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Opening up New Textile Futures through Collaborative Rethinking and Remaking

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Editors:
Nithikul Nimkulrat
Ulla Ræbild
Anna Piper

CUMULUS THINK TANK
Publication No 3 of Cumulus International Association of Universities and Colleges in Art, Design and Media

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Paola Bertola graduated in Architecture, Ph.D. in Industrial Design and Multimedia Communication at Politecnico di Milano (Polimi). Previously a scholar researcher at the IIT Chicago, Paola is now Full Professor at Polimi, where she teaches Design Processes and Methods. She is also the coordinator of the Ph.D. Program in Design and a deputy for the School of Design's international programs with northern American countries (e.g., FIT New York and Philadelphia University). She is a co-founder of the research collective "Fashion in Process". She is expert in creative processes and design management within culture intensive industries, with a specific focus on fashion. She has authored more than 80 publications including books, essays, articles, and exhibition catalogues. In 2011, she was awarded the ADI Compasso d'Oro Prize for Research.

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Vandana Bhandari is a Professor at the National Institute of Fashion Technology (NIFT), India, and is the Institute's former Dean of Academics. Extensively published in journals and magazines, Dr. Bhandari has also authored and compiled books on Fashion and Textiles. Her work includes *Celebrating Dreams: Weddings in India* (1998); *Textiles and Crafts of India: Arunachal Pradesh, Assam and Manipur* (1998); the NIFT Millennium Document titled *Evolving Trends in Fashion* (2000); *Costume, Textiles and Jewellery of India: Traditions in Rajasthan* (2005); and *Jewelled Textiles: Gold and Silver embellished Cloth of India* (2015). Along with teaching and research, Dr. Bhandari has been involved in the development of curricula, professional design projects for Industry, and craft-based projects, such as SGSY and Languishing Crafts of India. Currently, she is Project Coordinator of a national project titled "USTTAD."

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Carole Collet is a Professor in Design for Sustainable Futures at Central Saint Martins, University of the Arts London where she has recently been appointed CSM-LVMH Director of Sustainable Innovation to grow creative-led sustainable intelligence across the partnership. She is also Director of the Design & Living Systems Lab, a research initiative that explores the interface of biological sciences and design to propose new sustainable models of biofabrication.

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Delia Dumitrescu is a Professor in Textile Design at The Swedish School of Textiles. With a background in architecture and textile design, her research focuses on the development of cross-disciplinary design methods for smart materials and surfaces. Using practice-based methodology, her research explores how textile design methodology can be translated to the related design fields, e.g., product design, interiors, and architecture. Central notions of her research are patterns and transformability as a method to design interactive textile surfaces for body and space. Delia teaches courses in form and material, research methodology, and supervises at the graduate level.

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Icaro Ibanez-Arricivita is a fashion designer and academic. His studies and industry work have expanded to Barcelona, Buenos Aires, Antwerp, Brussels, Berlin, and Paris. His work has been showcased in prestigious publications such as British Vogue. Since 2015, he has relocated to Australia to work as a practitioner and a design lecturer at Queensland University of Technology in Brisbane. Despite being "design oriented," Icaro embraces practical and theoretical research as a way to enrich both his design and teaching methodologies. Some of his research interests are, but not limited to, cross-cultural collaboration with fashion as a language, industry & community engagement.

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Marjan Kooroshnia is a textile designer and Senior Lecturer at The Swedish School of Textiles, University of Borås. Much of her time as a master's student in Textile Design was spent at the printing lab, learning about thermochromic inks behavior when printed on textiles and designing dynamic surface patterns. In her Ph.D. research, Marjan explored the design properties and potentials of leuco dye-based thermochromic inks when printed on textiles, in order to expand the range of color-changing effects offered by thermochromic inks on textiles and to facilitate communication regarding the understanding of, and design with, thermochromic inks. Marjan teaches the basic textile printing courses and color theory; she also supervises at undergraduate and graduate levels.

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Kristi Kuusk is a designer-researcher working on the direction of crafting sustainable smart textile services. She is looking for new ways for textiles and fashion to be more sustainable through the implementation of technology. In 2016, Kristi defended her Ph.D. project (part of CRISP) on craft and sustainability qualities in smart textile services at Eindhoven University of Technology. Her related collaborative design work has been presented in various international exhibitions, shows, and conferences. Since 2016, she has worked as Associate Professor (0.5) in Textile Futures at Estonian Academy of Arts.

Pirjo Kääriäinen

Pirjo Kääriäinen is a Finnish textile specialist and practitioner, currently developing interdisciplinary collaboration between design and science at Aalto University, where she worked as Professor in Textile Art and Design and Head of Textile and Fashion degree programs (2008–2014). Pirjo has actively developed higher education studies in Finland in the field of textiles and design towards new frontiers including materials research, wearable electronics, and novel production methods. Before her career in academia, she worked 18 years in the Scandinavian textile industry and also gained experience as an entrepreneur and consultant.

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Hanna Landin is a Senior Lecturer in Interaction Design at The Swedish School of Textiles and has been Program Leader of M.A. in Fashion and Textile Design since 2011. She is Chair of the Board of Artistic Research and Education at the University of Borås, Sweden. Hanna teaches design methods and defended her Ph.D. thesis on anxiety and trust on form and aesthetics within interaction design at Chalmers University of Technology in 2009. She is interested in how people are led to interact with things and how their perception of themselves, others, and the world is affected by such interaction.

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Kirsi Niinimäki is Associate Professor in Design, especially Fashion Research, at Aalto University School of Arts, Design and Architecture. Her research focuses on a holistic understanding of sustainable fashion and textile fields and connections between design, manufacturing, business models, and consumption. Currently, she is building new knowledge for design strategies in the circular economy and systems thinking. She runs the Fashion/Textile Futures research group. Kirsi has gained significant expertise in the textile industry as an in-house textile designer and further as entrepreneur in Designstudio TRIARTE. She has been working internationally as a designer, teacher, and researcher.

Nithikul Nimkulrat

is a practitioner-researcher who intertwines research with textile practice, focusing on experiential knowledge in craft processes in the context of design research. Nithikul has worked at Aalto University (FI, 2004–2010), where she earned a doctorate in 2009, and Loughborough University (UK, 2011–2013), and is currently Professor and Head of Department of Textile Design at Estonian Academy of Arts (EE, 2013–present). Nithikul is an editor of *Crafting Textiles in the Digital Age* (Bloomsbury, 2016). She is an elected council member of Design Research Society (DRS) and Convener of DRS Special Interest Group on Experiential Knowledge.

Katya Oicherman

Katya Oicherman is a textile lecturer, researcher, and artist, currently living in the United States. She studied Textile Design and Art in Israel and the UK, and Modern Jewish Culture in Leeds, UK. Her practice-based Ph.D. dealing with Jewish ceremonial textiles was completed at Goldsmiths College, London. She is interested in craft and identity politics, more recently she explores the link of textiles and architecture in Islamic art. She worked in the textile industry, and produced conceptual textile work and mixed-media installations. Katya taught textile practice and history of craft at Shenkar College of Engineering, Design and Art in Israel, where she was also Head of the Department of Textile Design.

