FUTURE REVISITED: ARCHITECTURE AND FASHION THROUGH THE PRISM OF A DIGITAL ERA

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ABSTRACT

By focusing on substantial, formal and behavioural aspects of architectural and fashion design practices, this paper traces the dynamic interrelationship between the aforementioned disciplines in a digital era. In discussing contemporary design paradigms, which integrate digital technologies, and considering relevant theoretical references, which anticipate them, the collaboration potential of architecture, fashion and technology will be sought.

KEY WORDS

Architecture; Fashion; Design; Futurism; Digital Fabrication; Human-Computer Interaction; Gesamtkunstwerk.

INTRODUCTION

In his lecture entitled *The Art and Craft of the Machine* (1901), architect Frank Lloyd Wright laid stress on the fact that "in the Machine lies the only future of art and craft". According to his vision, this "glorious" future would represent the end of well-established techniques, and thus lead to the "metamorphosis of ancient art and craft" due to the spreading and dominance of mechanical methods – to the "modern Sphinx" that only artists were able to solve. In his discussion of mechanisation, Wright expressed his hope that the old ideals will give way to new purposes, enabled by the rise of new design and production technologies, in the field of decorative design and handicraft, placing particular emphasis on the discipline of architecture. A few years later, poet/writer Filippo Tommaso Marinetti published the convictions and intentions of Futurism in the verbal form of *Manifesto del Futurismo* (1909), praising an omnipresent beauty: "the new beauty that has enriched the splendor of the world: the beauty of speed". Fascinated by the "electric moons", the "adventurous steamers" and "the gliding flight of airplanes", the Futurists aimed to equally integrate the mechanical, innovational characteristics of their era, into diverse creative aspects. Being interested in a totalitarian approach of design, they experimented broadly with the application of their philosophy on a wide range of design products, varying from "a building to the fork of the table"[2] (Galante 1917). For instance, Giacomo Balla, one of the authors of *Ricostruzione Futurista dell'Universo* manifesto (1915), extended his artistic practice outside of the territory of his canvases and across different scales of function, such as interior spaces, pieces of furniture, umbrellas, and clothes.

At the dawn of the twentieth century, architecture and fashion practices could not remain intact from the extensive mechanical and technological phenomena of the era that followed the Industrial Revolution. These, often innovative, phenomena were affecting significantly the creative fields and were nourishing futuristic predictions regarding the design culture to come. In *Manifesto della Moda Femminile Futurista* (1920), poet/writer Volt[3] supported that "women's fashion has always been more or less futuristic," a creative platform that was conveying notions such as "speed, innovation and courage of creation," which could be considered an art, located under the same umbrella with architecture and music[4]. *Future Revisited: Architecture and Fashion Through the Prism of a Digital Era* encapsulates futuristic visions of theorists and artists, similar to the ones aforementioned, which are being reconsidered in the

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[2] GALANTE, N. "Note d'arte decorativa." *Noi*, **I**:1 (1917), in CERUTTI, C. and R. SGUBINA. *Futurismo, Moda, Design: La Ricostruzione Futurista dell'Universo Quotidiano*, Gorizia: Musei Provinciali di Gorizia, 2009, 39.

[3] Vincenzo Fani Ciotti was known to history under his Futurist pseudonym, Volt.

[4] "A dress that is ingeniously conceived and well-carried has the same value as a fresco by Michelangelo or a Titian Madonna." VOLT, *Manifesto della Moda Femminile*, 1920, in CRISPOLTI, E. *Il Futurismo e la Moda.* Milan: Padiglione d'Arte Contemporanea, 1988, 115.

digital – creative and innovational – context. Contemporary design paradigms that employ technological techniques in their design and manufacture processes are being explored, whilst participating in a cross-disciplinary narration of exciting possibilities.
The present paper considers the diverse ways in which the emerging technologies – integral part of the current digital era – become integrated in architecture design practices and interact with respective elements of fashion design processes, potentially informing one another. Gathered information is organised according to its relevance to substantial, structural and behavioural aspects of architectural and fashion design practices/products, and is then composed according to three main poles of analysis: the manipulation of material substance, the exchange of design/production techniques and the interaction between product behaviours. Each pole introduces a different kind of engagement with digital media, aiming to shed light on the communication, and thus collaboration, potential of the respective entities. *Future Revisited* will also investigate the inherent characteristics of the interrelationship between contemporary architectural and fashion design practices/products, attempting to outline their preeminent tendencies and trace paths for further discourse. Finally, it will draw out the existence, and the characteristics, of a holistic creative approach – evident as a performative osmosis – that may traverse various design branches simultaneously, whilst referring back to the era of the Futurists: as if the "future" they were envisioning was about to be revisited, or even reconstructed, in actual terms.

