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# CONNECTIVITY and CREATIVITY in times of CONFLICT

Cumulus Antwerp

2023

Cumulus Association

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# Preface

# Connectivity and creativity in times of conflict

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## Welcome to the Cumulus Antwerp 2023 conference proceedings!

Since the beginning of our academic journey, a plaquette was solemnly hanging in the teacher's lounge. proudly displaying Antwerp's affiliation with the esteemed Cumulus Association since 2011. Back then, our aspirations were limited to scholarly pursuits, with our primary focus on advancing research through design as a promising scientific avenue. How times have changed!

In the present era, we find ourselves grappling with a host of pressing issues that demand our attention. The looming climate crisis, coupled with global economic and political instability, escalating living costs, social injustices, and the prevalence of isolation, have collectively questioned the very essence and value of design and art. Our society is persistently confronted with conflicts, contradictions, and an ever-evolving perspective, shaped by the non-neutral influence of technology and organizations.

In the face of these challenges, however, we have the opportunity to nurture a more positive perspective. By recognizing the changing landscape, we can see it as an impetus for innovation and positive transformation. As designers and artists, we have the unique ability to navigate this complexity, using our creative skills to address and mitigate problems. Through broader thinking and an inclusive approach, we can redefine the role of design and art and contribute to a more resilient, harmonious, and interconnected society.The Faculty of Design Sciences of the University of Antwerp, in close collaboration with the Royal Academy of Fine Arts, hosted the Cumulus three-day conference in Antwerp from April 12-15, 2023. With a legacy of struggle, the city of Antwerp represents an economic and cultural hive of activity. The current situation, led to the definition of the overall theme of Cumulus Antwerp: **Connectivity and creativity in times of conflict**. Concepts from avant-garde to conformism fashion, product design and new media have flourished in Antwerp. In this tradition, we invited the Cumulus community, designers, artists, and educators to investigate how culture and creative industry can offer resilience, consolation, and innovation models on human scale. We believe that these proceedings will be a valuable resource for anyone interested in exploring how design and creativity can contribute to building a more sustainable, equitable, and connected world. It will act as a worthy addition to the plaquette we once found.

As a community of educators, researchers, and practitioners, the Cumulus Association envisions a world where creativity and design are instrumental in shaping a sustainable future. In this context, the four conference themes of Nature positive/Design for transformation, Digital futures/Hybrid reality, Handle with care/Inclusivity, and METHOD/ART align with the association's vision, and address how design can impact and harness the power of connectivity and creativity to promote positive change. Each theme addressed how design and creative industries can offer resilience, consolation, and innovative models on a human scale, and how our research and education in design can highlight novel directions.

The **Nature Positive/Design for Transformation** track at the Cumulus Conference presented thought-provoking questions on the role of design in the face of sustainability challenges. The programme included five workshops, visual papers, and posters. Eight themes were identified to guide the paper sessions, and keynote Leen Gorissen was invited to talk about Natural Intelligence (NI) – Towards Nature Positive Design and bio-inspired innovation.

Design methodology and design education were two prominent themes. Designers explored new approaches to addressing complex challenges and embraced transdisciplinary collaboration. Design Materialisation explored the future of material selection, while Biophilic Approaches integrated living organisms into design processes. The Eco-Social Transitions theme connected systems thinking and co-creation with leadership and business. Fashion Innovations addressed sustainable design thinking, indigenous textiles and changing unsustainable lifestyles. The intersection of people-centred design and urban planning was explored in Urban Design and Citizen Inclusion, which highlighted the importance of sustainable transport and meeting residents' basic needs. The democratisation of design and the potential of digitisation were discussed in sessions on Do-it-Yourself studies and Design & Digitisation, respectively. These sessions showed the transformative power of design in creating regenerative social paradigms.

Overall, the papers emphasised the need for nature-positive choices in design and highlighted the collective responsibility of designers as agents of change. In this track, a best paper award was granted to **Erminia D'Itria** (Politecnico di Milano) for the article *"Fashion design matter: the role of design in guiding a sustainable transformation in Europe"*.

**Digital futures/Hybrid reality** explored the intersection of design and technology. This theme discussed how we can use technology to create better designs and more immersive experiences. We heard from experts in the field of virtual and augmented reality, including the keynote of Guy Van Wymeersch from Barco, who reflected on Creative leadership in innovation in a technology company and how to stay relevant in a faster-moving world. We also contrasted this with the talk of Professor Bert De Munck, who talked about the reinventions of craft: A historical view on the usefulness of craftsmanship.

Generative AI systems such as ChatGPT and Dall-E have ushered in a new era of fear and hope and redefined the role of designers. This transformation requires a critical mindset, innovative passion, and skills to turn digital capabilities into valuable tools.

