PILOTING FASHION-TECH EDUCATIONAL STRATEGIES

PROOF OF CONCEPT FOR INNOVATIVE FASHION-TECH PRODUCTS AND SERVICES

edited by
Daria Casciani, Chiara Colombi

FTalliance

PILOTING FASHION-TECH EDUCATIONAL STRATEGIES
Proof of Concept for Innovative Fashion-Tech products and Services

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The publication has been prepared and curated by the editors that have checked the ethical aspects of the editorial processes to prevent any negligence during the publication process. The chapters has been peer-reviewed through a double blind process with a scientific committee that has reviewed and proofread the contents before acceptance and online delivery.

DELIVERED

July 15, 2022

PUBLISHER

Politecnico di Milano

ISBN 9788894167443

STATEMENT OF ORIGINALITY:

PILOTING FASHION-TECH EDUCATIONAL STRATEGIES

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FTalliance

FTALLIANCE
Weaving Universities and Companies to Co-create Fashion-Tech Future Talents

Erasmus+ KA2: Cooperation for innovation and the exchange of good practices - Knowledge Alliances
Call for Proposal: EAC/A03/2018
Acronym: FTall
Project Grant Agreement: 12662
Project Reference: 612662-EPP-1-2019-1-IT-EPPKA2-KA - FTall

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Co-funded by the Erasmus+ Programme of the European Union

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This publication is the result of a didactic research process involving students, teaching staff and industry experts from across Europe in three (3) learning experiences implemented over a period of almost one year (2021-2022). It aims to identify and describe the major lessons learned from the testing and piloting of three innovative Fashion-Tech learning experiences in order to discuss opportunities for Fashion-Tech (i) Strategic Innovation, (ii) applied Research for the future Education Agenda and (ii) cooperation, networking and partnership opportunities.

The work has been organised and synthesized by Politecnico di Milano as leader of the activities related to designing and piloting Fashion-Tech learning experiences (WP2), and project coordinator of the Fashion-Tech Alliance, a 3-years European academia-industries partnership project aimed to facilitate the exchange, flow of knowledge, and co-creation within the Fashion-Tech sector to boost students' employability and fashion-tech innovation potential. This project specifically involves five renowned Higher Educational Institutions Academic partners (Politecnico di Milano, Dipartimento di Design, ESTIA École Supérieure Des Technologies Industrielles Avancées, Högskolan i Borås, University of the Arts London - London College of Fashion, Technische Universiteit Delft), one Fashion-Tech research Centres (Centexbel) and seven industrial partners (Decathlon International, Pangaia Grado Zero, Pauline van Dongen, Pespow, Stentle / M-Cube Group, We Love You Communication, and PVH Europe). The aim of this project is to provide an evidence-based perspective on the Fashion-Tech education reporting on the relationship between advanced teaching/learning approaches about design, business management, and engineering that can be applied to the future generation of fashion-tech professionals.

This publication consists of five chapters presenting the learning experiences' workflow starting from the research premises, the implementation, and evaluation, followed by a reflection on the results with concluding remarks and future perspectives on Fashion-Tech education. Chapter 1 sets the premises of the Fashion-Tech educational research, meanwhile, the following chapters (2,3,4) present the case studies of the three piloted learning experiences describing the contents, objectives, and outcomes, reporting the methodology and lesson learned in terms of Fashion-Tech emerging topics, and reflections on the phases of the didactic experiences. Each of these chapters is followed by visual charts that present the results showcasing the portfolio of innovative Fashion-Tech concepts of products/services developed during the learning experiences. Finally, chapter 5 sets out the findings and future trajectories for Fashion-Tech education and collaboration. It discusses how the research findings led to setting the premises for prospective scenarios of the Fashion-Tech education, which serve as an invitation to open a collaborative discussion on the future of Fashion-Tech educational models, collaborative engagement between different stakeholders of the sector, and all concerned about the skills of future Fashion-Tech professionals.

This publication contains the deliverable D2.2 Proofs of Concept for innovative FT products/services, in fulfillment of the European Project FTalliance Weaving Universities and Companies to Co-create Fashion-Tech Future Talents (612662-EPP-1-2019-1-IT-EPPKA2-KA - FTall).

4. CASE STUDY THE SECRET LIFE OF CLOTHING

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4.1 EXPLORING GARMENT INTERACTIONS

As a society we are becoming increasingly aware of the need to understand product lifecycles, so that we can use, repair and re-use the material things we consume more sustainably. We are also increasingly aware of the issues relating to the usage of our data in product linked services. At the centre of these concerns sits the field of wearable technology (WT). By combining the cycles of obsolescence and novelty for which consumer technologies and fashion are notorious, WT is generally created with a limited period of utility. It often combines materials such as textiles with traditional electronics incorporating rare earth elements, making disassembly and recycling incredibly complex *(Saunders, 2021).* Plus, WT must capture data from the wearer's body, their digital presence and their surroundings to provide services to the waerer. To begin to address these issues it is vital to design interactions with WT which are useful in the long term, so that the lifecycle of a WT product is extended. Yet while a focus on interactivity is a key skill required by designers of WT, current pedagogic models evolving from traditional fashion, jewellery and accessories courses generally maintain a focus on aesthetics. Thereby limiting student designers' ability to fully engage with technology design. In addition, the interactions we have on a daily basis with the items we wear and in turn their interactions with our environment (including other technologies) are rarely understood or investigated.

This section situates the course 'The Secret Life of Clothing: Exploring Garment Interactions' in relation to existing literature on learning and pedagogy for WT, along with relevant design research methods. The design and implementation of the course are further described in the following sections, concluding with a discussion of student outcomes and our insights as educators having delivered the course.

The majority of literature exploring pedagogy for WT focuses on developing coding or physical computing skills through in-situ making activities, primarily in the form of hackathons *(e.g. Byrne, O'Sullivan, & Sullivan, 2017)*, or makerspace and maker community projects with particular social aims *(e.g. Okerlund, Dunaway, Latulipe, Wilson, & Paulos, 2018; Pasquini et al., 2020).* In addition, UX pedagogy is increasingly situated in studio practice models *(e.g. Mitchell et al., 2019).* While collaboration is often proposed to be a key competence in developing a WT design, the traditions of hackathons, community projects and studio pedagogy are challenged by remote, online learning in which student groups may be situated in different cities, countries and time-zones (the context of the FTalliance project).

As the foundational skills of coding and technology prototyping have taken precedence in prior pedagogic models, they often fail to develop students' understandings of the use and functionality of WT. While community projects sometimes attempt to solve problems through critical making *(Pasquini et al., 2020)* thereby engaging with the reasoning behind creating a garment or accessory augmented by technology, consideration of its day-to-day usage is rare. Instead, teaching primarily supports the creation of prototypes which often use technology to provide a novel *(Okerlund et al., 2018),* rather than a genuinely useful interactive experience. This reflects the majority of fashion WT projects which receive significant media attention, as they are created to generate publicity or to showcase emerging technical developments. These contexts are a major informant of designers sociotechnical imaginaries *(Jasanoff & Kim, 2015)* in relation to the purposes and applications of WT. As novelty WT has such a strong influence on designers' imaginations, it can be difficult for them to conceive what a truly useful and beneficial interactive technology, which maintains its relevance and utility in the long term might be.

For this reason, novel research methods were investigated to prioritise the exploration of the daily use of a designed product or service, and speculation on the application of emergent technologies in a product or service which cannot yet be realised as a functional prototype. These are discussed further in the following sections.

Thing Ethnography and Thing Centered Design

Thing ethnography' *(Giaccardi, Cila, et al., 2016; Giaccardi, Speed, et al., 2016)* refers to the use of sensor augmented objects (usually mundane, everyday items) to capture data which is used to produce an ethnographic account of the lifeworld of a non-human thing. It is derived from design ethnography and anthropology but places a specific emphasis on de-centring from human perspectives in order to gain new insight into human relationships with things, and their related use practices. This background informs the methodological aims of thing ethnography as a means to identify and solve problems (create actionable insights) for humans. Yet Giaccardi et al. *(2016)* dispute the ontological framing of humans as the only entities capable of generating such insights and solutions. Instead, they propose that things be treated as 'co-ethnographers', similarly to Pink's *(2015)* human research participants. The 'ontological symmetry' *(Giaccardi, Speed, et al., 2016: P237)* between humans and things, when exploring human processes is particularly suitable for emphasising the true usage of a fashion item and the associated habits, we develop around it. Crucially, thing ethnography attempts to de-centre from some of the cognitive biases we hold as humans but maintains a recognition of the role of the human within a vitalist (Bennett, 2016) New Materialism.

The primary methods reported in thing ethnography are visual. Using lifelogging cameras to automatically capture data depicting things as emplaced within their environments, from which adjacencies and relationalities to other things, along with temporalities are noted *(Chang, Giaccardi, Chen, & Liang, 2017; Giaccardi, Cila, et al., 2016; Giaccardi, Speed, et al., 2016).* In the studies reported, this visual data was organisedinto timelines, seemingly concurring with the importance of temporality in understanding material practices observed by *(Gowlland, 2015)*. Moving beyond visual data and methods Chang et al., *(2017)* propose the use of both time lapse cameras and smartphones for GPS tracking.

Finally, and importantly Giaccardi, Speed, et al. argue that 'as objects connected to the Internet become more common and able to collect massive amounts of data, they may begin to reveal patterns that were previously invisible to humans, and contest what we usually take for granted' *(2016: P236).* This suggests that the focus on data collected by connected WT can also be foregrounded through thing ethnography. Productively re-framing our perceptions of usage habits and passive data capture by connected WT.

Thing ethnography is conceived as a key informant of 'thing centred design'. A design process which leverages insights into the life of a thing through methods such as 'Interviews with Things' *(e.g., Chang et al., 2017)* and the creation of 'Object Personas'. Both can be informed by ethnographic data captured through lower tech methods than a true thing ethnography, even by the designer themselves capturing contextual data, although this is more limited in understanding the temporality of use of the studied thing. Arguably these methods are a creative and somewhat speculative response to the ethnographic data. Speculation is also a key method in exploring emerging technologies.

Speculative Methods

Speculative methods enable students to consider the use and functionality of a proposed technology, without recourse to what is currently possible to build, or to their perhaps limited knowledge of technology prototyping. For example, speculative prototyping was employed by Jewitt and colleagues *(Jewitt, Leder Mackley, & Price, 2021; Jewitt, Price, Leder Mackley, Yiannoustou, & Atkinson, 2020)* to explore participants' sociotechnical imaginaries (Jasanoff & Kim, 2015; Mager & Katzenbach, 2021) – hopes, fears, ethical concerns and collective predictions – for digital touch technologies. An area of technology which is currently emergent, largely lab-based and un-domesticated. Jewitt and colleagues' *(Jewitt et al., 2021, 2020)* methodology also incorporated storytelling and bodystorming with the speculative technology prototypes, an approach discussed later in this chapter.

The creation of speculative prototypes may be considered a form of design fiction, though the exact nature of what design fictions are is still contested. In some views, design fictions involve the creation of physical artefacts as a means to engage their audience with a speculative scenario, which questions current social norms and invites critical thinking *(Dunne & Raby, 2013).* These artefacts are known as 'diegetic prototypes' and are generally considered as props to help situate the viewer within a design fiction and to suspend their disbelief in a fictional world. The term diegesis refers to the world of the story and as such a diegetic prototype is a prototype which exists within and is consistent with the fictional world that has been created. Lindley et al. *(2014: P5)* observe that 'By prototyping, in the traditional sense, we can touch, feel, and interact with possible futures. In many ways prototypes allow designers to have 'situated' interactions with concepts.' Lindley et al. *(2014)* further argue the situating aspects of design fictions and diegetic prototypes can help to immerse an ethnographer in an imagined emplaced encounter. As Pink *(2015: P192)* observes: 'Uncertainty, anticipation and expectation are often considered to be feelings, as much as verbal articulations of what has not yet happened. We imagine not only with our minds, but also with our bodies.'

Bodystorming and Designing with the body

The critical role of the body in designing interactions, movements and engagements with a wearer is highlighted by research into WT development. Indeed, Tomico & Wilde *(2016)* propose a shift from Human Computer Interaction (HCI) to Human Garment Interaction (HGI). The body is a critical informant to 'Experience Prototyping' in UX *(Mitchell et al., 2019)* during which an experience is acted out, so it can be more fully understood, particularly through sensory experience as highlighted by Tomico and colleagues' research into 'Somatic Practices'. An emerging area in HCI derived from dance research (Dean, 2011). Such studies can be considered autoethnographic in that they contain first person accounts of otherwise inaccessible bodily (somatic) experience, particularly relating to movement and sensation *(Höök, Jonsson, Ståhl, & Mercurio, 2016; Loke & Schiphorst, 2018; Núñez-Pacheco, 2018; Núñez-Pacheco & Loke, 2017; Wilde, Schiphorst, & Klooster, 2011)*. Many of these studies use experiential activities to help the researchers become more attuned to their somatic experience, including body scanning and Feldenkrais exercises *(Höök et al., 2016).* Further methods include the creation of estrangement or destabilising established practices in relation to movement and bodily experience

(Wilde, Vallgårda, & Tomico, 2017). This is discussed as performing established tasks in new ways, using on-body props, or interacting with a material in a non-traditional context. This creation of familiarity and estrangement is similar to that proposed by speculative design *(Dunne & Raby, 2013).*

The learning experience proposed in the following section attempts to address the identified gaps in current WT pedagogy research and the collaboration and contextual issues posed by online learning and multi-sited remote teamwork. Additionally, it employs the methods of Thing Centred Design, Anticipatory Ethnography and Bodystorming to engage participating students in exploring the use of worn objects as design informants.

unctionality of WT. While community projects sometimes attempt to solve problems through critical making *(Pasquini et al., 2020)* thereby engaging with the reasoning behind creating a garment or accessory augmented by technology, consideration of its day-to-day usage is rare. Instead, teaching primarily supports the creation of prototypes which often use technology to provide a novel *(Okerlund et al., 2018),* rather than a genuinely useful interactive experience. This reflects the majority of fashion WT projects which receive significant media attention, as they are created to generate publicity or to showcase emerging technical developments. These contexts are a major informant of designers sociotechnical imaginaries *(Jasanoff & Kim, 2015)* in relation to the purposes and applications of WT. As novelty WT has such a strong influence on designers' imaginations, it can be difficult for them to conceive what a truly useful and beneficial interactive technology, which maintains its relevance and utility in the long term might be.

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4.2 FOCUSING ON THE LEARNING EXPERIENCE

The Secret Life of clothing learning experience focussed on aspects of interaction design research which could be conducted independently in diverse locations. The creation of a functional WT prototype was deemed to be impossible for a group to achieve through remote collaboration without placing an unfair burden on more technically skilled students. Though this may lessen the material competencies proposed as central to hackathon and maker pedagogies, different forms of material engagement were foregrounded through the focus on bodystorming and the development of soft skills *(Byrne et al., 2017; Kafai, Fields, & Searle, 2014)*. Through the development of soft skills, increased understandings of technology, collaboration and project development remain a part of the pedagogic experience.

