A NEW FASHION DESIGN PRACTICE AS ENABLER FOR A FASHION SYSTEM CHANGE

CHRISTIANE LUIBLE-BAER
University of Arts Linz / Fashion & Technology
christiane.luible-baer@kunstuni-linz.at
Orcid 0000-0002-6648-3266

JOHANNES BRAUMANN
University of Arts Linz / Creative Robotics
johannes.braumann@kunstuni-linz.at
Orcid 0000-0001-9924 2787

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.
Competing Interests: The Author(s) declare(s) no conflict of interest
DOI: https://doi.org/10.36253/fh-3115

Abstract

The term *fashion* has come to stand for particularly questionable profit-driven ecological and social imbalances. A closer look at its concept, however, shows that fashion itself is not the threat but rather contains solutions. To exemplify this, it is necessary to stress the difference between fashion and clothing. Nowadays, the fashion industry mainly promotes a supposed image of fashion. Nevertheless, a new perception of fashion in line with the 10R typology is beginning to emerge, as ultimately, society determines which clothing products become fashion. Clothing items are products realized by a design process. Today, contemporary fashion design moves away from disciplinary thinking. Designers make important material decisions, innovate processes, and have the potential to initiate thought processes in society. Fashion design practice should therefore be understood as an important knowledge culture with diverse mechanisms and principles. The cultural and social dimensions of design knowledge from design practices, as well as a designer's attitude, skills, and value systems, are of central importance to anticipate fashion for sustainable systems. The results of the *artistic-scientific* transdisciplinary research project *Fashion & Robotics* show how fashion design practices become not just fashion design solutions or technological advances, but *catalysts for systemic change in fashion*.

Keywords: *Fashion design practice, Knowledge culture, Circular systems, Redesign, Robotics*

INTRODUCTION

The term *fashion* has come to stand for particularly questionable profit-driven ecological and social imbalances. Complex global production networks and supply chains are highly fragmented, with thousands of players. The true cost is usually not included in the widely traveled textile product. The social conditions of production are far away from the UN sustainability goals. As a result of climate change and changes in ecosystems, the cultivation of textile raw materials is threatening our food chains, and yet global fiber production for textiles and fashion continues to increase (Textile Exchange, 2024). Design has contributed significantly to today's overproduction of goods by creating large quantities of very short-lived products (Shedroff, 2009). It is essential to fundamentally rethink our actions in relation to fashion in order to find a new balance between society's basic needs for clothing and fashion, decent work, and the desire for relative prosperity in line with the boundaries of our planet. The greatest challenge today is to harmonize these seemingly contradictory requirements. Fashion and *the discipline of fashion design are significant and today overlooked actors in the search for answers and solutions.*

THE IMPORTANCE OF SYSTEMIC THINKING FOR PROBLEM CATEGORIZATION

In the past, researchers have dealt with the concept of fashion in order to better understand its dynamics. In doing so, Loschek (2009a) distinct in her systemic thinking between fashion and clothing and between a fashion system and an economic system. Although both systems are structurally interlinked, 'change is not the primary thing about fashion, because change is brought about by the economic concept of the seasonal renewal of clothing […] without creating a fundamentally new image of fashion' (Loschek, 2009a, p. 30). 'Clothing [...] are products that are realized through a design process. Which products are accepted and become fashion is determined solely by society' (Loschek, 2009b, p. 161).

A multitude of negative impacts, currently attributed to fashion, are, strictly speaking, the result of linear business models of the textile and fashion industry, configured for fast pace and growth for short-lived mass-produced products, and are therefore much more related to the system economy. The discipline of fashion design today plays an embellishing role in the industry and is not perceived as an enabler of systemic change. Sustainability departments in fashion companies are increasingly moving from an advisory to a decision-making role (Ecosystex, 2024), however, positions in those departments are not filled by designers.

Looking at society, clothing-related sustainability discussions have now reached a wider audience. A flourishing second-hand fashion sector and a growing number of repair services are examples of how a new image of fashion is emerging in society that is no longer necessarily tied to novel fashion products.