The intersection of craft and digital immersive technologies explored hybrid workflows and production processes for augmented textile artefacts and fashion-tech products. Research by design publications addressed the integration of technology in music-making, enriched and accessible museums, and the role of technology in enhancing learning experiences. Design for and with extended reality explored immersive technologies, creativity, and materiality, offering new perspectives on ceramic creation and storytelling in virtual environments. Design for and with digital fabrication highlighted design methods and collaboration in additive manufacturing, looking at the impact of automation and new materials. Urban-scale digital analysed the relationship between technology and urban spaces, highlighting the need to rethink traditional urban planning and design for flexible and adaptable environments. Technology-driven design education integrated AI and virtual reality into design education, emphasising collaboration and the changing role of designers. Digital fashion examined sustainable fashion, the role of digital technology and the evolution of fashion in the metaverse, exploring innovative shopping experiences and deconstructing materiality. In this track, a best paper award was granted to **Diego Trujillo-Pisanty, Heriberto Olguin-Simon, Nicolás Spitalier-Tron, Paola Ferrari-Garcia, Jordi Fragoso-Terreros, Alejandro Lobo-Barrera, Ximena Peña-Rios, Patricio Pous-Pierson, Fabiola Toledo-Galindo, Julio Torres-Cazares** and **Roberto Cabezas-Hernandez** (CENTRO, Mexico City, Mexico) for the article *"Metaphysical instruments: prototypes for hybrid and live music-making"*.

**Handle with Care/Inclusivity** is a track linking Inclusive Design, Design for Health and Well-being and Cultural Heritage. The conference was kicked off with the keynote of Dirk Geldof, who positioned Antwerp as a superdiverse majority-minority city and expressed the importance of diverse-sensitive design. Scientific contributions addressed challenges related to care in design and care for cultural heritage, merging insights from different fields. 'Care in design' focused on bi- or omnidirectional interactions with attention to reciprocity between humans, non-humans, and technology. Design for/as communication explored the reciprocal connection between design and communication, using digital tools and design toolkits for sensitive issues. Design for Diverse Users examined the importance of gender and specific groups, aiming at more inclusive design processes and outcomes. The Care (full) spaces section analysed the role of the built environment from urban, architectural, and interior design perspectives. Co-creating care (full) designs involves involving end users, empowering unheard groups, and promoting (self-) acceptance. The section on 'Caring for heritage and conservation' took an integrated approach and explored how heritage can guide transformation and adaptation to global challenges. Inclusive Approaches to Intangible Cultural Heritage proposed design strategies to activate heritage and promote diversity and inclusion. Sustaining Traditional Crafts and Techniques focused on preserving cultural heritage objects and techniques. The Adaptation of the Built Environment component explored climate change and adaptive reuse. The Participation and Role of Communities section analysed digital solutions, participation in times of war and the role of communities in disasters. These sections provided insights and strategies to transform heritage in response to current and future global challenges. In this track, a best paper award was granted to **Silje Alberthe Kamille Friis** & **Annegrete Mølhave** (Royal Danish Academy, Denmark) for the article *"Artful care for self and others in daily design practice"*.

**METHOD/ART** explored the role of methodology in artistic practice and research, addressing how artists can use their unique perspectives to create innovative and impactful work. During crises, art processes emerge to address critical conditions, from the collapse of local social systems to global ecological catastrophes. Overcoming old conventions and the illusion of control is essential in times of conflict and requires new capacities for artistic engagement and co-action. Art (and design) has the capacity to absorb and reflect our value systems, making them powerful agents of transformation. We took the opportunity to congratulate the Royal Academy of Fine Arts Antwerp on their 360-year existence, and for their invaluable contribution to the creative landscape of the city.

Over the past days we have been fortunate to experience a truly enriching event, re-connecting and forging new ties with participants from all over the world. After a long period of absence due to the pandemic, the opportunity to network face-to-face during this conference has proved hugely rewarding. The physical networking opportunities provided by the conference will undoubtedly foster new collaborations and connections. We hope that the ideas presented at the conference will continue to inspire, influence, and spark discussions and collaborations in the design community for years to come. Moreover, we hope that the ripple effect of this conference extends far beyond the immediate participants. As attendees return to their respective communities, armed with newfound inspiration and fresh perspectives, they themselves will become catalysts for change and progress. The insights gained and connections forged here will inevitably spread and spark discussions, collaborations and synergies that will enrich the design landscape on a global scale.

Warmest regards from the Cumulus Antwerp team, we look forward to continuing our creative journey together.

## Acknowledgments

We would like to extend our heartfelt thanks to the Cumulus board and Association, our partners Antwerp Powered by Creatives, Visit Flanders, and Antwerp Convention Bureau, for their support in making this conference a success. We also express our gratitude to all contributors and presenters for their inspiring contribution and their connecting and creative mindset. Finally, we would like to express our gratitude to all our colleagues, volunteers and everyone who made Cumulus Antwerp 2023 a success.

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# President's message - Design for Adaptation in Times of Complexity

**Lorenzo Imbesi**

Full Professor, Sapienza University of Rome
President, Cumulus Association

The 2023 Cumulus conference in Antwerp at the Faculty of Design Sciences of the University of Antwerp, in close collaboration with the Royal Academy of Fine Arts, is the second conference in Belgium in the history of Cumulus and it is taking back our large community in presence in Europe after the global pandemic. The very large attendance from all over the world during the four days of the conference is well speaking about the strong need to get back to share design projects, research, and educational experiences in person. The city of Antwerp was a perfect place to host the large global community of Cumulus, while standing as an economic and cultural center, where have been flourishing creativity and design for the development of the sectors of fashion, product design, and new media.