The learning experience was delivered entirely online via Microsoft Teams for lectures and file hosting, Miro for collaborative workboards and a custom course site on the Moodle platform for course information and content.

Teaching took place over ten weeks and was divided into synchronous and asynchronous components, with asynchronous lecture content ('Theoretical Pillars'), quizzes and preparatory activities delivered during an initial two-week period of self-directed learning. The practical 'Challenge Based' component of the course began in the third week, at which point students were formed into teams and the collaborative aspect of the learning experience began.

Learning experience contents description

The course structure and focus were introduced to students at a kick-off event prior to the two-week period of asynchronous, independent study and included in the syllabus of the course *(2022).*

Brief indicative contents

Discover: The Theoretical Pillar lectures are intended to help students develop a comprehensive background knowledge of Fashion-Tech in their own time to inform students' responses to the challenge-based part of the course. Students were encouraged to manage their own learning, selecting the most interesting lectures before the challenge-based part of the course. During this time, they were invited to create a 500-word Blog post about a lecture of their choice and discuss it with their peers'. All students were required to engage with at least eight of the Theoretical Pillar lectures, demonstrating their engagement by answering the related quiz questions.

Design: Students were asked to create a low-tech prototype of an

interaction with an object worn on the body, which will be used in the long-term, makes considerate, ethical use of the wearer's data and may promote more sustainable behaviour. The challenge-based part of the course introduced low-tech interaction design methods to simulate the data generated by a connected wearable device, to inform an interactive experience that reflects long-lasting interaction and ethical data treatments. Students were guided through a process of research informed design ideation for an interactive wearable technology concept.
Deliver: Teams showcased their design concept and low-tech interaction prototype in a short video and accompanying project pitch.

Learning Experience Objectives

The general purpose of the course was to train future professionals in transferable interaction design research skills, applicable to a wide range of user centred technology and experience design contexts. Additionally, it aimed to support them in developing critical responses to current issues in the fashion WT sector, particularly in relation to sustainability and ethics.
To do this, the course aimed to provide students with tools to critically address contemporary social challenges in their development of interactive WT concepts and low-tech prototypes. In response to the increasing public awareness of data privacy issues and the negative environmental impacts of the fast fashion and consumer electronics industries, students were asked to explore sustainability and ethics holistically including the following:

- the identification of preferable futures as design contexts;
- the creation of genuinely useful interactive designs which offer repeated use by remaining in circulation longer;
- ethical sourcing, supply chains and social responsibility;
- use of less harmful materials;
- design for disassembly and end of life;
- economic sustainability; data capture and usage by interactive Fashion-Tech products.

Through an innovative combination of contextual asynchronous learning in 'Theoretical Pillars', and a challenge-based 8 week taught programme, students gained understandings of a range of interaction design research methods which they used to gather and analyse primary data. This enabled them to develop research skills while exploring the design context and use of a WT item.
The programme delivered a range of collaborative activities to diverse, international and interdisciplinary groups, allowing the students to develop teamworking skills that would prepare them for employment in the interdisciplinary field of Fashion-Tech.

The student teams were asked to develop a design concept and prototype for an interactive experience based on their primary research into the everyday lives of worn items. This would include a WT fashion item, considering sustainable principles, data ethics and long-term utility as well as aesthetics. Students were coached in pitching their design concepts in an appropriate manner for industry and investors, and asked to produce a video and accompanying project presentation. The videos needed to demonstrate the concept, the interaction design and low-tech interaction prototype. Students were also asked to contribute to online Miro development boards to share and reflect on their personal development.
To conclude, the challenge-based phase aimed to train professionals to collaboratively deliver a high level project in the field of Fashion-Tech (specifically WT), or in other sectors that also require the combination of a creative attitude, research informed proposals and sensitivity to economic, social, ethical and environmental impacts.
Learning Experience Outcomes
Upon successful completion of the course students will be able to:

- Select appropriate interaction and UX methods to conduct rigorous primary research into everyday behaviours and interactions;
- Critically analyse primary research data and apply findings to design development for interactive wearable technology;
- Apply an in-depth understandings of social, environmental and economic sustainability to the development of systems and product design for interactive wearable technology;
- Recognise key issues related to data ethics and propose solutions to manage and mitigate then when designing digital systems and products;
- Present design outcomes orally and visually in a professional manner appropriate to a wearable technology product pitch.

4.3 METHODOLOGY

Learning Experience Structure and Outline

The course was delivered over 10 weeks (September to December 2021), beginning with a welcome and 'kick-off' event that introduced the course syllabus, brief, and the asynchronous 'Theoretical Pillar' lectures and tests. During the initial two-week period of asynchronous learning, students were tasked to self-select and view 8 lectures which were of personal interest. There were(27 lectures to choose from grouped into 'Design', 'Methods', 'Technology' and 'Business' themes. Then they were asked to write a 500 word blog post about one selected lecture and discuss other students' posts.

Following this, the learning experience was structured in regular weekly online sessions that incorporated workshop activities and feedback on work in progress. The sessions were recorded and tasks were listed online so that students who were unable to attend had the option to catch up. Weekly asynchronous tasks were set to help students develop their projects, and were often related to a particular Theoretical Pillar lectures as a means to integrate synchronous and asynchronous teaching. The asynchronous tasks were documented by student teams on a shared Miro board.

To help students navigate the course, each week's topic, tasks and associated theoretical pillar lectures were organised into weekly tiles on the course Moodle site. Each tile outlined the class content and included an 'After the Session' section describing the tasks students were expected to complete before the next weekly class (see Fig. 17 to 19).

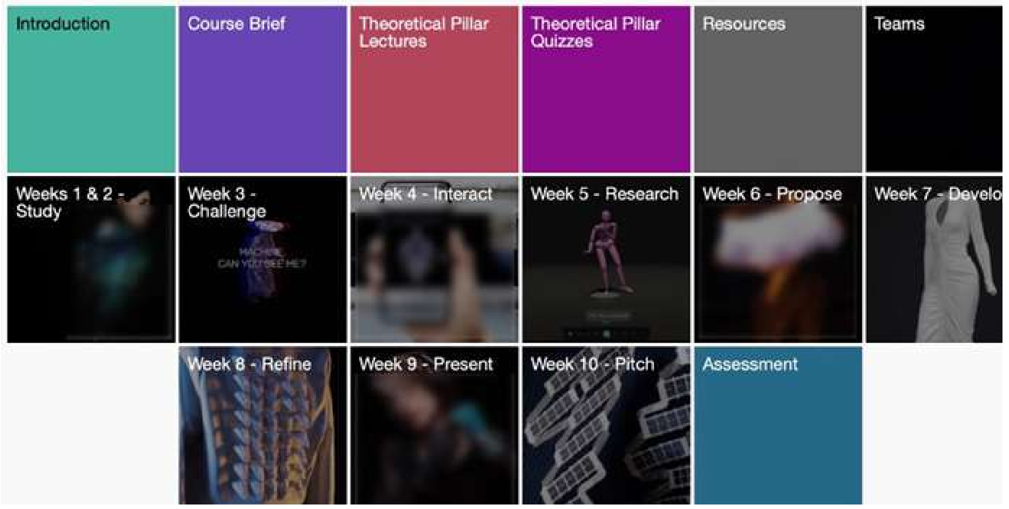


FIG.17 - WEEKLY COURSE STRUCTURE AND RESOURCES ON THE UAL MOODLE PLATFORM

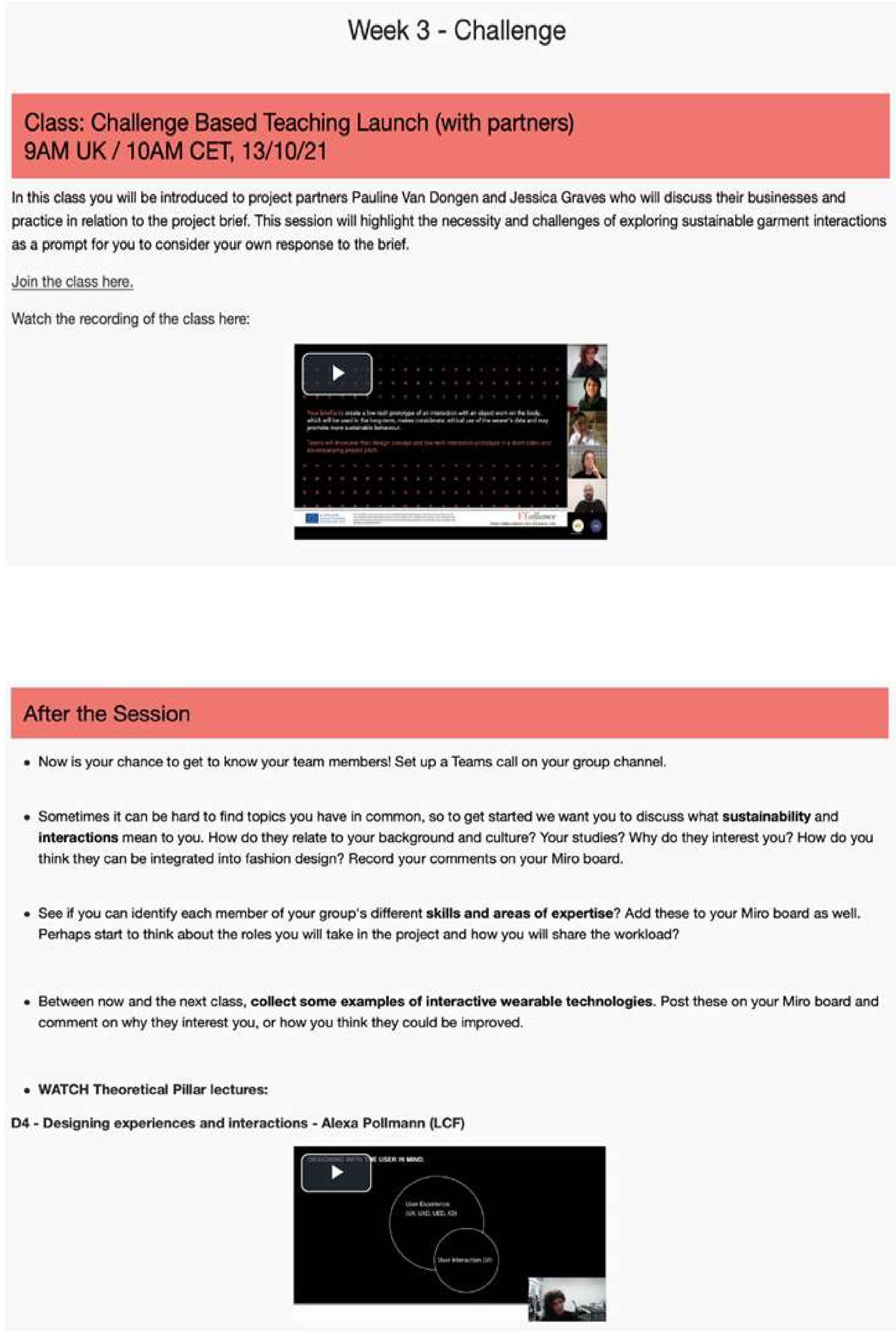


FIGURE 18 - EXAMPLE WEEKLY TASKS AND LEARNING ACTIVITIES

THEORETICAL PART

0 WELCOME + INTRODUCTION + SYLLABUS

WELCOME (Weeks 1)
The first weekly session introduced the representatives of the European partner companies: Pauline Van Dongen and Jessica Graves (see Participants section, below),and invited them to discuss their interest in the project brief and how it related to their practice. There was an opportunity for Q&A from participating students. At later stages,, the representatives of the European partner companies returned to discuss the student projects and give feedback, both at the initial project proposal stage (week 6) and then (week 10) final project pitches. This structure allowed students to maintain a longitudinal relationship with industry partners and to understand the perceived relevance of their proposed interactive designs..

1 DISCOVER (WEEK 1-3)

THEORETICAL PILLARS

FLEXIBILITY: FREE CALENDAR + HOURS/ETC (SUGGESTED TWO WEEKS)

2 DEFINE

EXAMPLES COLLECTION
PILLARS LECTURES
KEY INTERACTIONS INTRO

CONTENT SPECIFIC

SYNCHRONOUS: ESTABLISHED CALENDAR

DEFINE (Week 3)
Following the course kick off in Week 3, students were asked to collect examples of interactive wearable technologies and watch the theoretical Pillar lectures “Designing experiences and interactions”, and “Low-tech prototyping for high-tech designs”. This was to introduce key interaction and experience design concepts and prototyping methods

3 DESIGN

INTERACTION WITH WORN OBJECTS | IOT AND THING CENTRED DESIGN | THINGS ETHNOGRAPHIES | CAPTURING BODY DATA | INTEGRATING SUSTAINABILITY STRATEGIES

TUTORING COACHING AND REVIEWING ACTIVITIES

SYNCHRONOUS: ESTABLISHED CALENDAR

DESIGN (Week 4 – 9)
Weekly tasks were designed to guide students through a process of design research that explored everyday interactions with worn objects. This was to inform the development of a prototypical interaction represented in a short video. The weekly tasks were as follows:

Week 4 – Initial discussion about the examples of interactive WT identified by students, and bodystorming workshop to guide students to focus on everyday interactions. Students were asked to document the body, garment/accessories and environment interactions and to watch theoretical Pillar lecture: “IoT and thing centred design”.

Week 5 – Brief lecture presenting methods to capture and document the everyday life of a ‘fashion thing’, followed by group tutorials to discuss students’ choice of items to research and plan methods of data collection. Students were asked to conduct individual ‘thing ethnographies’ of the chosen wearable items and prepare a presentation about it.

Week 6 – Students presented initial ideas for their interactive design to peers and industry partners for feedback. A short lecture on data ethics for fashion brands was given by Jessica Graves from Sefleuria (to prepare students to consider data capture and usage of their device. Students were asked to propose a new iteration of their interactive design, based on received feedback and to watch Theoretical Pillar lecture “Capturing body data”.

Week 7 – Lecture discussing different additional approaches to sustainability in fashion items and WT, and sustainable adaptations to a business model canvas. This was followed by a workshop on design iteration and prototyping, guiding students through a rapid process of

FIGURE 19 - LEARNING EXPERIENCE STRUCTURE AND OUTLINE

sketching, making and digitising. Students were asked to integrate sustainability strategies into their final interaction design concept.

Week 8 – Group reviews to discuss the development and plans for presentation for the final delivery of interactive designs. Students were asked to watch the Theoretical Pillar Lecture: "The Pitch", giving tips for engaging presentations of interactive projects.