Manipulating Substance: The Fall of Marble, the Rise of Bone

In the third paragraph of *Manifesto della Moda Femminile*, Volt stresses the need for limited use of the raw materials employed in the dress-making process, in response to their shortage after three years of war, and describes the persistence on manufacturing leather shoes and silk dresses as "ridiculous". Nowadays, the motivation might differ but the need for the conservation of raw sources and materials is once again imperative. "The reign of silk in the history of female dress must come to an end," argues Volt, "just as the reign of marble is now finished in architectural constructions," while praising the integration of new materials in the construction process, by emphasising that "one hundred new revolutionary materials are rioting in the square, demanding to be admitted into the making of womanly clothes". Given that the Futurists were receptive to new ways of expression/creation, it was considered plausible to encourage fashion designers to "fling open wide the doors of the fashion ateliers to paper, cardboard, glass, tinfoil, aluminium, ceramic, rubber, fish skin, burlap, oakum, hemp, gas, growing plants and living animals"[5] (Volt 1920). The present pole begins with the analysis of selected design paradigms, in order to discuss indicative ways in which new technologies collaborate with fashion practices and promote new interpretations of materials; this will be followed by a tracing of beneficial effects for both the human and natural environment, such as the manipulation of recycled elements and the elimination of waste during the production process.

In the case of the 132 5 project (Issey Miyake and Reality Lab 2010), when the flat, two-dimensional, computer generated pieces of recycled polyester fabric covered in tinfoil – that comprise the diverse elements – are being unfolded, they produce three-dimensional geometric garments, resembling origami shapes, meant to be wrapped around the body. The effect recalls of the rising of a Chinese lantern from its flat state into a rounded object[6] and the project introduces to the public ten different templates for diverse garments to be worn in many variations, making use of no natural raw materials or of the long-established cutting and sewing methods[7]. 132 5 project addresses, indirectly, the difficulties in the seamless correspondence of three-dimensional (draping) and two-dimensional (drafting) techniques in the production of clothes; in short, between what is being applied on the body (worn) and what on the paper (designed). It has been observed that designers employ, digitally, either the draping or the drafting software/medium, hence lacking a simultaneous view/control of both parameters: the sculpted form and the flat patterns employed for its production, or vice versa. In the recent years, fruitful research discourse has emerged and nourished in the field of (interactive) cloth design and simulation, resulting in tools such as the Sensitive Couture

[5] VOLT, *Manifesto della Moda Femminile*, 1920, in PAULICELLI, E. *Fashion Under Fascism: Beyond the Black Shirt*. London: Berg, 2004, 112, 113.
[6] MENKES S. "Magical Reality in 3-D From Issey Miyake." *Fashion and Style: The New York Times* (November 22, 2010).
[7] The single-piece gesture, preeminent in 132 5, shares the same logic with the A-POC project (Miyake 1997), in which the garments derive after cutting them out of pre-marked, machine-processed tubes of cloth or the (even older) one-size only dresses, made from rectangular pieces of fabric that fit around the body via draw-strings or belts by Bernard Rudofsky, inspired by Ancient Greek garments.

(Umetani, et al. 2011) that proposes an "interactive, bidirectional editing between two-dimensional patterns and three-dimensional high-fidelity simulated draped forms"[8].

On the counterpart of materiality, and in the quest of promoting techniques that would restrict the use of raw materials, in the broad field of design practices, architect/designer Neri Oxman ultimately aims at producing an entire building via the employment of a three-dimensional printing method; in doing so, she examines the possibility of controlling the density of a material, such as concrete, and thus the structure of a building: one that traditionally consists of columns and walls. Oxman, in her lecture *On Designing Form* (2010), introduces the paradigm of nature, and precisely of human bones, in order to explain how natural structures may vary in material density (stronger on the outside, sponger on the inside), transmitting this notion to her three-dimensional experiments with form and materiality. The principal goal of the MIT Media laboratory, of which she is a preeminent member, is the exploration of "processes for digital fabrication like three-dimensional printing that are inspired by nature with the belief that we are going to emerge on the other side generating and making things that are more efficient and more effective" (Oxman 2012). Having succeeded in producing a small-scale object of variable-density, the Carpal Tunnel Syndrome glove, Oxman aspires of creating a single-piece, three-dimensionally printed building, featuring a density-gradient version of concrete, "being both lighter and stronger than conventional concrete" (Oxman 2011); a building that would resemble the variable material structure of a "living animal", following Volt's vision[9]. According to Oxman, "variable property fabrication aims at introducing a novel material deposition three-dimensional printing technology which offers gradation control of multiple materials within one print to save weight and material quantity while reducing energy inputs" (Oxman 2010). Among the advantageous features of this technique, the high degree of customisation of structural and material performance can be found, leading to the elimination of material waste[10] and to an accurate approach of the desired result. This precise manipulation of the final product is of vital significance to industries like the transplant production methods (that integrate such technologies), since it allows for highly customisable elements, such as an artificial hip (Materialise 2011) "crafted precisely for the intended patient" and bearing a "lattice-like" structure, one that resembles a bone and can be "easily integrated with the patient's actual bone" (Economist 2011). The mimicking of the bone's structure, and thus the manipulation of a single element's density is a technique that could not possibly be handcrafted; a technique that can be considered as testament of J.C.R. Licklider's "symbiosis" theory, supporting that "the symbiotic partnership (between man and the computing machines) will perform intellectual operations much more effectively than man alone can perform them"[11] (Licklider and Taylor 1968).

