



TEXTILE INTERSECTIONS DOCTORAL CONSORTIUM

Collaborations in Textile Design Research
London, 20–23 September 2023

TEXTILE INTERSECTIONS CONFERENCE 2023

DOCTORAL CONSORTIUM: EXTENDED ABSTRACTS AND BIOGRAPHIES

Loughborough University London

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CONVENORS:

Prof. Dr. Katharina Bredies (IU Berlin, Germany);

Dr. Ramyah Gowrishankar (Aalto University, Helsinki, Finland);

Dr. Elaine Igoe (UAL London, UK);

Prof. Dr. Jussi Mikkonen (DTU Copenhagen, Denmark);

Prof. Dr. Neelam Raina (Middlesex University, London, UK).

General Presentation

Textile Intersections Doctoral Consortium provided an opportunity for doctoral students to discuss their research in an international forum under the guidance of a panel of convenors and experienced textiles / design researchers.

The format of the doctoral consortium invited scholarly discussion and debate, especially on interdisciplinary approaches to textiles design and practice-based design research projects. Selected applicants have been asked to give short presentations or participatory sessions during the Consortium. The presentations were followed by extensive group discussions and peers' feedback as well as participatory sessions led by the co-chairs of the Doctoral Consortium. Focus of the discussions has been on design practice as means of knowledge generation, the relationship of research questions and design practice in doctoral research and impact of the research.

Participation in the Doctoral Consortium was independent of the participation in the conference and the exhibition. The doctoral consortium welcomed applicants whose approaches to textiles design research are embracing the interdisciplinary perspective and are currently undertaking doctoral study with a clear direction of research. We recognise that applicants will be at different stages of doctoral study as outlined below:

- **Early stage** – You have decided on a topic, and you have conducted initial explorations (such as an extensive literature review).
- **Intermediate stage** – You have narrowed down your research topic, you have formulated a research question and developed a suitable methodology for your research project.
- **Advanced stage** – You have conducted substantial research and analysis of your topic, and you are about to prepare your final thesis document.

Prevalence was given to research that fits in one of the six themes advanced by the conference: textiles and architecture, interactive and performative textiles, biotextiles and sustainable textiles, advanced textiles materials and processes, textiles and sport, critical textiles. We were particularly interested in applications from PhD students from institutions and research groups that support interdisciplinary research in the field of textiles.



Track 1

Petra Vicianova

Sarah Godfrey

Sabrina Recoules Quang

Mariko Grasso

Katherine Soucie

Bibi Samshad Duman

Speculative future in the context of textile design

Petra Vicianova | Academy of Fine Arts and Design in Bratislava, Slovakia | pe.vicianova@gmail.com

Formulation of the problem

Development in the field of textile design has always been naturally influenced by technological progress, as well as socio-cultural changes and environmental needs. The current problem of textile (over)production and consumption is not only its generally known negative environmental and social impact. A reassessment of the social approach towards textiles in their complex form (product, service, experience, emotion, value,...) is essential for future development. The situation calls for a change in the perception of the textile material and artifact, as well as the role of the textile designer.

Research objectives

This project follows a basic hypothesis: a social transformation toward socio-ecological sustainability will be achieved through the active participation of textile designers in putting the future into their practice. The hypothesis follows the book *Speculative Everything: Design, Fiction, and Social Dreaming* (Dunne & Raby, 2013). The authors explain that design plays an essential role in creating future experiences, both through convincing descriptions of the details from everyday future life and by evoking emotions that can initiate a change in mindset.

The main objective of this research is to understand:

1. how, from the position of a textile designer, to process and present textile materials which properties are changeable or they represent different kinds of limitations
2. how textile designers could effectively reflect on research in new materials with the help of public debate in social, ecological, cultural and personal contexts
3. how textile craft can serve as a method, technique and tool to build an open debate with an audience

Methodology

The project presented in this proposal is experimental design research where practical experimentation is seen as a process generating experiential knowledge (Mäkelä, 2006). The practical experiments in this project consist mainly of technological and material research within natural textile dyeing and printing. Natural dyeing is chosen with the intention of working with a practice offering often unpredictable and uneven results and thus supporting the set objectives. The research is conducted in the form of iteration cycles. Following this, it is expected that the project will generate several secondary research or/and design questions leading the further investigation.

The first stage of research is mainly focused on the technological investigation of the possibilities of dyeing and printing textiles with the use of mineral pigments obtained from various rocks and minerals in combination with a binder rich in plant protein (see Figure 1-3). The motivation for choosing these



Figure 1: Dyeing with mineral pigment (Vicianova, 2023).

materials is an assumption of a strong sustainable profile - working with natural materials found in the local habitat. Part of the research is also to confirm this assumption.



Figure 2: Textile printed with red ochre (Vicianova, 2023).



Figure 3: Rocks to obtain pigments (Vicianova, 2022).

The second part of the research will follow up on this technological research and place it in the context of critical and speculative design to achieve the research objectives. A critical and speculative approach to design opens up questions of future scenarios using the fictional scenario method (Dunne & Raby, 2013), which depicts a reality that does not exist yet.

Short Biography

(Born in the Czech Republic, currently based between Denmark and Slovakia)

In 2021 I graduated from Design School Kolding in Denmark where I studied a program called Design for Planet which represents a systemic perspective to working with many types of sustainability and encourages critical thinking in relation to sustainable agendas. Before, I studied in a studio focused on textile design at the Academy of Fine Arts and Design in Slovakia where I am currently conducting my design research project focusing on speculative design in the context of textiles.

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Creeping into myself: smocking, pleating and folding as trans orientation

Sarah Godfrey | University of Exeter | sg845@exeter.ac.uk

Abstract

My practice-based research uses sloppy craft techniques, smocking and pleating tools, and abject materials to explore how transgender embodiment can offer new ways of imagining transgender orientations outside of institutional parameters and language. As an interdisciplinary researcher, I use different making methods and public presentations of the work as 'mundane strategies' with the aim of developing the idea of creeping as a trans creative research methodology. My research examines how folding, in the specific forms of smocking and pleating, can reimagine the relationship between trans visual art, specifically textiles and crafts, and the wider textile and trans studies fields.

My research project is currently titled 'Creeping into myself: smocking, pleating and folding as trans orientation,' and my current research questions are:

1. Focusing on the specific use and performance of smocking, pleating and folding and their potential as a material language, how can these be used to propose creeping as a trans-specific creative methodology for examining the relationship between trans studies and textile studies?
2. How can abject and mundane materials be used through textile techniques (specifically smocking and pleating) to question the tropes of disruption, exceptionalism and anti-normativity often present in the field of trans studies?

The focus on creeping as a trans strategy is applied not only to my methods of experimentation and making, but also as a way for the public to interact with the work. Through creating work that one must 'creep into' and find ways to move through, the work questions the categorization of trans artists within textile studies and the possibility to 'creep' across taxonomies that cannot contain us. Within my work, the audience is invited to move and adapt their bodies to the space in order to interact with it, and this intentionally places focus on tactile interaction as well as strange and new bodily interventions. As an interdisciplinary artist and researcher, I often work with DIY technology and open-source software to create glitchy and uncanny digital environments, and work in collaboration with other trans and non-binary artists within the fields of performance and digital arts.

Overview:

For the Doctoral Consortium, I would like to present a short slideshow that discusses collaborative textile installation and performance work I have recently made as part of my research. This will consider the role of the digital and performative elements within my textile practice, and the importance of interdisciplinary collaboration across textile, performance and digital practices in crafting trans selfhood and community. At the time of submission to the conference, I am an early-stage researcher in the first year of my PhD.

Keywords: Folding; interactive textiles; trans studies; textiles and performance

Motivations/Expectations:

As I approach the end of my first year, I feel more confident with the direction that my research is taking and have established more defined research questions and methods. By presenting my work to the doctoral consortium, I am hoping to use this opportunity to expand on some of the methods that hopefully align with the themes of the conference around construction of identity, collaboration and the relationship between the digital and material in performative environments. Receiving feedback on these specific areas would be hugely beneficial, as would the opportunity to critically reflect on my research practice.

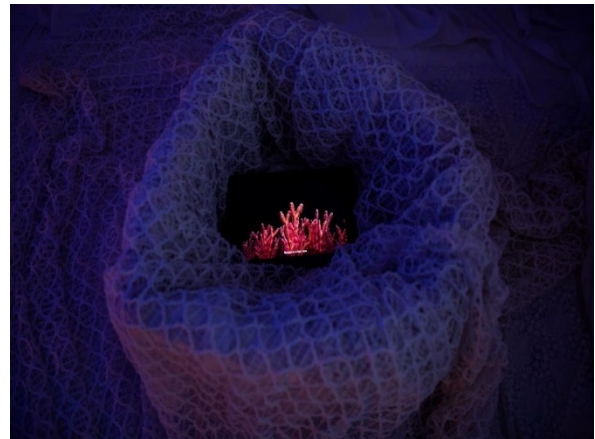


Figure 1: Sarah Godfrey, *love letters to watery others*, 2023, textile installation. Net curtains, foam, polyester fabric, cotton thread, metal, clay, plastic candles, screens, room installation. Installation and performance with Paula Mars Löffler at Make-up Project Space. Photography by Lena Ures.

Figure 2: Sarah Godfrey, *love letters to watery others*, 2023, textile installation. Net curtains, foam, polyester fabric, cotton thread, metal, clay, plastic candles, screens, room installation. Installation and performance with Paula Mars Löffler at Make-up Project Space. Photography by Lena Ures.



Figure 3: Sarah Godfrey, *love letters to watery others*, 2023, textile installation. Net curtains, foam, polyester fabric, cotton thread, metal, clay, plastic candles, screens, room installation. Installation and performance with Paula Mars Löffler at Make-up Project Space. Photography by Lena Ures.



Figure 4 (left): Sarah Godfrey, *what can this primary container do?* 2021, wearable textile sculpture. Wool, cotton, Arduino circuitry, battery, conductive thread. Performance. Photography by Sammy Holden.

Figure 4 (right): Sarah Godfrey, *what can this primary container do?* 2021, wearable textile sculpture, video with audio, 2:24 mins. Wool, cotton, Arduino circuitry, battery, conductive thread. Exhibited at Tender Hooks (Goldrausch Künstlerinnenprojekt 2022), Kommunale Galerie Berlin Wilmersdorf. Photography by Sebastian Egger.



Figure 5: Digital pleating using Blender software, part of NOTA residency with Jack Perkins, 2023.

Short Biography

Sarah Godfrey is an interdisciplinary artist and first year PhD researcher at the University of Exeter and Bath Spa University, funded by the South, West & Wales Doctoral Training Partnership. They work mainly with textiles but like to tinker with circuits, 3d software and DIY electronics. Using messy and sloppy craft techniques, they create interactive installations and wearable sculptures that encourage participants to reimagine bodily boundaries and potentials through physical interaction with the work.

Telling stories with material interferences

Sabrina Recoules Quang | (Royal College of Art) | (s.r.quang@network.rca.ac.uk)

Abstract

The research examines how the art of puppetry can support textile designers in their material experience. In the last two decades, weird materialities have emerged from the manipulation by designers of the boundaries between the digital and the analogue, the manufactured and the natural, and between the human and the non-human. As a result, textile practitioners investigate methods to translate the enactment of these weird materials' fluidic and ambiguous nature. The research is performative (Haseman, 2006). The practice of designing material experiences is performed between the boundaries of the fields of puppetry, textile and research design. The study focus on the thermochromic and bioplastic materials. Karen Barad's diffraction theory (2007) and the transposition model developed by Esa Kirkkopelto (2018) offer a stage for performing the research and interpreting the effects of the entanglement between the disciplines. Moreover, the transdisciplinary practice enters into an action research spiral of activities for making puppetry performance systems with weird materials and sharing puppetry concepts with textile practitioners and researchers in design.

The research weaves the activities of making, sharing, devising and staging into a qualitative system for collecting data on the significance of the puppetry-led exploration. The research outcomes consist of a catalogue of weird materials and their puppetry evaluations, and short animations, still images and artefacts (Figure 1) that reflect the evolution of the practice from devising a textile character to interference-making and demonstrate the effects of the entanglement between puppetry and textile design. The study interprets the data through a combination of puppetry evaluation and diffractive analysis. It visualises the research as a string marionette and the researcher as its puppeteer to illustrate the dynamic relationships between the researcher and the research, the practice and the theory, the methods and the methodologies, the research question, and the research activities.



