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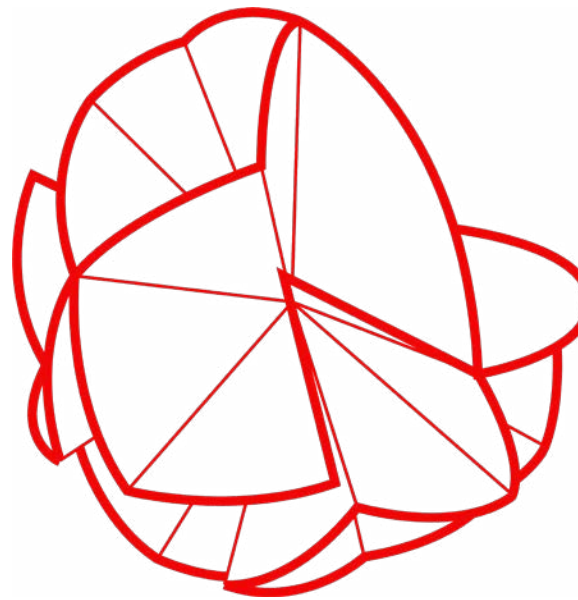
Disrupting Geographies in the Design World

Proceedings of the 8th International Forum of Design as a Process

Alma Mater Studiorum — Università di Bologna



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The Augmented Body: Technological Contamination in the Fashion-Tech Paradigm

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Abstract
The paper aims to address how dresses and garments in the fashion-tech are beginning to acquire their own shape and meanings: the technological, electronic dress with digital, bionic, or robotic components can act and move independently from the body that wears it, sometimes even modeling, modifying or altering its shape.

According to these perspectives, techno-fashion products become alive because they react autonomously to external or internal inputs, they become able to mediate the relationship between the human body and the world around it in a new material dimension that lives in a fluid environment with blurred boundaries between the physical, digital, and biological spheres. This highlights the pivotal role of new technologies for the study of fashion, as by empowering the human body they can influence human relationships with themselves, others, and the environment. These transformations involving the collision between technology and fashion could have long-term implications that affect the shape and meaning of our clothes as well as our bodies.

Keywords
Augmented body
Wearable technologies
Fashion-tech

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The de-structured body

The transformative energy of the contemporary is characterized by changes and challenges in which issues such as volatility, uncertainty, complexity, and ambiguity (VUCA) become central in addressing the demands of the present. Transformation proposes layered and intertwined complexities, laying in twin transitional phenomena - digital and sustainable- that are found to affect different phases of human production dynamics and thus consumption, production, communication, organization, and value generation. Disruptive changes also affect the very idea of dress concerning the body that wears it, making fashion an ideal testing ground for emerging paradigms (Kawamura, 2018).

As Bradley Quinn (2002, p.360) has already written, "technology has always been the essence of fashion". This assumes even greater importance in the emerging paradigms in which the digital brings about a radical transformation of the systems of use and production of goods, services and contents. In fact, while the widespread presence of digital tools offers fashion new ways of producing and manifesting itself, as demonstrated by the recent experiences of 3D fashion and digital couture, it also intervenes in the same symbolic and identity functions of clothes and garments. An example of this is the work of Anouk Wipprecht, who uses animatronic mechanical limbs that react to external stimuli defending the personal space of the wearer, as well as Iris Van Herpen's, in which the digital and the material, the human and the non-human intertwine. This type of interweaving refers to posthumanism "that postulates a dynamic notion of life in which human bodies are inextricably entangled with the non-human" (Smelik, 2020, p.2).

In this fast-paced and connected contemporaneity, dresses as spaces to live, disguise, cover, and protect oneself, come to take on their own meaning, often unrelated to the body that wears them: while maintaining a central role in the processes of culturalization of the body -that is, what makes human physicality to all intents and purposes a cultural object (Bovone & Ruggerone, 2006)- clothing is enriched by wearable technology, bringing out a new agency for inanimate things in a tangible matter (Smelik, 2018).

Thus, by conceiving a research framework for the advanced design culture in the Transformation Era, the contribution discusses some experimentations in fashion design aimed at pushing Transformation through Transition in both physical and digital dimensions of reality (Pozniak, 2019; Vaccari & Vanni, 2020), which, in turn, affect traditional fashion design paradigms. Hence, the paper will highlight how these values can soon affect fashion's production, distribution, and consumption models, as well as reshape the modes of representation by and through it. In these new dimensions, fashion can address new narratives by investigating the role of non-human factors through more-than-human design approaches. The aim is to contribute to a broader debate that helps to develop the next design direction for fashion, aiming at conceiving products able to trigger a new culture and consciousness of fashion by interpreting contemporary transformations.