Thomai Papathanasiou

Thomai Papathanasiou studied Accounting and Finance at Athens University of Economics and Business. She obtained her Master of Science in International Fashion Marketing from Heriot-Watt University in Edinburgh, Scotland. She has also taken classes in Fashion Illustration and Fashion Styling at Istituto di Moda Burgo and Fashion Journalism at London College of Fashion. Since 2013, she has been a full-time Professor of Textile and Fashion Design at University of Monterrey, teaching Fashion Marketing, Visual Merchandising, Fashion Strategy, Fashion Buying, and Merchandising and supervising thesis projects. In Spring 2017, she was a guest lecturer at Lahti University of Applied Sciences in Finland.

Laura Pavilonytė-Ežerskienė

Laura Pavilonytė-Ežerskienė, as a member of the artists group “Baltos Kandys” [White Moths] (1998–present) and as an independent artist, participates actively in the organization of exhibitions, symposiums, and educational initiatives, helping to create the image of the innovative and interdisciplinary Lithuanian textile scene for worldwide audiences. Laura has gained an Art Licentiate Diploma from Vilnius Academy of Arts in 2009 with her thesis titled *Textile Art School in Lithuania: Traditions and Transformations (1940–2005)*. She is currently Associate Professor and Head of Department of Textile Art and Design at Vilnius Academy of Arts (2011–present) and a member of Lithuanian Artists Association (2002–present).

Alice Payne

Alice Payne is a designer and Senior Lecturer in Fashion in the School of Design, Queensland University of Technology (QUT). Her research interests include the fashion design process, the Australian mass-market fashion industry, and the problem of design for sustainability within the fashion context. Alice is an award-winning designer and has exhibited in Australia and overseas.

Lydia Pearson

Lydia Pearson in 1989 after a decade of independent design, founded the eponymous Easton Pearson label. Over 25 years, it became an international brand, known for artisanal, original, and highly detailed clothing, sold in prestigious stores including Browns London, Bergdorf Goodman NYC, and Lane Crawford Hong Kong. When the label closed in 2016, the Easton Pearson Archive of over 3,000 garments was donated to the Museum of Brisbane to be turned into a teaching archive. Lydia is now a lecturer in Fashion at Queensland University of Technology in Brisbane, and consultant curator at Museum of Brisbane, working on innovative ways to teach modern collaborative artisanal practice.

Alessandra Perlatti

Alessandra Perlatti is a fashion designer, specializing in Marketing and Fashion Business with a postgraduate degree in Fashion Retail Management. She worked as a designer for several brands in Brazil for more than 10 years. As an educator, Alessandra has worked at Istituto Europeo di Design (IED) in São Paulo, Brazil, and CEDIM in Monterrey, Mexico, where she directs the Fashion Program. Since 2015, she has been Head of Textiles and Fashion Design Department at University of Monterrey in Mexico. She is also Brazil's and Mexico's Deputy Director for Strategy and Development of the Arts of Fashion Foundation.

Anna Piper

Anna Piper is a postgraduate researcher, textile designer, and lecturer. She is currently undertaking practice-led Ph.D. research into 3D and composite garment weaving, integrating hand and digital weaving technologies, at Nottingham Trent University (NTU). Her research and design interests include traditional hand weaving practices, digital weaving techniques, sustainable and zero-waste design, functional textiles, embodied knowledge, and design innovation. Anna is a lecturer at NTU teaching textile design, specializing in weave and CAD. She is an associate lecturer at Sheffield Hallam University teaching contextual studies for fashion design at undergraduate level. In addition, Anna has collaborated with NTU's Advanced Textiles Research Group and has experience of delivering smart and e-textiles workshops

Ulla Ræbild

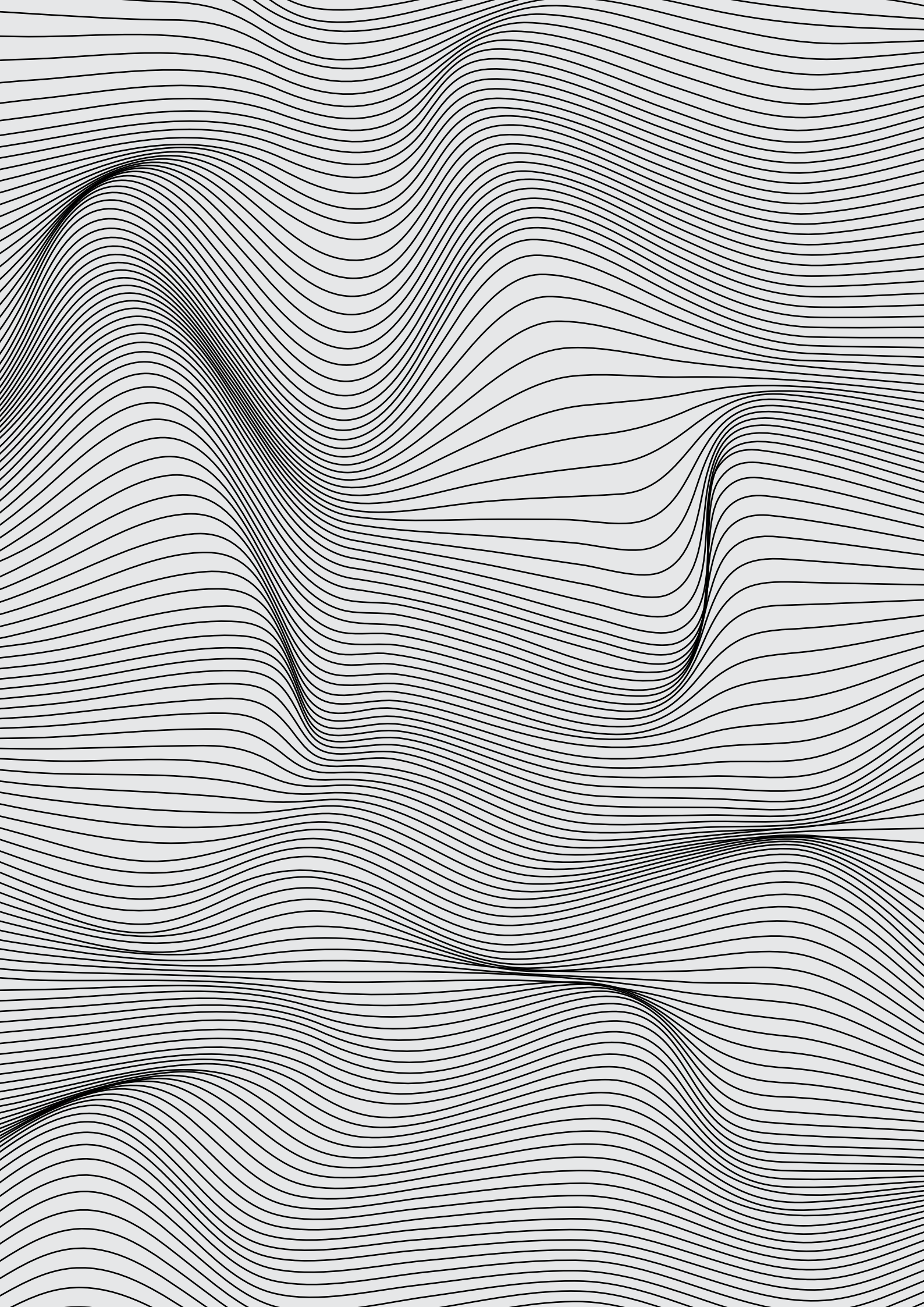
Ulla Ræbild is Assistant Professor and Head of MA Program PLANET – design for sustainable development at Design School Kolding. She has a background in fashion design and began working with fashion educational development in 1999. She earned a Ph.D. degree in 2015 with the thesis *Uncovering Fashion Design Method Practice—The Influence of Body, Time and Collection*. Her research interests lie at the intersection between fashion design practice and methodology, sustainability, and design pedagogy. Ulla has been a practical and theoretical supervisor at B.A. and M.A. levels for the past 10 years.