Figure 1: Sabrina Recoules Quang "Conversation between materials series: nature and man-made", 2021.

The thesis delineates how the practice expanded from designing puppetry systems to improvising with material interferences. Devising and staging material interferences emerged as the main proposal to support designers in translating abstract concepts into tangible metaphors. The main argument is that the transposition of puppetry practice into a storytelling method based on material interferences opens original paths for expanding the textile designers' material experiences and supporting design researchers in their creative process. It is an invitation for researchers in design to engage in physical improvisations with non-human materials and devise metaphorical correspondences for sharing their research and reflecting on their creative process. The thesis concludes that there are insights to be gained from thinking textiles through puppetry and reading the research as a string marionette. The research has value for artist researchers willing to transpose their practice into interdisciplinary research, textile designers producing material experiences and researchers in design exploring tools to share their research. The practice has also shown new potential for thermochromic and bioplastic materials to perform puppetry. By entangling the practical and theoretical knowledge gained in the research, this work provides a useful contribution to the field of design research.

Short Biography

I am a puppeteer and puppet maker investigating technological materials for designing puppet systems. After researching computational tools at Goldsmiths university in London, I pursued my exploration of new materials in the smart textile design department at the RCA. I am now working towards the submission of my thesis in the first quarter of 2024. In my research, I entangle textile and puppetry in puppet systems through making, staging and performing technological and natural materials embedded in textile structures. The practice of designing material experiences is performed between the boundaries of the fields of puppetry, textile and research design.

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Soft Touchscreen relationships through textile intervention

Marika, Grasso | Sheffield Hallam University | b9038463@my.shu.ac.uk

Abstract

When it comes to touch-based technology often there is little knowledge regarding the functioning systems operating under the fingertips. Since the Covid 19 pandemic, daily engagement with technology has increased often within through the sensibilities of the hand. The sense of touch being an instrument of knowledge and knowledge of materiality became the tool to think of ways of relating to the device. The practice-led research borrowed from textile thinking and material methods to investigate the wasted materiality of the wasted touchscreens.

Research Question

The presentation is focused on one of the thesis chapters: SOFT/WET, relating to the hidden qualities of the touchscreen layers, and artistic interventions on waste. The research questions focus on a material-centric perspective, for which I employ the New Materialist framework to investigate material human-computer interaction through Art practice. The questions developed by trying to break the hierarchical relationship with matter, in which the material becomes an equal agential part of the touching/touched relationship (Maurette, 2018). The questions subvert the relationship in speculative and ecological terms of material durability, and transformation.

- How is the excitable and interactive materiality documenting human touch?
- What material explorative approaches can comprehend the tech matter-human relationship?

Methodology

The presentation includes material methods (Woodward, 2020) and textile interventions (Dormor, 2020) employed to formulate soft relationships with hard and dry materiality. When investigating the softness of a hard material, I have tried to implement thinking and methods that would relate the object to modes of knowledge of the hand. The practitioner-material relationship works beyond the concept of tacit knowledge by shaping a conversation of reciprocal responsiveness and transformation (Bardt, 2019, Mäkelä 2016). Textile techniques are employed as the meaning of developing a collection is accompanied by the theory of material thinking (Carter, 2004).

Embroideries, stitching, and layering interventions aim to "soften" the hardness and limited tactile qualities of the Gorilla glass, by showing and unveiling the inside of the screen. Images 1,2,3 are different interventions, extending from questioning the elemental composition and soft layering (Figure 1), to tracing touch and breakages with stitching (Figure 2) and translating gestural collection into digital embroideries (Figure 3).



Figure 1: Researchers own experiment.



Figures 2 & 3. Researchers own experiments

Analysis and Findings

The analysis of the different artwork formulated an iterative system of development of the artwork through self-reflexive practices of visual and written documentation, such as journaling. The application of soft thinking (Soft Tissue,2021) to technology shaped the funding towards considering the decay of its

materiality beyond its functioning as a device. The use of cotton threads, gold leaf, silk, and dissolvable shaped encounters and juxtaposition enabled the classification and findings of the different qualities of the touchscreen for the thesis. Which are: Conductive, Broken, Soft/Wet and Caring/Cared. The textile interventions on wasted touchscreens allowed, in terms of art practice, dissemination and intimate comprehension of the entanglement of matter and meaning (Barad,2007). Which I'll disclose during the presentation.

Contribution

The research aims to provoke thinking and question over the materialities we engage in daily. The encounters of soft thinking, textile intervention and material methods present different perspectives towards technology. The E-waste, having lost its functionality, becomes a documentation of material relationships of possible future archaeology. The artwork with its soft alterations aims to ask questions about today's unaware usage of metal, glass and polymers composing capacitive touchscreens.

Short Biography

Marika is an artist and Ph.D. candidate at Sheffield Hallam University, in the Lab4Living, funded by Research England. Her practice focuses on material practice-based approach, to explore tactile relationships with technology. She studied Textile at The Royal College of Art, Fashion Design at Central Saint Martins. Her PhD work *Beyond touchscreens* exhibited at the CHI Interactive experience Free University of Bolzano and Stanley Gallery, Kingston. She attended the Activism Neurasthenics in Cognitive Capitalism organised by SFSIA. She took part in the online residency @Orbit, and her work *TS#25* is currently exhibited as part of *Conversations in Practice/se* at Yorkshire Art Space. She is currently a Junior Fellow at IWM (Vienna) with the research: *Digital Humanism and Care: What is digital humanism made of?*

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M.E.N.D Regenerative Upcycling of Waste Hosiery through Material Activism

Katherine Soucie | Kingston University London | k.soucie@kingston.ac.uk

Scope

The aim of my PhD research is to reclaim the practice of regional, cultural textile production through the creative remanufacturing of textile waste with the intention to provide a framework for an upchucking systems methodology I refer to as M.E.N.D (Method, Evaluation, Navigation, Design).

The PhD project will generate research, materials and methods using locally sourced waste materials (wool sock waste, wool waste) with obsolete machinery and tools acquired from UK manufacturers, factories or businesses that have closed or moved manufacturing offshore. The studio environment has been set up to create a geographical response to waste using 10 industrial pieces of equipment (each perform a different technique). This research will explore and innovate hybrid methods and processes with these obsolete tools and machines to reimagine their role and function beyond their traditional use. These tools will be utilized to develop new applications and joining methods that will expand the ability to form materials and sculpturally construct waste textiles together in new and *innovative* ways. Their role in this research is integral as they become co-creators in the upcycled cloth transformation process. As part of my original contribution to knowledge, throughout this research, all materials, tools, machinery will undergo an interview process. visual research methods such as drawing, tracing, photography, notetaking, printing will be explored and combined as part of the documentation process. The intention in all this is designed as a method of inquiry and a form of storytelling to capture and bare witness to the new relationships, methods and material forms that are being developed. This component of the research will build upon and advance my interdisciplinary hybrid approach practice with textile waste.



Figure 1: 2 Sock Waste, 2023. (Soucie)



Figure 2-4: Interview Process Sock Waste, 2023. (Soucie)



Figure 5 - Hybrid Use of obsolete machinery and tools

METHODOLOGY

The research methodology chosen is Constructivist Grounded Theory or CGT. Grounded Theory provides artists and designers with a well-known evidence-based method for generating knowledge that is compatible with their personal creative processes. The aim is to practice interdisciplinarity, understood as a systematic approach to social research that allows for new concepts and theories to emerge from gathered data, as opposed to relying on either established theory or personal conjecture to interpret social processes.

Although Grounded Theory is a well-known method within social science literature, it is relatively unknown in art and design practice led literature, even though it is useful for developing social context and human empathy. In recent years, the model has gained relative credibility in many other disciplines, offering potential advantages for interdisciplinary scenarios. It can assist in developing useful skills and sensibilities for gathering and analyzing data in a systematic self-documenting fashion. Its strength is that it can be a unifying approach to research that is adaptable for a variety of scenarios. These capabilities have perennial value for an artist and designer throughout their career.

RESEARCH QUESTION?

Can an upcycling systems thinking approach using hybrid methods aid in the formation of a framework for regenerative practices that work with textile waste?

Short Biography

Katherine Soucie is a Canadian/UK textile and fashion designer, waste textile researcher and educator who established an industrial upcycling process for waste hosiery that led to the formation of her award winning experimental zero waste studio and label Sans Soucie. The signature line of textiles, clothing and accessories made from this waste resource was developed out of a response to reclaim the practice of local cultural textile production in Canada. Since 2002, this research has resulted in an extensive body of work that addresses her interest in local textile and fashion localism, upcycling and creative remanufacturing, craft and resource preservation, alternative and regenerative design methods, material activism and entrepreneurship.

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Le fil de l'innovation: exploring historical and cultural, influences, including technological advancements in weaving

Bibi Samshad Duman | School of Design and Creative Arts, Loughborough University | B.S.Duman@lboro.ac.uk.

The scope of my topic

Our daily lives are significantly impacted by the fields of textile-design, which have developed over time as a result of historical and cultural factors. Crafts are works of art that reflect the culture and values of a society (Callikan, 2002). They are also symbolic mirrors of the soul of a nation and portray a way of life and the enduring characteristics of a people. The 20th century witnessed a significant shift in textile production due to modernization and the industrial revolution. Even, the Mauritian textile industry is more geared towards the production of mass-fashion for export. Technology-driven, it has neglected the basic traditional skills that are elementary in adding value to high-end fashionable product.

Purpose of the study

1. This research examines the history of textile-design connected to crafts- universally, the United Kingdom and Mauritius. From an academic perspective, I am interested in this historical investigation as no one has done this study before relating to the Mauritian textile.
2. Over the years, some of the crafts have primarily been preserved by Mauritian women. As gender has often determined the type of working material according to the local tradition. This study may address social and economic aspects as well as provide ways to decrease gender disparities in the Mauritius craft community. It could experiment with using eTextiles to make it more inclusive for both sides.

Since I am based in the United Kingdom, I found it relevant of doing this research here as it is probably going to be a comparison situation. As I think certain design-craft communities might be a model for what I want to study and help me investigate this approach.



Figure 1: School of Design and Creative Arts Weaving Lab, Loughborough University. Copyright: Bibi Samshad Duman.

Research questions

1. How do historical and cultural factors influence the development of pattern motifs?
2. How exactly were traditional patterns reinterpreted in face of social and technological changes?
3. How can I contribute to keep the repertory of patterns and give them a new interpretations?
4. What does it mean to have eTextiles in Mauritius craft community?

Methodology

I intend to comparative study between the United Kingdom and Mauritius to gain further insights in the developments and influences that have shaped the craft landscape. By setting a temporal barrier, this approach might help me explore various movements and changes that have occurred over time in both countries.

Analysis of ongoing work

A systematic literature review has provided me with a structured framework for conducting a comprehensive search of existing studies, assessing quality, analysing, and synthesizing the data and reporting the findings. This may suggest, on the one hand, the need for further studies in this relatively unexplored area or that no cross-cultural studies have been conducted in this sector in Mauritius.