The topic selected by the co-Chairs Inge Bertels, Kristof Vaes, and Jouke Verlinden is revolving around the concept of connectivity and creativity in times of conflict, which is a very current topic challenging designers, artists, educators to discuss and explore on how culture and creative industry are offering clear solutions for resilience and innovation models on human scale, crossing the three sub-topics of sustainability, digital futures, and inclusivity.

While producing large number of paper presentations, panels, keynotes, PhD networking and working groups, the conference was developed around four track topics, raising four dichotomies: Nature positive/Design for transformation, Digital futures/Hybrid reality, Handle with care/Inclusivity, and Method/Art.

As a final result, the volume of the conference proceedings is sending a clear message to the large global design community to work and give a positive answer to the challenges of our present and future society. The design action is always impacting the society and the environment with creative solutions, since it deals with local and global emergencies. Aspects such as complexity and plurality, uncertainty and nonlinearity, or reciprocity, force every designer to a new responsibility to the "other", be it a person, an animal, vegetable, or artifact. Consequently, the design action is always a problematic and multidimensional action, that is answering to new questions in creative ways, often related to the technological acceleration and the social development: the environment and the ecology, justice and social equity, globalization and local cultures, new technologies and scientific research, new forms of biological and artificial life and the responsibility towards future generations.
While exploring new approaches and addressing complex challenges through transdisciplinary collaboration, the conference addressed the notion of network, which is including openness, inclusivity, intelligence, evolution, innovation, sociability, creativity, development, so highlighting how it is important for the designers to adopt collaborative approaches to design.

Additionally, the notion of network is encompassing the mission of Cumulus Association to provide a global platform to encounter worldwide and to share knowledge: spanning all five continents and bringing together more than 350 members across different art, design and media educational institutions, Cumulus is a diverse global family, bound together by a multiplicity of experiences and perspectives, while fostering collaboration for creative solutions towards sustainability, equity and innovation. Since design is growing globally and becoming a large complex eco-system, it is essential for designers and educators to understand, and at the same time, to be connected to the proliferating global networks, so that they can develop new forms collaboration, and reach all those places in the world where research and innovation are moving in the direction of new scenarios for design.

While responding to the current and future challenges for design, the 2023 Cumulus conference at the University of Antwerp was reflecting and giving voice to such diverse and plural environment, so respecting the emerging differences and nurturing the values of plurality, global engagement, and open dialogue, at the same time generating a welcoming and friendly environment for innovation and a joyful experience for our members.

In the following pages of this volume, you will find part of the memories of such rich experience. The rest is staying in the mind, the soul and the actions of the people attending in Antwerp from all over the world, who will keep networking and collaborating after they are back, so extending the outcomes to the rest of our community even after the conference.

CONNECTIVITY and CREATIVITY in times of CONFLICT

# Track 1

# Nature positive/ design for transformation

# Nature positive/Design for transformation

**Bob Geldermans[1], Alexis Jacoby[2], Els Du Bois[2], Ivo Dewit[2], Dirk Van Rooy[2], Mario Rinke[3], Bert Belmans[4]**

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## Introduction

The Track Nature Positive/Design for Transformation started off with a few big questions: Even if we are technologically able to do so, are we still allowed to create our designed environment as we see fit? How can we navigate through sustainable transitions and within planetary boundaries? Can a systemic lens help us creating an overview to better overcome the present and imminent future conflicts? And can we regenerate ecological and social damage done? Indeed, the futures we want tomorrow are enabled by the actions we take today. Shaping societies, industries, buildings, products, and behaviours is a task to tackle by those able to cut across different disciplines and become agents for change. A call out to designers around the globe to put nature positive transformation at the heart of their actions. Many of them have responded within the framework of this Cumulus Conference.

We received 150 abstracts that, after a double-blind review process, resulted in 37 high-quality academic papers. Furthermore, out of 17 workshop proposals, 5 were selected for the conference. In addition, the program for our track includes several visual papers and posters. 8 themes were identified that determined the final division in paper sessions.