Week 9 – This was the final taught class prior to student's presentations of their design concepts which involved a mentoring session focused on developing and refining a professional standard project pitch.

4 DELIVER

FINAL PRESENTATION
FINAL REPORT
FINAL VIDEO

RESULTS
SYNCHRONOUS: ESTABLISHED CALENDAR

FLEXIBILITY
FREE CALENDAR + HOURSECTS

DELIVER (Week 10)
The final outcomes of the student groups were presented through video and presentation pitch.

FIGURE 19 - LEARNING EXPERIENCE STRUCTURE AND OUTLINE

Participants

The classroom was composed of 29 interdisciplinary and international students, 17 teaching staff, as well as 2 professionals from Fashion-Tech companies FTalliance consortium (internal and external) (Fig. 20).

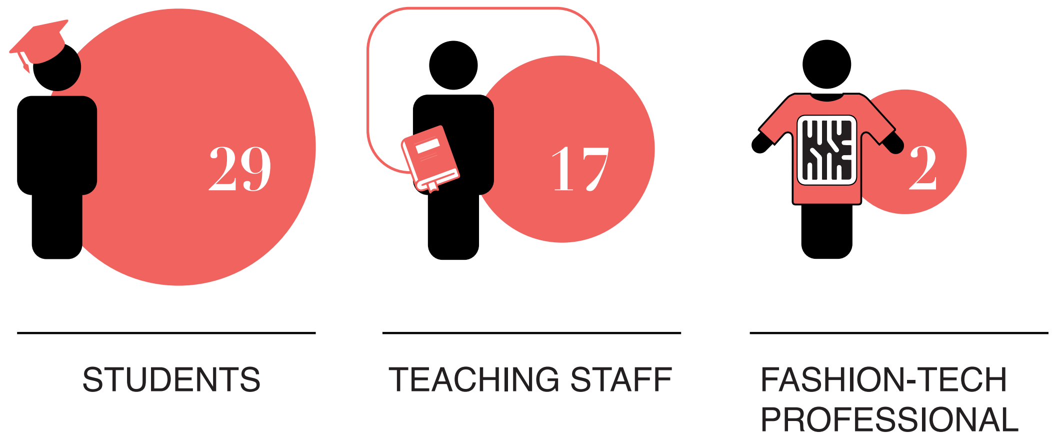


FIG.20 - LEARNING EXPERIENCE PARTICIPANTS

Teaching staff

Teaching staff members involved in delivering the learning experience are as follows (Fig.21):

- 5 professors from Politecnico di Milano, School of Design (Italy) focusing on Fashion and Fashion-Tech Design, Human-centered qualitative research methodologies, Sustainability, Circular Design and Materials;
- 3 professors from University of the Arts London – London College of Fashion (UK) focusing on Trend, Fashion and Speculative Design, pitch methods, low-tech prototyping, interaction and user experience;
- 4 professors from Hogskolan i Boras - The Faculty of Textiles, Engineering and Business The Swedish School of Textiles (Sweden) focusing on Circular economy, value chain innovation, Fashion-Tech value chains and business models;
- 3 professors from TU/Delft - Industrial Design Engineering Faculty (The Netherlands) focusing on Smart materials and textiles, textile sensors, sustainability in smart textiles;
- 2 professors from Ecole supérieure des Technologies industrielles avancées (France) focusing on Robotics.

94% of teaching staff (16 professors) were involved in delivering theoretical lectures during the theoretical part and 23% (4 professors) were involved in delivering the challenge-based part of the learning experience, being available during the project design through a series of mentoring and tutoring activities covering different topics such as user experience, interaction design, qualitative research methodologies, bodystorming, low fidelity prototyping, pitching.

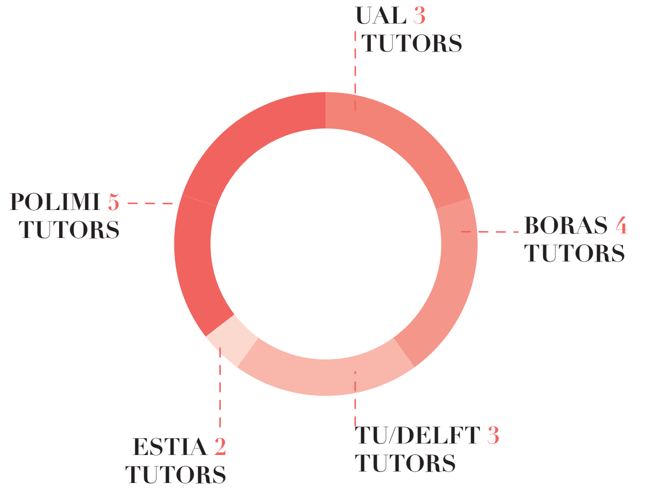
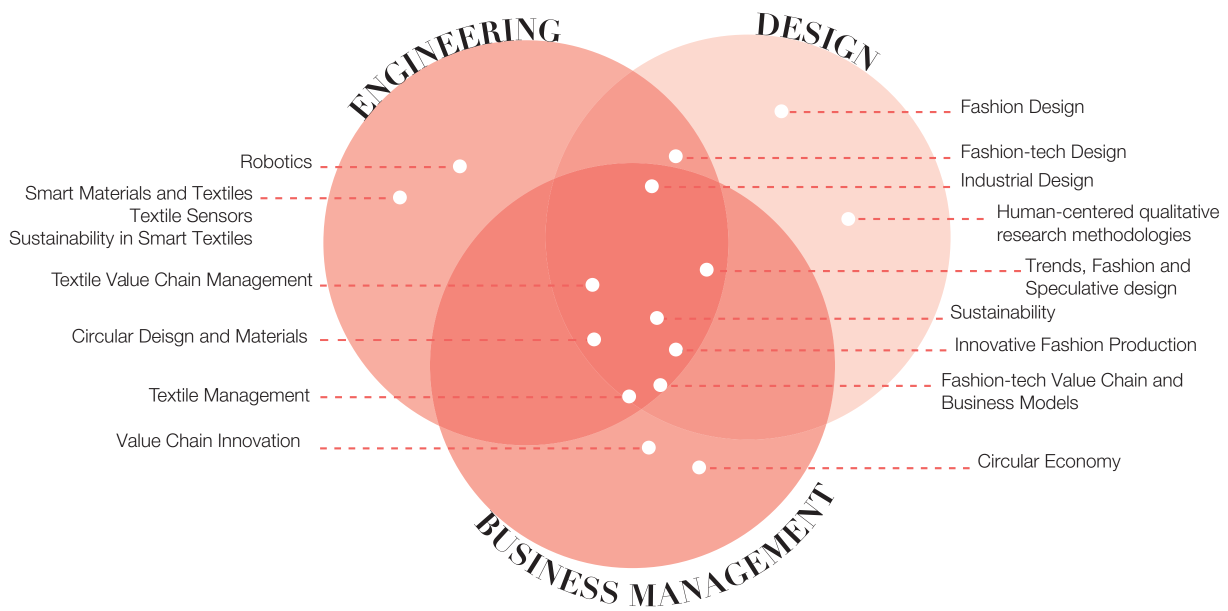


FIG. 21: LEARNING EXPERIENCE TEACHING STAFF



Students

Students who participated in the learning experience were selected from the following Universities and courses (Fig. 22):

- 12 students from Politecnico di Milano, School of Design (Italy) (second year MA in Design for the Fashion System and Integrated Product Design),
- 17 students from University of the Arts London – London College of Fashion (UK) (first and second year MA in Fashion Film and Digital Production, Innovative Fashion Production, Fashion Design Technology: Womenswear/Menswear, Fashion Photography, Strategic Fashion Marketing, Fashion Artefact, Footwear Design).

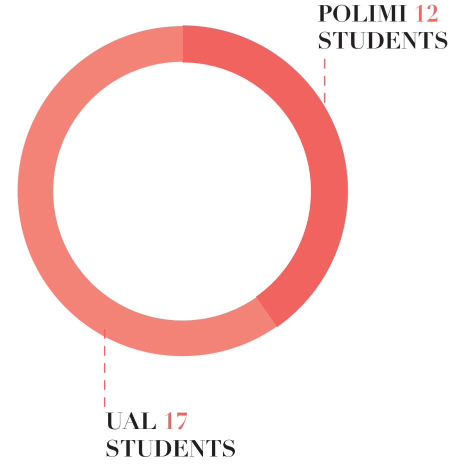
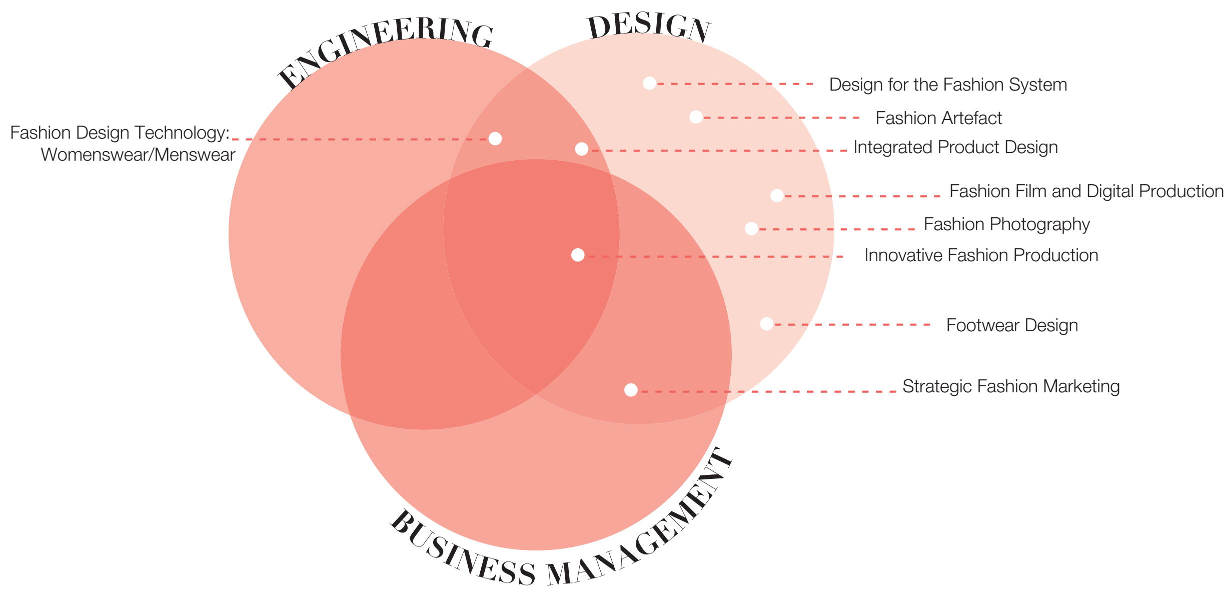


FIG.22: LEARNING EXPERIENCE STUDENTS



Students worked in 10 teams of about 3 members per group, all with interdisciplinary backgrounds and vareid abilities. Participating students were allocated a group on the basis of their degree specialism, to ensure groups contained a range of skillsets. This was intended to promote skills sharing and to allow students to take ownership of different aspects of the project work.
The learning experience has been partnered with two European companies leading the sector of Fashion-Tech, Pauline Van Dongen (PVD) from the Consortium of FTalliance and Jessica Graves of Sefleuria (2022). They mentored students through the process of developing their interaction prototype. They were chosen as mentors due to their respective practical expertise in data ethics for the fashion industry and WT design.

4.4 RESULTS

The learning experience has been able to implement a series of the Subject-specific Skills as resulting from the three focus group and integrated into the E4FT project (see Chapter 1). Subject specific skills related to Fashion-Tech Design process and methodology and Fashion-Tech project management were implemented in order to allow students to collaborate from different disciplinary domains and to produce Insights into multi-disciplinary area of Fashion-Tech and its industrial applications. In particular, this learning experience focused on a design-driven approach to technology, aiming to design new ways of applying smart wearables to increase sustainable products, processes, systems and users' behaviours (Fig. 23).

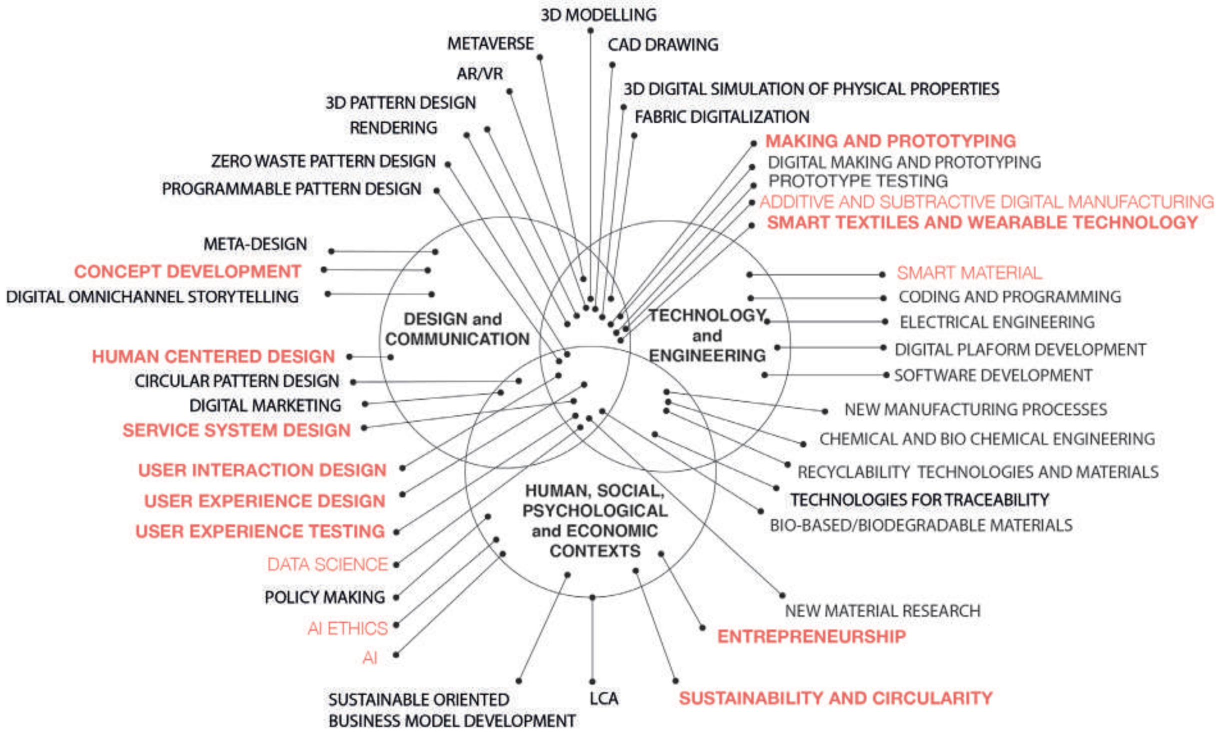


FIGURE 23 - SUBJECT SPECIFIC SKILLS IMPLEMENTED IN THE LEARNING EXPERIENCE

Lessons learned from integrating novel methods in WT education for fashion

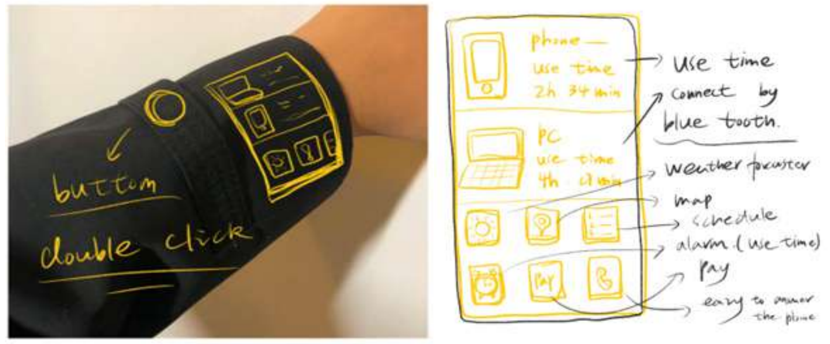
In this section, reflections on the course are captured from the teaching team, and student feedback is discussed in relation to strengths, weaknesses and areas for future development. Finally, the emergent themes represented in student projects are discussed in relation to the project aims of developing interactions with WT which would be sustainable, both in terms of durational use and environmental impact.