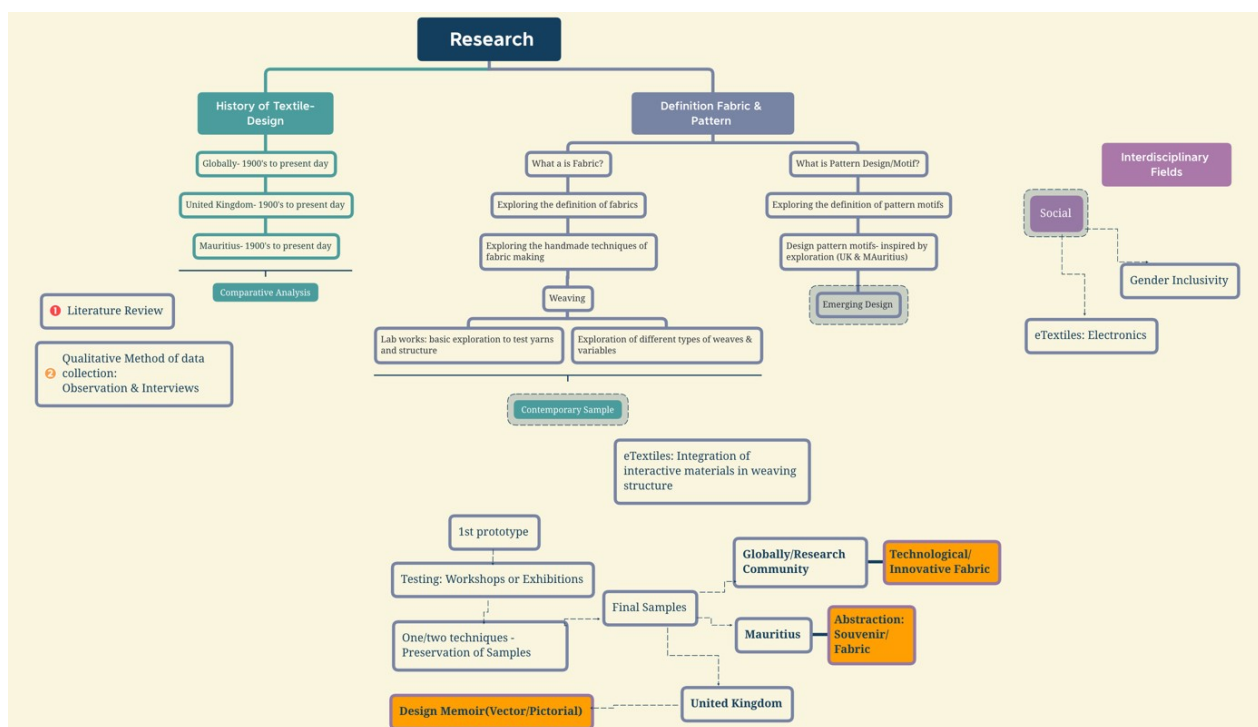


Figure 2: Brain map of my research

Expected contributions

This research can contribute to a universal understanding and celebration of cultural diversity, heritage preservation, and innovative design practices. It has the potential to create meaningful and engaging experiences that bridge the past and the present. Additionally, it can promote appreciation and cross-cultural dialogue.

Short Biography

Duman Bibi Samshad is currently a PhD student at the Loughborough University in School of Design and Creative Arts.

Bibi holds a degree in Textiles and Fashion Design from University of Mauritius in 2010 and registered as a design and textile educator with solid teaching experience. She completed her master in design innovation and Collaborative Creativity with Glasgow School of Arts & University of Glasgow in 2020. Her research interest lies in the area of weaving, sustainability, up-cycling and textile design. She has collaborated with various NGOs and stakeholders in Scotland such as RNIB, NESS Association, Visibility, and Johnston's of Elgin.

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Track 2

Romy Kaiser

Maria del Pilar Bolumburu-Perez

Paula Nerlich

Siren Elise Wilhelmsen

Leonardo Hidalgo-Uribe

Lars Claussen

Magdalena Kohler

Knit-Mycelium based Bio fabrication: Towards Material Hybrids

Kaiser Romy | Hub for Biotechnology in the Built Environment, School of Architecture, Planning and Landscape, Newcastle University, UK

Abstract

The urgent need to address the climate impact of the construction sector drives recent research and material developments towards sustainable alternatives of traditional building materials and construction methods. Biobased materials and approaches are well understood and provide solutions towards climate neutrality but smart and adaptive functionalities beyond the traditional performances as well as scaling up methods of those novel materials are required to support a transformation to net zero in the sector and the vision of building with living biomaterials. The multidisciplinary, novel field of Engineered Living Materials (ELMs) proposes a new materiality of living materials including autonomous functions as sensing, self-replication and self-healing capabilities. This work investigates the creation of Mycelium-based Composites (MBCs) focusing on the integration of 3D knitted formworks within the fabrication process. Mycelium has gained attention as a sustainable, biodegradable, construction material with insulating, and self-healing capabilities. While there have been advancements in MBC, challenges remain in terms of structural complexity, stability, and design control at scale. Recent interest has emerged in digital fabrication methods and mould creation using textile logics and CNC knitting but fabricating mycelium within soft moulds presents still challenges regarding design possibilities and control at scale.

This research positions knitted textiles as a key strategy for biofabrication within the novel Living Textiles field. It introduces the concept by linking requirements of living materials, and mycelium with textile possibilities. It highlights the potential of textile scaffolds acting as scaling up tool, shaping agent and potential life support system for constructing in relation to mycelium and knitted formworks (Figure 1). The work presents various strategies of building with mycelium and knitted scaffolds based on several experiments concerning knit scaffolds for mycelium growth. Those vary across scales from mycelium on textile samples (Figure 2) as well as prototypes at scale introducing a novel technique using injection filling of mycocrete (Figure 3), a viscous mycelium paste. This method enables the creation of complex designs with various design and structural possibilities at scale (Figure 4). While drawing on several case-studies based on mycelium composites, various fabrication techniques, and their challenges and opportunities are identified.

The PhD work proposes steps towards a living hybrid material system based on knitted scaffolds and highlights its importance for future bio fabrication processes (Figure 5).

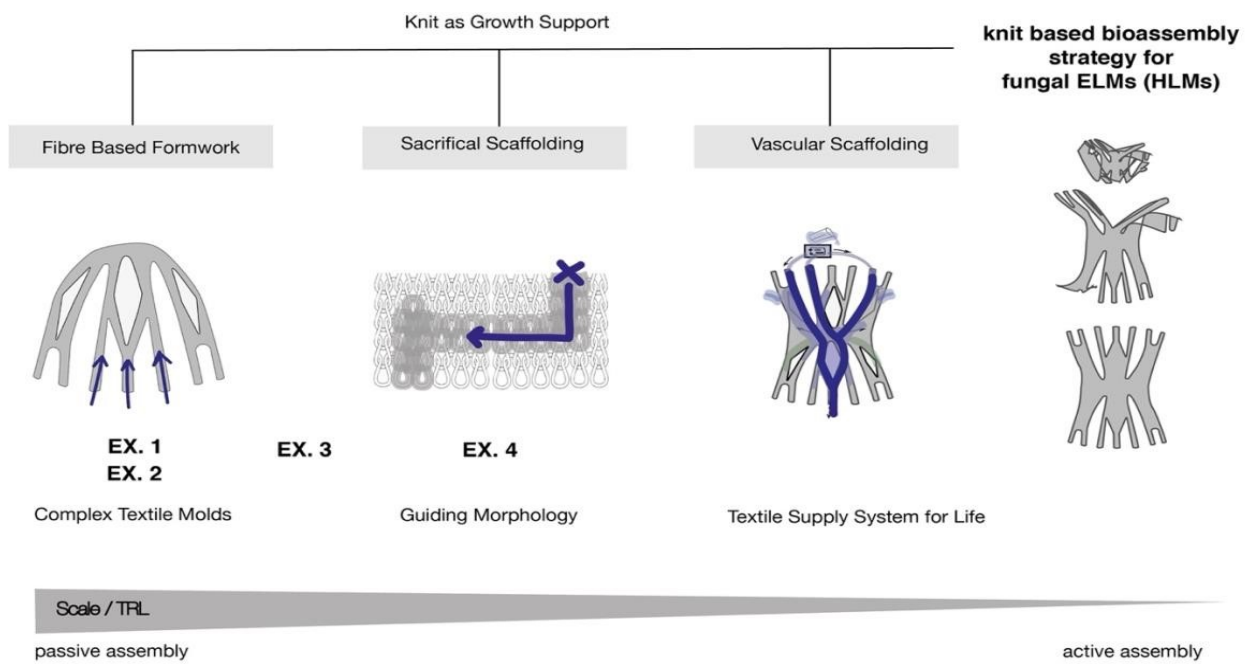


Figure 1: Conceptual Framework for Knit as Growth Support for mycelium based biofabrication.



Figure 2: Experiment with knitted textiles as scaffold for Mycelium growth; various yarn qualities.

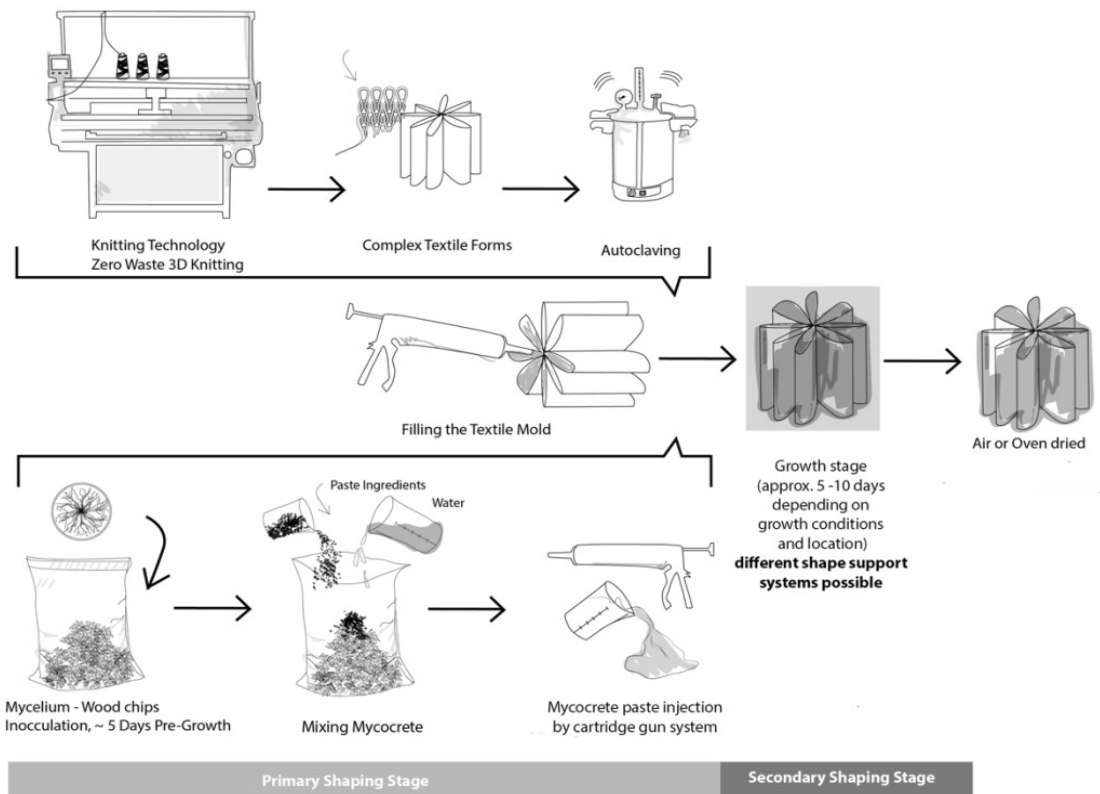


Figure 3: Workflow chart for the Mycocrete Process, proposed for scaling up MBCs.



Figure 4: Example of scaled up Prototype: MycoKnit CompoSITe based on 3D knitted soft moulds.