The attention for ***Design Methodology***, a theme to which 2 sessions were allocated, is not surprising, since existing methods and tools are to be critically assessed with respect to the challenges we face. The envisioned transformation concerns a large-scale systems integration of deep ecology strategies, which is a complex endeavor. Departing from the notion that current design approaches are incapable of dealing with *uncertain* conditions of critical complexity, as argued by an increasing number of scholars (Ceschin & Gaziulusoy, 2016), we need to break away from attraction to *existing* systems and values. At the same time, high levels of complexity pose new questions concerning ***Design Education*** (Meyer & Norman, D2020), which comprises another theme within our program. Philosophical and pedagogical concepts concerning design education are discussed, as well as the role of the physical learning space. Trans-disciplinarity is put forward as a mode of collaboration that looks beyond bridging divides in academia, engaging directly with external sources of knowledge. Internalizing environmental and social awareness has inherent material implications. A third theme has thus been dedicated to Design Materialization. Within this theme, the future of material selection for products and interior design is discussed, amongst other topics. Enhanced guidelines for Life Cycle thinking are addressed in one of the papers, making the connection with circular material use: a hot topic in practices and policies alike. The act of repairing and caring for living systems in truly *restorationist ways* is closely connected to this, but often neglected in simplified circular concepts towards material use. The theme of ***Biophilic Approaches in Design*** elaborates further on such notions of restoration. Bio-receptive Design, as an example, embeds living organisms in design processes through the creation of materials and artefacts, whilst connecting design and biology. In another article, boundaries between living and non-living are pushed through the parametrical control of plants in the creation of furniture. As such, the biophilic approach centers on both local and global human/nature relationships (Kellert, Heerwagen & Madort, 2008). Other perspectives on those human/nature relationships are brought to the fore in the theme ***Eco-Social Transitions***. Here, the concepts of systems thinking, and co-creation have been connected to leadership and business, for example. One paper takes the role of Design as central to sustainable change processes, underscoring the transformative power of the designer to unlock solutions by sequencing seemingly distant dots and generating new meanings. One theme has been allocated completely to ***Fashion Innovations***. The diversity of angles varies from negotiations with fabrics, form, and future for re-balancing design thinking, to issues of greenwashing and brand communication, and from the importance of indigenous textiles and know-how to difficulties in changing unsustainable lifestyles. Although we have grouped these articles into one topical session, it can be observed that challenges and opportunities are in many ways overlapping with those in other fields of design. From that perspective, also the urban scale shows parallels, based on the rationale that human-centric approaches transcend scales through conscientious contextualization, as can be found in the session on ***Urban Design and Citizen Inclusion***. Time-limited planning of urban living circles, for instance, reconnects the physical proximity of urban residents with basic daily needs, such as food, health, and education. This gives way to slower means of traffic, such as walking and cycling, whilst reducing negative effects to human well-being, climate, and the environment. A similar scope can be found in yet another research, in which an innovative form of development is proposed to radically change the urban landscape in favor of a human-centric approach, by means of a quantitative measuring method. End-user in-

clusion is also central to a paper on Do-It-Yourself studies to establish new 'partnerships' between products and users. This can be filed under the act or process of *democratizing design*. And that aspect seems to join the various tracks within this Cumulus '23 Conference: no matter from which way one approaches it – nature positive, inclusion and care, hybrid realities, or otherwise – the *human scale* is paramount for understanding contemporary challenges and finding solutions. Talking of new methods to facilitate this, the digital world is never far away. The theme ***Design & Digitization*** showcases assets of computation regarding the shift from a degenerative societal paradigm, to a regenerative one. For example, through serious gaming to create awareness, understanding, and – ultimately – behavioral change. To increase imaginative capabilities, less conventional methods have been proposed for approaching unsustainable behavior. One study does not shy away from using dystopian futures, fantasy-scape, and even zombies, exploring new ways of inquiry and how (sub) conscious perceptions of time and space affect people's beliefs and the choices they make.

Choices made through design should always be 'nature-positive'. The opposite is no longer viable. If there is anything this selection of papers shares, it is that: in the transition we are all agents of change.

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# Fashion design matter: the role of design in guiding a sustainable transformation in europe

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## Abstract

Today, sustainability is one of the main, most dynamic, and influential topics, for all sectors. The growing emphasis on sustainability is relevant to everyone, as today, there is a need to focus on sustainable objectives, approach them, and consider all the modern processes to implement sustainable development and value-creation strategies. As underlined by several scholars, over the next few years humanity needs to adopt a paradigmatic change from a consumeristic society where well-being is measured in terms of economic growth to a new society that can reach the same levels of prosperity but consuming less and relying on renewable resources (Vezzoli et al., 2021; Keitsch, 2015; Thackara, 2005; McDonough and Braungart, 2002). It is, therefore, necessary to change the way demands are met and to develop sustainable consumption patterns and lifestyles that are based on better consumption of far fewer resources. There is an urgent need to move towards new socio-technical systems capable of operating within the planet's limits. This means operating inside the nine planetary boundaries that are the spaces within which humanity can continue to develop and thrive for generations to come (Rockström et al., 2009). These systems will address not only the technological sphere but also the environmental, social, cultural, institutional, and organizational ones. The proposed understanding suggests that sustainability is the defining concept of the whole system and not a characteristic of its individual elements. Therefore, achieving sustainability requires a process-based approach, sustainable development, which must be intrinsically applied systematically and in different dimensions to plan new virtuous paths. In the presented scenario, the Fashion industry is one of the main actors as it influences ecosystems making a sizeable contribution to climate change, resource exploitation, and systemic pollution. But it also shapes cultural developments, their driving forces, and patterns of change (Bertola et al., 2016). According to the above, the presented paper discusses the fashion necessity of facing the challenges of sustainability - and the related complexities – with a radical transformation of the current development model. Through the analysis of different case studies, possible directions for the sustainable transformation of fashion systems are defined and presented. Specifically, such direction addresses how it becomes essential to review development paths with the aim for the fashion sector to dissociate sustainable innovation from the notion of exploitation of resources through a strong focus on proposing material and meaning that are alternatives to the very notion of "new".