FASHION DESIGN RESEARCH IN THE CONTEXT OF SUSTAINABILITY

PRACTICE-ORIENTED FASHION DESIGN RESEARCH

'It is estimated that the product design and development phase carries approximately 80% or even more of the environmental and social impacts of the product […]' (Tischner & Charter, 2001, p. 120). The design phase includes material choices and influences how long products last, whether they can be repaired, or what happens to the product at the end of life. In terms of clothing, this phase is currently the least researched. Despite a steady increase in academic influence on fashion (cultural studies, fashion studies, media theory, sociology, gender studies, etc.), contemporary debates are preponderated by discussions about the acceptance and social relevance of fashion, postcolonial facets, or technical and mercantile aspects of fashion. There is a lack of critical contributions that analyze fashion projects and related creative processes in terms of sustainability. A crucial part of the fashion design process, namely the act of creation, remains largely unexplored with regards to methods and new strategies that are required in circular or regenerative environmental systems. As Bigolin (2012) states, practice in fashion is mainly defined by its traditional production. New fashion design practices, however, are, as shown by Lidström (2023a) and Bigolin (2022), of fundamental importance for the progress of fashion design in terms of ecological and social balances. Fashion design must develop the knowledge necessary for systemic change, increase the quality of projects in this area, and contribute to deepening the general discourse on the subject. (Mareis 2011a) understands design as a historically contingent knowledge culture with diverse practices, mechanisms, and principles. The term knowledge culture refers to practices of knowledge creation through design and emphasizes the cultural dimension of this knowledge. It is crucial to adopt this perspective in fashion design to perceive this discipline as a changemaker with its own scope for action. It can achieve this by emancipating itself from traditional methods and outdated requirements of linear economic business models. *Fashion design must evolve from a role of 'prettifier' to a serious practice-based design discipline.*

PROJECT-GROUNDED RESEARCH FOR FASHION

Findeli (2022a) emphasizes in the summary of his long-time research that design is not about providing solutions to problems but is a process that moves a complex system from a situation 1 to a situation 2 that is considered *preferred*. In his *project-grounded* research (PGR), he highlights the importance of thinking in terms of projects to exploit the full potential of design. The basis of PGR is the scientific principle of *knowledge production* through action. In his so-called *Bremen model* (Fig. 01), a model of a general design project

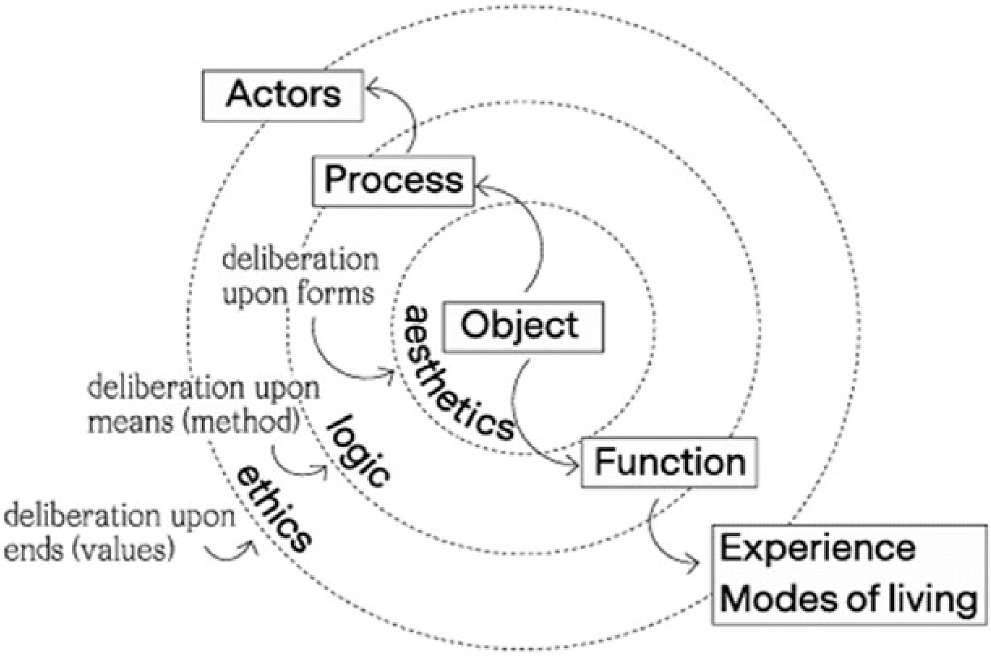

Fig. 01

theory, he points out the historical change from an object centered design (concerned with aesthetics) towards a design that involves all actors (concerned with ethics).

Later, Findeli (2022b) expands the boundaries of the Bremen model from a human-centered to a more complex design conception of the *habitability of the world*. 'Not the product, but the human being and ultimately the habitability of the world must be the goal of design' (Findeli, 2022c). He considers the designer's attitude as well as their skills and value systems to be important elements to design preferred configurations. *'Designers consciously or unconsciously draw on their most vivid cognitive, affective, and conative resources in their work [...]. Looking outwards, but also inwards, is crucial for good projects'* (Findeli 2022d). Fashion design and related research must now move away from a purely object-centered / aesthetic (or market-driven or technical or socio-cultural) character and instead adopt a more systemic and holistic design (research) approach, moving beyond the implementation of technical solutions to problems or behavior recommendations. Existing sustainable (fashion) design approaches range from cradle-to-cradle (McDonough, 2010) to design for circularity (Ellen MacArthur, 2017a) to the sustainability framework of Williams (2019) to others, summarized by Adler et al. (2022a) and are systemic approaches that take the entire product value chain into account. *However, the focus of existing approaches is on the object/product level and thereby important influencing factors for preferred solutions are overlooked.*

