PLYMOUTH COLLEGE of ART

making FUTURES

Digital Crafting for Fashion Accessories. From Static Products to Open Interactive Experiences

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Abstract

The digital technologies' widespread has so deeply affected the design practice and more generally the entire fashion system, to be defined as a third industrial revolution. Today it is possible to design, produce, distribute and communicate through the web: this has drastically changed the relationship among designer, product, production and final consumer. In this context, the word digital-craft refers to a varying production process that combines hand and mind to digital media. The aim of this paper is exploring the procedures of Making within the field of fashion technological accessories, demonstrating how in the liquid contemporary scene the boundaries between handcraft and digital technologies are increasingly blurred. First, the work describes how the third industrial revolution has carried along a shift of the classic paradigms of design, such as the ones of materials, processes and languages, turning the different opposing dichotomies in a continuous spectrum: natural elements versus artificial materials, analogic versus digital, standardization versus personalization, artisanal attitude versus engineered, surfaces versus essences, form versus function. All the opposites blended in, cohabiting within the classic design categories. This has drastically changed the relationship among the different professionals involved along the value chain, as a constant collaboration across phases and disciplines, causing the spread of new boundaries productive realities. Since the needs and desires of people always come first, in this context, our purpose is to show how digital making transforms matter not only into products, but also into valuable customer experiences. The paper analyses case studies of best practice highlighting how sharing practices become the starting point value at the base of the systemic interaction. The digital artisans not only tend to share knowledge, but also materials, productive technologies, hardware and software tools, creative processes, methodologies and meanings in an integrated collaborative open system based on mutual connections. The introduction of new technologies, in terms of materials, algorithmic models and productive process allow producing custom-made pieces, complex systems, yet more responsive and intuitive in the use. This has led to a significant redefinition of the nature of the fashion accessories, from being static objects to become open structures, not fully defined, interactive interfaces able to autonomously behave and be adaptive to the consumers' needs and desires. Finally, the paper demonstrates how a deeper relation with the digital practice has not only strengthened virtuality, but also how it has enhanced physicality, creating a hybrid immersive experience.

The last part explores the procedures of Making within the field of fashion technology, in particular with a case study related to an experience in the field of smart accessories. As a result, digital crafts rely on a hybrid nature of making, where virtual and physical practice overlay, surpassing and scattering the dichotomy, therefore sanctioning the dignity of virtuality as being as real as the physical reality.

1. Fashion making and the industrial revolutions

The handcraft knowhow had been gradually flanked and, for some sectors, entirely replaced by the use of machine tools, with significant benefits in terms of quantity, speed and efficiency. The industrial revolution marked the transition from artisanal manufacturing to mass productive process. It is during this very shift that the contrast between “manus” (hand) and “machina” (machine) comes to light. These two opposing elements have characterised every productive and artistic sphere for the centuries ahead. (Bolton, 2016). Also, the fashion sector, thus, has been affected by the dichotomy generated from the manufacturing revolution.

Hand manufacturing and mechanized production, respectively hand and machine, has marked and settled over time two opposite ways of creating and therefore conceiving fashion products: from one side the manufactured object, one of a kind, often custom-made, aimed at an elite; on the other side the piece industrially produced, standardized, affordable and addressed to the mass market.

On the one hand, manual work was nostalgically ensuring the production quality and it was associated with positive values, such as exclusiveness, spontaneity and authenticity; on the other hand, the machine was indeed seen as synonymous of progress and accessibility, but it was also linked to the idea of inferiority and homologation.

2. Productive paradigms shifting

Digital Technologies and ICT (Information and Communications Technology) revolutionised the fashion system, reducing progressively the antithetical distance between hand and machine (Bolton, 2016). The shift carried along by the digital revolution has globally soften the classic design paradigms of the system, such as the ones referred to process, languages and matter, turning the different opposing dichotomies in a continuous spectrum: natural elements versus artificial materials, analogic versus digital, standardisation versus personalisation, artisanal attitude versus engineered, surfaces versus essences, form versus function. All the opposites blended in, cohabiting within the classic design categories. This has drastically changed the relationship among the different professionals involved along the value chain, as a constant collaboration across phases and disciplines, causing the spread of new boundaries productive realities.

In the age of digital technology, the distinction among the different spheres is increasingly less defined, and the productive paradigms tend to blend and to contaminate with each other.

