equity and cohesion: this new role was shortly named System Design for Sustainability. Indeed, a system approach to design for sustainability may be referred to other studied approaches, i.e., Distributed Economies (DE) design for sustainability, design for (sustainable) social innovation, systemic design and design for sustainability transition (Ceschin & Gaziulusoy, 2016).

How S.PSS design has been specified and articulated in relation to the clothing system, it is described in chapter 6 "Sustainable Clothing Product-Service System Design" concerning the win-win sustainable clothing product-service system types, the sustainable clothing product-service win-win benefits, a scenario for sustainable clothing product-service system, sustainable clothing product-service systems, limits and barriers, designing sustainable clothing product-service system, approaches and skills, and sustainable clothing PSS design, strategies, guidelines and examples. The method and tools for sustainable clothing product-service system are described in chapter 7 "Methods and tools for sustainable clothing product-service system design".

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The Fashion System is at the center of the international debate as one of the most polluting and most impactful industries on the environment. In the last decade the fashion industry has changed, and is still modifying, its approach, aware of the fact that the attention to the environment can no longer be considered a trend: the entire system needs to find and adopt a methodological approach to the project and to the production of goods and services.

Today all the stakeholders on the supply chain follow a path from upstream to downstream: from the treatment of pollution, to the intervention on the production processes that generate a product, to the redesign of products and/or services to reach the discussion and reorientation of social behavior. This path shows the need to intervene in design terms and that the growth in responsibility and role of design, requiring reference scenarios, knowledge and new tools.

The book defines the features and scenarios of sustainable development, as well as the evolution of sustainability in research and practice of fashion design, addressing the strategies for the design and development of environmentally sustainable products. The authors describe the Life Cycle Design approach and the strategies and guidelines for integrating environmental requirements into product design for sustainable fashion. They present the so-called Systems of Sustainable Products-Services, namely the most promising scenarios and models to make design for sustainable fashion economically convenient. Finally, they provide a method and related tools to support design for sustainable fashion in the evaluation of the environmental impact of products, with particular emphasis on the LCA (Life Cycle Assessment). The text is enriched by a full-bodied review of interviews and case studies, with the dual purpose of making the design options clear and of highlighting their specificity for the different design contexts.

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