INCLUSION OF HUMAN CREATIVITY FOR A TRULY INTER- AND TRANSDISCIPLINARY APPROACH

Preferred configurations cannot be found in disciplinary silos but require an inter- and transdisciplinary approach, including economic, natural science, humanities, and design perspectives. According to Mareis (2011b), design practice has its own original epistemology. Findeli (2015a) suggests design project thinking as fundamental to conveying ethical values as a circular economy (CE) not only needs a systemic approach. He suggests a corrected version of the 3P model (Profit/Planet/ People) or 3E model (Economy/ Environment/Equity) as all 3 poles possess their own logic: the force of economics (to produce more for a larger number), the force of ecology (to respect the environment, to preserve nature, and therefore the living conditions of future generations), and the force of social equity (to fight poverty and distribute justly). 'Only through the inclusion of human creativity and subjective inner aspects of the creator and human being can a real system change be achieved with the three poles: *comprehensive economics, social equity and human creativity*' (Findeli, 2015b). According to Mareis (2011c), *design could be the discipline of synthesis*, as the discipline of the in-between, where knowledge and action are combined in a unique way. Contemporary fashion design has moved away from disciplinary thinking, and multiple factors, including political, social, economic, technical, ecological, or cultural aspects, are taken into account in design projects. *Fashion designers not only make key material decisions and innovate processes, but also have the ability to initiate important thought processes in society through projects*.

TOWARDS A NEW FASHION DESIGN PRACTICE: EXAMPLE DESIGN RESEARCH PROJECT *FASHION & ROBOTICS (FAR)*

In the transdisciplinary artistic-scientific research project FAR, novel fashion design practices and interconnected new processes were developed for possible use in new regenerative and circular fashion systems. Researchers from fashion design, creative robotics, and biochemistry worked together on various design case studies. Economics and humanities perspectives were included in one feedback round with an advisory board.

FAR FRAMEWORK (BREMEN MODEL: LEVEL ETHIC)

The ethical framework in which the design case studies were located could be no less than preserving planetary boundaries and associated required fashion system changes. To protect valuable finite resources, it will be crucial in the future to invent *regenerative and circular frameworks*, where goods are sourced locally and returned to the system again and again after one use cycle. As production phases have the greatest negative impact (Roos et al. 2016), the aim should be to keep products in good condition for as long as possible during the use and reuse phases (Ellen MacArthur, 2017b). Reike et al. (2018a) analyzed scientific publications for retention options (RO) in CE and combined the most common views in their 10R typology: refuse (R0), reduce (R1), resell-reuse (R2), repair (R3), refurbish (R4), remanufacture (R5), repurpose (R6), recycle (R7), recover energy (R8), and remain (9). From a manufacturing perspective, long loops (R7-9) mean that components and products lose their original function and value. Medium loops (R4-R6) exist when parts are retained and less value is lost. In short loops (R0-R3), products remain close to their most valuable state and function, so that the greatest value is preserved. Few of the ROs are regularly applied in fashion today. Companies offer repair options, and clothes are collected or bought back from textile sorters to serve companies 'pre-loved / pre-owned' markets. However, *ROs are not considered as fields for design today, although design practices have great potential to impact all 10 ROs for fashion*.

With regards to human actors involved, labor-intensive production steps for the manufacturing of clothing are currently carried out with the cheapest labor force worldwide. The production of clothing has ceased to be a craft and has instead become a simple serial assembly line labor process, in which the seamstress is often exploited and the resulting garments are disposable products for the wearer. Any relationship and appreciation between human actors involved has been lost. In a circular fashion system, the 'wearer' is the raw material supplier at the same time and the system only works with trustful relations. In regenerative systems, non-hierarchical relationships and a valuable co-existence with nature are central. New local productions, not only reduce GHG emissions, but also allow to re-establish a connection to the product when locally sourced materials, for example secondary raw materials or new biomaterials, are applied on-site for either producing, remanufacturing, or repairing textiles. The idea of urban production, moving production back into urban areas, into the immediate proximity of both the user and the producer, creates a new sensibility for production processes. *Fashion design for local (re)manufacturing must include the conceptualization of new relationships between stakeholders so that products are valued, used, returned, and either transformed into new goods or disposed of correctly*. Through the definition of the ethical framework, it quickly became clear where design projects were needed to advance fashion practices in terms of sustainability. This approach enabled the focus of the case studies to be ultimately on fashion and its current challenges, rather than on a proof of concept for a technology or a specific consumer target group.