The behavioral modes and dressing of Generation Z belong to an often decontextualized dress that subverts the canons of use: thus, the parts of the dress system take on a different meaning than what had been established over time, rendering clothes devoid of stable relations to the environment, occasion, gender, and person. While it is thus well known that wearing clothes represents not only the fulfillment of a physiological necessity, the contribution aims to highlight that the functions of dressing remain unchanged in their material aspect but are transformed and amplified with digital components in their performance, symbolic and emotional aspects.

In this scenario, the potential of embedding technologies merges with designing for embodiment, bringing the field of wearable computing more closely to the field of fashion. As wearable technologies are becoming more than just mediators of perception (Seymour & Beloff, 2008), fashion tech emerges as a field of study through design. The paper, therefore, aims to investigate how new forms of wearable technologies blur the boundaries between technologies and the body, creating an augmented body (Wissinger, 2017) and fostering new relationships between bodies, materiality, humans, and technologies (Toussaint, 2018).

From wearable technologies to techno fashion

The massive development of technologies has led to a radical transformation of information fruition and production systems due to the introduction of devices that enable interactive and multidirectional communication. The function of the body thus goes seamlessly into the scenario of a technological-cultural *mediamorphosis* in which the progressive evolution of processors and digital components intervenes on the wearability of digital technologies by making the device itself an integral part of the garment.

Three different functions are generally recognized in dress: protection, modesty, and exhibitionism (Morris, 1982). The function of protecting is connected to the comfort, to the psycho-physical well-being of the person. To protect ourselves and our bodies, modesty takes over: we usually cover ourselves to block some physical signals; the more society shows anti-sexual needs, the more the dress hides the body, the more society does not exclude itself from manifesting its sexual impulses, the more the body is discovered. The last function of the dress is the exhibitionistic one (Roach-Higgins & Eicher, 1992) which fulfills the arduous task of giving the subject insertion within a specific social group, related to the dress one wears.

A large number of enabling technologies (Čolaković & Hadžialić, 2018; Silva et al., 2018) have become widespread, easier to use, non-invasive, mature, cost-effective, and above all, potentially combinable with each other. This has made digital devices smaller and smaller in size, but better performing: as computer scientist Mark Weiser (1991) predicted, technology has now receded into the background of our lives, becoming so sophisticated that it is embedded in clothes, pillboxes, toothbrushes, and smartphones (Schüll, 2016). Transmission technologies are progressively abandoning their old role as simple devices for storing and transmitting data, to shape themselves in relation to users' needs (D'Andrea, 2005).

In fact, until a few years ago, research on wearable technologies had mainly focused on their application for health and fitness (Choi & Kim, 2016), or electronic textiles (Berzowska, 2005) by proposing devices to support self-tracking with the goal of monitoring, analyzing, and sharing personal data on well-being and lifestyle (Sanders, 2017).

In the Internet of Everything paradigm (DeNardis, 2020), wearable technologies become objects and tools integrated into everyday products, blurring the boundaries between the physical and digital worlds. Augmenting the physical through the digital, technologies can now be worn as integrated components in textiles, fibers, clothing, and accessories. Robotics, mechanics, and mechatronics, as well as bio and nanotechnology, enter the garment allowing the introduction of foreign elements and new ways of relating to traditional components of a wearable product. Thus emerges a new body, re-dressed, technological and electronic, intelligent, flexible, resilient, communicating and working, extended to internal and external prostheses, enriched by sensors, shells that repair it, extend it. Thus, the wearable landscape enriches body-mounted technologies (Dunne, 2004) with smart and electronic textiles in which the digital can be woven, knitted, embroidered, sewn, and printed (Berzowska, 2005), then integrated into materials that allow fashion to enter the field of wearable technologies, embracing both high-tech functionality and fashionable design (Wright & Keith, 2014). With the rise of fashion tech, wearable technologies address a new space of experimentation between the body, the environment, and materials leading to new kinds of hybridization that go beyond the body, but also beyond the traditional concept of dress. By enabling new forms of relationship with the external environment and shifting the boundaries of the body, devices accelerate and promote interactions, redefining the identity of dress.