Reflections on emerging topics for research and education

Technology Archetypes

As previously discussed, WT has developed many recurrent themes and forms. These often feature in student's' proposed interactive designs, demonstrating the power of social understandings of technology development *(Jasanoff & Kim, 2015; Mager & Katzenbach, 2021).* This is sometimes problematic as it prevents students from following interesting themes in their research because they do not relate to existing WT, or students sociotechnical imaginaries. An example of this is seen in the development of the 'Bubble Life' project. For one member of the group, their thing centred research and bodystorming highlighted the significance of the sleeve as a multi-purpose form of protection and cushioning for the hand during day-to-day activities. In their initial designs, the focus on the sleeve resulted in sketches of a smartwatch like device integrated into a garment sleeve, rather than exploring the function of protection which the research revealed.

FIG.24 - BUBBLE LIFE INITIAL SKETCHES DEMONSTRATING A FOCUS ON EXISTING TECHNOLOGY ARCHETYPES



Thematic understandings of sustainable WT applications

Developing from, and referencing established WT archetypes, the following sociotechnical imaginaries of WT revealed by students' project outcomes were identified: Shape and Property Change Clothing, Anti-Technology Technology, Safety and Wellbeing. Each is discussed in further detail below, providing a snapshot of contemporary aspirations for WT and exploring what was enabled or revealed by the selected methods employed by the project. Each theme is also discussed in relation to the way it constructed sustainability and longevity of the interactive WT.

Shape and Property Change Clothing

A significant number of projects proposed garments and accessories which might change shape (e.g., 'BM Jacket', 'Bubble Life', 'Moov', 'Pillow Hat' and 'Weathair'). The primary motivations for this were to enable garments to function in multiple contexts, or weather conditions, therefore enabling the wearer to use them more often and potentially reduce consumption by eliminating the need to purchase additional items. However, the convenience and wellbeing of the wearer also featured as motivations, for example in relation to protection from adverse weather conditions, or discomfort when too hot or cold in 'Moov' and 'Weathair'. These projects were often developed from personal insight into usage of clothing in different contexts, derived from students' thing centred design research. For example, the need to often add, or take off an item of clothing when transitioning between activities or locations. Shape change was differently conceived as a way to provide emotional support in the 'BPM Jacket' (discussed further in Safety and Wellbeing) which was designed to mimic the haptic sensation of a hug. In this case the project's bodystorming activities focussed on exploring where on the body the pressure of a hug was experienced and how to mimic this with inflating materials, thereby inspiring the location of the shape changing elements.

The speculation of technical processes by which garments and accessories might transform enabled students to envisage products and related services which they could not easily prototype. These were extrapolated from research into emerging textile technologies such as soft sensors and actuating fibres. By proposing speculative solutions, students were able to move beyond troubleshooting technical limitations of a prototype and explore the ecosystem in which a shape changing garment or accessory would be sold, used and re-used. This often happens when considering modularity and recycling services which exist beyond the temporal and functional focus of a physical prototype.

Anti-Technology Technology

A contradiction is often evident in contemporary sociotechnical imaginaries of technology, proposing that we use technology too much and need to reduce our screen time or tech addiction, but also that additional technologies can help us to 'digitally detox'. The 'Bubble Life' project exemplified this in its final outcome, inflating cuffs which monitor the wearer's screen time and inflate to prevent them using a keyboard or touchscreen until they take a break. This final iteration returned to the protective role of the sleeve identified through bodystorming.

The 'Everyday Hacking Hoodie' presented a humorous and DIY approach to protecting the wearers' identity and data. Using a kit of sound dampening materials and white noise generators to protect against the concern (or sociotechnical imaginary) of the voice assistant services on our devices listening in on conversations without our awareness. Both projects can be seen as social comments whose outcomes are more akin to diegetic prototypes *(Dunne & Raby, 2013)* which push current concerns to extremes, rather than commercial products. Though the 'Everyday Hacking Hoodie' presented a well-developed business model and marketing campaign, along with nuanced consideration of the potential to sell DIY kit form of WT to digitally skilled programmers and gamers. Similarly 'usPockets' devised as a service to customise existing garments with a smart pocket lining. In this way the WT did not require the wearer to buy more clothing or accessories and could be removed for re-use and disposal. 'Bubble Life' had a similar, though a less explicit focus on one element of a garment (the cuff), demonstrating an understanding of modularity as a key means to reduce consumption, waste and enable repair in WT.

Safety and Wellbeing

While WT for safety is a relatively well-established use context. For example, the use of safety lights for cycling, which were incorporated in a shape changing jacket proposed by the 'Moov' project. This was developed to encourage the use of a more sustainable form of transport (cycling) by protecting the wearer from road hazards as well as climate protection. Many of the student projects explored wellbeing in relation to experiences of isolation during the Covid-19 pandemic. The 'Scentiment', 'Blue: focus' and 'BPM Jacket' projects all utilised forms of sensory feedback to promote wellbeing, including the less commonly explored senses of scent and touch. Thing centred research revealed habits of fidgeting with jewellery when stressed, or the need to cocoon and hug oneself when feeling lonely. Both of these actions formed the trigger for interactions designed to reduce negative emotions. In these projects the key to inspiring repeated daily use of the proposed WT products was their role as day-to-day support for stress the wearer might experience.

The themes of wellbeing and safety overlapped in 'usPockets', a project which proposed a subtle form of private communication and connection among a closed group of users. Tactile messages could be sent and received through the wearers' pockets, limiting the need to visibly use a mobile phone. This was a particular concern in public contexts when wearers might feel unsafe and wish to signal this to friends and family. However, the creation of a personal tactile language for communication in a chosen group was also considered to be a way to develop and maintain personal connections.

Reflections on tools and phases of the didactic experience

In addition to an analysis of student outcomes, the following reflections are linked to student experience during the phases of the learning experience and the learning methods particular phases employed:

Discover
Connecting critical discussion with critical design and making

During the Discover phase learning was exclusively asynchronous and student-led, with no live peer to peer interaction. While this opportunity for self-directed learning was welcomed by the majority of students, it presented certain challenges which suggests that synchronising theoretical lectures with the design phase would work better.. In this phase the Moodle platform was the primary resource, hosting the Theoretical Pillar lectures, quizzes and a blog for discussion of the lectures. The blog posts on the Moodle platform are not widely accessible, requiring the student to visit and post on a sub-section of the Discover phase Moodle page. A more accessible, or public platform may have encouraged greater engagement and gained more peer feedback on blog posts. However, careful consideration of creating a safe space for students to share should be balanced with fears around exposure when discussing an unfamiliar topic. Though students chose a favourite Theoretical Pillar lecture to discuss in their blog posts, these were not taken into account when allocating student groups, as the diversity and interdisciplinarity of student groups was prioritised. In future projects if students are allowed to self-select their groups, the discussion of blog posts could be used to aggregate groups with shared interests. This would overcome some of the negotiations necessary when forming groups with very different imaginaries and expectations of WT and fashion more broadly. It would also help the students to reach a consensus on their design aims more quickly and therefore have a longer period to refine their proposed interaction design.

The Theoretical Pillar lectures were intended to prime participating students with additional theoretical and technical understandings (beyond the scope of the core learning experience). The impact of this on their projects was not assessed, instead, multiple choice quizzes were used as a metric for measuring student comprehension and engagement with lectures which could be undertaken while watching, or immediately after a lecture.   This format failed to capture students' nuanced understandings of complex topics such as sustainability and ethics, and the longitudinal impact of the Theoretical Pillar lectures was not captured. Therefore, it potentially reduced their perceived relevance and connection to the main learning experience.

Define
Understanding the nature of interactions

The initial student research for the course highlighted that prior to the synchronous teaching some students found it difficult to differentiate between interactive and non-interactive WT. For example, there were many references to light up garments and accessories which focussed on the visual change in the garment, rather than whether this was caused by a trigger and response mechanism sensing an input. This may in part be due to the influence of Miro as a visual platform in which eye-catching images will be prioritised, creating an effect similar to a mood board.

Understanding the nature of an interaction may also be a beneficial aspect of hands-on prototyping with physical computing systems, as such activities that allow students to immediately observe inputs and outputs *(Byrne et al., 2017),* triggers and responses, or complex interactions between multiple sensors and actuators. They promote learning through 'tinkering' and from making and troubleshooting mistakes *(Pasquini et al., 2020).* Therefore, when working remotely, it could be beneficial for students to undertake the initial inductions in person on physical computing systems. These could be organised in local groups (e.g., per participating University), as this may help their comprehension of the topics and interactions. Some participating students continued to apply terms such as sensor and actuator inaccurately throughout the project, possibly because they had no physical examples of the separate hardware and stages involved in a process of sensing and responding.

Design

As well as producing novel designs, the methods introduced during the Design phase created challenges for students due to their unfamiliarity, and due to the the limitations of applying these methods in an online and distanced context.

Thing Centred Design & Ethnography
The challenge of changed perspectives

A thing centred design perspective foregrounds new perspectives on fashion items. Many students found this to be valuable in thinking differently about their relationships to everyday items, making comments such as:

"Thing ethnographies were the area I was most interested in and it allowed me to observe how my jackets/outwear changed along with my lifestyle changes. For the first time I was able to take a third perspective on these clothes and it was an amazing experience that reconnected me with what clothes mean to me."

However, it was not always easy for students to change perspectives from documenting their lives with a fashion item, to imagining and documenting from the perspective of a fashion item. The 'Interviews with Things' method was helpful for students to make this cognitive shift. Additionally, a more subtle shift in perspective was impacted by the online context of the learning experience: the ability to observe others

from a third person perspective. While conducting digital and online ethnographies is not a new phenomenon *(Kozinets, 2010)*, the recent constraints of the Covid-19 pandemic have highlighted that many of the traditional, embodied aspects of ethnographic study, particularly the role of the ethnographer's body as a research tool (which despite being less foregrounded in thing ethnographies, is still present in the analysis of the interaction between humans and things), and the observation of activities in a broader situated context, are restricted by the visual capabilities of digital platforms. Students were restricted from observing one another, or a peer's daily engagement with fashion things and so their reflections were primarily autoethnographic and sensory *(Pink, 2015).* This may have informed the focus on highly personal emotional and sensory experience in many of the project outcomes, yet these themes were also foregrounded in social consciousness by collective experiences of reduced sensory stimuli and isolation during Covid lockdowns.
The limitations in sharing full body experience and occlusion of participant perspectives, also proved problematic for bodystorming activities, as discussed in the following section.

Bodystorming
Understanding the relevance of 'acting' and audience
Similarly, a key consideration of bodystorming is its live, situated character. Although carried out to reflexively gain insight into the designer's own bodily experience, bodystorming is often carried out in group contexts *(Mitchell et al., 2019).* The external observation of a bodystorming process can often highlight observations which the wearer may overlook, or afford different value, and is particularly useful in understanding the social acceptance of a worn item (e.g., publicly visualising emotion), action (e.g., sleeping in public spaces), or interaction. Though restricted when conducted over video call, some of these aspects can still be observed and understood when watching a designer bodystorm. However, a significant collaborative issue was the contrast in timetables between participating students, meaning that prototyping activities were often carried out asynchronously and independently, only being shared afterwards in still images or video. Asynchronous bodystorming no longer provides the same opportunities for social feedback, as it does not offer the opportunity for comments and questions which can alter the way a designer considers the experience they act out, or the way they may move and behave in response. In addition, asynchronously shared documentation can be edited and curated, removing vital original context.
Asynchronous and individual bodystorming offered a way to circumvent students' insecurity around performing and being the focus of attention, which was also demonstrated in an initial reluctance to act out interactions. Yet in this instance it is precisely this social critique and duality of perspective which is desirable.
A further consideration in relation to perspective and bodystorming, is whether the creation of familiarity and estrangement when performing everyday tasks differently *(Wilde et al., 2017)* is impacted when the mediation of a video calling platform such as Teams already serves to make the familiar strange and differently experienced?

Deliver
Interdisciplinarity: Perceptions of skillsets and ability to contribute
Students confirmed that the team-working and business focussed aspects of the course helped them to develop soft skills *(Byrne et al., 2017; Kafai et al., 2014)*, particularly relating to collaboration across disciplines, and increased their confidence in presenting project work. However due to the interdisciplinary nature of the student groups, perceptions of students' ability to contribute to it were varied. Though the project was designed to be accessible to all, and requiring no particular design skills, the derivation of the course methods from design research led to an epistemic and linguistic framing of the course tasks which seemingly prioritised design. Indeed, the term 'interaction design' itself may mislead students from business, marketing and engineering backgrounds to feel excluded. While interactions and interactivity can be understood from many perspectives, the weekly activities were often based on visual documentation, such as photographing, filming etc. Some students observed that they had not had tuition in drawing skills, or film making and felt the need to produce visually refined outcomes, rather than focus on the research exploring interactions. The introduction of business planning tools earlier in the project may have helped balance students' perceived ability to contribute. Groups with well-developed business model canvases and value propositions undoubtedly created more nuanced and believable proposals for their interactive WT products.