FAR PROCESSES (BREMEN MODEL: LEVEL LOGIC)

In future regenerative and circular fashion frameworks, the need for novel methods, processes and skills arises from the inherent functioning of the new systems. Designers need on the one hand new knowledge to be able to make low-impact or renewable-oriented design decisions, what includes expertise about material streams (Adler et al., 2022b). On the other hand, Designers need extended know-how and skills about the correct handling of used clothes and novel materials, as they have not learned to think fashion for multiple use cycles, neither to work with volatile secondary raw materials (Lidström, 2023b) or grown biomaterials, nor to think fashion as redesign or for sharing services. Important new skills include on the one hand the revival of unlearned processes and crafts (mending, repair, bespoke tailoring techniques, weaving, embroidery, etc.) and on the other hand new technologies that have not yet played a role in fashion (robotics, digital techniques, AI, blockchain, 3D biomaterials, etc.). A design-based combination of traditional fashion techniques with new technologies has particularly great potential to reduce the impact of (re)manufacturing and to open up new tracks, as we can see within the practical examples in 4.2.1. and 4.2.2.

From an economic/technological but also societal point of view, it is crucial that the production of clothing becomes, to some extent, independent of simple manual lowest-wage labor. Local (and digital) production processes need to be invented with a high degree of individualization at a reasonable price so that the new *(digital) tailor* earns a living wage and clothing remains affordable for the wearer. In technical and economic-oriented research, automation processes are still being pushed for new garments, duplicating existing manual processes (Fengming et al., 2024). This will remain a difficult undertaking because of the complexity of garments. It is easier to automate individual small process steps on existing garments for redesign, repair, or remanufacturing. This approach has, however, not yet been pursued and is the field where the use cases of this research project started. During the process design, it was important to weigh up from case to case which automation made sense for the project to find an ideal skillful division of labor between robots and humans to avoid the degree of automation led by a proof of concept from a technological point of view. Finally, various 3D processes and 3D materials for several ROs were developed.

NEW DIGITAL 3D PROCESSES FOR REPAIR (R3), REFURBISH (R4) AND REMANUFACTURE (R5)

Our bodies are complex three-dimensional forms. To be able to dress them with 2D textiles, elaborate pattern making and draping techniques were developed and refined over centuries. When designing with worn and/or damaged 3D garments in circular systems, it would be absurd from an environmental point of view to first dismantle 3D garments into 2D surfaces to be able to apply traditional 2D pattern-making and sewing processes. New 3D processes hence are needed to keep the products at their highest value. To this end, the ROs Refurbish and Remanufacture were first analyzed in more detail, and potential applications for use cases were investigated:

- Refurbish (R4) is used when the overall structure remains intact while components are replaced or repaired, resulting in an overall improvement of the product. Remanufacture (R5) is when the entire structure is dismantled, inspected, cleaned, and, if necessary, replaced or repaired in an industrial process (Reike et al., 2018b).

Lidström (2023c) dealt extensively with redesign as a method of remanufacturing and shows that developing something new out of an existing, discarded, or still loved item of clothing is an exciting new design task. Both ROs are still often not considered, taken seriously, or promoted today due to quality and labor (and cost) concerns. During the first months of the project, robotic processes for 3D garments have been extensively researched. The robotic arm acted as interfaces between an analogue and digital world, which enabled the designers of the research team to create their own 3D processes and transfer their expertise and material knowledge to the machine. For example, hand movements were tracked with a Vicon motion tracking system. In a digital workflow, this motion developed digital surfaces, geometries, and textures by capturing and analyzing hand movements in different body practices and full body tracking. These digital results were transferred to robotic motion to create, interact, or intervene with different surfaces and materials. Also, 3D printing technol-