In the transformative context, the fashion-technology connection is manifested through moving fibers, polymers, sensors, invisible or photoluminescent that act on the garment by making it an intelligent envelope adaptable to changing conditions. The garment thus becomes a surface, an interface, in which the channels of dialogue with the surrounding environment and the body wearing it are increasingly sophisticated and performant.

The augmented body

The arguments expressed so far place us in front of a transformative scenario of the clothing system, in which what suggests interesting areas of experimentation is the body-wearable-technologies relationship itself. Thus, a research space in Fashion-Tech is being consolidated that brings out new areas of experimentation between the input and output of wearable technologies that intervene on the human body by extending and expanding it through wearable products that are increasingly autonomous in terms of functionality and formal aspects, but increasingly connected with the external world.

In this section, therefore, three case studies, the result of experimentation carried out at the REI laboratory of the University of Florence, Italy, will be exposed and discussed. The proposed experimentation is not limited to the implementation of technologies on

the garment (e.g., through the use of robotic systems, biomaterials produced through 3D printers combined with traditional materials); but aims at a vision of augmented body and interpreter of futures, in which mechatronics, combined with robotics, enters the wearable product, configuring a product form not directly related to the body shapes with the ability to mutate autonomously and defining new performances in relation to the different morphology.

The three presented are the most significant cases extrapolated from a production of 50 concepts that highlight the variety with respect to the ways of interpreting the augmented body. Full-size prototypes of these concepts were produced.

XXXCo,Ltd

This dress is part of a collection of clothing and accessories that alter the modes of covering oneself and interpret social transformations in non-contact collective interactions. The concept emphasizes the importance of lower limbs for walking long distances, running, and being able to observe, and the non-necessity of upper limbs replaced with a series of multifunctional and multisensory elements with the ability to move independently; with the covered mouth, the importance of sight and hear is emphasized. This is a concept for a different social security, a population focused on information accumulation and not practice, reducing their practical experience and creating new visual and auditory knowledge.

Materials: phosphorescent composite fabrics, graphene fabrics, flexible screens, polymer optical fiber, copper wire, carbon powder. Self-heating Fig. 1.

Fig. 1
XXXCo a project by Cai He, Ji Chenxi, Zhou Anqi, Zhou Haoze. The XXXCo,Ltd project features a dress composed of a series of modular, flexible doughnuts that can move on their own, tighten, inflate and come to life on the body. The operation, enabled by a special combination of silk and Nitinol threads (a nickel titanium alloy), is simple: if the thread heats up, the doughnut changes shape by shrinking; as soon as it cools, the rigidity of the thread allows it to inflate. The lining of the fabric is made entirely of graphene, a material consisting of an atom-thick layer of carbon, as strong as a diamond and as flexible as plastic, which gives the garment the ability to absorb, transmit and dissipate heat; it counteracts the reproduction of bacteria and gives the fabric itself high durability. Model prototype made with Clo3d software.

Myrtillocactus

The concept involves a transformable dress, capable of taking on different configurations depending on inputs from the indoor and outdoor environment. The dress is equipped with an electronic control that can emit light in a spectrum of 256 colors. It thus takes on various configurations: opaque, transparent, luminous, and the upholstered part is of variable density. The dress concept expresses, breathes, covers, or uncovers the body by altering its function of protection, modesty and exhibitionism (Morris, 1982).

Materials: elastic and heat-regulating fiber Fig. 2.

Fig. 2, 3, 4
Myrtillocactus, a project by Elena Guidi. The dress is designed using MaTech[1] technology, a photoluminescent polyester yarn, where power can be supplied by a standard transformer, a commercial 9V battery, or small rechargeable batteries. The fabric lights up through optical fibers, and thanks to a microchip the light emitted can be varied in a spectrum of 256 colors at the push of a button, without the need to change garments. In this case, the clothing becomes recognizable in a dark environment by promoting a human experience of recognition and defense in hostile environments. The model image was made with Clo 3d software. In image 2b we can see the prototype made on canvas.

1
matech.it/materiali/filato-luminoso-nella-notte/

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Those are concepts extracted from a collection dedicated to a fluid society in which the concept of gender and occasion no longer exists. Dresses for everyone in which the form can be determined by a mechanical system or by the movement of the body. These clothes interpret the emotional state of the wearer that is made manifest through luminous bodies, the transformations of clothes from soft to hard as armor, and the need for more and more protection from others and the external environment.