Opportunities and limitations of the study
The study highlights several opportunities for the design of future learning experiences and topics which they might address.
In organisational terms, it is suggested to further connect the asynchronous and synchronous parts of the course, giving the students incentives to engage in discussion and peer feedback, by linking early stage conversations around theoretical interests to the development of group projects. Include assessment of students' recall and application of theory to support their project development longitudinally throughout the learning experience. Providing live feedback is crucial to their physical and psychological engagement and also to the results of the projects but

also in the learning outcomes and skills.Some insights emerged from students' feedback in regards to the topics of interest:

- **Histories of WT archetypes**. As students often designed familiar WT applications, a contextual lecture, or lectures, highlighting the common themes in many past WT projects may help students to think outside the box and challenge their sociotechnical imaginaries.
- **Introductions to wearable actuators**. While the focus of the project was on sensing to trigger an interaction and ethical handling of the sensed data, many projects proposed shape change in a fashion item. Inflation and deflation were the most commonly proposed method of actuation, demonstrating limited awareness of other options such as servo motors, Nitinol shape memory wires, or recently developed shape change yarns. Further learning experience should focus on organising inductions to physical computing hardware early in the learning experience, emphasising input and outputs, trigger and response, so that an understanding of cause and effect is developed at an early stage.
- **Designing non-digital experiences and interactions with clothing**. In relation to the projects which highlighted a perception that technology was not always necessary, or a positive force, teaching could consider how interaction and experience design might be used to create novel experiences with conventional clothing. Thereby demonstrating the transferrable skills developed through exploring WT. During early stages of student research, it may be beneficial to provide students with templates highlighting the temporal nature of an interaction, e.g. a blank storyboard with multiple frames which they must populate, encouraging them to consider and document the interactivity of WT they discover during research.
- **Psychological principles for WT design**. Given the focus on wellbeing in the majority of the projects of the students, the inclusion of psychological theories of wellbeing in supporting lectures could help students in exploring how emotional experience could be supported through mechanisms validated by psychological studies. Lectures could also incorporate methods and metrics accepted in psychology studies which students could apply when assessing the impact of an interaction design on wellbeing.

Analysis of the use of thing ethnographies and bodystorming in the learning experience have highlighted that embodied pedagogic activities still benefit from third person observation and feedback. As this is problematic in online and asynchronous learning designs, a key pedagogic challenge will be to explore how future learning experiences can create collaborative spaces online, in which the full body is visible, and not subject to restrictive framing. Teaching staff should ensure that when conducted remotely, bodystorming activities are always carried out live, with at least one observer and one performer. Small groups of up to three may be ideal and reduce anxiety around performance. The observer should be instructed that they may direct the performer, the camera angle and frame (where possible) and question the performer about their experience as they move/act. Invite students to swap roles and reflect on the differences between observing and acting. Group learning in virtual, or augmented reality (VR or AR) may offer a solution to this issue when used in conjunction with motion capture systems. The significance of seeing aspects of the full body such as posture and gaze in collaborative garment design environments has already been highlighted *(Yang and Lee, 2021)*. Yet, while this is an interesting pedagogic application of Fashion-Tech, there is currently a lack of fashion or interaction design specific VR collaboration environments *(Ibid.)*. This possible future is also currently limited by the cost of VR equipment, possibly leading to concerns over digital exclusion of students not able to afford the technology.
In relation to the study's aim to explore sustainable interactions, while student projects made significant attempts to define useful day to day contexts in which WT would be used over long periods of time, they highlight the problem of finding genuinely useful interactions which are not already supported by other technologies, or low-tech solutions which do not present the same ethical or sustainability concerns as current WT. It may be advisable when teaching WT projects to maintain a balance between allowing students to follow their enthusiasm for experimentation with new technology and ensuring they consider the utility, relevance and sustainability of their design outcomes. Although it is desirable for final product/service designs to show a nuanced understanding of their end usage, social and environmental impact, it is suggested that students be allowed to ideate initial WT proposals following their own technology interests and later refine, or adapt their proposals to be more practical, ethical and sustainable. Considering all these aspects when first designing with a new technology may be overwhelming and stifle experimentation.
All these elements considered, the field still requires further research and experimentation to discover a truly essential day to day application for WT, or to define a sustainable interaction. However, the inclusion of strategies for modularity, repair, or rental and shared ownership in the student outcomes demonstrate that while a 'killer app' for WT may be elusive, consideration of the secret life of clothing can help to foreground more sustainable ways to own and use WT.

REFERENCES

Aneja, A.P. & Pal, R. (2015). Textile Sustainability: Major Frameworks and Strategic Solutions, Bennett, L. (2016). Thinking Like a Brick: Posthumanism and Building Materials. In C. A. Taylor & C. Hughes (Eds.), Posthuman Research Practices in Education (pp. 58–74). London: Palgrave Macmillan UK.

Byrne, J. R., O'Sullivan, K., & Sullivan, K. (2017). An IoT and Wearable Technology Hackathon for Promoting Careers in Computer Science. IEEE Transactions on Education, 60(1), 50–58.

Chang, W.-W., Giaccardi, E., Chen, L.-L., & Liang, R.-H. (2017). "Interview with Things:" A First-thing Perspective to Understand the Scooter's Everyday Socio-material Network in Taiwan. Proceedings of the 2017 Conference on Designing Interactive Systems - DIS '17, 1, 1001–1012. https://doi.org/10.1145/3064663.3064717

Dean, S. E. (2011). Somatic movement and costume : A practical, investigative project. Journal of Dance and Somatic Practices, 3(1&2), 167–182. https://doi.org/10.1386/jdsp.3.1-2.167

Dunne, A., & Raby, F. (2013). Speculative Everything: Design, fiction and social dreaming. Cambridge, Massachusetts: MIT Press.

Giaccardi, E., Cila, N., Speed, C., & Caldwell, M. (2016). Thing Ethnography. Proceedings of the 2016 ACM Conference on Designing Interactive Systems - DIS '16, 377–387. https://doi.org/10.1145/2901790.2901905

Giaccardi, E., Speed, C., Cila, N., & Caldwell, M. L. (2016). Things as co-ethnographers: Implications of a thing perspective for design and anthrolopogy. In R. C. Smith, K. T. Vangkilde, M. G. Kjærsgaard, T. Otto, J. Halse, & T. Binder (Eds.), Design Anthropological Futures (pp. 235–248). London: Bloomsbury Academic. https://doi.org/10.5040/9781474280617.ch-015

Gowlland, G. (2015). Unpacking Craft Skills: What Can Images Reveal about the Embodied Experience of Craft? Visual Anthropology, 28(4), 286–297. https://doi.org/10.1080/08949468.2015.1052324

Höök, K., Jonsson, M. P., Ståhl, A., & Mercurio, J. (2016). Somaesthetic Appreciation Design. Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems - CHI '16, 3131–3142. https://doi.org/10.1145/2858036.2858583

Jasanoff, S., & Kim, S.-H. (Eds.). (2015). Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power. Chicago: University of Chicago Press.

Jewitt, C., Leder Mackley, K., & Price, S. (2021). Digital touch for remote personal communication : An emergent sociotechnical imaginary. New Media and Society, 23(1), 99–120. https://doi.org/10.1177/1461444819894304
Jewitt, C., Price, S., Leder Mackley, K., Yiannoustou, N., & Atkinson, D. (2020). Interdisciplinary Insights for Digital Touch Communication: Springer Briefs in Human Computer Interaction: Cham, Switzerland: Springer Open.

Kafai, Y. B., Fields, D. A., & Searle, K. A. (2014). Electronic Textiles as Disruptive Designs : Supporting and Challenging Maker Activities in Schools. Harvard Educational Review, 84(4), 532–565.

Kozinets, R. (2010). Netnography: Doing ethnographic research online. London: Sage.

Lindley, J., Sharma, D., & Potts, R. (2014). Anticipatory Ethnography: Design Fiction as an Input to Design Ethnography. Ethnographic Praxis in Industry Conference Proceedings, 2014(1), 237–253. https://doi.org/10.1111/1559-8918.01030

Loke, L., & Schiphorst, T. (2018). The Somatic Turn in Human-Computer Interaction. Interactions, 55–58. https://doi.org/10.1145/3236675

Mager, A., & Katzenbach, C. (2021). Future imaginaries in the making and governing of digital technology: Multiple, contested, commodified. New Media and Society, 23(2), 223–236.

Mitchell, V., Wilson, G. T., Leder Mackley, K., Jewitt, C., Golmohammadi, L., Atkinson, D., & Price, S. (2019). Digital Touch Experiences : Educating the Designers. In Proceedings of CHI 2019: EduChi. New York, NY, USA: ACM.

Núñez-Pacheco, C. (2018). Reflection through Inner Presence: A Sensitising Concept for Design. Multimodal Technologies and Interaction, 2(1), 5. https://doi.org/10.3390/mti2010005

Núñez-Pacheco, C., & Loke, L. (2017). The Body as a Source of Aesthetic Qualities for Design: Explorations and Techniques. Proceedings of the Tenth International Conference on Tangible, Embedded, and Embodied Interaction - TEI '17, 767–770. https://doi.org/10.1145/3024969.3025049

Okerlund, J., Dunaway, M., Latulipe, C., Wilson, D., & Paulos, E. (2018). Statement Making : A Maker Fashion Show Foregrounding Feminism , Gender , and Transdisciplinarity. In Proceedings of the 2018 Conference on Designing Interactive Systems - DIS '18 (pp. 187–199). New York: ACM Press.

Pasquini, L. A., Knight, K. A. B., Knott, J. L., Pasquini, L. A., Knight, K. A. B., & Weaving, J. L. K. (2020). Weaving critical theory, fashion, electronics, and makerspaces in learning: fashioning circuits – a case study. Interactive Learning Environments, 28(4), 497–511. https://doi.org/10.1080/10494820.2018.1542317

Pink, S. (2015). Doing Sensory Ethnography (2nd ed.). London: Sage.

Saunders, J. (2021). Do e-Textiles for Fashion Require Specific Legislation and Developmental Guidelines in Order to Avoid Harmful Waste? Multidisciplinary Digital Publishing Institute Proceedings, 68(3), 10–12.

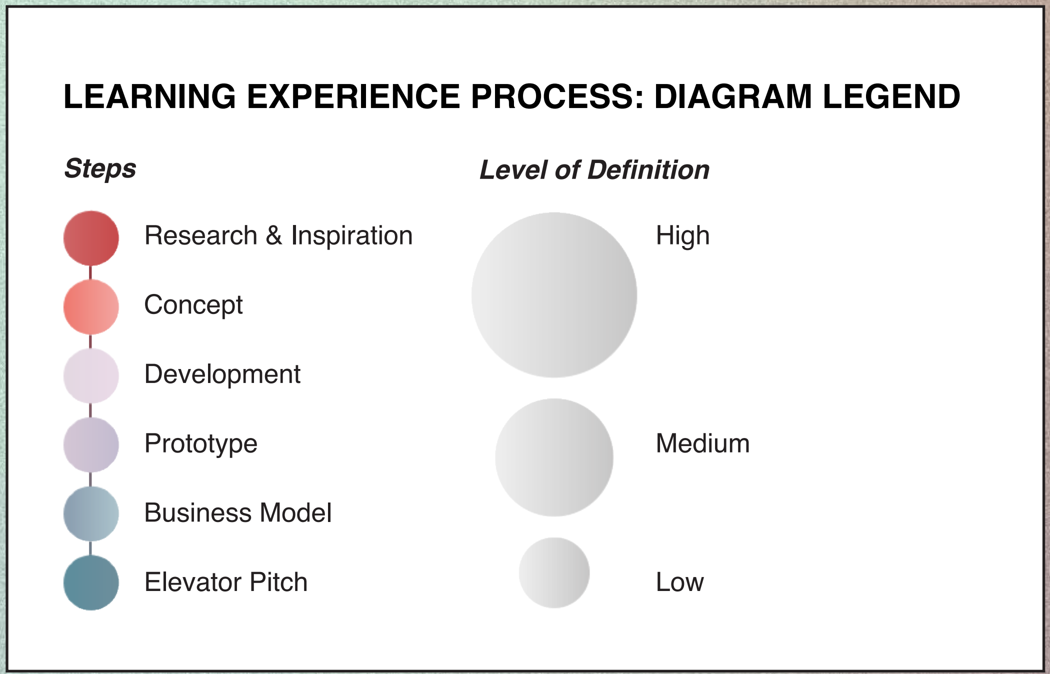
The Secret Life of Clothing. Exploring Garment Interactions Syllabus (2022) [31 May 2022] at https://fashiontechalliance.eu/en/the-secret-life-of-clothing

Tomico, O., & Wilde, D. (2016). Soft, embodied, situated and connected: Enriching interactions with soft wearables. The Journal of Mobile User Experience, 5(3), 1–17.

Wilde, D., Schiphorst, T., & Klooster, S. (2011). Move to design/design to move: a conversation about designing for the body. Interactions, 18(4), 22–27.

Wilde, D., Vallgårda, A., & Tomico, O. (2017). Embodied Design Ideation Methods : analysing the power of estrangement. Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17), 5158–5170. https://doi.org/http://dx.doi.org/10.1145/3025453.3025873

Yang, E. K. and Lee, J. H. (2021). Classifying virtual reality-based collaboration environments: practical insights for application in fashion design, International Journal of Fashion Design, Technology and Education. 14(3), 314–324.