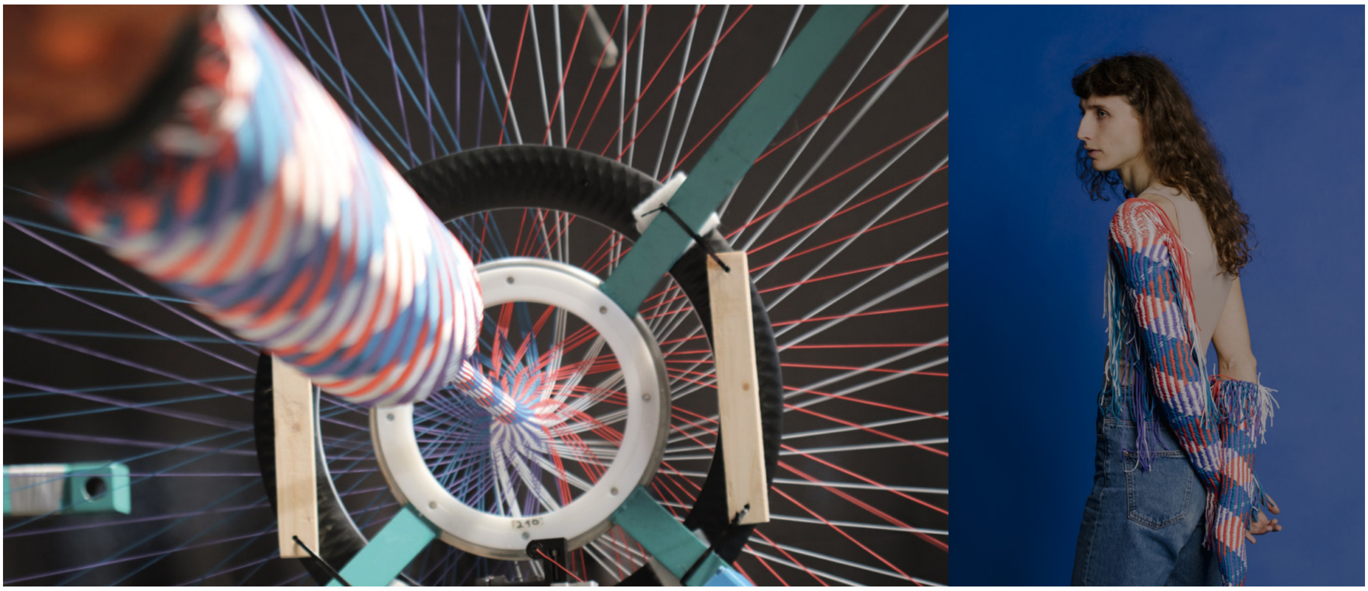

Fig. 02

ogy was explored with a 6-axis industrial robot to manipulate fabrics. Experiments included the creation of 3D surfaces, printed trims applied during a remanufacturing process. At the end of this first research phase, it was possible to design and implement precise 3D manipulations (cutting, welding, printing, etc.) on 3D clothing on a mannequin and its digital replication, by hand and digitally. In a follow-up project, these 3D processes will be implemented in a local micro-factory. Next, the RO Repair was regarded more in detail.

- Repair (R3) is used to extend the lifetime of the product, making it as good as new, recreating its original function after minor defects or replacing broken parts. Repairing can be done by different actors and with or without change of ownership (Reike et al., 2018c).

Repair as a digital redesign service was identified within the project as a new field for fashion design where the design is developed globally and applied locally. The research team implemented a design-led framework for collaborative garment repair that combines visual programming with parametric design, collaborative robotics, and electrospinning. The team researched a process in which nanofibers made from recycled polymers, obtained from garments that can no longer be recycled, were applied to repairable clothing made from the same polymer using high voltage. This automation considerably reduces repair costs compared to manual work. This application, in turn, leads from 3D repair to 3D redesign, in that the repair could be invisible or designed. This allows clothing to be worn for longer and creates new fields of service-based fashion design. A more detailed description of this use case is published in Gollob et al. (2025).

NEW DIGITAL 3D PROCESSES FOR REPAIR (R3), REFURBISH (R4) AND REMANUFACTURE (R5)

Our bodies are complex three-dimensional forms. To be able to dress them with 2D textiles, elaborate pattern making and draping techniques were developed and refined over centuries. When designing with worn and/or damaged 3D garments in circular systems, it would be absurd from an environmental point of view to first dismantle 3D garments into 2D surfaces to be able to apply traditional 2D pattern-making and sewing processes. New 3D processes hence are needed to keep the products at their highest value. To this end, the ROs

Refurbish and Remanufacture were first analyzed in more detail, and potential applications for use cases were investigated:

- Refurbish (R4) is used when the overall structure remains intact while components are replaced or repaired, resulting in an overall improvement of the product. Remanufacture (R5) is when the entire structure is dismantled, inspected, cleaned, and, if necessary, replaced or repaired in an industrial process (Reike et al., 2018b).