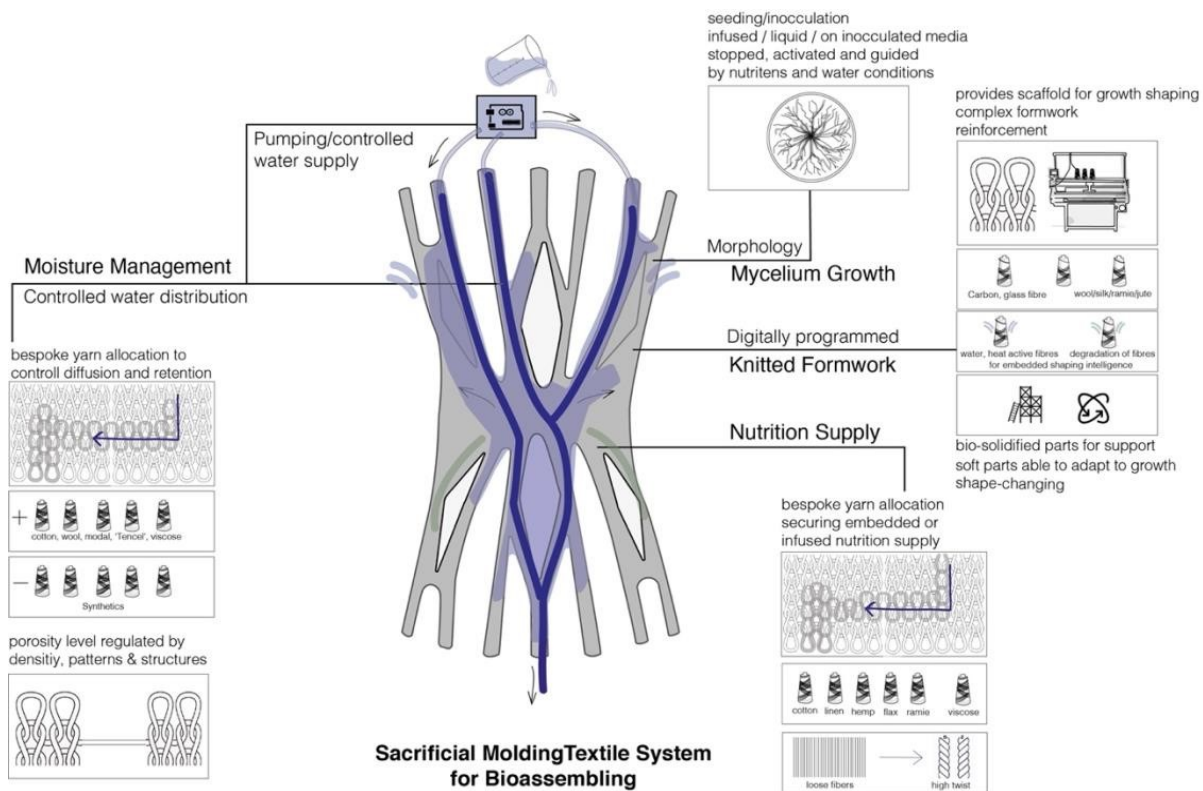


Figure 5: Proposition/Simulation of Future hybrid material systems based on mycelium growth and knitted scaffolds.

Short Biography

Romy Kaiser is a bio designer and researcher with focus on biomaterials, textile thinking and fibre-based bio fabrication methods. After obtaining her Master's degree at the Swedish School of Textiles, Borås, Sweden in 2020, she currently holds a PhD position at the Hub for Biotechnology in the Built Environment, Newcastle (UK) working at the intersection between biotechnology, textiles, and architecture as part of the Living Textiles Group. Romy's research is investigating the shaping and scaling up potential of Mycelium based Composites (MBCs) based on knitted scaffolds. The work is contributing to expansion of novel methods for bio fabrication and using textiles as a tool for scaling up 'Biological Engineered Living Materials' (Bio-ELMs) in the Built Environment.

Understanding and mapping supporting elements for emerging biomaterial developments led by designers within a sustainability framework

Maria del Pilar, Bolumburu Perez | Loughborough University | m.d.p.bolumburu-perez@lboro.ac.uk

Abstract

The emergence of the bio-based materials field has been on the rise in the last years from different disciplines and levels, with a steady increase in SMEs in this area and funding schemes to stimulate these developments as one of the strategies to address the current plastic pollution (Rosenboom et al., 2022). At the same time, with the increase in access to more advanced technologies like digital fabrication and synthetic biology, the number of designers involved in the early stages of biomaterial development has boosted (Camere & Karana, 2018; Gough et al., 2021; Kääriäinen et al., 2020). However, this involvement in new fields has demanded a unique skill set for designers, requiring new knowledge, skills, and methodologies to navigate this area and collaborate with other disciplines like chemists, biologists, engineers, material scientists or artists (Ayala Garcia et al., 2017; Camere & Karana, 2018; Collet, 2021; Gough et al., 2021; Völk, Chen, et al., 2022). Some of the main challenges that these initiatives face when they want to scale up are the uncertain demand for these materials, high cost, and lack of management guidelines in comparison to petrochemical plastics (Rosenboom et al., 2022; Van De Velde & Kiekens, 2002). Furthermore, biomaterials claim to be a more environmentally sustainable alternative to petrochemical materials, but it is necessary to analyze their overall fabrication process to confirm these statements within sustainable production frameworks like the circular economy (D'Amato et al., 2017;

Rosenboom et al., 2022; Van De Velde & Kiekens, 2002). Authors such as Rosenboom et al. (2022) have emphasized the urgency of a comprehensive analysis of bio-based advancements to evaluate their economic, social, and environmental impacts. Additionally, researchers like Camere & Karana (2018) have stressed the necessity to understand better the primary obstacles and enablers of emerging innovations in this field to encourage these developments as potentially more sustainable alternatives to petrochemical substances.

This research aims to understand *'How can emerging biomaterials development be supported within an environmentally sustainable framework?'.* It focuses on understanding the main challenges and opportunities that designers face when engaging in biomaterial development and how to assess the overall sustainability of biomaterials compared to other fossil-based materials. A mix-method approach has been preliminarily proposed to allow a more complete and comprehensive analysis of the under-researched topic (Bryman, 2016).

First, a literature review will focus on relevant frameworks for analysis and mapping key initiatives in the area. Then, the proposed strategy follows an exploratory sequential design (Creswell & Creswell, 2017). To better understand the current start-up and small business landscape in the area, a survey will be applied to collect quantitative data. This information will then inform a qualitative second stage, delving deeper into identified information-rich case studies through semi-structured interviews and observation.

This research aims to contribute to a better understanding of the state-of-the-art of these developments and their main challenges to succeed. It also expects to broaden the evaluation criteria for these initiatives where sustainability criteria are critical. In addition, this research could aid in improving the understanding

of the designer's role in the developing biomaterial industry, leading to more effective training for future designers in sustainable practices. Finally, from an innovation perspective, the research could support the development of designer-led innovation projects in the biomaterial and sustainability field. The study could help to identify key elements and factors for the success of these developments.

Short Biography

Pilar is an interdisciplinary designer pursuing a PhD in Design at Loughborough University. Her research areas focus on design, education, sustainability and open-source technologies like digital fabrication and biomaterials. She graduated as a Designer from the Universidad Catolica de Chile, the Fabacademy programme of the global FabLab network, and from the MA in Education and Technology at University College London. Pilar collaborates as a Materials Researcher at Materiom, an open platform that focuses on making accessible knowledge around biomaterials. She has worked on projects around circular economy and technologies in Europe and Latin America. Currently, she is involved in 'Pacific Plastics: Science to Solutions' (UK-Latinamerica) and 'Bioplastico Territorial' (Chile).

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The Materiality of Well-Being: Designing living textile-bacterial hybrids

Paula, Nerlich | Hub for Biotechnology in the Built Environment, Newcastle University | p.nerlich1@newcastle.ac.uk.

Abstract

This research investigates how textile design and microbiology can be merged to create scent-emitting, living textiles-bacterial hybrids to improve human well-being within architectural spaces.

A multi-species centered approach utilizes design methods to develop textiles that host selected microbes and emit a forest-related scent triggered by human-microbe interactions, forming a living interface.

The outcomes of this Creative Practice PhD include a portfolio of living textiles. Qualitative and quantitative data collection, focus groups, an immersive art installation, and multimedia narrative analyze the portfolio's impact on subjective perception of olfactory and physical space, as well as its potential to activate new forms of cohabitating architecture with non-human entities.

Research Questions:

1. How can textile fabrication techniques and microbiology be merged to create living textiles that are reactive to sensory stimuli input and produce a sensory output?
2. How can we best design textiles as living, sensory interface structures for an architecture that is situated within a framework for multi-species well-being?
3. What is the potential of scent-emitting live-textiles to support human well-being through stress-release within interior spaces?

The methodology employs a textile thinking approach, combining textile fabrication methods with microbiology scientific methods. It explores the relationship between textiles and bacterial organisms, focusing on the intangible aspects of scent and space connected to the samples. Designing with living organisms, guided by Biodesign practices (Wakkary 2021, Collet 2017), is central to this approach.

Textile Design utilizes textiles thinking and fabrication processes to generate Dubied and CNC knitted textile samples. These samples, selected based on fibres, yarns, and processing, are then subjected to controlled trials in the lab. The trials investigate how well the samples host the selected bacterial species and their resulting scent output and bacterial Volatile Organic Compounds.

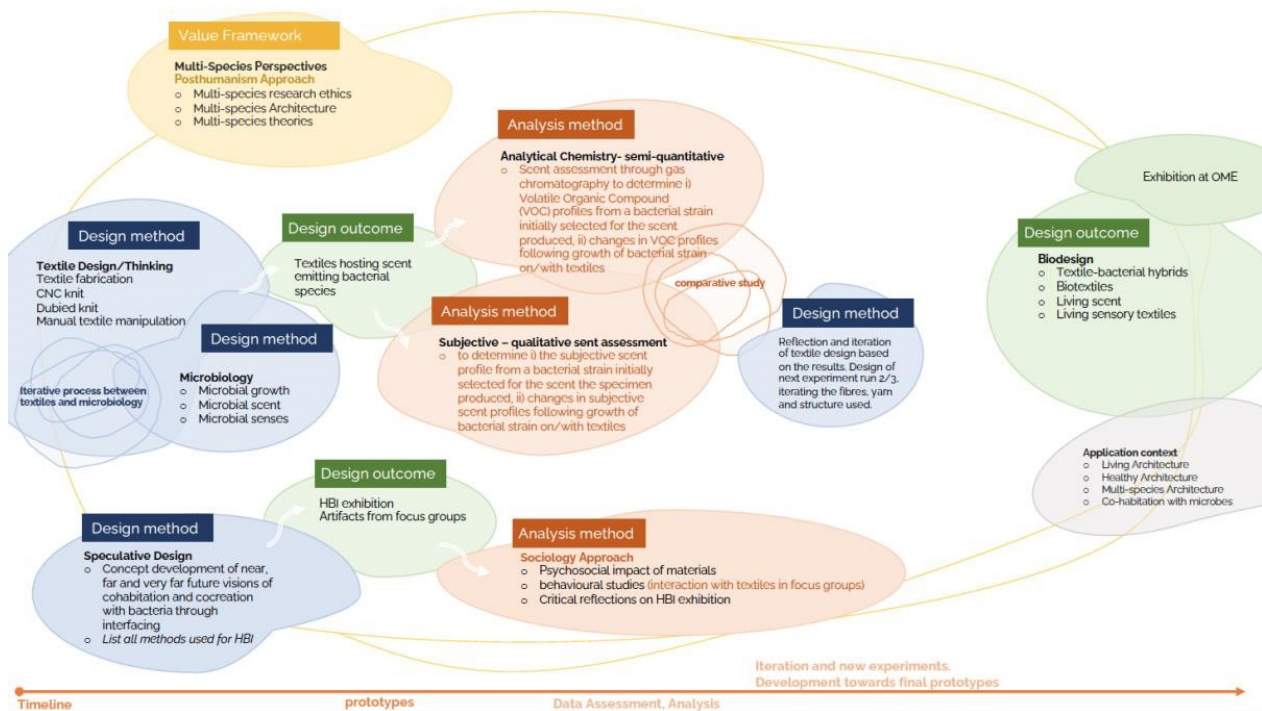


Figure 1: Methodology

Developments: observing scent

The current experiment series explore the scent developments of three bacterial strains within their life cycle. Recent tests have revealed similarities and differences in VOC profiles on linen and cotton yarn. Moreover, it demonstrated the transfer of bacterial VOCs onto textiles, paving the way for textile bacterial hybrids.