The boundaries between the two different production processes are becoming more and more blurred, and the cases of a hybrid approach are more frequent. Digital platforms and the diffusion of new means of production, such as additive printing machines, have democratised the process and revolutionised the role of actors within the supply chain, encouraging an open innovation approach to the creative process. New small and medium-sized productive companies are spreading up, start-ups that combine the means of industrial production with the artisanal practice, undermining the dichotomous system handed down by tradition. Smart companies are companies that, overtaking the constraints imposed by physicality, have dematerialised their own structure. They base their action on open-source co-design and on rapid prototyping production techniques, thus avoiding the costs related to machinery, warehouse and employees. While in the traditional manufacturing system the artisans have the tool to manage the ideation and the production phase, the designers can handle only the ideation part. The fragmentation of the traditional manufacturing process, which is still the most adopted, is one of the greatest problems of the industry today. Thorough new technologies it is possible to reunify the

process. Thanks to the new desktop manufacturing tools, digital artisans become creators and entrepreneurs, managing the entire production process through the network.

They integrate technologies to the traditional craft processes: modelling software, algorithmic and computational design and 3D technologies mould the matter starting from a digital file.

The resulting products, created ad hoc, are often manually finished. The projects are then shared online, modified, selected and purchased through the network directly by final users. Innovation will also affect the distribution dynamics: the retail is often managed through online e-commerce platforms. Consumers today have the potential possibility to design a product, make it and physically see it in their own hands. Not only a 0 km logistics and a reduced amount of waste, what is more people actually have the opportunity to take part in the creative and productive process. The design dimension expands and moves from the closed to the open dimension, and it goes from being the autobiographical expression of an individual talent to a collective profession (Cappellieri, 2016).

This creates new experiences for the consumer, who takes part in the process, actively interacting across the value chain. Today the end users not only can customise the final products, but can join the design and creative stages. This leads to a kind of production based on mass customisation: the products are tailor-made, unique and infinitely customisable by the consumers. The Post-Couture Collective represents an interesting example of a productive reality moving to an open, collaborative structure. The fashion company actively engages final consumers: they can go online, download, customise, produce and self-assemble their clothing designs. AwayToMars (Awaytomars.com, 2018) is a crowd-funding platform supporting designers aimed to solve production difficulties. They advertise open calls for design projects, to which designers may submit their drawings and ideas. All funding proposals are made public on their website, and remain available for a limited amount of time. Users may express their preference, and the projects that get the highest number of likes are selected for production and launched on the market; if these sell well, their respective designers get a cut of the profits. The designer Danit Peleg designed the first home 3D printable jacket, enabling the user to go online, interact and modify the object, order it, and have it printed and sent. Maison 203 (Maison203.com, 2018) is an Italian innovative fashion reality, collaborating with many different collection designers. They use additive manufacturing technology and hand finishing, combining new technologies with traditional handwork.

The transition from a close dimension to an open dimension creates new experiences for the consumer, who actively interacts within in the process: not only consumers can design their objects, but also to create one-of-a-kind, bespoke and custom-made piece. Objects are conceived as "open structures", characterised by a configuration that makes them similar to concepts: despite the apparent formal finiteness that characterises them, they are not defined in use and content. This uncertainty margin makes them in various ways interpretable by the user. The result of this digital DIY (Do It Yourself) is an extremely positive proof that the involvement of the consumers in the designing phases can be useful and stimulating. Users participate enthusiastically in the activity, in some cases not limited to the pedestrian execution of the instructions given by the designers, but working in an independent and critical way, to make changes to improve the product as they please.

Designers are no longer conceived as the only undisputed authors of the design process. They assume the role of technicians aimed at promoting widespread creativity, with the task of educating, guiding, informing the consumer, providing the necessary tools for the realisation of the final product. Producing on demand reduces losses and allows production when it is required.

Digital technologies not only have modified the paradigms related to processes, but also the ones related to languages, generating a new aesthetics.

The “language” is intended as the narrative dimension that overcomes the classic expressive codes and leads to a hybridisation, and sometimes to a synthesis, of apparently conflicting symbolic categories: freedom of form with constraints of function, male and female connotation and the gender neutrality; vernacular traits of local language with the Babel of the global culture.

Products, for instance, can be inspired by the virtual-scape as it is for Noa Raviv, who designed a collection evoking images of corrupted 3D drawings made using a computer modelling software.

Scilla Stuart (Scillaandriolistuart.com, 2018), instead, reinterprets the traditional techniques of filigree, typical of some regional Italian tradition, making it with the additive manufacturing to create jewellery; or ThreeASFOUR (Threeasfour.com, 2018), Travis Fitch and Stratasys developed a collection made with new kinds of intertwined geometries creating fabrics with 3D printing, overtaking the phases of pattern making and sawing, typical of the traditional process.

Even the matter has been permeated by digital technology, redefining the relationship between conflicting attributes, such as the narrative surface and conceptual essence; enhancement of the natural matter and research within the artificial matter; recovery of artisanal techniques typical of the analogic dimension and the alterations by the digital realm.

3. From digital to post-digital fashion

‘We become what we behold. We shape our tools and then our tools shape us.’ (McLuhan, 1965, rpt. 1994).