Lidström (2023c) dealt extensively with redesign as a method of remanufacturing and shows that developing something new out of an existing, discarded, or still loved item of clothing is an exciting new design task. Both ROs are still often not considered, taken seriously, or promoted today due to quality and labor (and cost) concerns. During the first months of the project, robotic processes for 3D garments have been extensively researched. The robotic arm acted as interfaces between an analogue and digital world, which enabled the designers of the research team to create their own 3D processes and transfer their expertise and material knowledge to the machine. For example, hand movements were tracked with a Vicon motion tracking system. In a digital workflow, this motion developed digital surfaces, geometries, and textures by capturing and analyzing hand movements in different body practices and full body tracking. These digital results were transferred to robotic motion to create, interact, or intervene with different surfaces and materials. Also, 3D printing technology was explored with a 6-axis industrial robot to manipulate fabrics. Experiments included the creation of 3D surfaces, printed trims applied during a remanufacturing process. At the end of this first research phase, it was possible to design and implement precise 3D manipulations (cutting, welding, printing, etc.) on 3D clothing on a mannequin and its digital replication, by hand and digitally. In a follow-up project, these 3D processes will be implemented in a local micro-factory. Next, the RO Repair was regarded more in detail.

- Repair (R3) is used to extend the lifetime of the product, making it as good as new, recreating its original function after minor defects or replacing broken parts. Repairing can be done by different actors and with or without change of ownership (Reike et al., 2018c).

Repair as a digital redesign service was identified within the project as a new field for fashion design where the design is developed globally and applied locally. The research team implemented a design-led framework for collaborative garment repair that combines visual programming with parametric design, collaborative robotics, and electrospinning. The team researched a process in which nanofibers made from recycled polymers, obtained from garments that can no longer be recycled, were applied to repairable clothing made from the same polymer using high voltage. This automation considerably reduces repair costs compared to manual work. This application, in turn, leads from 3D repair to 3D redesign, in that the repair could be invisible or designed. This allows clothing to be worn for longer and creates new fields of service-based fashion design. A more detailed description of this use case is published in Gollob et al. (2025).

NEW 3D MATERIAL FOR REDUCE (R1)

In fashion the RO Reduce (R1) is primarily understood as 'less material'. Zero waste 2D pattern making methods (Rissanen & McQuillan, 2016) today built on this. Also 'buy less' campaigns act in the same direction.

- Reduce (R1) refers to using less material per unit of production, or to a dematerialization as an explicit step in product design (Reike et al., 2018d).

Numerous individual production steps are necessary in clothing manufacturing to bring the 2D textile to the 3D body: pattern making, cutting, sewing, etc. Some of these steps could be eliminated if garments were developed directly three-dimensionally. With the use case 'Grow Whole Garments', a 3D process in which entire garments made of bacterial cellulose grow seamlessly in textile membranes, was developed (fig. 4). Komagataeibacter xylinus is an aerobic acetic acid bacterium that uses oxygen to metabolize sugar into cellulose and can be seen as fabric-producing bacteria and future alternative to the cotton plant. Since clothing has to fulfill functions that are not evenly distributed throughout the body, experiments were made to observe and locally influenced the cellulose growth by a robot to grow different material properties in a fluid transition. More detailed information about this use case can be found in Eichinger et al. (2022). For now, the pieces are still small, flabby parts from basic science experiments. However, the laboratory grown bacteria-based shirts and trousers are the first visionary step on the way to a future application.

Fig. 03

A dematerialization in product manufacturing could also mean less energy. Within the MA design project braided textile (Fig. 03) the garment is created by a radial braiding machine, in reference to braid social relationships. The process needs 20 seconds in comparison to up to 3 hours in 3D knitting.

NEW ARTEFACTS (BREMEN MODEL: LEVEL AESTHETIC)

In fashion, aesthetics are influenced by applied production processes, such as sewing or knitting, and typical textile materials. The artifacts created with the newly developed 3D processes and 3D materials are characterized *by an inherent new aesthetic that ultimately expresses the attitude of a designer and conveys values*: Traces of use overlaid by a novel-looking material or prints, materials that wrap around body parts like a second skin or lines that circulate independently of a garment's construction.

The applications developed are ready to be also transferred into a service-based fashion design system, where redesign concepts are created globally but produced locally in line with sustainability requirements. According to Reike et al. (2018e), Reduce (R1) also means the shared use of products or services. Future fashion design projects that conceptualize relationships and connections and create a *new type of immaterial, service-based fashion or a serial or collaborative use system ultimately* change the fashion image away from the economic concept of seasonal renewal of clothing. Further artistic experiments of the projects, realized during two residencies, even went a step further and focused on the interaction of robots, textiles, and space and ultimately explored the question of who is the actor in new more-than-human design processes, who is the helper and co-creator, and in doing so questioned what is actually a design object (Tepe et al., 2023).