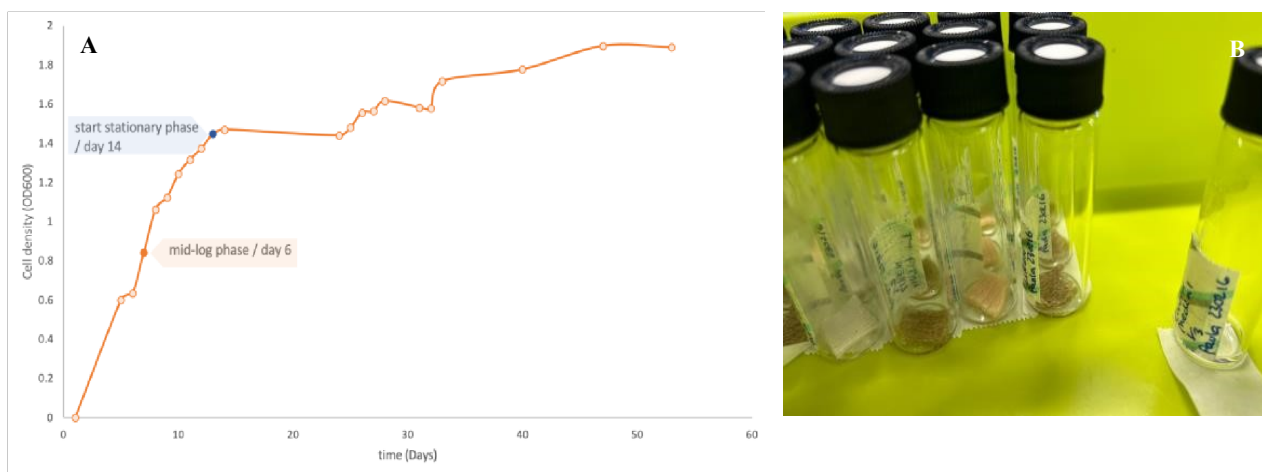


Figure 2: growth curve *Streptomyces violaceus* (A), vials for VOC data collection (B)

The resulting living scent from these textiles exhibited various odours, including earthy, soil, floral, jasmine, and fruity notes. These selected odours hold potential for further exploration through fibre and yarn selection, as well as structural design.

In conclusion, this initial development of living sensory textiles not only confirmed the presence and change of bacterial scent on the textiles during growth, but it also provided a platform for investigating the influence of fibre and structural factors on the bacterial scent profile.



Figure 3: Textile developments for future experiments, looking at diverse inner and outer structures.

Developments: imaginaries of future applications

A speculative design approach combines mixed methods to create concepts of living materials for inter-species interfacing. It envisions near, far, and far-far future applications of diverse living textile-bacterial hybrids. The concept of Human-Bacteria Interfaces (HBI) explores novel relationships with microbes through science-based prototypes. A key aspect of HBI involves designing microbes as living sensors that can respond to stimuli based on their genetic makeup. The concept is currently on show at ZKM, presenting a large-scale immersive and responsive knitted architecture, an experimental bioreactor, and a concept, showcasing the potential for biological sensors in the built environment.



Figure 4: Human-Bacteria Interfaces exhibition, Berlin 2022.

Short Biography

Paula is currently a PhD candidate at The Hub for Biotechnology in the Built Environment as part of the project [The Living Textile Interface](#) group, led by Dr Jane Scott. Her PhD project 'The Materiality of Well-Being: Designing living Textile-bacterial hybrids' investigation how textile design and microbiology can be merged to create scentemitting, living textiles that allow for human to non-human interaction through sensory stimuli.

The search for sensory exchange is further explored in the collaborative project 'Human-Bacteria Interfaces' in form of an immersive multi-media installation, currently exhibited at ZKM.

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Odd New Spring, What We Learn from You

Siren Elise Wilhelmsen | University of Bergen, Faculty of Fine Art, Music and Design | Siren.Wilhelmsen@uib.no

Abstract

The substantial expenses associated with measures against Invasive Alien Plant Species (IAPS), along with the ecological impact and effort involved in their spread and control, prompt the inquiry into the necessity of an alternative and comprehensive approach. This PhD project in artistic research seeks to view these unruly plants as potential teachers and allies rather than adversaries. The urgency of the climate crisis (UNEP, 2021), coupled with the significance of local production and self-sufficiency demonstrated through the pandemic and the ongoing war in Ukraine, underscores the value of utilizing resilient local plants to secure future access to products and food.

The project is based at the Department of Design and is associated with the focus area of textiles, including the weaving- and dye workshop. Supervised by Professor of Colour Mette L'Orange and Professor in textiles Timothy Parry-Williams. The textile focus area has a strong connection to the Department of Fine Art but is expanding to include new expertise in 3D knitting and a stronger bond with design and production. The expansion opens a broader field and further possibilities for collaborations. Being part of this process is truly exciting, since the PhD project also aims an interdisciplinary approach to the field of textiles, and to the holistic and multifaceted planning of local production. Amongst others the local municipality, the waste enterprise and an ecologist are conversational partners in the process.

Textile production has historically relied on a diverse range of raw plant materials, in contrast to the current emphasis on a few sources, such as cotton. In Scandinavia, local plant fibres like flax, hemp, hop, and nettle have been well-known and utilized (Skoglund et al., 2020; Bergfjord et al., 2012). Today the need for plant fibre mostly relies on imported goods, putting significant pressure on the global cotton market (Voora, 2022). Moreover, climate change is expected to impact global cotton production as cotton plants require specific temperature and moisture conditions to yield fibres of sufficient quantity and quality (Hughes, 2021).

In other parts of the world, the utilization of plant fibre for textile production has a longer and more extensive tradition compared to Scandinavia (Karimah, 2021). Considering the broad potential of natural fibres from various regions, it is plausible that our own contemporary flora may also harbour new fibre plants. Invasive (fibre) plants, from this perspective, can serve as locally available, fast-growing, and renewable resources, offering sustainable alternatives to imported textiles. As part of the PhD project, a study focusing on potential fibre plants among the IAPS in Norway has identified approximately ten to twenty plants that exhibit promise as sources of high-quality natural fibre. Through the ongoing practice-led PhD, these findings will be exemplified and explored through artistic investigations. The project has currently reached an intermediate to advanced stage, with initial explorations and studies culminating in three case studies. Two of these case studies have been conducted, while the third is slated for completion prior to the final exhibition and documentation.

The focus in this project aligns with the TEXTILE INTERSECTIONS theme "Biotextiles and Sustainable Textiles".



Photo: Line Møllerhaug, 2019

Figure 1: The exhibition "Interpreting *Fallopia japonica*" at Joy Forum in Bergen showcased samples and material investigations based on the plant Japanese knotweed. This comprehensive study of a single plant became a starting point for further exploration into the possibilities of fibers and dye pigments.

Short Biography

Siren Elise Wilhelmsen (1982) is a Norwegian designer, educator and artistic research fellow at the University of Bergen, Faculty for Fine Art, Music and Design. After graduating as an industrial designer from Berlin University of the Arts in 2010, she founded her own studio. Wilhelmsen has been engaged in commercial projects, exhibitions, design-led research and material explorations, and her work has been presented internationally and honored with grants and awards. The ongoing PhD-project mainly focuses on pigment and fibre obtained from Invasive Alien Plants, as an attempt to develop new holistic approaches for co-existence and local sustainable systems of production and consumption.

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Colours from living lands

Leonardo Hidalgo-Urbe | Aalto University | leonardo.hidalgouribe@aalto.fi

Abstract

The emergency of the environmental impact of the dyeing industry in textiles has pushed the need to explore alternative ways to dye and work with colour. A relevant part of research on biocolourants has focused on a perspective that attempts to follow the same logic of industrial manufacturing but integrates it with bio-based materials (Datta et al., 2022; Gözütok & Bahtiyari, 2022) or bioengineered dyes (Chieza & Ward, 2019). This viewpoint goes hand in hand with what anthropologist Tim Ingold (2010, pp. 91-93) describes as the hylomorphic model of making. Here forms are seen as “imposed by an agent with a particular design in mind”. The main problem with this logic is that it detaches dyeing materials from the environments where they grow (Keune, 2021) and also understands organisms as mere resources that can be mastered and isolated from their complex assemblages (Tsing, 2017).

Contrary to a hylomorphic model for making, Ingold (2013) proposes a processual perspective that acknowledges materials as flows and processes of becoming. This perspective does not understand matter in terms of absolute and stable properties that can be controlled and predicted. Instead, it considers materials in a constant transformation journey within the environment. Recent research on biocolourants has examined inhabitants’ knowledge of their ecosystems from a place-based perspective (Sengupta, 2019), and it has brought into the discussion the idea of making-with the environment into colour (Perret, 2020). However, the relations between dyers and environments require further exploration in dyeing practice, particularly in how practitioners know landscapes and materials through embodied experience and movement (Tilley, 2010; Tilley & Cameron-Daum, 2017).

This research aims to involve human-environment relations in the process of making colour by bringing an understanding of dyeing practice in textile design that addresses the embodied experience of working-with and being-in the landscape where materials grow. The main research question is: How can textile design practice develop ways of using and understanding colour in relation to the environments where bio-based dyes are produced, and in which forms do dyers correspond to the environments they inhabit throughout their practice?

This research incorporates a combination of sensory ethnography (Durrani, 2021; Pink, 2015) and practice-led research methodologies (Mäkelä & Ruotarinne, 2006; Smith & Dean, 2009). During the research, I use ethnographic interviews and participant observation (Guber, 2012), and walking (Aoki & Yoshimizu, 2015; Ingold & Vergunst, 2006; Pink et al., 2010) as methods in combination with performing and reflecting on my practice (Mäkelä, 2016) of dyeing. The documentation includes diary methods (Bartlett & Milligan, 2015; Bolger et al., 2003; Mäkelä & Nimkulrat, 2018), photographs, videos and sound recordings, which I later assemble and analyse using thematic analysis (Braun & Clarke, 2012) and collage methods (Butler-Kisber, 2010) similar to mood boards.

I started with a literature review that conceptualised dyeing practice with bio-based materials as a process of correspondence (Ingold, 2013, p. 31) between dyers and the environment. Then I worked on the first case study in Southern Finland and developed the idea of dyeing as a place-making practice where practitioners build a dialectic relation between practice and the embodied experience of the landscape by creating colour libraries from foraged materials. For my second case study, I did fieldwork in the Northern

Amazon in Colombia. I am currently analysing the data by exploring the notions of temporality and coordination between dyeing and ecological rhythms.

Images

The following images illustrate the documentation and analysis methods I used for my first case study in Southern Finland.



Figure 1: Collecting broken twigs with lichen (*Hypogymnia physodes*) in April 2022 in Vanhankaupunginlahti. Booklet spread with a collage of encountering with the dyeing material. 2022. Helsinki. © Leonardo HidalgoUribe.



Figure 2: Progression of lines of movement in Vanhankaupunginlahti from December 2021 (upper left) to August 2022 (lower right). Individual lines following walking routes are drawn and juxtaposed. 2022. Helsinki. © Leonardo Hidalgo-Uribe.



Figure 3: Progression of walking and dyeing experiences from December 21 to August 2022. Compilation of booklet spread with a collage of walks, encounters with plants and dyeing experiences. 2022. Helsinki. © Leonardo Hidalgo-Urbe.

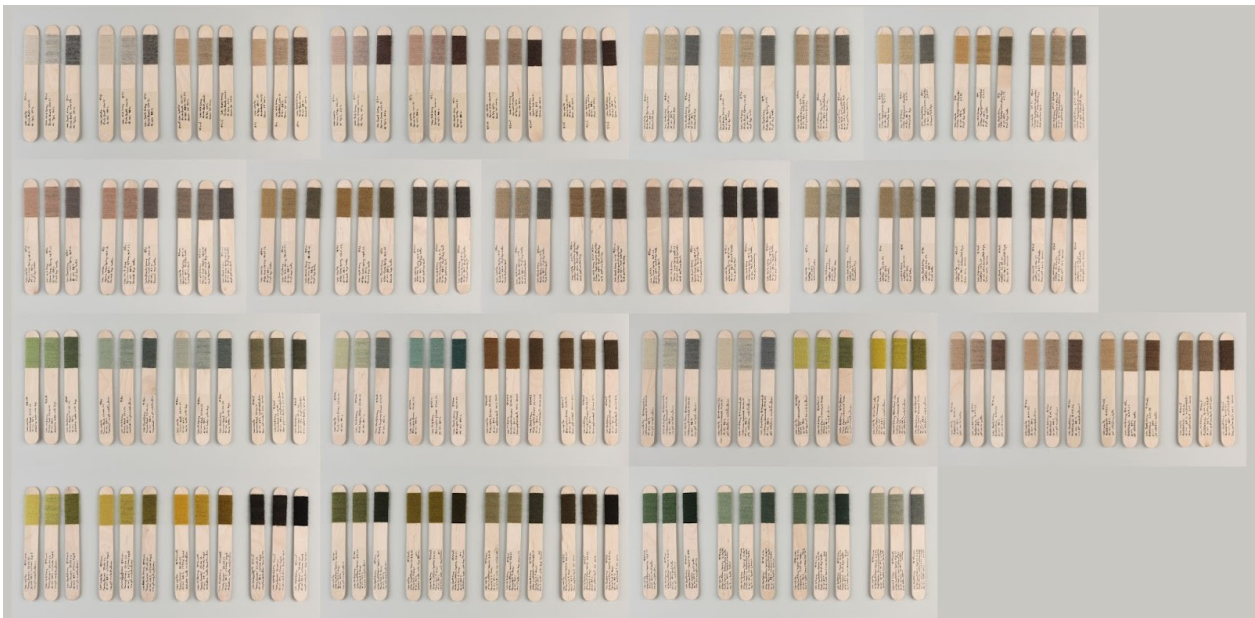


Figure 4: Compilation of entire colour swatches from materials collected in Vanhankaupunginlahti and Kalkiranta from December 2021 to August 2022. 2022. Helsinki. © Leonardo Hidalgo-Urbe.