## Author keywords

Fashion Design for Sustainability; Sustainable Development; Industry Transformation.

## Introduction

Today - fashion is one of the most significant, dynamic, and influential industries, as well as one of the most impactful due to its highly invasive processes, especially the ones involving environmental aspects and consumption of the finite resources of our Planet (EU, 2022; EMF, 2017). Moreover, this industry profoundly influences with its approaches and practices the environmental and economic dimensions due to its vocation to codifying current patterns of change (Bertola et al., 2016). In this context, it also strongly impacts changes related to the social and cultural spheres. As argued by Kate Fletcher (2018), the fashion industry is a powerful cultural driver which influences the consumerist economic model based on mass production that currently characterizes the economies, even if our experiences of fashion are now dominated and limited by this same model that involves fashion in essential issues.

Niinimäki et al. (2020) argue that the industry consumes vast quantities of water, land, and raw materials. For example, the fashion sector produces 8% of all carbon emissions and 20% of all global wastewater, with an anticipated 50% increase in greenhouse gas emissions by 2030 (Bailey et al., 2022). The sixth annual State of Fashion report by The Business of Fashion and McKinsey & Company (2022) reveals that globally, the fashion industry is responsible for around 40 million tonnes of textile waste a year, most of which are either sent to landfill or incinerated. This can be attributed to the current development models promoted by the industry that encourage an increase in clothing consumption and, therefore, fashion production. Pro-capita fiber consumption almost tripled from 1950 to 2008, increasing from 3.7 kg to 10.4 kg per person (Sanchis-Sebastiá et al., 2021). From 2007 to 2014, textile fiber production increased by an additional 20.2 million tons to 90.8 million tons, and this number is expected to grow by 3.7%, compounded annually (Pensupa et al., 2017). These phenomena are the direct results of the economic model based on the linear development of the fashion sector (Dissanayake and Weerasinghe, 2021). This model is dominant, a legacy of the first industrial revolution, which is based on so-called cradle-to-grave dynamics that exploit natural resources and then directly dispose of them without taking into account their regeneration potential and

the possibility of reusing them in the next production and/or consumption cycle (Braungart and McDonough, 2009). This fuels the phenomena of production overabundance, compulsive consumerism, physical and semiotic obsolescence of the fashion product, and disaffection culminating in irresponsible behaviors of serial accumulation and early disposal of garments. This context is so alarming that it prompts the Global Fashion Agenda, a leading forum for sustainability in the fashion industry, to conduct a study to quantify global fashion consumption in the Pulse Report (2017-2019). The purpose was to return a numerical figure that would allow manufacturers, and their consumers, to compare their impacts. The study estimated that if current trends remain unchanged, apparel consumption will increase 63% to 102 million tons by 2030 (Global Fashion Agenda, 2019). Since consumption is no longer focused on satisfying a need but on fulfilling a desire, it is bound to remain unavoidably insatiable by its very nature. This realization is also the direct consequence of a garment's semiotic and physical impoverishment. This deficiency allows production costs to be drastically lowered. And the consequent lowering of prices will enable buyers to purchase garments more easily. In this landscape, the logic of waste is established as a direct consequence of a supply chain that turns out to be excessive, misleading, and distorted. Waste becomes an entity in this context and acquires all its characteristics: value, importance, and impact (Binotto and Payne, 2017).

Considering what has been discussed, reviewing linear development paths is essential. This can be done by adopting more sustainable models of development, such as the circular economy model, which is to date recognized as the leading entrepreneurial model for meeting the goal, for the fashion industry, of decoupling sustainable fashion innovation from resource exploitation through a strong focus on proposing alternative materials and meanings to the notion of "new" (Dan and Østergaard, 2021; Rathinamoorthy, 2019; EMF, 2017). In this context, this paper investigates how, from a design perspective, new trajectories are being defined in the contemporary fashion industry to contribute to the development of a closed-loop system in which the goal is to recover or recycle secondary raw materials in multiple stages of the supply chain (Muthu, 2018).

## Methodology

The article aims to present the result of an investigation conducted on how fashion companies are pursuing circular initiatives, making it possible to create strategic actions that can stimulate a new understanding of what virgin material is and encourage a reinterpretation of the concept of new. The data analyzed were extracted from the knowledge repository produced by the – *Fashion in Process* - Research Lab. at the Design Department of Politecnico di Milano of which the author is a member. The data were generated from: (1) the research conducted by the research Lab (DGGROW, Mapping Sustainable Fashion Opportunities for SMEs, 2019; Erasmus+, FashionSEEDS, 2019) and (2) the doctoral research of the author (D'Itria, 2022). According to the authors' investigation, a mapping of "secondary" raw materials-driven circular practices of European fashion companies is carried out through an iterative process: an initial desk research phase followed by applying a case study methodology. This process allowed the selected research field to be narrowed into topics that emerged from the analysis and codified the main approaches to circularity that inform the definition of directions for addressing sustainable development issues. Defining the directions allowed the boundaries of the study to be identified. A selection of best practices is presented among the case studies identified. The author focuses on specific cases and uses them as a sample of the context of interest. However, as Johansson (2007) discussed, such a methodological approach includes many variables and qualities for reworking explanatory knowledge.