Maarit Salolainen

Maarit Salolainen is Adjunct Professor for 3D Surface Design and Textile Design at Aalto University. She is an experienced international textile design professional with a passion for bringing textile knowledge to multidisciplinary platforms. Maarit has developed higher education in the field of textile and surface design, focusing on renewing textile studio pedagogy and linking textile studies to fashion education. She has expanded experimental pedagogy for multidisciplinary courses exposing engineering students to design processes. In addition to her academic work, she works globally as a creative director advising textile manufacturers and interior textile editors.

Riikka Talman

Riikka Talman is a Ph.D. student in Textile Design at Smart Textiles Design Lab at The Swedish School of Textiles in Borås, Sweden. With a background in textile design, she has an interest in how different materials can be combined with textile structures to create expressions that evolve over time. Her research focuses on how inherent changeable qualities could be embedded into textiles to create materials that change irreversibly over different time spans, and how these changes could look like. Riikka teaches form and material, and weaving courses; she also supervises at undergraduate level.



Preface

Soft Landing is the first publication of the Fashion and Textile Working Group of the Cumulus International Association of Universities and Colleges in Art, Design and Media and the third volume of the Cumulus Think Tank publication series. The Fashion and Textile Working Group has been established and led by Estonian Academy of Arts (EAA) since 2010. *Soft Landing* was initiated in 2015, by EAA's Department of Fashion Design—Prof. Vilve Unt and Assoc. Prof. Marit Ahven—and International Affairs Office—Sandra Mell, with the purpose of providing the members of the Fashion and Textile Working Group and Cumulus Association in general with a debate on the future of fashion and textile education and research.

This publication is a compilation of essays written by experienced educators and researchers from member institutions of the Cumulus Association spanning 11 countries and 4 continents. The chapters address critical questions for fashion and textiles through the reflection and discussion of student projects, curricula, and research. They suggest various approaches that fashion and textile education may take to develop the fields for a better future. I hope this publication will be useful for readers who are interested in the future trajectory and evolution of fashion and textile education and research.

My grateful thanks go to all authors contributing to this publication for sharing their views on fashion and textile education and to my co-editors, Ulla Ræbild (Design School Kolding, Denmark) and Anna Piper (Nottingham Trent University, UK), for smooth co-operation during the preparation of the manuscript. Without their assistance, this book could never have been completed.

I would also like to express my gratitude to Eija Salmi, Cumulus Secretary General, and Justyna Molik, Cumulus Coordinator, for their endless patience and generous support throughout the process of preparing this publication; not least to Prof. Signe Kivi, EAA's former rector, who championed the publication in the Cumulus Executive Board. My sincere gratitude to the Cumulus President and Executive Board for giving the Fashion and Textile Working Group the opportunity and financial support to make this book come into being.

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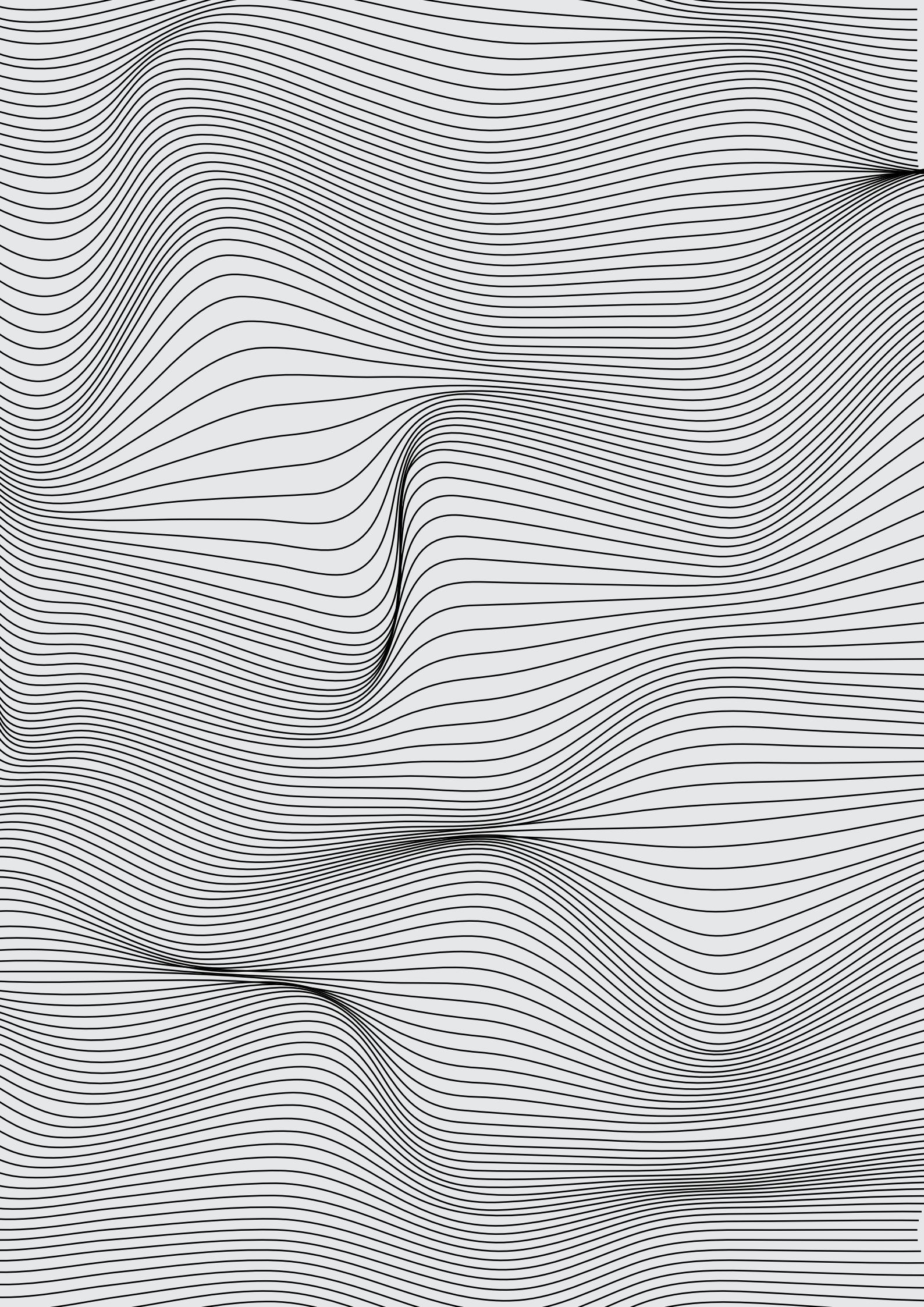
Leader, Fashion and Textile Working Group, Cumulus Association