FIELD EXPERIENCES
The portfolio of innovative fashion-tech concepts of product and services

MOOV
SCENTIMENT
USPOCKETS
BLUE
BUBBLE LIFE
WEATHAIR
EVERYDAY HACKING HOODIE
SPI-C
PILLOW HAT
BPM

MOOV

Chiara Surace, Design for the Fashion System (POLIMI)
Ajun Yao, Fashion Film and Digital Production (UAL-LCF)
Chris Vooren, Integrated Product Design (TU/D)

#PHYSICAL FEELINGS **#MOOD** **#ENVIRONMENT**

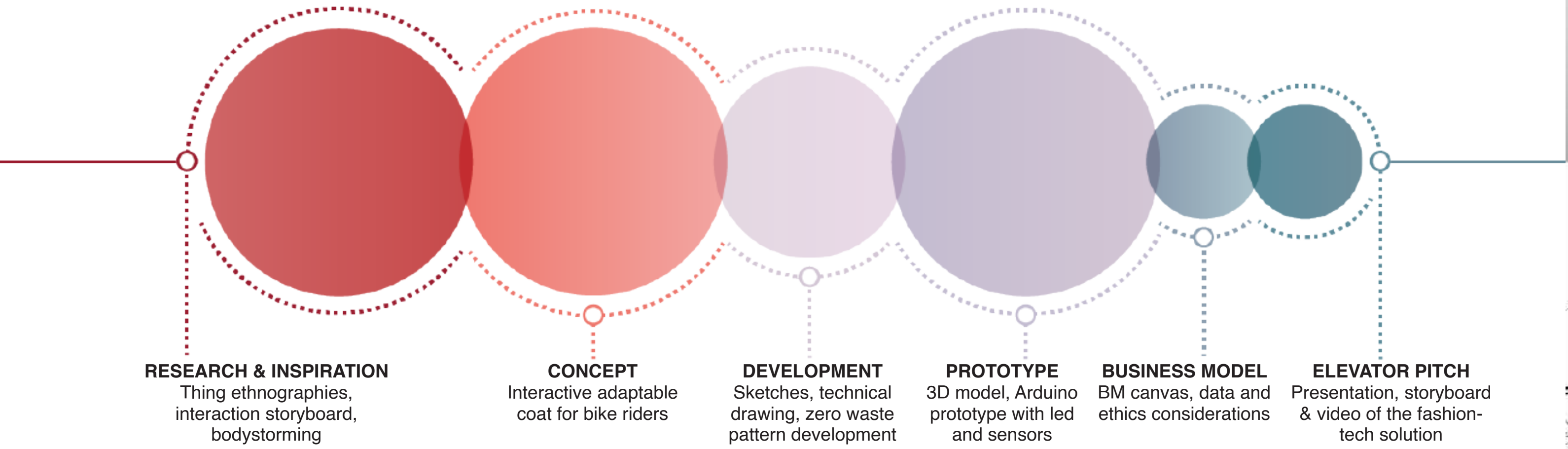
ABSTRACT

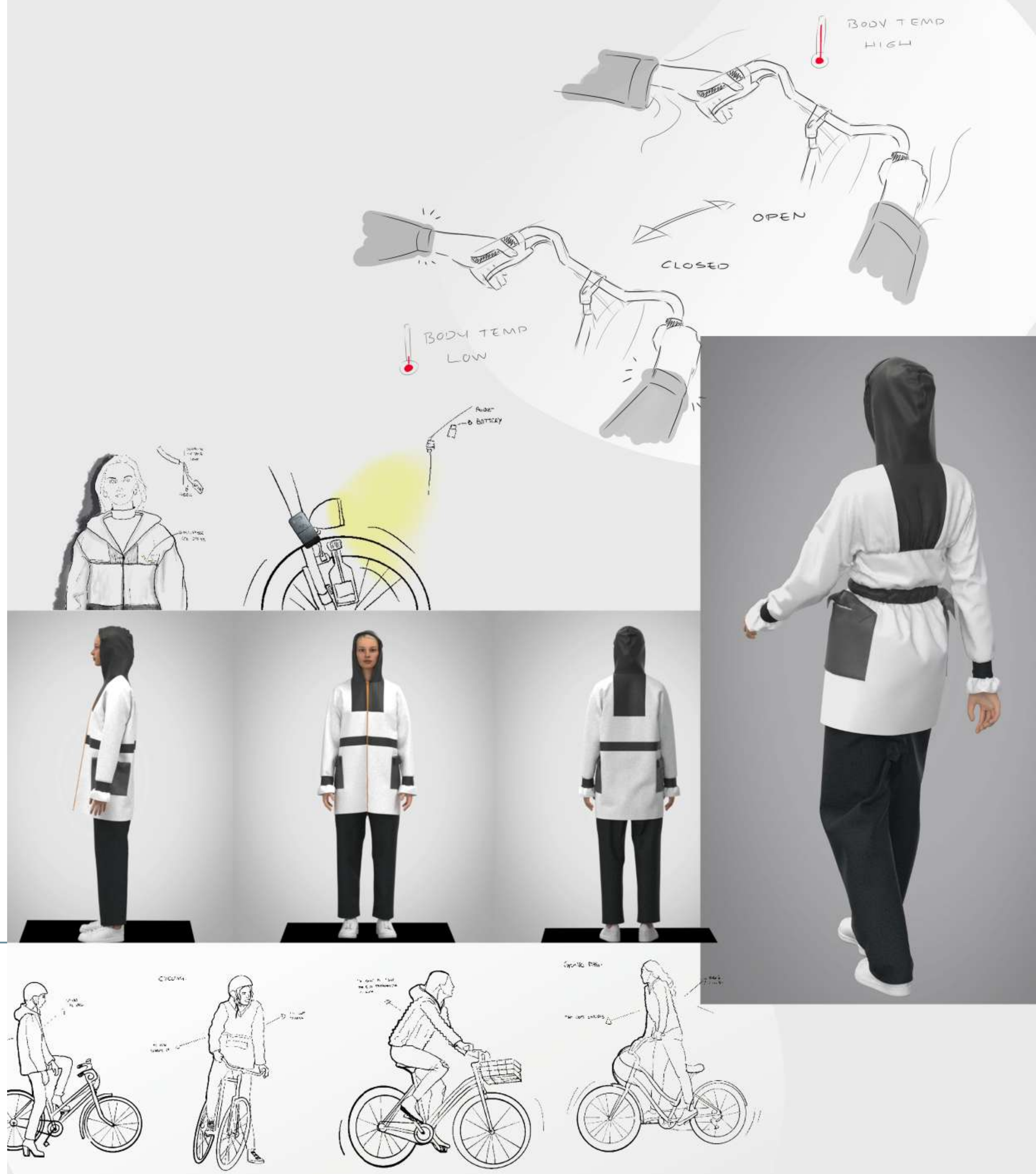
MooV is an interactive coat that aims to promote healthy behaviours, like cycling, being more sustainable and conscious about the environment. Body temperature defines the interaction: in colder situations, sections of the waist and cuffs will be tight and close to the body to trap heat and keep the body warm; in warm conditions, the coat will open and be looser to allow air to enter, cooling down the body. In addition, a light sensor turns the jacket's integrated LEDs when biking at night.

LEARNING OUTCOMES

Soft Skills	***Subject Specific Skills***
Multidisciplinary collaboration	Wearable technologies
Collaboration with professionals	prototyping
	Interaction design process

LEARNING EXPERIENCE PROCESS





SCENTIMENT

Angela Martino, Integrated Product Design (POLIMI)
YiYang Tang – Yvette, Innovative Fashion Production (UAL-LCF)
Mo Xie – Raphaël, Fashion Design Technology: Womenswear (UAL-LCF)

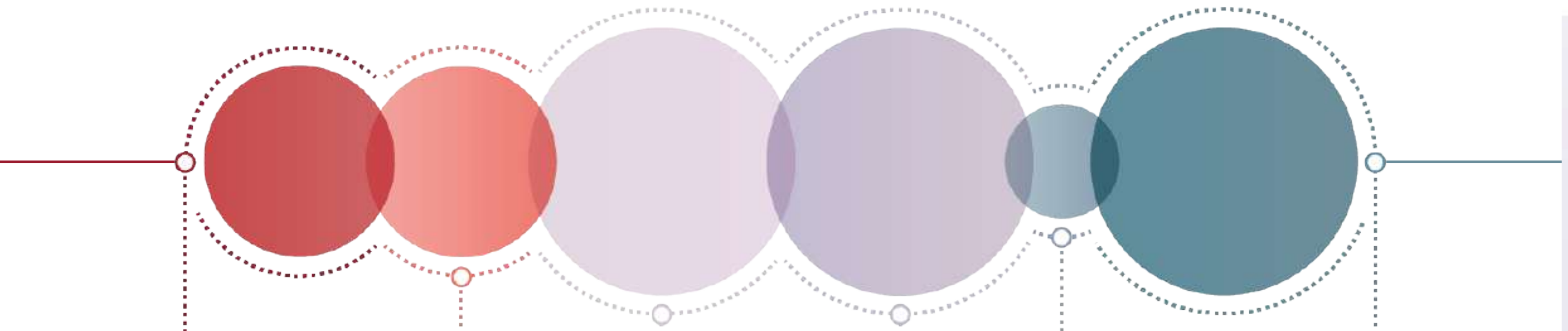
#ANXIETY #STRESS #FIDGETING

ABSTRACT
Scentiment aims to relieve peoples' anxiety and stress through an interactive necklace that uses aromatherapy. When the user is feeling stressed or overwhelmed, they can grab the bead of the necklace, fidgeting with it or shaking it. The movement will activate a heating element, which will pass heat through a copper tank that will quickly warm up and melt a bit of the scented wax encased within it. The perfume is released, calming the wearer.

LEARNING OUTCOMES

Soft Skills	*Subject Specific Skills*
F-Tech research and state of art	Sensors application
Real life challenges	Sustainable design process

LEARNING EXPERIENCE PROCESS



RESEARCH & INSPIRATION
Thing ethnographies, interaction storyboard, design scenario: stress and anxiety

CONCEPT
Interactive necklace to relieve anxiety through aromatherapy

DEVELOPMENT
Sketches, technical drawings & gas sensor implementation

PROTOTYPE
3D model & 3D-printed prototype

BUSINESS MODEL
BM canvas, data and ethics considerations

ELEVATOR PITCH
Presentation, storyboard & video of the fashion-tech solution

USPOCKETS

Stefano Di Tomaso, Design for the Fashion System (POLIMI)
Ting Lan, Fashion Design Technology: Menswear (UAL-LCF)
Zhexi Xu, Fashion Photography (UAL-LCF)

#CONNECTION #PRIVACY #FEELING

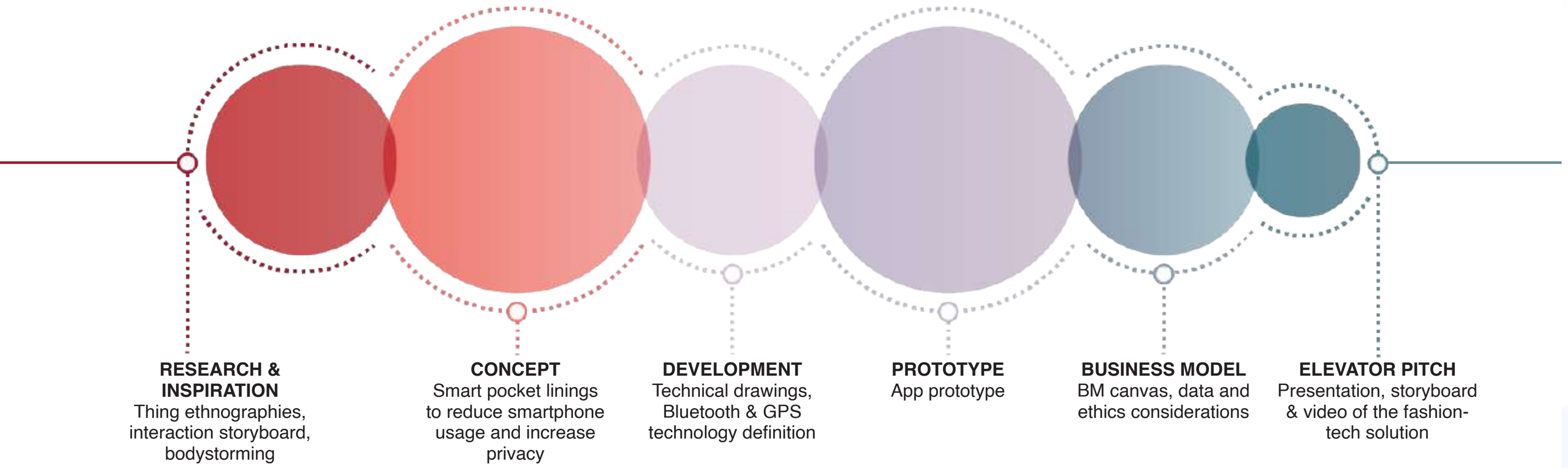
ABSTRACT

usPOCKETS are smart inner pocket linings that can be applied to existing jackets as a product-service system. Left pockets are supplied with a pressure sensor, used to send a tactile message, and GPS for tracking, while right pockets have a speaker to receive the vibration or audio message. The aim is to create a safe way to communicate with friends without other people noticing. usPOCKETS are a way of communicating with peers to make users feel safe, in dark streets, crowded areas, play games, create an intimate moment, or connect people far away.

LEARNING OUTCOMES

Soft Skills	***Subject Specific Skills***
Task distribution	Interaction design process
Time management	Product service system design

LEARNING EXPERIENCE PROCESS



BLUE

Nadia Loliva, Design for the Fashion System (POLIMI)
Zhen Zhang, Innovative Fashion Production (UAL-LCF)
Sivkan Singh Puri, Strategic Fashion Marketing (UAL-LCF)

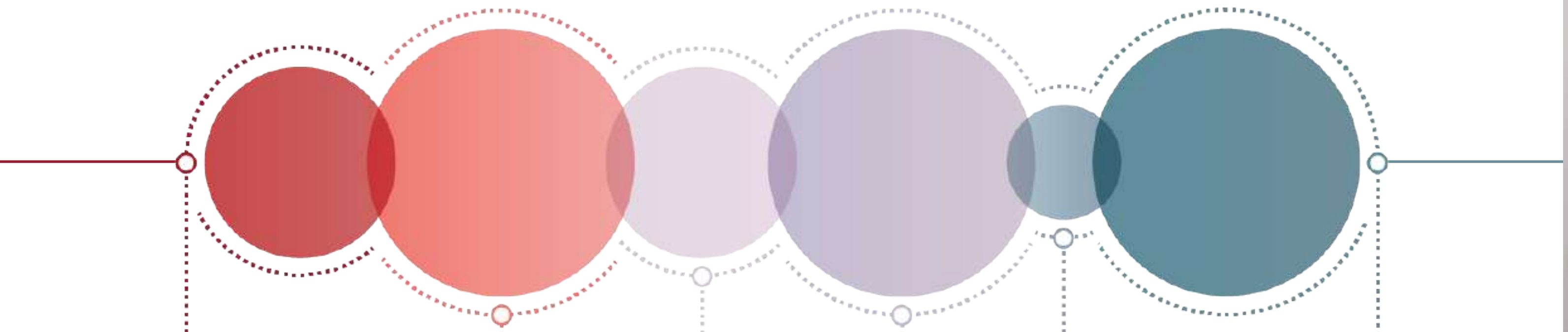
#MENTAL HEALTH #HUGS #ANXIETY

ABSTRACT
Blue promotes physical contact in the form of hugs to alleviate stress and anxiety through two components: a ring and a sweater. The ring tracks the user's stress level, while the sweater soothes tensed body parts via a vibrating mechanism. Further, when a pressure sensor perceives physical contact, LEDs light up, conveying the changes in stress and anxiety level. These real-time data can be used by medical professionals in clinical treatments of their patients and to provide immediate relief in case of an anxiety attack.