CONCLUSION

Fashion design has contributed significantly to the overproduction and exploitation of resources and people. Fashion design, seen as a contemporary design discipline and emancipated from outdated economic concepts, can today contribute significantly to the functioning of circular or regenerative systems. Fashion designers must act in an informed manner and collaborate with inter- and transdis-

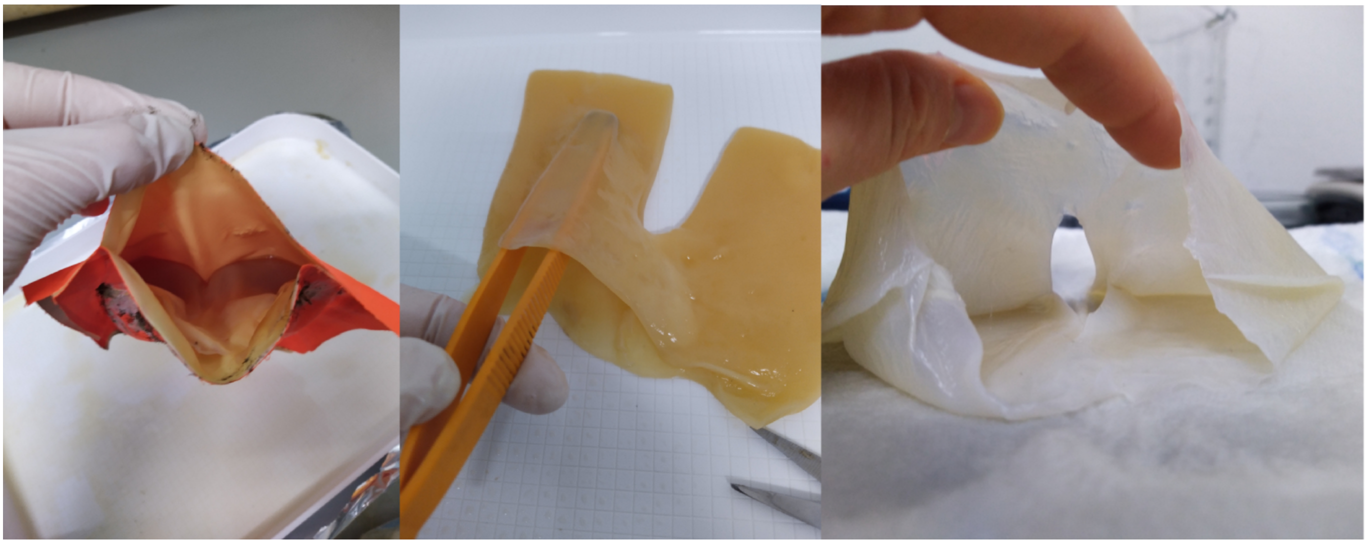

Fig. 04

ciplinary teams to develop solutions that strictly pursue the preservation of the habitable world. On the basis of the design research project Fashion & Robotics it was described how new preferred situations and systems can be pushed forward and finally established, which are not technical improvement or design artefacts, but catalysts for a system change. The practical examples show how opportunities for a new design practice are opened up and how new local processes can be developed, and finally how new attitudes are expressed with a new aesthetic.

ACKNOWLEDGMENTS

The project Fashion & Robotics has been funded by the *FWF of the Austrian Science Fund*. We thank our team of researchers at the University of Arts Linz, who largely contributed to this project: *Amir Bastan, Emanuel Gollob, Miriam Eichinger, Julio Escudero, Katharina Halusa, Viktor Weichselbaumer and Michael Wieser*. We also thank our project cooperation partner of the JKU Linz, *Werner Baumgartner*, head of the Institute of biomedical mechatronics and his team member *Agnes Weth*. The machine braiding of the Master project braided textiles from Katharina Halusa was financed by the FAR project.

CAPTIONS

[Fig. 01] Findeli & Bousbaci, 2005, *Bremen model in the eclipse of the objec*t.

[Fig. 02] Project *Fashion & Robotics*. Collaborative 3D repair with an electrospinning process.

[Fig. 03] Katharina Halusa. Project *braided textiles*. The garment is created by a radial braiding machine, in reference to braid social relationships. The process needs 20 seconds in comparison to up to 3 hours in 3D knitting. Photo credits: Leon De Haas (left), Lea Sonderegger (right).

[Fig. 04] Project *Fashion & Robotics*. Seamlessly grown 3D pants.

REFERENCES

Adler et al. (2022). Adler, F., Schmidt, L., Weber Marin, A., Willi, B., Sustainable Design Decisions for Circularity – a Challenge. Paper presented at the Global Fashion Conference Berlin 2022, ISBN: 978-989-54263-3-1

Braumann, J., Gollob, E., Singline, K. (2022). Visual Programming for Interactive Robotic Fabrication Processes. Proceedings of the 40th Conference on Education and Research in Computer Aided Architectural Design. DOI: 10.52842/conf.ecaade.2022.2.427

Bigolin, R. (2012). Undo Fashion: Loose Garment Practice, School of Architecture + Design, College of Design and Social Context, RMIT University, doctoral thesis, 2012