6 Opening up New Textile Futures Through Collaborative Rethinking and Remaking

Kirsi Niinimäki, Maarit Salolainen, and Pirjo Kääriäinen

Introduction

Textile design is a field where art and technology meet. In the broad field of design, textile design is regarded as a special discipline because it requires not only creative skills, but also a deep understanding of production technology. Textile designers use and sometimes even create materials from a molecular level in collaboration with material scientists (e.g., Kääriäinen, Niinimäki, & Lindberg, 2017; Aalto University School of Chemical Engineering, 2015; Smirnova, Ilén, Sixta, Hummel, & Niinimäki, 2016). The textile and clothing industry (including technical textiles) is one of the largest industrial sectors globally, with a huge economic and environmental impact. Textiles are designed for many different purposes, and accordingly textile designers have an important role to play as material experts and interpreters of users' needs. This is not enough, however. In the future, textile experts will need a complete understanding of the complex system of textile commerce, use, and lifecycle. Textiles are an essential part of our everyday life and will be needed to protect and comfort us even in an increasingly digital future.

Textile design education at Aalto University School of Art, Design and Architecture (Aalto ARTS) has gone through major transformation during the last decade. Recent developments in textile education are based on three key elements: (a) developing a new, effective pedagogy, which has been essential in opening textile design courses to fashion students as well as other design students; (b) building bridges across disciplinary boundaries to enable collaboration between design, science, and engineering disciplines; and (c) establishing academic research. By opening up textile design courses to other design fields and disciplines, Aalto ARTS has renewed the presence and importance of textile design, not only in academia but also in society. Knowledge creation in the textile field is more dynamic and collaborative than ever before.

Background: Transformation of Textile Design Studies

To provide a deeper understanding of fundamental changes in textile education, this section describes the transformation process at Aalto University (the

former University of Industrial Arts Helsinki UIAH and University of Art and Design Helsinki TAIK). By the end of the 1990s, the textile industry had disappeared from Finland and the necessity of retaining textile design education was under discussion. Despite this, the teaching staff maintained and developed good textile studio premises at the university and brought in new technologies that laid the foundation for future development in textile studies. New staff members introduced new thinking, strengthening collaboration with existing industry while discovering new industrial collaboration partners outside Finland.

More intensive curriculum development started in 2007; the Knits and Knitwear course was added into the Fashion and Clothing Design B.A. program, and a new type of studio pedagogy was introduced to woven fabric studies in the Textile Art and Design B.A. program. The next, more radical, step was taken in 2009–2010 when advanced textile courses across all textile studios were offered as minor studies to B.A. students in fashion design. In 2011, the M.A. program in Textile Art and Design was opened up to B.A. students in any design discipline. This prudent decision brought many other knowledge areas like architecture and graphic design to the realm of textile design and enhanced new textile thinking. In 2014, through a thorough curricula development process, the Design Department launched new B.A. and M.A. programs, which integrated textile design studies into Fashion B.A., Design B.A., and Fashion and Collection Design M.A. curricula, and discontinued separate textile B.A. and M.A. programs. Thereafter, both Fashion and Design B.A. programs offered a possibility to concentrate on textile design studies. The Fashion B.A. became a shared platform for fashion and textile studies with a fashion viewpoint, whereas the focus in the Design B.A. is more on interior textiles, textiles as products or with multidisciplinary applications. The Fashion B.A. program was constructed to enable the students to first learn the basics of both fashion and textiles and then choose either area to deepen their studies. However, as most of the students wanted to learn both, since 2017 the B.A. curriculum has provided the students with textile and fashion courses, thereby gaining both skill sets.

In both Aalto ARTS B.A. majors—Design and Fashion—students can study up to 34 credits of textile-design-related courses along with 10 credits for the B.A. thesis. In addition to these majors, textile minor studies of 15–25 credits are offered widely to B.A. students in other Aalto programs. Moreover, the current M.A. studies are quite flexible and can be personalized. Students follow their personal study plans and are able tailor their study paths. The master's students specializing in textile design can take up to 45 credits of textile- and surface-design-related studies along with an internship of 10 credits and M.A. thesis of 30 credits. The M.A. thesis is often done in collaboration with the textile industry (e.g., Yoshizawa, 2014; Haikonen, 2016; Paavilainen, 2015) or in an ongoing research project (e.g., Tanttu, 2015; Smirnova, 2017).

These new approaches to open and collaborative textile design education as well as multidisciplinary research have recently received recognition, e.g., H&M Global Change award 2016 for the project "Making waste-cotton new" (2016).

Moreover, textile design education has gained a solid position and appreciation at Aalto University. For example, this can be seen in the renaming of the M.A. program in 2016 to Fashion, Clothing and Textile Design (http://fact.aalto.fi/) and the increasing collaboration with Aalto School of Chemical Engineering in the current investigation of textile prototyping machinery for yarn production.

Openness Inside Design: New Methods in Textiles

Textile design is about exploring materials and structures, surfaces and constructions. Textile practices interweave expression, storytelling, and artistic and technical mastery—important skills in the broad discipline of design. Whereas difficult questions related to sustainability can only be assessed through an understanding of textile processes, teaching that clings to traditional pedagogical methods has made the essence of the highly technical, creative realm of textiles unreachable to students in other design fields. Time-consuming, purely craft- or technique-related practices, often taught at the start of textile studies, have distracted students' focus and taken time from experimenting and exploring. Simultaneously, theory (such as drafting woven structures) has been taught separately from practice instead of trusting the students' ability to understand theory through practice-based learning and self-driven exploration.

Opening up textile design to a wider audience requires a major rethinking of pedagogy. At Aalto ARTS, the renewed pedagogy has enabled design students to learn the basics of textile practices efficiently and then quickly proceed to more advanced textile studies, implementing and applying the acquired skills in fashion design or other fields. In the new approach to textile design pedagogy, priority is given to skills that lead directly to the essence of textile design—the interplay of different materials, structures, and