Methodologically, three phases were conducted: (1) the first phase was desk research to identify current practices in the fashion industry. This mapped current sustainability practices and identified best practices; (2) the second phase was an in-depth qualitative analysis of the best practices identified during the desk research; (3) and the last phase systematized the previously produced knowledge to define business directions for implementing sustainability through practices of recover or recycle of secondary raw materials at multiple stages of the supply chain, from design to retail and waste collection. The mapping led to the identification of 68 companies located in 21 nations in the

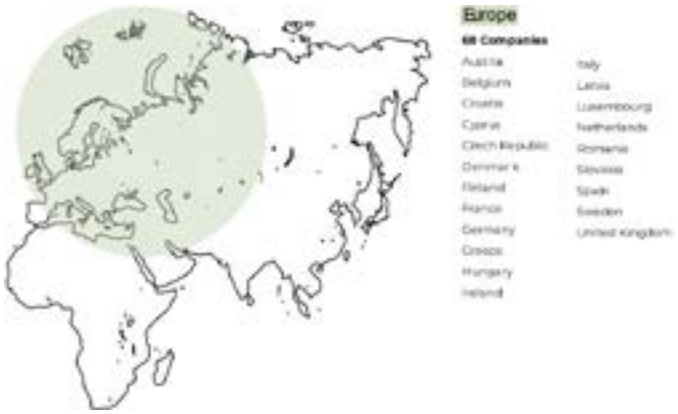


**Figure 1.** Companies' locations.

European continent, which have addressed aspects related to new sustainable development models by using secondary-raw materials in their practices (Fig.1).

The choice to focus on the European region was driven by the interest in investigating a context undergoing a solid transformation due to policy initiatives put in place for the sustainable transformation of the examined sectors (Green Deal, https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_it; EU Strategy for sustainable and circular textiles, https://www.interregeurope.eu/news-and-events/news/new-eu-strategy-for-sustainable-and-circular-textiles), by reasons of geographic proximity, and by past experiences of collaboration with local companies. The composition of the company was heterogeneous. They were textiles companies (24%) and brands of shoes (9%), apparel (60%), and accessories (7%). Of the 68 companies mapped, 6 were selected as case studies (Table 1).

**Table 1.** Case studies list.

| Country | Name of Initiative | Description of Initiative | Sector | BIG | MEDIUM | SMALL | MICRO |
|---|---|---|---|---|---|---|---|
| France | Vestiaire Collective | Online marketplace for second hand high-quality designer fashion. | Apparel | | | X | |
| Italy | Fulgar | Sustainable textiles brand. | Textiles | X | | | |
| Italy | Manteco | Sustainable textiles brand. | Textiles | X | | | |
| Sweden | Filippa K | Longer technical life, lease, sharing own product take back. | Apparel | X | | | |
| United Kingdom | Christopher Raeburn | The RÆMADE ethos in particular has pioneered the reworking of surplus fabrics and garments to create distinctive and functional pieces. | Apparel | | | X | |
| United Kingdom | Helen Kirkum | The studio ethos in particular has pioneered the reworking of surplus fabrics and shoes to create distinctive pieces. | Footwear | | | | X |

All these companies stand out for the way they are pursuing implementations of sustainable practices within their system, often adopting a design-driven approach as support. The following phase consists of further desk analysis to prepare for long-distance interviews with representatives from selected companies. These companies have distinguished themselves for their approaches to designing waste out of the system, using it as new raw materials or products. This phase allowed for exploring possible theoretical relationships and allowed for a deeper understanding of the subject through the use of these case studies (Tellis, 1997). The third phase focused on data interpretation. This phase supports the author in understanding the criteria a company must meet when working on design-led sustainable practices to move to new circular development models for better use of available resources. These aspects are now linked to the concept of waste recovery and lead toward circularity, decoupling economic growth from increasing environmental problems by imagining and implementing processes and practices with sustainability characteristics with three particular approaches at different stages of the supply chain: (1) *reducing/sourcing*, redesigning materials, products, and services so that they are less resource-intensive; (2) repurposing/manufacturing, recycling waste, and scrap, without destroying them, to create products that have more value; (3) and reusing/retailing, making products and values last by transferring them to another user.

## The Directions

This paper codifies the data collected to identify the directions that drive current design-led practices related to a new concept of waste in the fashion industry. This section discusses the results of the presented methodology by introducing several case studies that illustrate the main approaches identified by the study. Such approaches could inform and foster relevant new directions in sustainable fashion design. This paper aims to define potential pathways for developing a closed-loop system that aims to either reduce resources exploitation, repurpose secondary raw materials, or reuse the fashion product - at different stages in the supply chain (Fig.2).