LEARNING OUTCOMES

Soft Skills	***Subject Specific Skills***
Overcoming technical difficulties	Design ethnography methodology
Multidisciplinary collaboration	Product service system design
Time management	Interaction design process

LEARNING EXPERIENCE PROCESS



RESEARCH & INSPIRATION
Thing ethnographies, interaction storyboard, design scenario: mental health issues

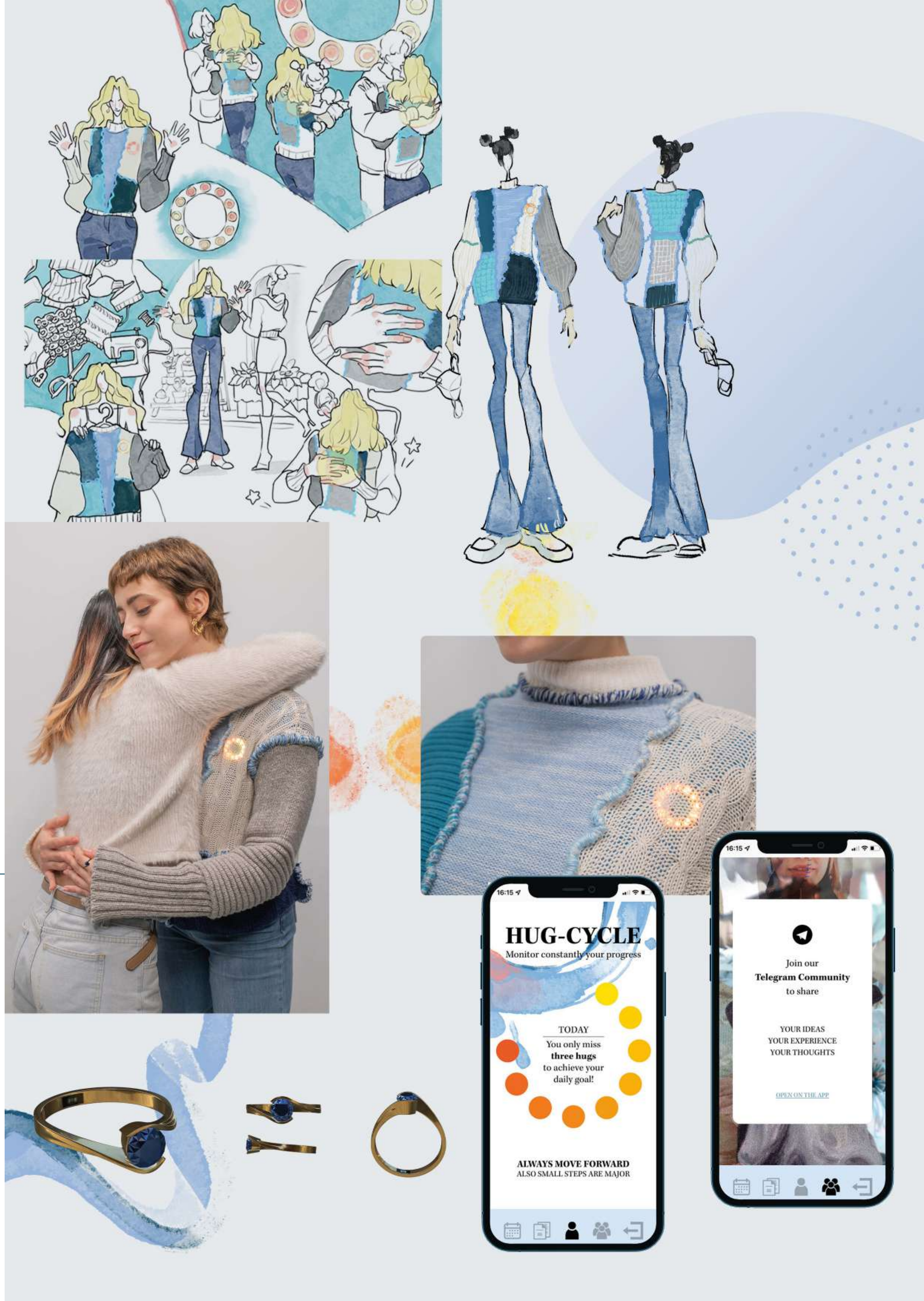
CONCEPT
Hugs-detective interactive sweater and jewellery

DEVELOPMENT
Sketches, technical drawings, pressure sensors definition

PROTOTYPE
3D & physical prototype, Arduino prototype with led and sensors

BUSINESS MODEL
BM canvas, data and ethics considerations

ELEVATOR PITCH
Presentation, storyboard & video of the fashion-tech solution



BUBBLE LIFE

Ye Tian, Fashion Artefact (UAL-LCF)
Shitong Fu, Design for the Fashion System (POLIMI)
Haizhu Dong, Fashion Film and Digital Production (UAL-LCF)

#TECHNOLOGY ADDICTION **#SOCIAL DISTANCING**

ABSTRACT

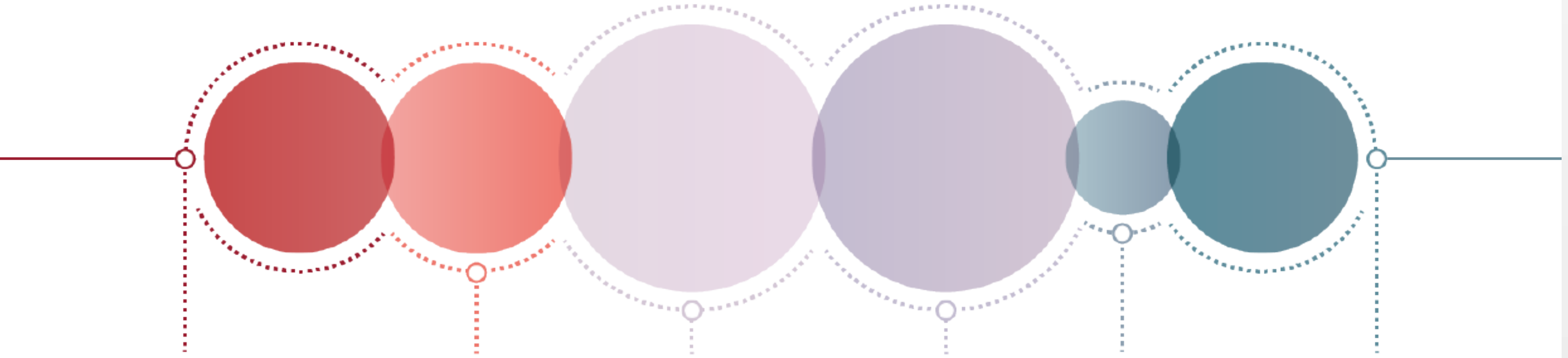
Bubble Life is a garment with interactive sleeves that remind people to limit their use time of smartphones, thus reducing the addiction to electronic devices. The user puts on the garment, first setting their expected maximum use time on their mobile phone, and connecting to the inflatable sleeves via Bluetooth. When the usage time is longer than the time set, the sleeves inflate, sending a visual message and creating a physical barrier to stop using the electronic device. The sleeves will slowly return to their original shape during the rest period.

LEARNING OUTCOMES

Soft Skills
Real life challenges
Design thinking
Research and critical thinking

Subject Specific Skills
Business strategy tools
Research methodology
Wearable technologies
prototyping

LEARNING EXPERIENCE PROCESS



RESEARCH & INSPIRATION
Thing ethnographies, interaction storyboard, design scenario: technology addiction

CONCEPT
Garment with inflating sleeves to reduce smartphone usage

DEVELOPMENT
Sketches, technical drawing, sensors implementation

PROTOTYPE
Product low-tech prototype

BUSINESS MODEL
BM canvas, data and ethics considerations

ELEVATOR PITCH
Presentation, storyboard & video of the fashion-tech solution

WEATHAIR

Dejin Chen, Design for the Fashion System (POLIMI)
Ruoyan Dong, Footwear Design (UAL-LCF)
Lucia Galiotto, Integrated Product Design (POLIMI)

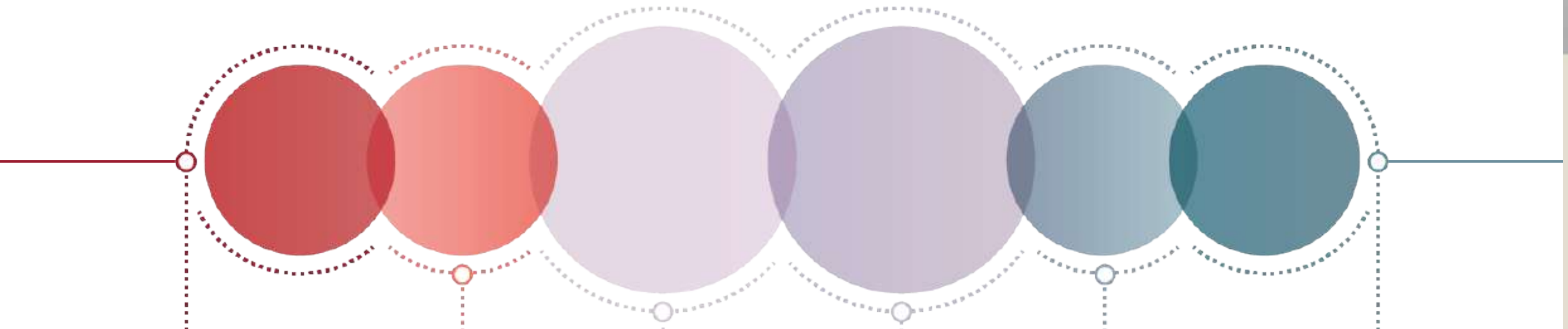
#COMFORT #ADAPTING #DATA COLLECTION AND SHARING

ABSTRACT
Weathair is a jacket designed to face climate change conditions and allow data sharing for the community's benefit. The jacket automatically inflates or deflates in response to external temperature changes perceived by a sensor or via direct user control of the inflation mode. Collected sensor data are shared with smartphones and combined with location data to provide real-time weather updates in urban communities. Weathair is also a sustainable jacket thanks to its sales and repair service system: obsolescent, broken components can be collected by the company, who will substitute / dispose of / repair / resell them as refurbished items to new customers.

LEARNING OUTCOMES

Soft Skills	*Subject Specific Skills*
Multidisciplinary collaboration	User journey mapping
Pitching	Bodystorming
Task distribution	F-tech research and state of art

LEARNING EXPERIENCE PROCESS



RESEARCH & INSPIRATION
Thing ethnographies, interaction storyboard, bodystorming

CONCEPT
Inflating jacket providing real-time weather updates

DEVELOPMENT
Materials & sensors, moodboard, sketches & technical drawings

PROTOTYPE
3D model & Arduino prototype

BUSINESS MODEL
BM canvas, data and ethics considerations

ELEVATOR PITCH
Presentation, storyboard & video of the fashion-tech solution

EVERYDAY HACKING HOODIE

Giulio Baldan, Integrated Product Design (POLIMI)
Meijun Chen, Design for the Fashion System (POLIMI)
Xinyue Ma, Strategic Fashion Marketing (UAL-LCF)

#SONIC WAVE #PRIVACITY #SAFETY

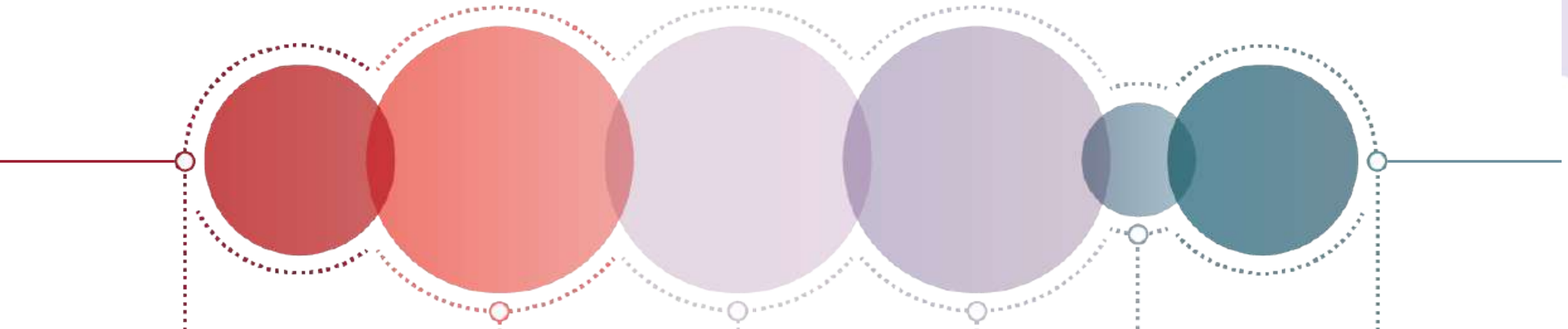
ABSTRACT
Everyday Hacking Hoodie aims to combine high-tech technology with everyday clothing to ensure data security. To tackle this issue, the hoodie incorporates electronic components located on each side of the hood that can be activated to play white noise, thus interfering keeping conversations private from digital voice assistants, or voice recognition software. Also, in the pocket of the Everyday Hacking Hoodie, RFIDsafe(TM) blocking material prevents information loss by protecting credit card NFC chips from being scanned.

LEARNING OUTCOMES

Soft Skills
Working within tight deadlines
Tasks distribution

Subject Specific Skills
Interaction design process
Wearable technologies prototyping

LEARNING EXPERIENCE PROCESS



RESEARCH & INSPIRATION
Thing ethnographies, interaction storyboard, design scenario: data security

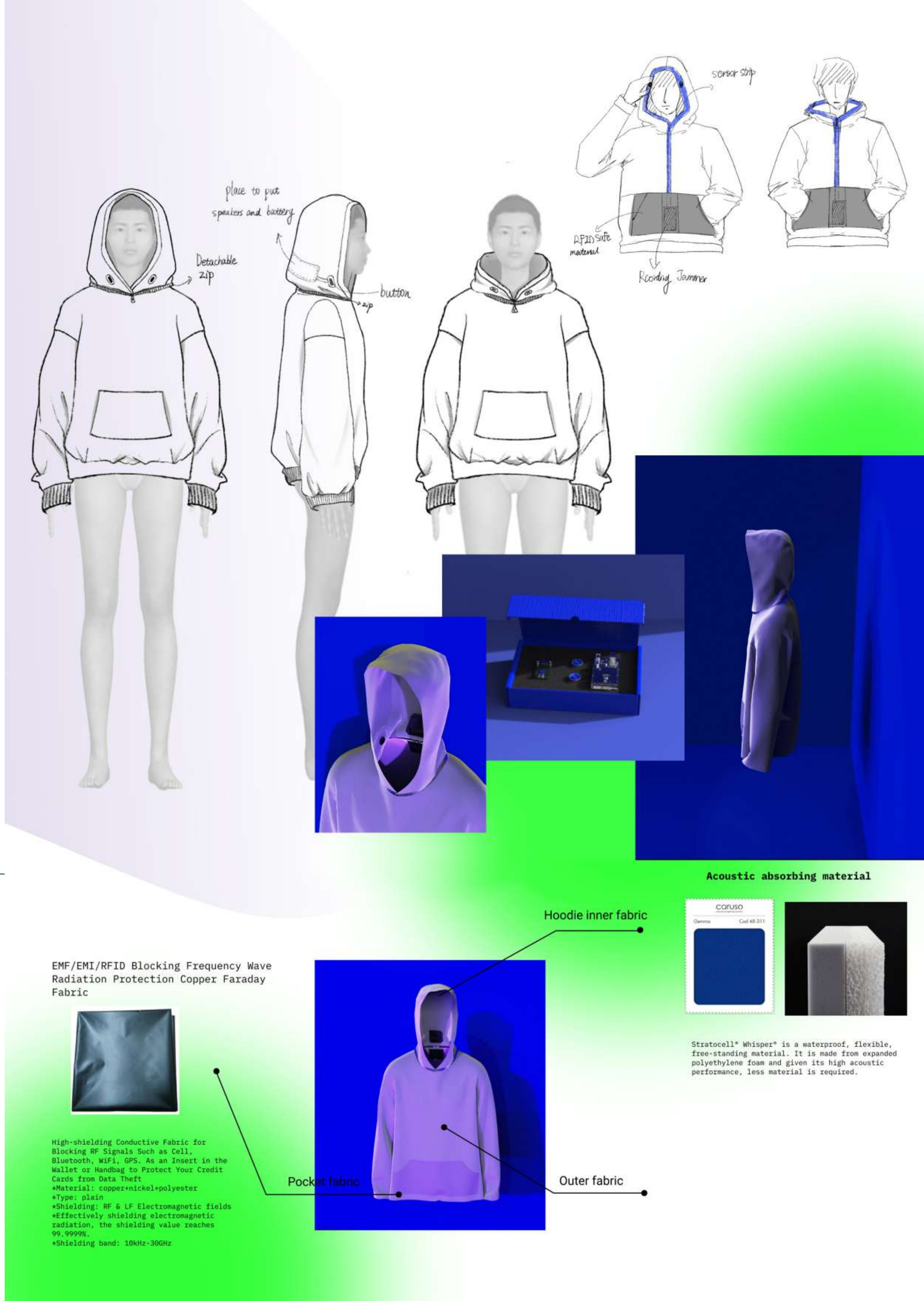
CONCEPT
Interactive hoodie to ensure privacy through white noise and innovative materials