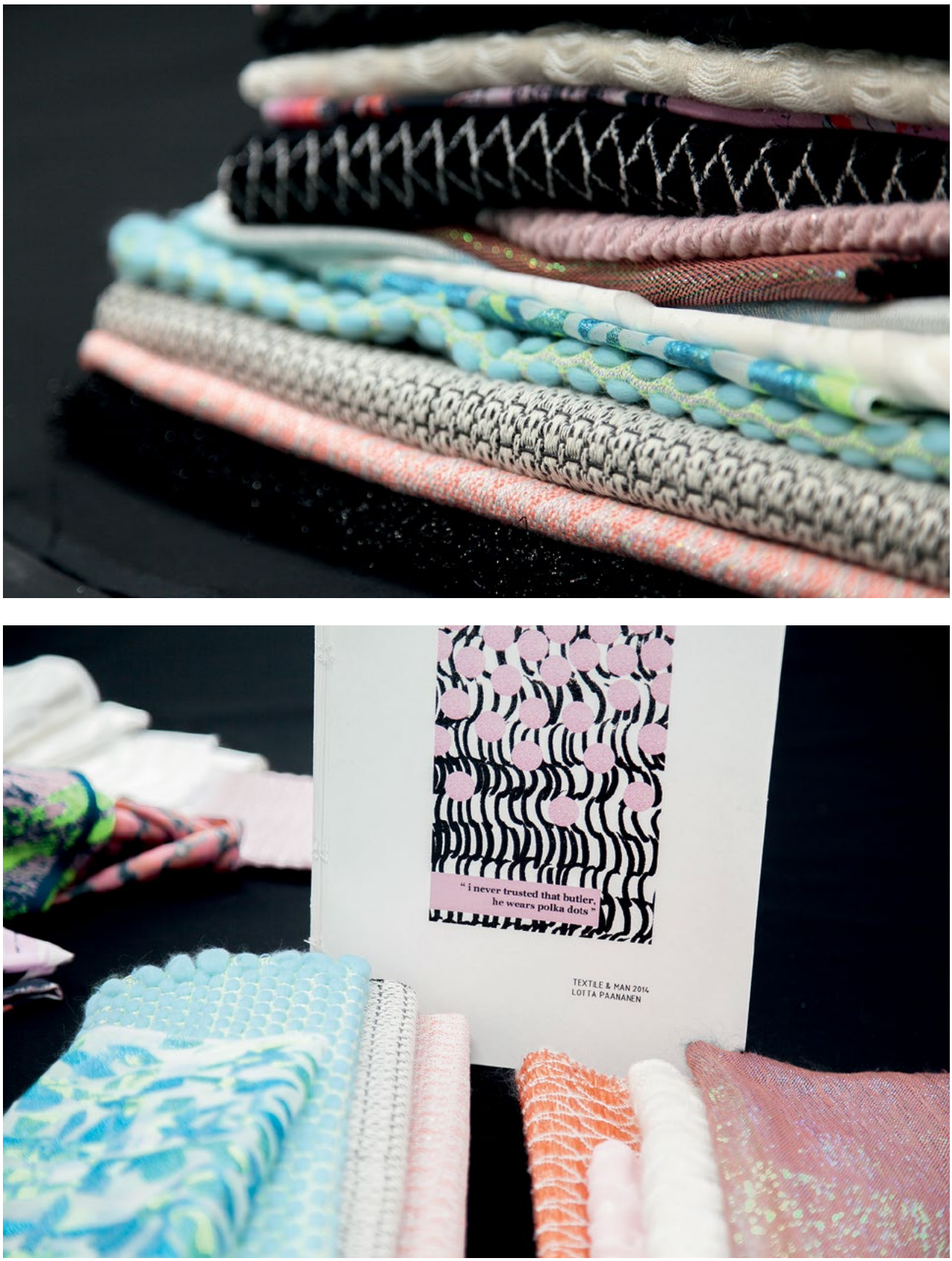


Figure 6.1. *I Never Trusted that Butler, He Wears Polka Dots*, collection by Lotta Paananen, 2014 (second year, B.A.), combines different techniques. Photograph: Eeva Suorlahti.

techniques as well as collection building. The learning process is driven by strong artistic and visual research, storytelling, and conceptualization skills. Textile collection design is constructed with different techniques, combining work in all the textile studios (Figure 6.1).

To illustrate the shift, up until 2007 the teaching of woven textiles at Aalto ARTS (in those days, University of Art and Design Helsinki) started from a theory course on woven structures and drafting, then moved on to learning weaving skills and techniques and finally on to design. Theory was distanced from practice, and the path from learning simple weaves to familiarizing with more challenging derivative weaves and jacquards took years. After the implementation of the new pedagogy, students begin to weave immediately, learning woven structures through hands-on experimentation on warps planned and set-up in advance. In addition, visual research mood boards prepare the ground for design work, making storytelling and collection design the driver for the hands-on weaving and creative experimentation in the studio.

Textiles and fashion are fundamentally interlinked and mutually dependent. The recent curricula and pedagogy development together with the well-equipped textile studios at Aalto ARTS have brought fashion students to success in international fashion competitions, e.g., Festival de Hyères, Designers' Nest in Copenhagen (Figure 6.2), and the annual fashion show has been appreciated by the fashion community and press (Figure 6.3). Fashion design by Aalto students is praised for its rich, immersive design

Figure 6.2. Portfolio with visual research, woven jacquard experiments and the final collection, Marja Korkeila's B.A. collection, 2016, finalist and Schiparelli special award winner at Festival de Hyères, 2017. Photograph: Maria Korkeila.

research, expressive use of materials, and profound mastery of textile techniques. This is the result of their textile studies that focus on fundamental technical and manufacturing skills combined with creative skills, including dobby and jacquard weaving, knitting, embroidery, printing, and finishing.

The close connection between textile design studies and the fashion and collection design courses enables the fashion students to concentrate on their material concepts and innovative textile design work. In addition, the students are encouraged to work in teams to complement each other's skill sets (Figure 6.4), and very often fabrics for fashion collections are created through collaboration with the textile industry (Figure 6.5).

Figure 6.3. Marja Korkeila's collection in Näytös16 Fashion Show. Photograph: Guillaume Roujas.


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Figure 6.4. Rolf Ekroth's B.A. collection, 2014, Designers' Nest 2015 First Prize. Jacquards by Yuki Kawagami. Photograph: Niklas Kullström.

Figure 6.5. Anna-Mari-Leppisaari's M.A. fashion collection, 2014. Jacquard on an industrial loom and the final look. Photograph: Anna Mari Leppisaari and Sara Riikonen.

Figure 6.6. During "Woven Fabrics—Material and Structure," the first course for woven textiles, students select yarns based on visual research. Photograph: Eeva Suorlahti.

Intensive Learning: Shorter Textiles Courses

The new pedagogical approach, which intensifies the learning process through the shortened duration (from over 10 credits to 5 credits) for learning the basics of woven textiles, has proven to yield desirable outcomes. During the basic (5-credit) course lasting four weeks, the students learn the fundamental and most important derivative weave structures, including multiple weft/warp systems and double weaves. As a result, they are able to manipulate these structures to design woven fabric collections suitable for various applications. The process is guided by thorough visual research and inspired by the student's will to express concepts and tell tactile stories through an exploration of materials and structures (Figure 6.6). The work done in the studios is integrated into the student's fashion collection or other ongoing design processes.

This practice-based design process also plays an important part in textile technology studies. Practical knowledge, building on fibers' and yarns' properties, behaviors, and relation to different weave structures, is fostered by the task of creating a versatile fabric collection already at the beginning of woven textile design studies (Figure 6.7). Students with various

Figure 6.7. Weaving in the studio, designing and experimenting on the loom. Photograph: Eeva Suorlahti.

Figure 6.8. Interim critiques—exploring possibilities on the different set-ups and warps. Photograph: Eeva Suorlahti.

backgrounds, and even without any previous textile knowledge, learn to use weave structures and various fibers and yarns to influence the properties and appearance of the finished fabric in a short course. After the first course, the students are ready to proceed to compound weaves and jacquards and to innovate, implement, and apply their skills.