The evolution of wearable technologies has passed through the screen. And the screen, as every tool, has shaped us, by modifying our mind-set and the linearity of thought that has characterised much of the Western history has been dismembered by digital sharing, swiping, storing, saving (Openshaw, 2015). The digital has affected the analogical: virtual reality has influenced human interactions and expectations of physical reality. On the one hand, the frustration of the screen, which flattens the experience: we touch an interface but the screen interface does not touch us back. Digital changes our relationship with sensoriality, creating a dissonance between the new spheres of experiences that can be explored online and the physical experience to passively look at a screen.

On the other hand, the interaction with digital technology through the screen has progressively changed the way of approaching the surrounding physical environment with new expectations of modifiable forms, surfaces that are capable of responding, and connected behaviours. The material world has become alive enriched with new possibilities, because this is what the digital world has taught us to expect, and we can become frustrated with materiality when it does not keep the digital promise (Openshaw, 2015).

With the “post-digital” era there is the tendency of moving from the screen to a multi sensorial immersive experience. The effort is the one to bridge physical and digital: 3D printing and generative design trends have only accelerated the process of slippage and cross-contamination between digital and real formats. All this has led to a new relationship with matter, which is partly configured as a return to physicality, but at the same time this renewed physicality is enriched and interactive. In this context, technology has become increasingly accessible and the practice of new digital artisans is aimed to create multisensory experiences in order to engage with the consumer’s emotions on multiple levels.

This enriched dynamic interaction with the matter is well represented by Kino, a project dedicated to cinematic jewellery developed by MIT Media Lab (Media.mit.edu, 2018). This living jewellery items move across the garments: thanks to the addition of embedded sensor devices, these interactive jewellery pieces can actively respond to environmental conditions, modifying the clothing, changing location on the body and reconfiguring

appearance (Kao, et al. 2017). DuoSkin (DuoSkin | MIT Media Lab, 2018), instead, is a fabrication process that enables the user to create customised wearable functional devices. Such as temporary tattoos, they can be attached to the skin and, thanks to NFC (near-field communication) wireless communication chips; they can be connected to smart devices (Kao, et al., 2016).

Another project related to matter interactivity is the 4D printed self-assembly shoe project developed by the Self-Assembly lab at MIT. By printing a precise 2-dimensional pattern, the shape of a shoe can self-transform after being released from the machine, programming the material (Tibbits, 2017). While Shamees Aden (Shameesaden.com, 2018) developed a self-repairing shoe with 3D printed proto-cells. Designers, scientists and engineers work together to create a living matter. The degree of complexity has led to redefining the professional skills involved, the role of the actors in the process, and the designing methodologies. All these constitute the theoretical premises behind of our practical experience.

4. Hands on experience: the procedure of making in Fashion-Tech

Objective. The aim of the following workshop was exploring the procedures of Making within the field of fashion and technology, in particular with a case study related to the field of smart accessories for a well-known international commercial sportswear company. It is a hands-on pilot workshop exploring the practice of prototyping a fashion technological item, investigating the methodology of designing, and crafting products with embedded technologies.

Location and timing. The five-day experience was conducted within an academic context. The workshop was hosted at Polifactory, an interdepartmental research laboratory at Politecnico di Milano exploring the relationship between design and new digital manufacturing processes, promoting a new culture of making. The location was very appropriated for the scope as it is a place where to investigate the possible future scenarios of advanced manufacturing, from distributed production to open hardware up to high interactivity product-service design.

Actors involved. The workshop was organised by the Department of Mechanical Engineer together with the support of the Department of Design and involved a multidisciplinary and diversified group of 20 International PhD Candidates at Politecnico di Milano, belonging to the field of Fashion Design, Product Design, Interior Design, Design Engineering, Mechanical Engineering, Electronic Engineering and Architecture.

Methodology. Next to the learning-by-doing phase, the experience was carried out through the theoretical lectures held by different international experts belonging to different fields of expertise, such as Neuroscience, Mechanical Engineering, Electrical and Computer Engineering, Sound Computing, Interaction Design, and Fashion Design. All this supported the entire design process by helping participants throughout each phase.

Project brief. The company asked the PhD students to re-design and prototype a smart backpack that could enable a multisensory experience for the wearer through embedded technology.

Participants had to use virtual and physical prototyping methods and technologies to transform a conventional backpack given by the brand into an interactive one, offering users the possibility to make new experiences when using the item.

Phases of the workshop.

Day 1

- presentation of the brand and product

- launch of the brief
- theoretical lectures on multisensory perception and experience design
- individual work on defining possible concepts and scenarios

Day 2

- theoretical lectures on wearable technologies, VR technology, olfactory interfaces
- team work - 4 heterogeneous groups consisting of 5 people
- ideas and concepts generation through brainstorming and key-words
- each group defined with sketches and storyboards the scenario (the context of use) and the personas (user's analysis)
- defining the materials needed to develop the prototype (fabrics, sensors, batteries, led, microphones, Arduino – an open-source electronic prototyping platform enabling users to create interactive electronic objects -, 3D printing, ...)