Bigolin et al. (2020). Bigolin, R., Blomgren, E., Lidström, A., Malmgren de Oliveira, S., Thornquist, C., Material Inventories and Garment Ontologies: Advancing Upcycling Methods, paper in Fashion Practice in Sustainability, 2022

Eichinger, M., Gollob, E., Escudero, J., Weichselbaumer, V., Wieser, M., Katharina, H., Weth, A., Baumgartner, W., Braumann, J., Luible, C. (2022). Growing Whole Bacterial Cellulose Garments with Membranes and Industrial Robotics. GFC Global Fashion Conference 2022. DOI: 10.57649GFC978-989-54263

Ellen MacArthus (2017). Ellen MacArthur Foundation. A new textiles economy: Redesigning fashion's future. www.ellenmacarthurfoundation.org, last accessed November 12th, 2024

Fengming, L., Dang, H., Tianyu, F., Tianyu, F., Jiexin, S., Wenbin, H., (2024). Research on robot sewing method based on process modeling, International Journal of Intelligent Robotics and Applications, 8(2):1-21.

Findeli, A., & Bousbaci, R., (2005). L'Eclipse de L'Objet dans les Théories du Projet en Design (The Eclipse of the Object in Design Project Theories), The Design Journal 8(3): 35-49

Findeli, A., (2022). « Adieu au design ? », in La vie. Modes d'emploi et stratégies de permanence, Collection Actes, Toulouse, Éditions CAMS/O, p. 59-88

Gollob, E., Bastan, A., Braumann, J., Luible, C. (2025). Envisioning Individualized Fashion Remanufacturing: Empowering Non-Experts through Visualization-Enhanced Human-Multi-Robot Interaction, HRI '25: ACM/IEEE International Conference on Human-Robot Interaction Melbourne, Australia

Gollob, E., Mayer, M., Braumann, J. (2021). Using Robotics and A.I. to Physically Explore a Space of Aesthetic Possibilities: Defining a Physical Aesthetic Experience by the Targeted EEG Feedback of the Perceiver. In Proceedigs of the Fifteenth International Conference on Tangible, Embedded, and Embodied Interaction (TEI '21). Association for Computing Machinery, New York, NY, USA, Article 28, 1–8. DOI: https://doi.org/10.1145/3430524.3440647

Lidström, A., (2023). Redesign Foundations, University of Borås, Faculty of Textiles, Engineering and Business, doctoral thesis, monograph

Loschek, I., (2009). When Clothes Become Fashion. Design and Innovation Systems, Oxford-New York, ISBN 978 184788 366 7

Mareis, C., (2011). Design als Wissenskultur, Interferenzen zwischen Design und Wissensdiskursen seit 1960, transcript publishing, ISBN: 978-3-8376-1588-3

McDonough, W. & Braungart, M., (2010). Cradle to cradle: Remaking the way we make things. North point press.

Reike et al. (2028). Reike, D.., Vermeulen, W. J. V., Witjes, S., The Circular Economy: New or Refurbished as CE 3.0? — Exploring Controversies in the Conceptualization of the Circular Economy through a Focus on History and Resource Value Retention Options, Resources, Conservation and Recycling, Sustainable Resource Management and the Circular Economy, https://doi.org/10.1016/j.resconrec.2017.08.027.

Rissanen, T., & McQuillan, (2016). Zero Waste Fashion Design, Bloomsbury Publishing, ISBN: 9781472581983

Roos et al. (2016), Roos, S., Zamani, B., Sandin, G., Peters, G., Svanström, M., A life cycle assessment (LCA)-based approach to guiding an industry sector towards sustainability: the case of the Swedish apparel sector, Journal of Cleaner Production, Volume 133, p. 691-700

Shedroff, N., (2009) Shedroff, N., Design is the Problem, Brooklyn, Rosenfeld.

Tepe, J., Gollob, E., Escudero, J., Bastani, A. (2023). Intra-Acting Body and Textile Expressions Becoming with Digital Movement Translation: Exploring relational expressions of the body and textiles using a human-robot-textile installation. In Extended Abstracts of the 2023 CHI Conference on Human Factors in Computing Systems (CHI EA '23). Association for Computing Machinery, New York, NY, USA, Article 416, 1-11.

Textile Exchange, (2024) Textile Exchange materials Market Report 2024, https://textileexchange.org/knowledge-center/reports/materials-market-report-2024/, last accessed November 12th, 2024

Tischner, U., & Charter, M., (2001). Sustainable Product Design in Sustainable Solutions, Developing Products and Services for the Future, Sheffield: Greenleaf, p 118-138, e-book ISBN: 9781351282482, pictures

Williams, D., (2019). Fashion Design for Sustainability: A framework for participatory practice, Lens Conference, Milan.