The exploration of structures and yarns starts on various sample warps in the studio that are of different threading plans, tie-ups, setts, and materials (Figures 6.8 & 6.9). Each warp introduces new aspects to weave structures and the properties of textile fibers. As this process resembles the use of standard warps in the weaving industry, it fosters the student's understanding of processes in the textile industry and collection design. In comparison, the traditional learning method of woven textile design usually begins with lectures on weave structures and proceeds to designing one's own warp, choosing materials, planning a weave, sett, threading, and tie-up, dressing the loom, and finally weaving. This time-consuming process that heavily focuses on learning the principles of artisanal hand weaving makes textile studies very difficult to include in a fashion design curriculum.

A similar artistic, research-driven, and practice-based pedagogy has been adapted to the knitting, printing, and finishing courses. After efficient

Figure 6.9. Final critiques—presenting collections, telling stories through the materials and structures. Photograph: Eeva Suorlahti.

and thorough introduction courses into the different techniques, students proceed to building collections combining different textile techniques and finishing. Students undertake fundamental visual and material research during the textile collection courses, leading to textile or fashion collections that display skills in a variety of qualities and techniques. The process implemented in the studies is related to the professional world, whereby the collection process starts from a solid concept and is led by materials.

There is increasing need for knowledge and understanding of textile processes, structures, and materials from outside the textile domain. Numerous new and innovative products result from interdisciplinary projects, in which textile techniques and surface constructions are applied to non-textile materials, or conversely new technologies such as 3D printing are combined with textile surfaces (e.g., Salolainen et al., 2017; Moslemian, 2016). Through efficient pedagogy, the textile studio courses are open, not only to textile and fashion design students, but also interior design, architecture, and industrial design students. This pedagogical approach, which aims at making students ready to apply and implement their skills, helps to disseminate knowledge to a wider audience. Co-operation and development of ideas with peers in multidisciplinary groups are encouraged through shared face-to-face sessions. Furthermore, students organize open displays of their textile experiments in mini-fairs inside the university to find other students and collaboration possibilities, e.g., in product, furniture, or spatial design. Creativity thrives in an atmosphere of openness where there is space for equal give and take, the group of students working together for the common goal of learning.

CHEMARTS: New Experimental Collaboration Between Design and Material Science:

Four driving forces of the future of textiles at Aalto ARTS include: (a) an increasing demand for more sustainable products and systems; (b) the ongoing development of new materials and production technologies; (c) an increasing use of textile structures at different scales, from architecture to the nano scale of healthcare applications; and 4) the integration of textiles and electronics. All these developments have triggered emerging interest in textiles from outside the traditional textile industry, creating new opportunities for textile design and engineering. CHEMARTS is an interdisciplinary collaboration in Aalto University focusing on biomaterials, including sustainable textile materials and processes (http://chemarts.aalto.fi/).

Textile material consumption has been markedly increasing along with population growth and wealth increase. Textile production is causing severe environmental problems, which have to be tackled by all possible means, including the development of new raw materials and innovative production processes (Table 6.1). Change may appear to be slow, but resource scarcity, such as lack of water, and consumers' increased awareness of ecological issues are pushing the industry and commerce towards renewal. New production and recycling methods can save water, raw materials, energy, and costs. Innovations flourish in multidisciplinary environments and require a deep understanding of textile production technology as well as specific knowledge of how textiles are and could be used for different purposes. Designers have important roles to play as interpreters of users' needs and as material

CONCEPT	MATERIALS	METHODS	OBJECTIVES
Transforming new kinds of materials into textiles	Wood, algae, orange peels, manure—anything containing cellulose, or protein-based materials, such as feathers	New, sustainable, and resource-efficient production processes	Renewable raw materials only, sustainable processes, and less toxic chemicals used
Growing textile-like materials	With microbe or fungi	Synthetic biology, bioart, and biodesign	No waste materials and no extra production phases
Designing materials	New DNA combinations and genetic manipulation	Synthetic biology	New materials and production processes, and designed material properties
Recycling textile materials	Cotton, polyester, viscose, etc.	Chemical or mechanical recycling	Less need for virgin materials

Table 6.1. Approaches to textile material development in current material research.

Figure 6.10. Multidisciplinary student team experimenting with nanocellulose in the CHEMARTS laboratory during the "Design Meets Biomaterials" course, 2017. Photograph: Mikko Raskinen.

experts. Their capacity is to challenge the business community and to help technology developers by creating future-oriented concepts and scenarios. Designers can also help to communicate scientific results to all stakeholders by, for example, prototyping with new materials to find application areas for material innovations (e.g., Tenhunen et al., 2016).

CHEMARTS has two main objectives: (a) to inspire future designers and material scientists to work together and (b) to create novel sustainable biomaterial innovations for future business development. In order to enable these objectives in higher education, which is still an environment dominated by disciplinary pedagogical traditions, a set of completely new pedagogical approaches have been tested. CHEMARTS consists of multidisciplinary courses open to all design and engineering students at Aalto University. Launched in 2014, the Design Meets Biomaterials course (3–5 credits) is an introduction course targeted at a broad audience (86 students in 2017), and the more focused CHEMARTS Summer School (10–15 credits, max. 20 students) has been organized annually since 2012. The pedagogy is practice-based and student-centered where no strict guidelines are given; the students have to frame, define, and solve interesting problems by themselves, mostly by working in multidisciplinary teams (Figure 6.10). The role of the supervisors is to provide background information on existing materials, discuss relevant ongoing research, and describe applicable design and research methods. The students are encouraged to explore existing and emerging materials and to challenge technologies and their related systems. At the end of each course, the collaborative process as a whole and its results are presented publicly through visual presentations and an exhibition. Students should go beyond their comfort zones; designers might become engineers and vice versa (Kääriäinen et al., 2017).

The tight collaboration between two Aalto schools—School of Chemical Engineering (Aalto CHEM) and School of Arts, Design and Architecture (Aalto ARTS)—has enabled students to develop interesting textile and fashion projects by combining creative design with materials research. For example, one fashion design student collaborated with a research team in bioproduct chemistry to develop a non-toxic, water-repellent coating for cellulosic fabrics. In this case, the fashion student shared her knowledge of textile and garment use and production, helped to test the results, and communicated the findings of the early-stage scientific project through prototypes. Another example of CHEMARTS collaboration was a 3D-printing project where a multidisciplinary team of engineers, scientists, and designers experimented

Figure 6.11. 3D structures of cellulose printed on cellulose by Pauliina Varis and Ilona Damski in collaboration with VTT (DWoC research project, 2016). Photograph: Eeva Suorlahti.

Figure 6.12. Cardboard and paper recycled into textiles by Ioncell-F technology, designed by Marjaana Tanttu in collaboration with Aalto CHEM (DWoC research project, 2014). Photograph: Eeva Suorlahti.

with printing cellulosic materials on cellulose-based fabrics (Figure 6.11). The textile designer's role was to design suitable 2D patterns that transformed the fabric into 3D structures when printing paste shrank, and to create design concepts to explore how this technology could be applied in the future.