Short Biography

Leonardo Hidalgo-Urbe (MA) is a textile designer and doctoral candidate at the Department of Design at Aalto University. His research explores biocolours and dyeing practices within local contexts and examines the intersection between ecological knowledge, colour, aesthetics, and design. His approach involves ethnographic and practice-led research methodologies by exploring foraging and dyeing practices from a dwelling perspective. Leonardo has a background in weaving, dyeing and collection coordination and is interested in navigating the relationships between place, materials and colour through textile practice.

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Sustainability without compromises: Long-term quality of polyester sports t-shirts.

Lars, Claussen | Loughborough University | l.claussen@lboro.ac.uk

Abstract

As a large contributor to environmental pollution, the sports apparel industry is transforming towards greater sustainability and circularity (Niinimäki et al., 2020). Extending the lifespan of garments and switching to more sustainable/recycled fibres are among the most effective ways of reducing the industry's environmental impact (ECOS, 2021; United Nations Climate Change, 2021; Wiedemann et al., 2021; WRAP, 2017). These suggestions are also increasingly adopted in policies. The EU textile strategy, for example, has the vision that by 2030 "all textile products placed on the EU market are durable, [...], to a great extent made of recycled fibres,

[...]" (Directorate General for Environment, 2022). Extending garment lifespan and switching to more recycled fibres raises additional questions for the apparel industry, including how best to objectively assess clothing longevity and to what extent recycled fibres can influence this longevity. My PhD research is part of my contribution to the answering of these questions. Therefore, my PhD is structured into three parts:

Conceptualizing sports clothing quality, observing long-term quality of virgin and recycled polyester sports t-shirts during a wear trial, and replicating real-life quality changes in the laboratory.

The first part involved experts' interviews, consumer questionnaires, and online shop analysis to generate a terminological foundation of sports clothing quality and to identify the most critical attributes of sports clothing quality. The initial results of the first part are already published and build the foundation for a perceived quality questionnaire used in the second part (Claussen et al., 2021).

In the second part, the perceived and material quality of virgin and recycled polyester sports t-shirts will be tested in a wear trial that started in February 2022 with 244 participants and is still ongoing. Every two months, a survey is sent out to measure perceived quality, and every six months the material quality of a sample is tested by textile testing. The aim of this part is to create the largest data set on the use and quality development of sportswear yet available in literature.

In the third part, real-life quality changes are replicated by washing virgin and recycled polyester sports t-shirts up to 52 times. After different washing cycles, the material quality of the shirts is tested, and the quality perception of the shirts is assessed in a store and in a training scenario. The results of the third part are compared with the second part to better understand how to test clothing longevity.

Short Biography

Lars is a trained textile engineer who received an MSc from Hochschule Niederrhein and a double bachelor's degree from Hochschule Niederrhein and Tianjin Polytechnic University. Before starting his PhD, he gained industrial research experience in the field of textile auxiliaries. Lars joined the Environmental Ergonomics Research Centre at Loughborough School of Design and Creative Arts in April 2020, where he is conducting a PhD in collaboration with Adidas. His research focuses on sportswear, testing methods, quality perception, and sustainability.

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Re:Value - Holistic consideration of the wool fibre cycle for clothing textiles, in particular the recovery of mixed fibre waste from knitted post-consumer waste

Magdalena Kohler / Technical University Chemnitz/ m.kohler@udk-berlin.de

Textile engineers and fashion designers are based on a multitude of natural and man-made fibres that can be mixed in almost unlimited combinations and mixing ratios for further processing in the textile chain, that are currently hardly recyclable.

Sorting Process - Results & Evaluation

Regarding the insufficient factual situation concerning the current ingredients of recyclable feedstock for further use within the clothing industry, I worked at the European largest used textile sorting company SOEX and finely sorted the article "acrylic mix", which do not go into the second-hand sale, but are currently sorted out for insulation wool and further processing into nonwoven fabrics for the automotive industry.

In order to understand which fibers are hidden, which are possibly suitable for further recycling steps within the clothing industry, I have divided the goods into that following categories: Cotton, Viscose/ Modal, Wool, Polyacrylonitrile, Polyester, Polyamide, non-usable fabric (woven fabric, jersey fabric, ...) in the first step.

Through my observation around 46% per bale (wool content, PAN content, PES content) would be suited for further use within the fashion industry.



Figure 1: Bale - „Acrylic Mix“ (Kohler, 2022)



Figure 2: Labelling - mixed wool blend (Kohler, 2022)

1st bale: total - 378.7 kg.

category	kg	%
Cotton content	114,0	30,1
Viskose- & Modal Konten	60,1	15,87
Wool content	42,4	11,19
Polyacrylonitrile content	110,7	29,23
Polyester content	22,0	5,8
Polyamide content	3,9	1,02
not-usable fabric	25,6	6,75

Table 1: 1st Bale - „Acrylic Mix“ (Kohler, 2022)

2nd bale: total - 493,3 kg

Category	Kg	%
Cotton content	144	29,19
Viskose- & Modal content	85,3	17,29
Wool content	85,7	17,37
Polyacrylonitrile content	114,1	23,12
Polyester content	28,9	5,85
Polyamide content	11,6	2,35
non-usable content	23,7	4,80

Table 2: 2nd Bale - „Acrylic Mix“ (Kohler, 2022)

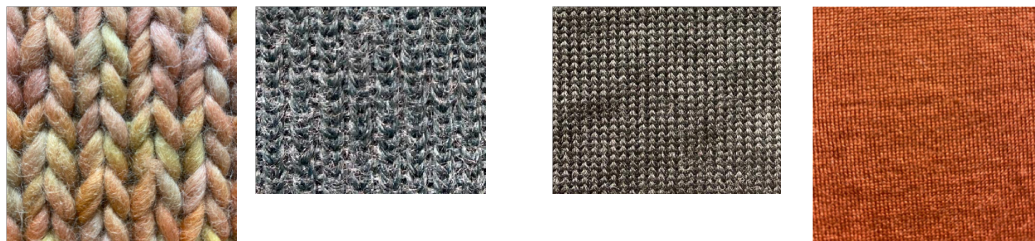
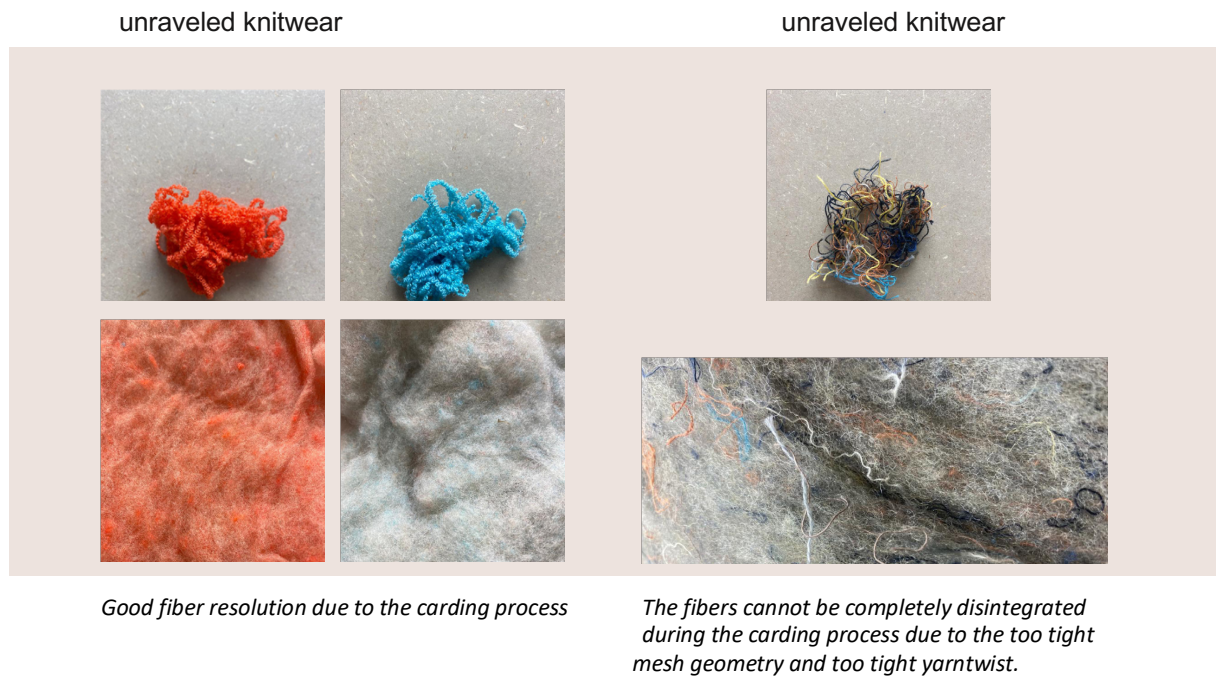
In the subsequent step, each individual category must be sorted again into various subcategories, since these articles mainly consist of 3-7 components. Only then real clusters can be created for future fiber recycling processes in the wool blend fiber sector.

I am currently working on this step and want to analyze if wool blends with Polyacrylonitrile, Polyester and Elastan behave differently from each other, so the sorting process becomes a more important step in the fibre recycling or if the sorting process doesn't matter at all.

Cutting & Tearing Process

After clustering based on the reusable materials, the final step is to sort the fabric by stitch geometry, yarn twist and yarn count to achieve a consistent quality before I can analyze the different blending ratios with virgin merino wool to derive a stable production process.

The modification and adaption of the existing cutting/tearing process, considering the stitch geometry and the yarn twist, as my second research focus is as relevant as the finer sorting process, to keep the fibre qualities and lengths as far as possible for further recycling steps.



The different mesh geometries require a modified cutting process before carding.

Figure 3: first research regarding the different stitch geometry and the subsequent carding process (Kohler 2021)

As I have the aim to transfer my research into the existing textile industry, I work with local manufacturers along the textile chain from the very beginning, to understand the current processes and work on better recycling strategies to close the loop for the existing post consumer waste.

1. Sorting: SOEX Bitterfeld-Wolfen (Germany)
2. Cutting & Tearing: SAXON TEXTILE RESEARCH INSTITUT - Chemnitz (Germany)
3. Carding: NOMACO / DELL ÓRCO (Germany & Italy)
4. Spinning & Weaving: GEBRÜDER MEHLER (Germany)

5. Knitting: STRICKCHIC GMBH (Germany) & others

6. Fabric Retailer: LEBENSKLEIDUNG (Germany)

The urgency of a finer sorted starting material and the necessary factual situation, as well as the adapted cutting process will be the subject of my doctorate in order to guarantee a better recyclability for the clothing industry in the future.

Short Biography

Starting at the age of 15, I learned to be a goldsmith and worked in this profession until 2004. After studying fashion design at the UdK Berlin (2004-2009), I founded the technology-based knitwear label TRIKOTON with a developed regional on demand production in Germany, that is still very important in the sustainability debate.

Since 2017 I am working as an assistant at the fashion department at the University of the arts Berlin, with a focus on knitwear design, and started my PhD in 2021 on recyclable wool blend fibres at the Technical University in Chemnitz.