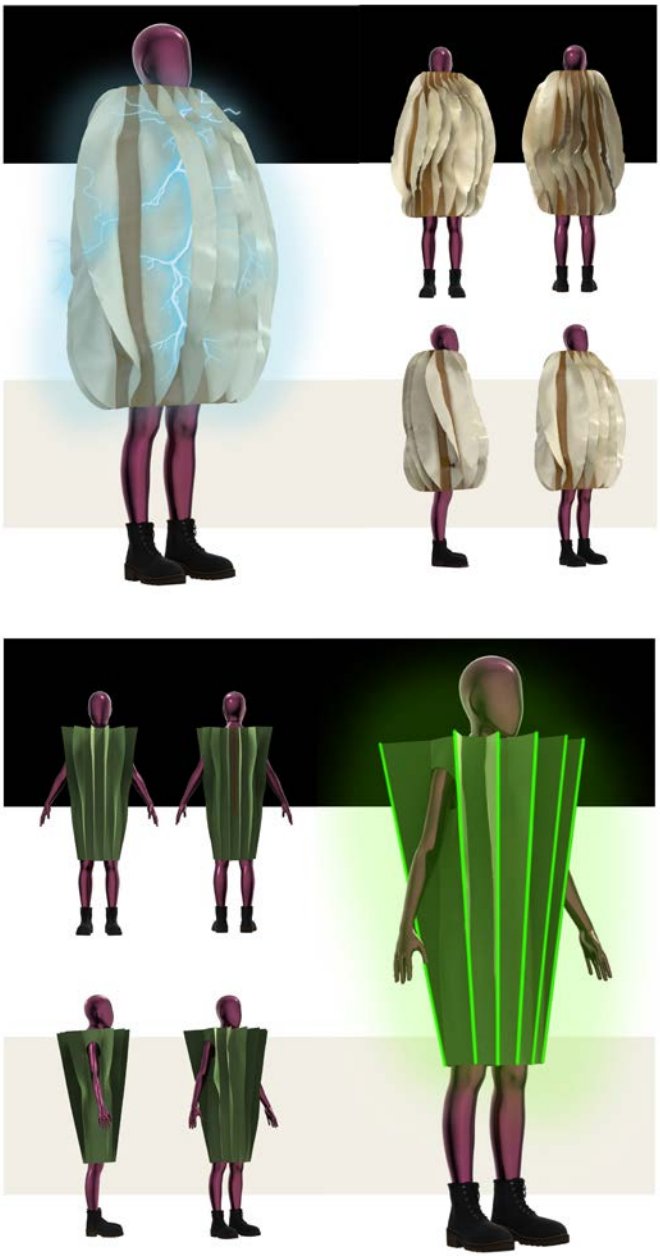

Fig. 5, 6
Pumpkin_Anxiety e Roll_Anxiety a project by Clarissa Salvicchi, Roberta Baroni, Rebecca Benelli, Matilde Gelosia. In the Pumpkin_anxiety gown, the supporting structure is obtained through the whale splint and is derived from baleen (foils found in the mouths of whales). Each baleen is composed of a substance made of keratin that gives it elasticity but also rigidity and lightness. The skeleton is then covered with fabric, creating a contrast between rigid and soft, fluid and static. Model prototype made with Clo3d software.

The Fashion-Tech paradigm explored in these concepts proposes a framework in which technologies act and distribute the result of action in the surrounding environment autonomously, redefining the identity of bodies and wearables themselves. The result is an augmented body (Wissinger, 2017) that interprets the functional, decorative, and symbolic transformation proper to the acceleration taking place, in which technology is not only added, but conjugated to other technological, mechanical, or bio-nanotechnological systems capable of providing new physical and intellectual capabilities, going on to augment human ones through formally and performance autonomous wearables (Quinn, 2013).
Thus, clothes as a representation of an *equipped* body capable of transforming the quality of a person's life, bodies wearing clothes independent in form and function that give it the ability to choose the level and mode of performance.

Conclusions: post-human fashion

With a series of case studies of fashion experimentations through the integration of sensors, solar cells, responsive materials, and numerous other technologies into fabrics and clothing the paper addresses how dresses and garments in the fashion-tech are beginning to acquire their own shape and meanings: the technological, electronic dress with digital, bionic or robotic components is in fact able to act and move independently from the body that wears it (Toussaint 2018), sometimes even modeling, modifying or altering its shape (Quinn, 2013).