The most successful example of CHEMARTS is the long-term development of Ioncell-F fibers. Ioncell-F is a new technology to produce cellulosic fibers with excellent mechanical and haptic properties. It belongs to the Lyocell-type spinning category and is based on a novel solvent, ionic liquid. It is a closed-loop process that avoids the use of toxic chemicals. Raw materials can be virgin pulp, paper, cardboard, or cotton waste. In this project, the designers had to test material properties by knitting, weaving, printing, and dyeing, and to produce prototypes to promote the technology (Aalto University School of Chemical Engineering, 2015) (Figure 6.12). The multidisciplinary Ioncell-F team received the Global Change Award in 2016 from the H&M Conscious Foundation for its cotton recycling process.

Establishing Solid Research

In spring 2015, the "Fashion/Textile Futures" research group (http://ftfutures.aalto.fi/) was established at Aalto ARTS to explore new perspectives on design research through materials, textiles, clothing, and fashion. Although its strong research focus is on sustainable design, the group members' research activities and strengths encompass material-based research, creativity studies, practice-based research, and strategic fashion and textile management. The group is involved in several significant research projects, which integrate closed-loop and circular economy approaches in fashion and textile systems. Multi- and interdisciplinary collaboration is the basis for building new knowledge that can open up future innovations in material, textile, or fashion fields. Systems thinking, holistic approaches to sustainability, user-centered evidence, and creative design-driven methods are all employed in new knowledge creation, based on collaboration with other design or research fields or industry. The group has significant academic outreach, and it has successfully collaborated in applied research fields. Ongoing research projects include:

The New Road to Silk: Bio-based production of silk-like materials (NEWSILK) 2017–2020 project focuses on synthetic biology in interdisciplinary settings. The textile industry is in need of new material innovations, and engineering material properties through biotechnical production will be one of the key enablers of new materials and a future bioeconomy. At the level of DNA, technologies offer the possibility to design molecular structures for protein polymeric materials. The aim of the project is to design material properties according to the needs of final application areas. Funded by the Academy of Finland, the research consortium combines three areas: Biotechnology (Aalto CHEM), Polymer

Chemistry (University of Helsinki), and Art & Design (Aalto ARTS). It will develop and strengthen multi- and interdisciplinary research collaboration and lead to new ways of doing science.

In the *Trash-2-Cash (T2C) 2015–2018* project, new material and product opportunities are developed via creative design from textile waste or process by-products. With collaboration between 19 diverse partners from across the EU, from design research, material science, market research, and industry, this Horizon 2020 funded project aims to reduce the utilization of virgin materials, improve material efficiency, decrease landfill volumes and energy consumption, and foster design for recycling with the vision of closing material loops (trash2cashproject.eu). During the project, creative design methods for interdisciplinary material-based research are developed. Aalto ARTS contributes to the project through the development of design methods for interdisciplinary collaboration, defining principles for design-for-recycling and constructing a methodology for design-driven material innovation. For interim results, see, e.g., Smirnova et al., 2016; Niinimäki, Tanttu, & Kohtala, 2017; Niinimäki, Tanttu, & Smirnova, 2017; Tanttu, Kohtala, & Niinimäki, 2016).

Design Driven Value Chains in the World of Cellulose (DWoC) 2013–2018 is a multidisciplinary project focusing on cellulose materials and their novel applications by combining design, science, and business. The DWoC concept is based on the combination of design thinking and design-driven prototyping with a strong technology development competence. One of the focus areas is concerned with textiles, including both material innovations and production process development for fibers, filaments, and 3D-printed structures. Funded by Tekes, the Finnish Funding Agency for Innovation, the project aims to actively communicate design concepts to potential entrepreneurs and to facilitate the development of a new cellulose ecosystem in Finland (cellulosefromfinland.fi). The partners are the Technical Research Centre of Finland (VTT), Aalto University, Tampere University of Technology, and the University of Vaasa.

The establishment of the "Fashion/Textile Futures" research group was a turning point for textile research at Aalto University that had previously focused on the development of historical or artistic knowledge undertaken by individual researchers. Currently, the research group aims to open up future possibilities, which contributes to Aalto University's strategy to be an innovation university. Solid research not only produces new knowledge but also supports and challenges teaching. By bringing new approaches, methods, and research knowledge into teaching, and thereby challenging the current teaching, robust research can expand new views on the future of the profession. One principle of Aalto University is that everyone conducts teaching and research; research here can be understood as academic or creative practice. This principle has driven rich collaboration and dialogue between education and research. For example, CHEMARTS began as a pedagogical experiment, driven by designers, but it has already generated several multi- or interdisciplinary research projects. Pedagogical collaboration has been a platform for learning to understand different disciplines, to show design skills to other scientific fields, and to build networks. The *DWoC*, *T2-C*, and *NEWSILK* research projects are all initiated from this interdisciplinary mindset and require new kinds of collaboration among textile researchers, textile designers, and material scientists.

Our scientific work not only builds new knowledge, but also influences development at large. For example, research linked to future materials and closed-loop and circular-economy thinking could have a great impact on how the textile and fashion industry looks and functions in the future. New sustainable materials may revolutionize textile fiber production. It may be possible to design new material attributes at the nano-level through synthetic biology. Green business models combined with sustainable textiles and fashion systems may enable changes in current industrial production. A more holistic understanding of design and its strategic input into the consumption side might enable different ways to design in the future. Experimental design research can tackle issues at the societal level such as unsustainable consumption practices or even people's wellbeing in society. But to educate future textile and fashion designers, courageous design research is needed. Researchers can serve as inspiring role models who show students how to be activists in their own field.

Opening up the Future

This chapter has shown how the textile arena in Aalto ARTS has renewed its presence through the bold rethinking and remaking of textile skills and knowledge in open collaboration. Opening up textiles to other design fields and other disciplines has challenged but strengthened the core of textile design. New kinds of textile thinking, knowledge, and skill sets are used in new application and research sectors such as fiber and material design, systems thinking towards a circular economy, and developing new textile-like materials. Textile designers' skills have expanded towards co-design and participatory

design in multidisciplinary design-driven projects. Through textile expertise, Aalto ARTS's fashion design has boosted its international reputation, as can be demonstrated by the prizes awarded to our students. For example, fashion student Maria Korkeila won the Schiaparelli Prize at the Hyères Fashion Festival 2017 with her strong textile-driven fashion collection. She expresses her experience at Aalto ARTS:

> Having had the opportunity to study textiles (extensively) alongside my core studies in fashion design has been essential to my personal work (B.A. collection) as well as opening up more opportunities in terms of my career. It has given me the tools to truly be able to design a garment/collection from scratch, meaning I am not necessarily limited to existing materials. Learning these skills (mainly knitwear, woven jacquards, printing, and embroidery) during my studies helped form, and became an important part of my design process. My studies in textiles have helped me and my work stand out. In terms of jobs I now have more opportunities, since I can (and have) worked also within the sphere of textiles (for example on the Rick Owens' Textile team). I am presently working as a freelance designer, including textile design for a Parisian haute couture house. (M. Korkeila, personal communication, November 11, 2017)

H&M has been collaborating with Aalto University over recent years. Maria Olofsgård from H&M says that the company aims to enhance this relationship even further in the future due to the quality of textile and fashion design education at Aalto ARTS (Aalto University School of Arts, Design and Architecture, 2015). Suzanne Oude-Hengel, from the Netherlands with a background in product design, was an exchange student at Aalto ARTS in autumn 2014 and is currently working as a freelancer with expertise in knitting technology. She describes that her exchange semester profoundly opened new career opportunities in knitting and weaving. "Definitely it was my basement [sic] for everything that happened ever since. I think it opened my possibilities and brought me further. [It] set up a nice step to build up a network knowledge combo of experimental and technical knowledge from textiles" (S. Oude-Hengel, personal communication, November 11, 2017).