DEVELOPMENT
RFIDsafe(TM) blocking material, sketches & technical drawings

PROTOTYPE
3D model, packaging and adv mockups

BUSINESS MODEL
BM canvas, data and ethics considerations

ELEVATOR PITCH
Presentation, storyboard & video of the fashion-tech solution



SPI-C

Shanshan Yan, Footwear Design (UAL-LCF)
Ziqian Yu, Design for the Fashion System (POLIMI)
Jiaqi Wang, Innovative Fashion Production (UAL-LCF)

#INTELLIGENT INTERACTION #DETECTION AND TREATMENT

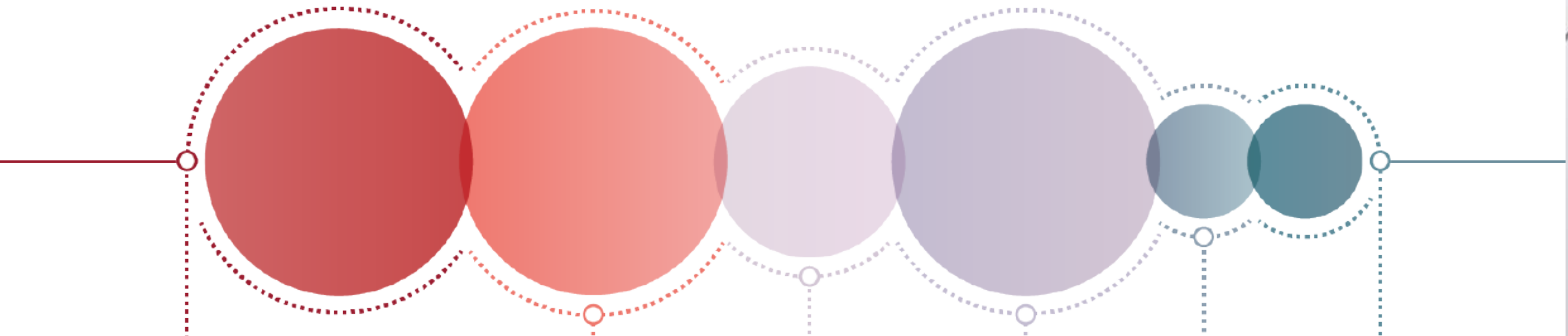
ABSTRACT

Spi-C is a light, comfortable, washable, intelligent top designed to protect the spine. By locating contact points and recording body move-ments, the top reminds users to stay in the correct posture. It also detects fatigue levels and includes a physical therapy mode that can be manually turned on and adjusted through a mobile app. The app can record the frequency and position of the users' bad posture and analyze this data to generate a treatment plan.

LEARNING OUTCOMES

Soft Skills	***Subject Specific Skills***
Research and critical thinking	User journey mapping
Time management	Market research
Working within tight deadlines	Video editing

LEARNING EXPERIENCE PROCESS



RESEARCH & INSPIRATION
Thing ethnographies, interaction storyboard, design scenario: encouraging good posture

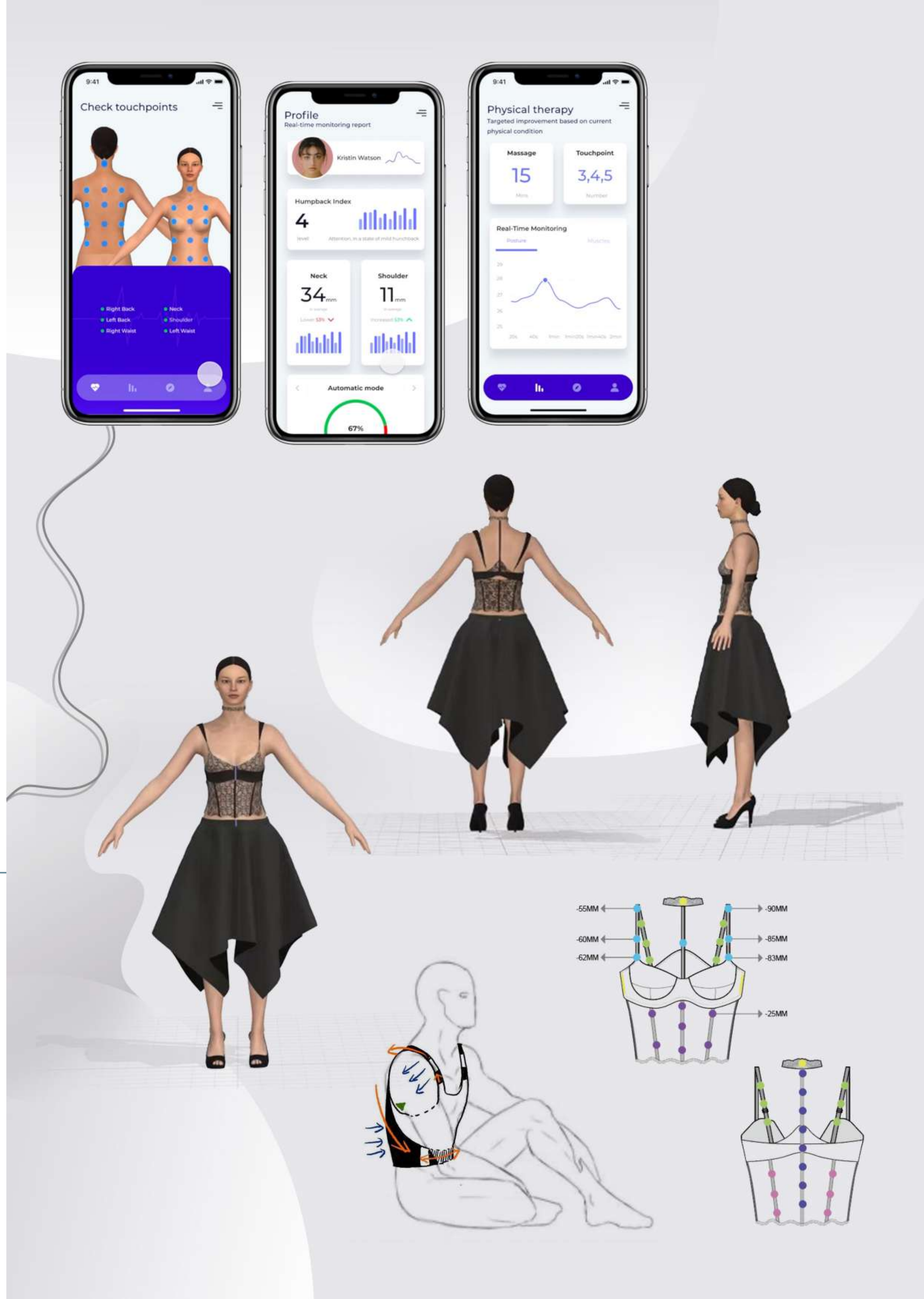
CONCEPT
Smart top to protect the spine

DEVELOPMENT
Smart textile definition, sketches & technical drawings

PROTOTYPE
3D model & app prototype

BUSINESS MODEL
BM canvas, data and ethics considerations

ELEVATOR PITCH
Presentation, storyboard & video of the fashion-tech solution



PILLOW HAT

Yuxi Sun, Footwear Design (UAL-LCF)
Shenhao Lyu, Design for the Fashion System (POLIMI)
Difei Qu, Fashion Artefact (UAL-LCF)

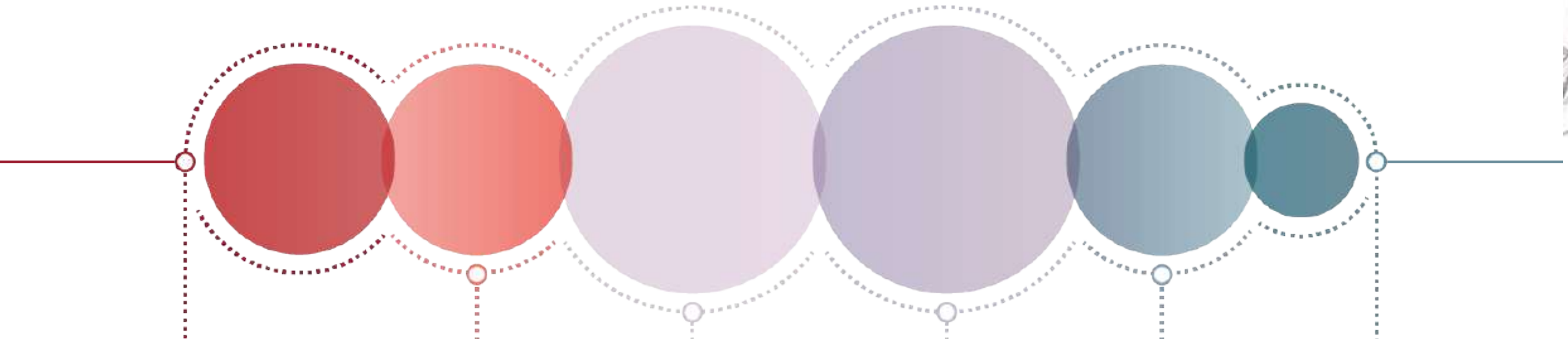
#COMFORT #RELAX #PORTABILITY

ABSTRACT
Pillow Hat is a portable accessory that aims to support busy people, such as tired workers and students, to rest comfortably in public spaces. Once inflated, the hat is worn on the user's head and provides support to relax and rest without neck pain. Pillow Hat is designed to be rented in spaces like Libraries, or public transport systems and returned after the user has taken a nap. To reduce storage space requirements, when not in use the hat can be deflated and folded using origami principles.

LEARNING OUTCOMES

Soft Skills	***Subject Specific Skills***
Multidisciplinary collaboration	Understanding societal need
Communication skills	F-tech research and state of art
Tasks distribution	Sustainable design process
Team development	Ergonomic design

LEARNING EXPERIENCE PROCESS



RESEARCH & INSPIRATION
Thing ethnographies, interaction storyboard, target audience

CONCEPT
Portable smart accessory to offer support when resting

DEVELOPMENT
Inflating technology and fabrics definition, sketches & technical drawings

PROTOTYPE
3D model, social media & adv mockups

BUSINESS MODEL
BM canvas, data and ethics considerations

ELEVATOR PITCH
Presentation, storyboard & video of the fashion-tech solution

BPM

Ying Ou, Footwear Design (UAL-LCF)
Miriam Kristen Perez Escudero, Fashion Photography (UAL-LCF)
Francesca Zeccara, Integrated Product Design (POLIMI)

#SAFE PLACE #ANXIETY #CONTACT

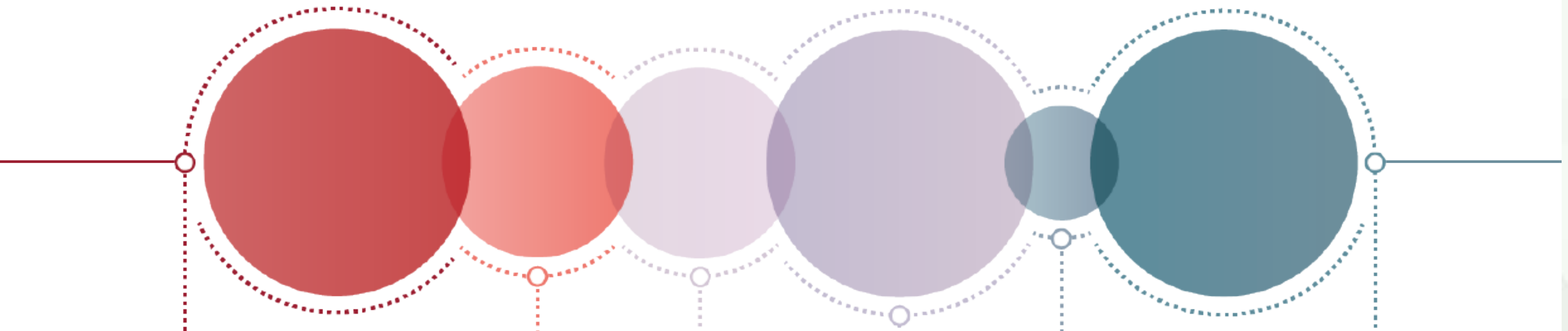
ABSTRACT

Beats Per Minute (BPM) is an interactive emotional jacket, conceived as a safe place where users pay attention to their emotions. This jacket reacts to heart rate data by inflating when beats per minute accelerate. The inflatable sections are located so that as they inflate the increasing pressure mimics a gentle hug, creating a calming effect for the wearer.

LEARNING OUTCOMES

Soft Skills	***Subject Specific Skills***
Multidisciplinary collaboration	Concept development
Research and critical thinking	Prototyping and user testing
Remote teamwork	Storyboarding

LEARNING EXPERIENCE PROCESS



RESEARCH & INSPIRATION
Thing ethnographies, interaction storyboard, bodystorming

CONCEPT
Interactive jacket detecting emotions through heart rate

DEVELOPMENT
Fabrics & sensors definition, sketches & technical drawings

PROTOTYPE
3D & low-tech physical prototype

BUSINESS MODEL
BM canvas, data and ethics considerations

ELEVATOR PITCH
Presentation, storyboard & video of the fashion-tech solution