Track 3

Shih Wei Chieh

Katrin Hedlund

Sofia Guridi

Lingxiao Luo

How Intelligence Understands Itself through the Collaboration of Traditional Craftsmanship and Contemporary Technology: A Technological Discourse Generated from Big History Theory

Shih Wei Chieh | National Yang Ming Chiao Tung University | shihweichieh@icloud.com

Abstract

"My artistic practice often involves both contemporary technology and traditional crafts, which has led me to develop an interest in the history of technological development and how concepts are influenced by technology. In addition, the cultural and historical backgrounds that I engage with in my work often run in parallel and are unrelated to each other. This may be a result of globalization, where these historical fragments are juxtaposed like glitches, creating a certain natural coherence. This has led me to explore how, through cosmology and the history of computational technology, the contradictions between these dispersed histories can become a tool. I aim to explore interdisciplinary methods to establish new connections between the past and the future on a planetary scale, developing new frameworks linking technology and concepts.



Figure 1: Laser Dye Live Installation is a real-time cyanotype exposure created using a laser projector. The laser pattern is derived from astronomical data on Incan dark constellations obtained from the Gaia Project. (Shih, 2022)

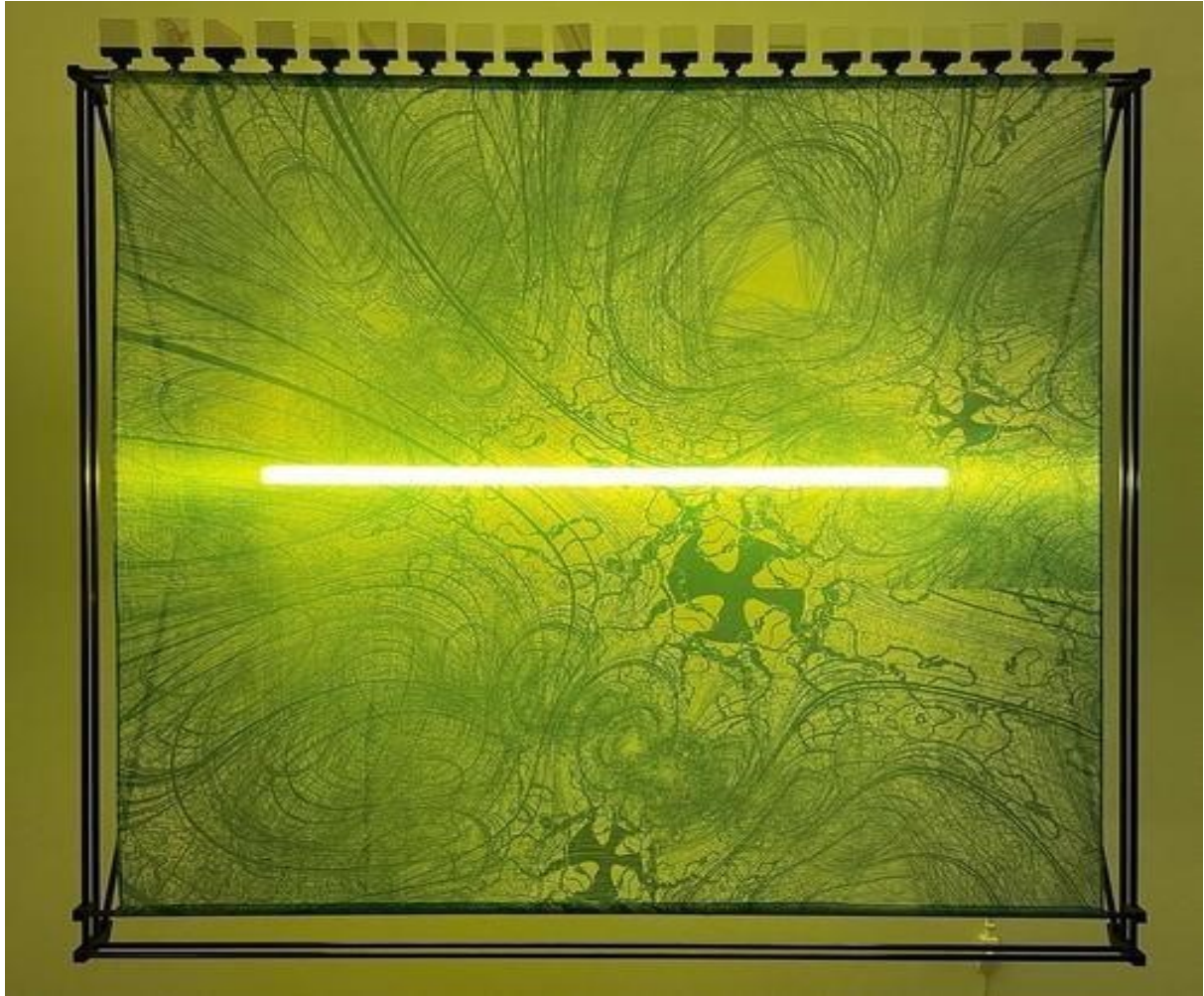


Figure 2: The textile pattern depicts the dark constellation region of Incan Yutu, derived from data obtained from the Gaia Project Library. The print was created using the Laser Dye technique. (Shih, 2022).

In resolving the contradictions arising from juxtaposing heterogeneous histories, one potential approach is to use Big History, a transdisciplinary narrative that includes everything from the Big Bang to modern societies. This theory allows us to connect seemingly unrelated historical events and cultural processes across vast timescales and understand their relationships. Therefore, one direction of my research is to philosophically explore how contemporary technology and traditional crafts influence each other, and how seemingly unrelated cultural histories can be integrated in the context of globalization, providing the basis for developing new theories of technology.

Another approach is through DIY methods, breaking down traditional knowledge hierarchies and disciplinary boundaries, exploring how interdisciplinary knowledge emerges through the exchange between traditional craft cultures and contemporary technologies, fostering mutual benefits.

In terms of practical exercises, I have chosen two collaborations as subjects of my research. The first is the collaboration between contemporary astronomy and cultural astronomy in the I_C Project, which is expressed through my laser dyeing technique. The second is the collaboration of desensitized solar technology with Funakubo-Orimono on the Hogushi Ori technique."



Figure 3: The TiO₂ photo-electrode prototype of dye sensitized solar cell developed on Polyimide film, which will be applied with Hogushi Ori technique in the project. (Shih, 2023).



Figure 4: The Jacquard loom and the open warp threads with screen printed patterns in Funakubo Studio. (Shih, 2023).



Figure 5: The screen-printing system in Funakubo Studio. (Shih, 2023).

"Under the above framework, for my practical exercises, I currently have selected two collaborations as subjects of my research. The first is the collaboration between contemporary astronomy and cultural astronomy in the I_C Project, which is realized through my own laser dyeing technique. This project involves reconstructing ancient constellation cultures using contemporary observatory data and expressing them through data visualization on fabric. The second is a collaboration with Funakubo Orimono on the Hogushi-Ori technique, using dye-sensitized solar textile technology. Currently, we are attempting to establish the first step of collaboration through the shared process of dye printing in Hogushi-Ori and solar textiles."

Short Biography

Shih Wei Chieh works with wearable art, e-textile, laser audiovisual. He is also a self-taught material science researcher. His "Laser Dye Project" innovates an optical textile printing method by programmable laser projector and New Cyanotype solution, which inspire him to explore the transdisciplinary collaboration between new medias and traditional craft techniques. He's the founder of "Tribe Against Machine", a project explores how culture preservation work with modern technologies. His current research develops a DIY dye sensitized solar glass made with natural dye in large size, which is used for both energy and smart interface.

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Printing strokes - uncovering the potential of toolpath manipulation in fused deposition modeling

Katrin Hedlund | University of Borås

The research program explores the field of additive manufacturing in architectural and textile design. It questions what digital tooling can learn from hand craft methods of surface design: painting, graphic design and intaglio, and how additive manufacturing toolpaths can be inspired by said crafts and manipulated to challenge hyper local, meaning vertex-located, and textural expressions of digital form generative processes. With few exceptions digital fabrication in general and specifically additive manufacturing today is focusing on precisely matching a digital input with a physical output. In the post-digital movement, architecture tries to move beyond the mere utilization of digital tools for representation or fabrication and explores the potential of hybridity and the blending of digital and physical realms to enhance the expressiveness of surface and form.

Looking closely at tool pathing in additive manufacturing and specifically fused deposition modeling (FDM) this first experiment has a starting point in the craft of painting, where the tool - the brush, and the way that it is locally moved are two parts of generating strokes. The experiment is influenced by textile design methodology seeking to explore non-hierarchical structures based on the use of curves where filament instead of yarns are the foundation of expressiveness and structural thinking.



Figure 1: Outline print stroke using handheld 3d pen at 45° angle

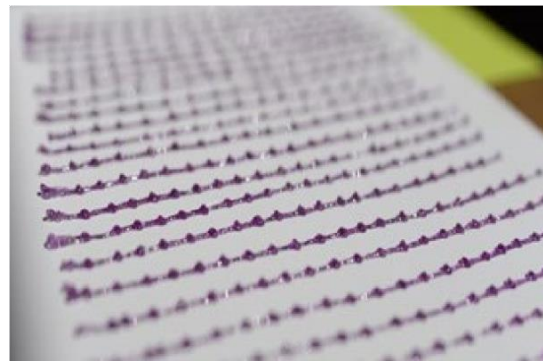


Figure 2: Thin-to-thick print stroke using handheld 3d pen

Research questions

1. What can digital additive manufacturing learn from the creative potentials discovered in artistic domains like painting, graphic design and engraving, where the embodiment of manual craftsmanship plays a vital role in the creative process?
2. How can curves, being the fundamental constituents of fused deposition modeling, be employed as both impactful and foundational elements in shaping 3d surfaces and objects and how can local manipulation of the toolpath enable design freedom and the creation of intricate surfaces and form geometries that are the result of fabrication rather than modelling?

Methodology

The methodology used is experimental design research where the object of investigation is produced continuously and further analyzed in order to derive or adjust the next step in the process (Rheinberger, 1998).

Through working with both a handheld 3d pen and controlling a 3d printer with custom G-code, concepts from painting are translated from brush via 3d pen to digital print strokes. Brushes and corresponding brush strokes used in aquarelle painting are analyzed in terms of hand movement and resulting shape. By controlling pressure or layer height, angle, temperature, extrusion speed and tool speed, 3d printed strokes with varying height, local distribution of material and thickness can be achieved. Selected strokes based on similarity with brush strokes or with novel expressions will be translated into G-code and printed on a Prusa 3D printer as two-dimensional textures. Following this, three-dimensional objects will be printed by layering strokes.

Workshops with two types of student groups will be conducted expanding on their pre-existing knowledge of detail and surface design (textile design students) as (architectural students), building on teaching focusing on robotic drawing. The experimental techniques will be used in producing three artefacts, each manifesting found surface and structural effects in a visual and tactile way, contributing to the field with a hand craft inspired digital tool pathing method resulting in intricate fabrication and material derived expressions.

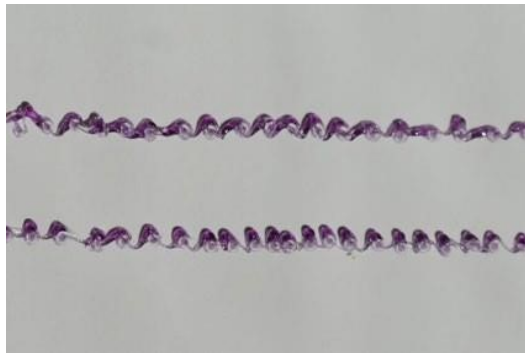


Figure 3: Thin-to-thick wave print stroke using handheld 3d

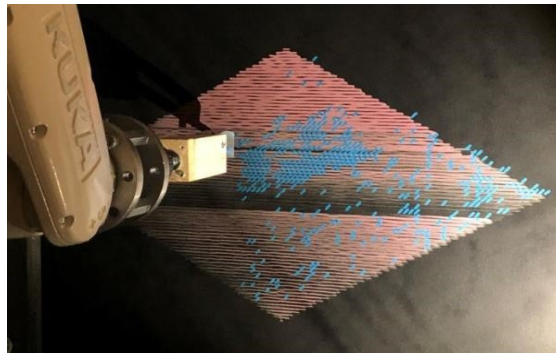


Figure 4: Robotic drawing, course taught at Chalmers

Examples within the field

Software used in additive manufacturing today has been developed to approximate surfaces of geometries and if needed fill them with a structure that makes them stable. Texture comes from the modeling software in which it is produced via direct modeling or scripting; and the resulting surface is then approximated in a slicing software.