Through new collaboration, a solid textile knowledge base has been key to building bridges between different disciplines in both pedagogical and research contexts. Research is tightly linked to education, and researchers also contribute pedagogically to academia. It is important to note that education can be transformed through new knowledge produced in research. Pedagogy and research can have a creative, successful, and mutually beneficial dialogue. This has particularly been the case in the textile and new materials sector, e.g., CHEMARTS, which has been an experimental pedagogical platform, has introduced interdisciplinary collaboration to textile designers and material scientists. This pedagogical experimentation has produced several academic research projects and thereby new knowledge in both design and material research.

Current areas of focus for textile education and research at Aalto Arts are:

- advanced concept and product design for fashion, interiors, or architecture using ambitious artistic and technical approaches;
- multidisciplinary and experimental approaches in pedagogy and research;
- materials research including new biomass-based applications through design processes, experimental material-led design research, and scientific research;
- integration of textiles and electronics for human-centered concepts and products (e.g., wellbeing, healthcare, sports); and
- sustainability embedded in all of these areas as a well-established research entity in textiles and fashion.

The transformation process has not been easy; it has caused some conflicts and even unnecessary competition between teaching staff. The overall curriculum design and scheduling are always challenged and sometimes the students are not able to organize their textile studies according to their preferences. When analyzing the ongoing interdisciplinary collaboration, it has to be stated that it takes time and effort to create a common language, an understanding of, and a mutual respect for each other's working methods. However, by extending the borders of textile knowledge and collaboration to other fields, textile education has reintroduced its presence and meaning. The textile field, which has long been underappreciated, has returned to claim a meaningful role in societal-level discussions. When discussing future industrial practices, especially in the material sector, new materials have a pivotal role in starting new business and new industrial factories, in the context of a bioeconomy. Furthermore, through collaboration and teaching textile knowledge to other designers, the textile field has gained new appreciation and interest from other design fields. Opening up the "secrets" of

textile knowledge makes textiles more relevant than ever. By re-emphasizing the importance of textile knowledge and rethinking the meaning of textiles, textile education and research can lead to new future opportunities. The future of textiles looks brave, promising, and creative.

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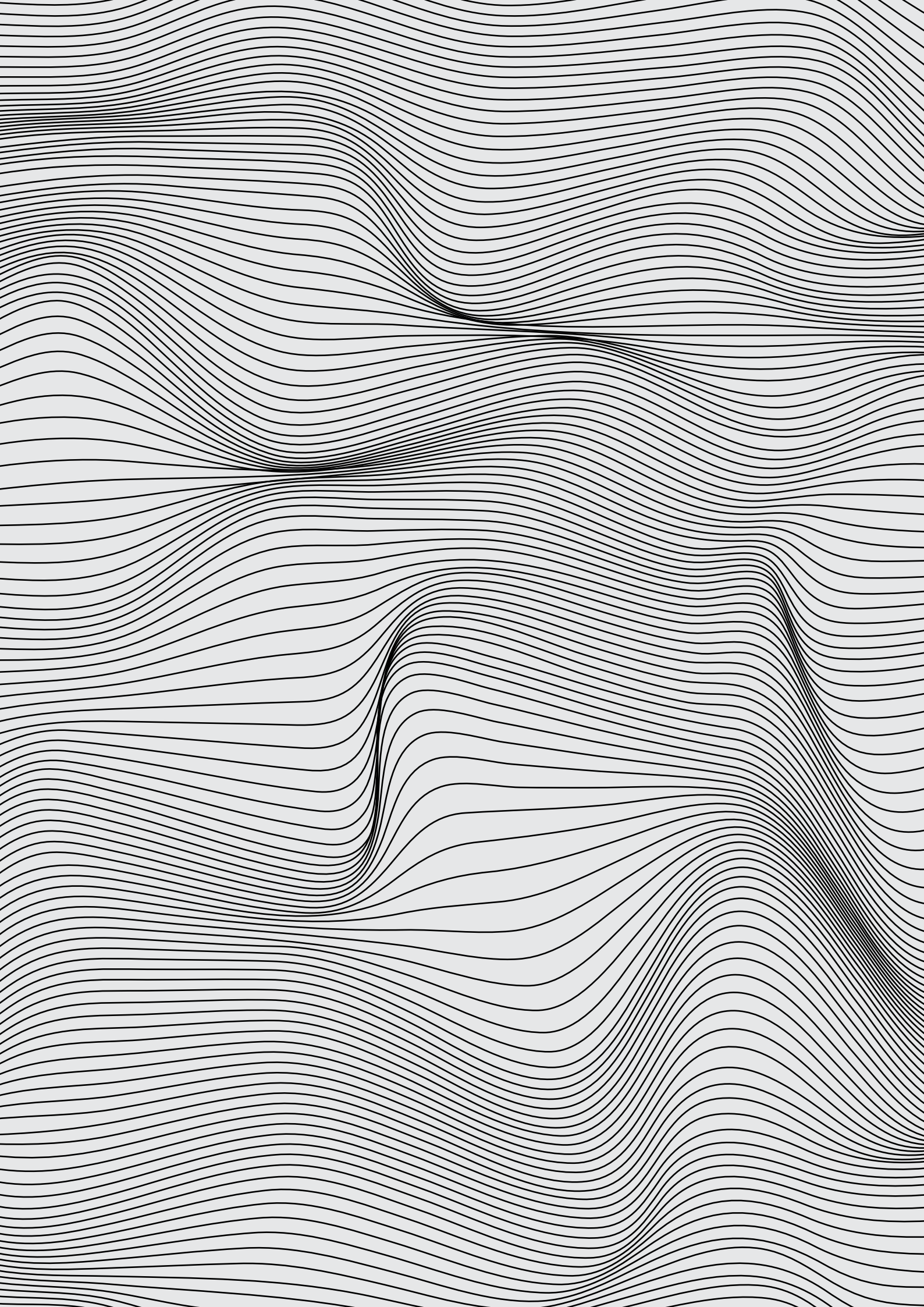

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Soft Landing is a collection of essays that pinpoints where fashion and textile education is today and where it may shift in the future. Initiated by Cumulus's Fashion and Textile Working Group, the essays in this volume address critical questions for fashion and textiles. They shed light on different ideas, approaches, problems, and solutions from teaching and research, as well as contemplating the future trajectory and evolution of fashion and textile education. *Will the landing be soft or with turbulence?*

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