Day 3

- theoretical lectures on haptics, sonic interaction design
- teamwork - concept and aesthetic and functional features definition
- prototype development

Day 4

- prototype development

Day 5

- working on the graphics of the digital presentation
- final presentation

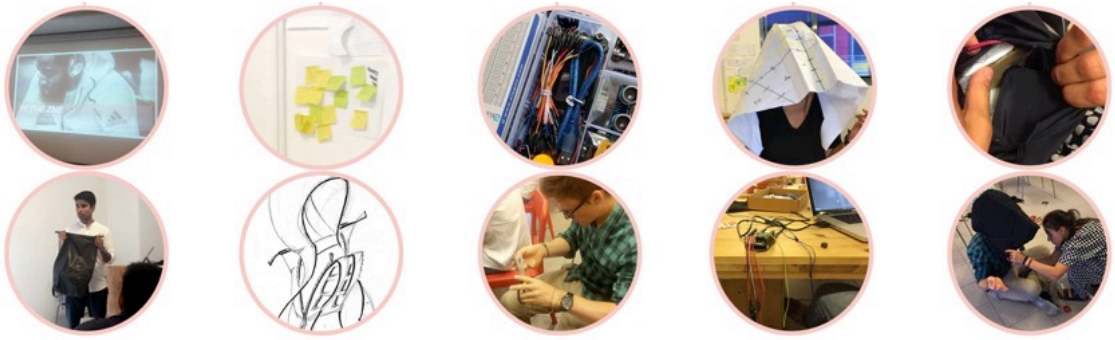

Fig. 1: The design process.

OUTPUTS

Products. The products delivered described very different scenarios and contexts of use, dealing with issues ranging from security, to active wear and from the transportation needs to the work sphere.

Fig. 2: Hut Hood. It is a convertible backpack with an integrated hood that doubles as a portable study: it creates a private space that affords the wearer concentration whenever required and under all circumstances. The hood shuts out the environment and selectively obliterates or amplifies environmental sounds, while the backpack can be turned into a comfortable seat on which to work.

In order to evaluate the obtained outputs, we defined different parameters, such as

- technological feasibility
- technological integration
- creation of innovative scenarios
- relationship between form and function
- coherence with the brand identity

The two groups that could better manage to succeed in integrating the technology and also redefining the aesthetics (even not accordingly to the brand identity) were the groups more evenly composed, where the know-how of the designers was blended with the skills of those ones who knew how to manage the technology, both hardware and software.

OUTPUTS
PRODUCTS

GROUPS	TECHNOLOGICAL FEASIBILITY	TECHNOLOGICAL INTEGRATION	INNOVATIVE SCENARIOS	FORM/FUNCTION	BRAND IDENTITY
1 engeneering driven competences in programming	X	X			
2 design driven no competences in programming			X	X	X
3 balanced competences in programming	X	X		X	X
4 balanced competences in programming	X	X	X	X	

Fig. 3: The evaluating chart.

Process. The different participants collaborated on every step of the process development, redefining the constraints and modifying the set-up of trials to reach together the final goal. During this process, the phases of scenario and personas definition had been crucial to orient the design process, and also to avoid the tendency of featuring the object with over-functionalities.

According to our experience, it is not recommended to start the design process from an existing product, as we did, just by adding new technological features: the aesthetics should reflect the functionality of technology.

5. Outcomes | Designing fashion technology, as per the experience conducted.

The process of fashion technology design cannot be handled by a single professional, but it requires diverse competences in order to generate innovation and, therefore, it is crucial to develop a common language among the professional involved. Moreover, as well as for a fashion designer it is important to know how to physically craft the products in order to design and innovate, the same happens for a fashion technology designer, for whom it is crucial to be confident with technology at a practical level, in order to co-design and share the process with the other professionals involved.

To conclude, technology has for a long time belonged to the immaterial realm, to the industry and to the idea of standardisation. Post-digital age, in bridging digital with physical, has marked a return to a crafting dimension that includes technology. In this context, new makers are hybrid professionals that share knowledge and processes, defining a new collaborative methodology. Digital technology adds a new meaning to the concept of ‘made to measure’ and ‘customisable’: these products become interactive interfaces, responsive, that can react to the consumers stimuli, adapting and evolving with them, producing quantifiable data. This has led to a significant redefinition of the nature of the fashion accessories, from being static objects to become open

structures, not fully defined, interactive interfaces able to autonomously behave and be adaptive to the consumers' needs and desires.

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