A different approach can be found for example within the field of clay printing, or in experimental material research such as the Vinnova project Would Wood. In this project exhibited at Compound Cellulose (2019), texture was achieved through toolpath deviation from the base geometry resulting in a type of digital craftsmanship producing a hybrid expression between digitally controlled and physically errant.

Another example of letting the material properties and deposition technique come to the forefront is Zach Cohens work Piling and Pressing (Cohen, Carlsson 2020) where concrete was laid down through point deposition within base structures of wood and steel resulting in billowing and semi-controlled forms and textures.

At Branch Technology robotic printing of individual trusses form volumetric lattice structures where deposition speed and delays are critical.

Short Biography

Karin Hedlund is a PhD student the University of Borås. Her work focuses on procedural geometry, and she is currently experimenting on additive manufacturing and textile. With an architectural master's degree from Chalmers University her thesis was on textile landscape furniture. She also holds a post-professional degree from Southern California Institute of where her final project was a color changing face using machine vision and capillary action. Previous work experience includes adjunct lecturer and main instructor at Robot Lab, both at Chalmers University, and architect at White Arkitekter. Her interactive textile Watercolors is included in the permanent collection of ArkDes, Sweden's national center for architecture and design.

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Sustainable Computational Fabrics

Sofía Guridi | Aalto University | sofia.guridi@aalto.fi

Abstract

My research is situated in the field of smart textiles, integrating sustainability concerns for the development of textiles with computational capabilities.

Developing smart textile materials capable of sensing, reacting, and adapting to environmental stimuli has contributed to the growing field of Wearables (Wu et al., 2019). When combined with digital components and technologies, these now eTextiles, also gain the computational capabilities that have proven to have potential in various fields such as performance or healthcare (Gopalsamy, 1999 & Xiaopei, 2019). Nevertheless, the ubiquitous integration of electronic components, such as metallic conductive fibers, into textile structures creates complex multi-material substrates. Considering the challenges regarding textile waste (European Parliament, 2022) and electronic waste management (UN's Global E-waste Monitor, 2020), this reveals an urgent need to address the issue of sustainability in creating new eTextiles. To approach it, I am looking into waste preventive eco-design guidelines, including reducing the diversity of materials in a product, reducing the weight, and prioritizing using renewable and recycled materials (Köhler, 2013 & Veske et al., 2021).

My initial focus is on the last one, particularly, how bio-based eTextiles could create new alternatives to the industry, where adaptive, biocompatible, and biodegradable materials could replace metals and plastics. Examples of this approach can be found in using carbon-based conductive inks to replace metal nanoparticles (Kahir et al., 2019) or cellulose-based waveguides for light-emitting fabrics (Guridi et al., 2022).

Therefore, my research aims to explore the use of bio-based materials to create novel sustainable computational fabrics. From a design perspective, the research will be led by a Practice-Based and Constructive Research approach, together with Material-driven design methods to generate new knowledge based on physical outcomes that connect knowledge inputs from four different research groups at Aalto University at Arts, Electrical Engineering, and Chemical Engineering.

Based on the interdisciplinary nature of this research, the results include the work led by myself but in collaboration with the team of researchers. The results will be tangible, physical samples of bio-based computational fabrics and its operating systems: power supply, processing units, and AI algorithms. Scientific results and practical-use technology could be later used as the basis for applied research and commercial innovations. Artistic work and aesthetics explorations will also be developed, in order to expose the work to a wider and diverse audience.

So far, I have published two conference papers discussing the use of biodegradable cellulose for light transmitting textiles, and I am currently working on a Literature Review on Biomaterials for Smart Textiles. I have also created the Chilean Pavilion at the London Design Biennale, where I presented

hand woven biodegradable smart textiles. In addition, I am collaborating with Chemical Engineers to create new samples of all-cellulose interactive textiles utilizing new functional fibers, considering LCA, design for disassembly and biodegradability studies.

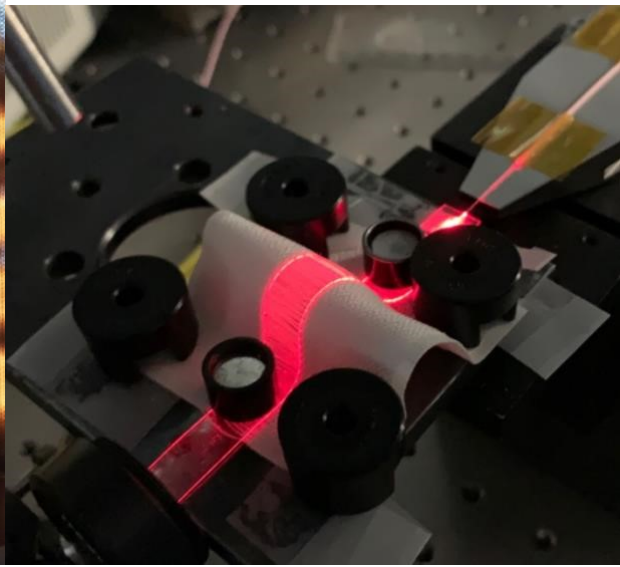
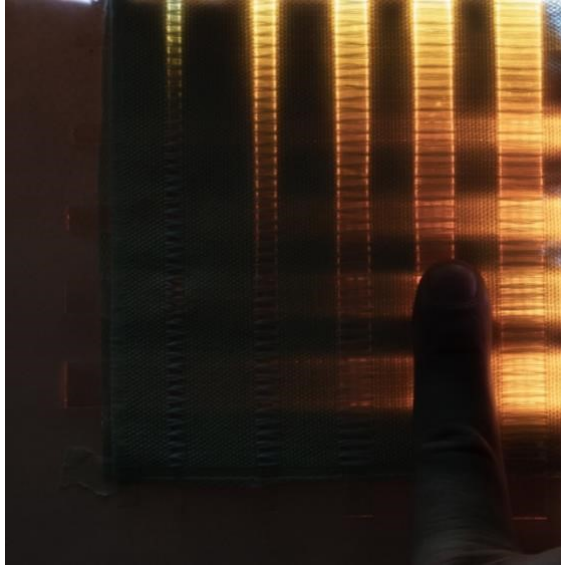


Figure 1: Woven cellulose optical waveguides for the creation of light emitting textiles. Credits: Sofia Guridi **Figure 2: Laboratory testing of soft optical bending sensor creation of using cellulose waveguides. Credits: Vertti Virasjoki.**



Figure 3: Chilean Pavilion at London Design Biennale 2023: Biodegradable cellulose-based interactive textile pieces.

Credits: James Retief



Figure 4: Chilean Pavilion at London Design Biennale 2023: Biodegradable cellulose-based interactive textile pieces.

Credits: James Retief

Short Biography

I am Design researcher from Chile based in Finland. My research is situated in the field of smart textiles, integrating sustainability concerns for the development of computational fabrics. Following a practice-based approach, I aim to explore the use of novel bio-based materials, proposing new alternatives for the creation of soft interactive interfaces capable of capturing and processing data. My background in contemporary design, textiles, digital technologies, and interdisciplinary collaboration facilitates the connection between myself and research groups from Arts, Electrical Engineering, and Chemical Engineering. I am currently part of the [Fashion/Textiles Futures research](#) group and the [Bioinnovation Center](#) at Aalto University.

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Exploring Knitting Techniques for Sustainable Soft Actuator Integration in Textiles and Wearables

Lingxiao LUO | MSCA-DN PhD of Ensadlab, Ecole des Arts Décoratifs - PSL University | lingxiao.luo@ensad.fr

Abstract

This research aims to develop an integrative and sustainable approach for seamlessly integrating electro-active soft actuators into the textile and clothing context, with a specific focus on leveraging the potential of knit technology in the rapidly growing field of wearables. Soft actuators, known for their compliance and flexibility, hold immense promise for the development of next-generation smart textiles (Sanchez et al., 2023) and wearable devices (Albaugh et al., 2019; Luo et al., 2022), particularly yarn or fiber-based actuators (DuTa et al., 2022). While previous research on knit sensors has demonstrated the potential of using conductive yarns to directly fabricate interactive e-textiles (Oujifei et al., 2019; Wicaksono et al., 2022), this study focuses on effectively integrating these advanced materials into knit structures, considering aesthetics, interactivity, and sustainability.

With an emphasis on sustainability, this study addresses the environmental impact and circularity associated with soft actuator integration into textiles. It explores sustainable materials, production methods, and strategies to extend product lifespan. The methodology combines theoretical inquiry, material experimentation, and iterative design processes to investigate integration. Literature reviews establish a theoretical foundation and examine the distinctive characteristics of soft actuators in relation to smart textiles. Physical probes and explorations identify suitable knit structures and fibers for effective integration. Collaboration within the MSCA SOFTWAREAR doctoral network facilitates

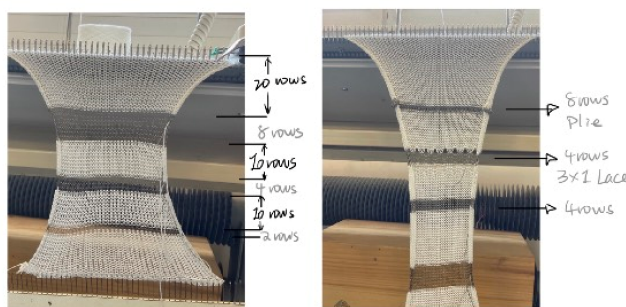


Figure 1: Knit Samples of different conductive yarns and structures (Lingxiao, 2023).

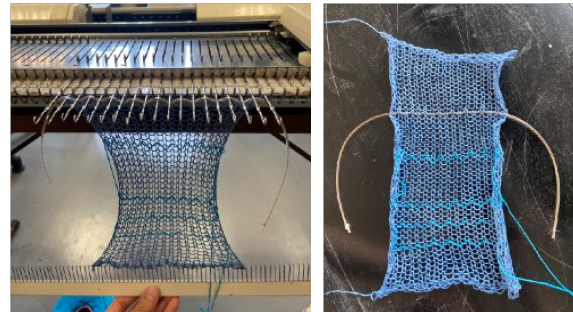


Figure 2: Knitting Process and a Textile sample of weaving Fiber Pump with inlay technique (Lingxiao, 2023).

interdisciplinary work with physicists, engineers, and material scientists, fostering knowledge exchange.

The ongoing work includes conducting experiments with various smart materials, such as conductive yarns capable of sensing touch and generating resistive vibrations. Additionally, the investigation explores the utilization of Fiber Pump, a fluidic actuator trigger, within textile design, leveraging advancements made by EPFL researchers Smith, Cacucciolo, and Shea (2023) in wearable fluidic systems. This exploration involves investigating knitting techniques and fiber materials to optimize integration and functionality. The development process encompasses iterative design iterations,

prototyping, and testing, with analysis focusing on evaluating design outcomes, performance, and potential applications.

This research project aims to bridge the gap between academia and industry, contributing to the field of soft actuators by exploring their integration into textiles and expanding their wearability. It also has the potential to enrich textile design by showcasing novel expressions and creating techniques enabled by soft actuators. Furthermore, it contributes to the advancement of smart textiles, wearables, and eco-design by exploring sustainable and aesthetically appealing solutions.

Short Biography

Lingxiao Luo is a knitwear designer, material researcher, and a Marie Skłodowska-Curie Actions (MSCA-DN) funded PhD student within the SOFTWEAR doctoral network. The PhD is prepared in the Soft Matters research group of Ensadlab, at Ecole des Arts Décoratifs - PSL University. She is the founder of Radical Fibre Lab and has collaborated with academic institutions like the MIT Media Lab. Graduating with an MA degree in Knitwear Womenswear from the Royal College of Art in 2018, Lingxiao has made significant contributions to the fashion industry, partnering with renowned brands and manufacturers. Her design work has garnered attention from the media and received accolades such as the Golden Prize of Textile and Materials at IDA 2018. With a strong commitment to interdisciplinary work, Lingxiao aims to develop innovative solutions that bridge the gap between the fashion industry, technology, and sustainability.

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