From an operational point of view, the work identified three macro directions in the approach to sustainability through design-driven practices that emerged from the case analysis. Companies such as Manteco or Fulgar are acting upstream in the supply chain. They are working to improve their strategies to capitalize on the circular distinctiveness of their products. They are now pursuing actions to develop

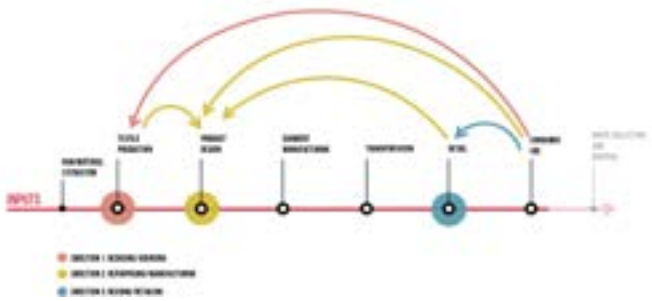

**Figure 2.** The directions model.

a new approach that can significantly reduce textile waste by rethinking sourcing practices through traceability. On the other hand, Christopher Raeburn and Helen Kirkum are experimenting with the designer's role in reworking surplus textiles and garments to create distinctive and functional pieces, underscoring their attributes of conscious manufacturing. Companies like Vestiaire Collective or Filippa K work down the supply chain. They keep items out of landfills, changing traditional retail's linear "take-make-away" model (EMF, 2017). So the author discusses strategies with a common pattern of avoiding waste and working on the meaning of "new." The study examines how these identified directions work for a common goal but differ from each other. The analysis offers insight that aims to describe the behaviors identified comprehensively. However, the author acknowledges that there are limits within which these behaviors are adopted. Although a common guideline is highlighted, the different cases need to be understood in the specificity of their context, territory, and actors involved. In the following sections, the selected cases are explored.

### Reducing/Sourcing

The first direction refers to companies working upstream in the fashion supply chain. They work on their sourcing to achieve sustainable supply chains by leveraging their position at the beginning of the flow of goods and services. Companies rethink the system by redesigning the processes of buyers' access to materials, production, logistics, and transportation, and distribution. To achieve this, transparency in supply chains is critical to validate the origin of sustainable materials (Fung et al., 2021). For example, the Italian textile company Manteco launched Project43. This is a unique strategy based on circular economy principles. They aim to optimize existing materials and design pre-consumer waste out of the system by recovering offcuts from the garment manufacturers that

use their fabrics. The collected materials are then regenerated into 'new' fabrics. Manteco acts as a single point of contact between all the actors along the supply chain to monitor the material lifecycle. Project43 is now reducing and regenerating textile waste using the company's facilitates through a transparent system. (Fung et al., 2021). By addressing the critical issue of traceability, Project43 is also a tool capable of overcoming the linear waste model and providing the fashion sector with a different understanding of "new" materials. Another company that is making a significant contribution on this front is Fulgar. It is a leading manufacturer of synthetic yarns. It is now experimenting with the traceability of its eco-friendly Q-nova yarn. This is an environmentally friendly fiber made exclusively from raw materials regenerated through a mechanical process rather than a chemical one. A special ingredient in polyamide, the innovative traceability system called ID (Identity), makes it possible to verify the authenticity of the recycled origins of the yarn. The ID system allows third-party organizations, such as consumer groups and governments, to verify the reliability of the data provided. All the presented companies working on this first approach recognize that traceability is a crucial aspect of supply chain sustainability (Naden, 2017; Sodhi and Tang, 2019). While for some companies, traceability helps to identify environmental issues and is a starting point for the improvement of the entire supply chain, which is actively involved in the process of mapping the existing material, in other cases, the monitoring process takes place directly within the company, acting on the material, in the intimate mixture, to generate a cascading effect on actors inside and outside the fashion supply chain.

### Repurposing/Manufacturing

The second direction characterizes the rising strategies fashion companies adopt through a project approach that enhances the use of discarded goods' materials and components to transform them into new, high-value products. Christopher Raeburn is a pioneer of upcycling in fashion. He started his eponymous brand in 2008 using British Army parachutes as his primary fabric source to create new garments. Since then, he has developed expertise in reconstructing military surpluses, such as parachutes, parkas, and military jackets. This process is called reappropriation by the designer. The designer's approach is guided by research on the garment and the process of deconstruction itself; even the shape and silhouette of his designs are developed based on the source of the fabric rather than being cut and shaped on the design. Designer Helen Kirkum carries out similar experiences. Through her work, Helen Kirkum is hacking the footwear industry using waste as a raw material. The designer uses recycled and dead stock materials as sourcing. These materials are transformed into sneakers crafted to provide an individual experience to consumers. The design philosophy applied to these products is to mix the components of the "repurposed" products, allowing the seams between the different parts that compose the final shoe to be visible. Accentuating these points of connection aims to stimulate emotional value to allow the user to own something inherently personal and unique. The approach developed positions her as a pioneer of the "deconstructed" aesthetic in the sneaker industry and at the forefront of the sustainable footwear movement. In all the cases presented in this section, the circular link with the development of products made through innovative and disruptive craftsmanship becomes a challenging tool for maturing the meaning of consumption and the way we interact with the products we own. Moreover, creating a story around the product gives additional intangible value to the object.