According to these perspectives, techno-fashion products become alive because they react autonomously to external or internal inputs, they become able to mediate the relationship between the human body and the world around it in a new material dimension that lives in a fluid environment with blurred boundaries between the physical, digital, and biological spheres (Schwab, 2017). This highlights the pivotal role of new technologies for the study of fashion, as by empowering the human body they can influence human relationships with themselves, others, and the environment. These transformations involving the merging of technology and fashion could have long-term implications that affect the shape and meaning of our clothes, "how we use clothing, what we expect of our garments and how we relate to fashion" (Brunstein, 2011, p.89).

The concepts presented are aimed at future markets generating advanced products to respond to new lifestyles but with the desire to experience sensory emotions that have their roots in the genius loci of our country. The concepts provide an experimentation on advanced wearable products in which technological innovation is combined with the innovation of all processes (formal, productive, performative). They reflect the need to intervene in a context that is so hyper-volatilized that it generates a design without a market (Celaschi, 2014): this implies that the same market should be designed, giving the designer a strategic role of aggregation around the autonomous observation of needs that have not yet been "filtered by the market nor by entrepreneurs that [usually] commission their resolution and transformation in goods or services" (Celaschi, 2014).

The research framework provides fashion design with new coordinates – identified as futuring through fashion design –, which have been experimented and tested through design. At a first glance, the framework relies on a radical shift in focus compared to the approaches traditionally related to them. In fact, it seems that fashion design practice is undergoing a sort of relational turning point by not assuming the centrality of the human in the design processes but focusing on the complexity that surrounds human beings and things (Smelik, 2021). A plurality of interdependent relationships emerges, resulting in tangled lines influencing each other mutually. In this sense, the very concept of *humanity* as we know it falters, with its profile appearing far more blurred than expected.

Reference is made to what Laura Forlano (2017, p.17) discusses as the emergence of "the hybrid figure of the posthuman – and related concepts, such as the non-human, the multispecies, the more-than-human, the transhuman and the decentering of the human – [which] greatly expands our understandings of the multiple agencies, dependencies, entanglements, and relations that make up our world". The blurring of the human concept actually reflects a much wider extension, which embraces the entire perception of reality, both in its physical and digital component. Hence, the paper will explore these two dimensions considering, however, that they cross, overlap, and influence each other seamlessly.

This encouraged a series of experimentations which frame fashion design as the activity to conceive and develop wearable products tout court (Hrga, 2019), taking advantage of the latest technological advancements: in this sense new fashion products are not only sewn, but also 3D printed, assembled, welded (Bolton, 2016; Smelik, 2018). The projects presented combine robotics and nano-electronics, making fashion an experience that transcends mere appearances through products that augment the human body. In fact, the resulting garments gain the ability to facilitate and augment the interactions we have with ourselves and our surroundings, suggesting the challenging contribution of fashion in designing more-than-human proximity. Other than handheld devices, such experiences reshape the individual dimension and its spaces of expression through fashion, triggering new ways to interact with the world around us.

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DIGITAL SPECIAL ISSUE 1

The 8th International Forum of Design as a Process, themed "Disrupting Geographies in the Design World" was held in Bologna from 20 to 22 June 2022. The event was organised by the Advanced Design Unit of the Alma Mater Studiorum – Università di Bologna, Department of Architecture, in collaboration with two partner universities: Tecnológico de Monterrey (TEC) and Pontificia Universidad Católica de Chile.

The Forum engaged speakers from the Global Design community, expanding the original vocation of the Latin Network for the Development of Design as a Process to include researchers and designers of the Mediterranean Area, Middle East, IOR (Indian Ocean Region), and Global South regions. The goal was to share new perspectives on imagining design futures in a responsible and just perspective, at the forefront of change, while building strategic partnerships and creating accessible knowledge.

Structured around three pillars — seminars, workshops, and exhibitions — the Forum hosted meetings, reflection opportunities, networking activities. It involved designers, scholars, young researchers, design entrepreneurs, in an experimental format.

Speakers' contributions not only inspired the practices of the designers' community, but also resonated with students and the broad audiences. The presentations explored intersections of materiality and culture, post-coloniality, decoloniality, gender studies, and other areas of human thought and action which seek to analyse, question and challenge the disruptive geographies in the world, today.

The papers submitted to the five tracks proposed are published in the Digital Special Issue 1 of *diid. disegno industriale – industrial design*, celebrating during those days its 20th anniversary and serving as the fourth partner of the event.

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