### Reusing/Retailing

The third direction addresses sustainability issues related to bringing second-hand clothing back into the market, creating a circular system. Fashion companies in this category must devise and implement innovative business models that reflect the changing landscape and evolving consumer behaviors. One example of a company engaging consumers in using products as long as possible and keeping them in the market loop is Vestiaire Collective. This online platform, launched in 2009, allows customers to buy and sell secondhand fashion items. Sellers place items on the marketplace and, after validation by Vestiaire's team of curators, the items become available for sale. Vestiaire is exploiting the enabling power of digital technology to recontextualize the concept of new applied to unused clothing items. Providing these products to new customers increases the number of uses, giving a second, third, or even fourth life to existing products. In addition, through the creation of a community the company has created a sense of belonging among those who share values and actively choose to enter a circular system. Filippa K proposes a different approach to this direction, which involves - in its practices - actors within its supply chain such as logistics departments and retail. In 2008, the brand opened its first second-hand store in collaboration with a local entrepreneur, Judit's Second Hand. The initial model operated as a consignment store where customers returned their Filippa K clothes, shoes, and accessories for resell. What characterized this initiative was the fact that the customer maintained ownership of the product and after the product was sold, the customer received 50% of the profit. If not sold, the product was returned to the owner again or donated to a charity. The success of this resale initiative allowed the brand to recognize the program's potential to enable a circular business model. The company's pilot program was scaled up to become the "Preowned" program. This program is now running only in Sweden. Customers return a used garment from the brand to the store, or if the physical location cannot be reached, the customer uses the brand platform. In return, the customer receives a monetary incentive. Garments brought to a physical that are ready for resale are machine or dry-cleaned using environmentally friendly cleaning processes. Users that post garments on the platform earn either cash and receive 60 percent of the resale price, or they can choose to receive 100% as a credit toward the purchase of Filippa K garments from the current season. The cases presented here discuss how the same product creates revenue multiple times by offering new ways to involve stakeholders, both when consumers resell their clothes and when different actors along the stages of the supply chain (logistics, retail, collection/waste management) engage in reintroducing "new" second-hand clothes back into the market.

## Conclusion

From what has been illustrated, the rethinking of waste and its connotation of "new" emerges as a strategic factor that is now leading the transformation of fashion companies towards a sustainable development model. Here are presented

the opportunities that have occurred, for fashion companies, to trigger innovative processes that favor iterative activities to disrupt the linear economy logic of waste and nurture a change in operating models. Such models could inform directions toward a circular paradigm enabled by adopting design-led practices in the European fashion industry. One of the most critical levers the fashion industry can pull to preserve non-renewable resources and eliminate waste is to design it out of the system. The different approaches suggest that to reach this goal, the link between circularity and design-driven innovation in the fashion field is related to a systemic perspective. The one illustrated here represents a system that is now starting to be rolled out at scale, promising to limit the extractive production of virgin raw materials and decrease textile waste. As these approaches mature, companies will need to embed them into the design phase of product development while adopting reducing, repurposing, and reusing processes. The key element linked to this systemic transformation is the reorganization of the supply chain to achieve the goal of eliminating the concept of waste by involving all stakeholders, from designers to consumers. Each company connected to the supply chain must develop company-specific strategies. Directions for further development of the work based on this study are being outlined within the specific framework of the Italian Recovery and Resilience Plan (https://www.mef.gov.it/en/focus/The-National-Recovery-and-Resilience-Plan-NRRP/). The author is involved as a researcher at her institution in SPOKE 2 - Circular and Sustainable Made in Italy. The material presented here provides the initial impetus for the work that is being developed on the investigation of possible directions for the evolution of waste reduction practices towards the complete reintegration of materials into production flows and design-led strategies that impact upstream through the decisions of designers (e.g. choice of materials, garment construction, and finishing) that could implement design practices to plan waste out of the system by intention. Directions for further development of the work based on this study are being outlined within the specific framework of the Recovery and Resilience Plan presented by Italy, in which the author is involved as a researcher at her institution in SPOKE 2 - Circular and Sustainable Made in Italy (https://www.mics.tech/). The material presented here provides one of the initial knowledge inputs for the work that is being developed on the investigation of possible directions for the evolution of waste reduction practices towards the complete reintegration of materials into production flows and design-led strategies that impact upstream through the decisions of designers (e.g. choice of materials, garment construction, and finishing) that could implement design practices to plan waste out of the system by intention.

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C3

This book contains academic papers and posters of the Cumulus Antwerp conference, held in Antwerp on 12-15 April 2023. The Cumulus community, designers, artists, and educators were invited to submit contributions on how culture and creative industry can offer resilience, consolation, and innovation models on human scale, in line with the conference theme 'Connectivity and Creativity in times of Conflict'.

The contributions were double blind reviewed in the tracks

1) Nature positive/Design for transformation,
2) Digital futures/Hybrid reality,
3) Handle with care/Inclusivity, and
4) PhD network.

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