A different way of manipulating material density is demonstrated via the gowns designed by Atelier Manferdini: their shape is characterised by full/empty areas of fabric, achieved via the use of a laser-cutter – a precedent to the three-dimensional printer tool of digital fabrication. In a similar manner to Oxman's multi-targeted application of three-dimensional printed methods, Manferdini acquires a simultaneous approach of design, varying from an object and a dress, to a showcase installation and a building, covering numerous scales and functions. Focused more on the manipulation of the formal, rather than of the structural (in Oxman's case) characteristics, Manferdini creates products that bear detailed voids, whether these voids refer to a dress (such as Cherry, Bones and Swarm dresses), a tray for Alessi or a window installation for Valentino. From the small scale of fashion and industrial design, the experimentation field extends here, to include the skin of buildings, and its patterned appearance, either resembling a fine piece of silk lace (Fabric Tower, Guiyang 2008) or a perforated synthetic fabric (West Coast Pavillion, Beijing Biennale 2006).

In discussing the various ways of digitally manipulating substance, one may reach the conclusion that Frank Lloyd Wright and the Futurists were probably referring to a different kind of 'Machine' when envisioning the future of design, yet they had traced guidelines that can be still considered modern and valid. Nowadays, design leans towards mechanisation as defined by methods such as: additive manufacturing, laser cutting or CNC routing, all of which are

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[8] Its creators are aiming to extend the principles of Sensitive Couture in various additional disciplines, such as architecture, industrial design and engineering, and it would be interesting to observe the common elements of cross-disciplinary products, designed with the same digital tool/s.

[9] "The nervous systems of animals, too, turn out to be similar to things made possible by additive manufacturing." "3D Printing: The Shape of Things to Come." *The Economist*, (10.12.2011).

[10] Moreover, the final product approaches the desired form at a great extent, as the gap between digital simulation/representation and final result is very narrow.

[11] "(...) in the anticipated symbiotic partnership, men will set the goals, formulate the hypotheses, determine the criteria, and perform the evaluations. Computing machines will do the routinizable work that must be done to prepare the way for insights and decisions in technical and scientific thinking. Preliminary analyses indicate that the symbiotic partnership will perform intellectual operations much more effectively than man alone can perform them." LICKLIDER, J.C.R. and R.W. TAYLOR. "The Computer as a Communication Device." *Science and Technology*, **76**:2 (1968).

methods of digital fabrication, expanding rapidly in a relatively short period of time, whilst crucially rearranging the design scenery. In their discussion of the "new structuralism" – outlined by the collaboration of design engineering with emerging technologies – Rivka and Robert Oxman note that "fabrication is not a modeling technique, but a revolution in the making of architecture," in their definition of the "new structuralism" phenomenon. According to the Oxmans, the latter "designates the cultural turn away from formalism and towards a material practice open to ecological potential," referring to this type of (architectural) design that is "motivated by *a priori* structural and material concepts," in which structuring is regarded as "the generative basis of design" (Rivka and Robert Oxman 2010). This notion may also be adapted to additional design disciplines, such as fashion design, where the influence of fabrication gradually becomes more evident, through the prism of relevant collaborations. The focal point is thus shifting from a rigid, one-dimensional interest in materiality, and substance, to a rather holistic approach that examines how materials may affect the structure of a product, and thus influence its function and form.

Exchanging Techniques: Weaving Buildings and Moulding Dresses

In reflecting on the structural elements and parallel means of design or production of a building and a gown, respectively, in the digital context, one observes that emerging technological media enables the employment of craft methods in architecture and sculptural ones in fashion, nourishing a new hybrid nature. In the first proclamation of Bauhaus, architect Martin Gropius discussed the approach and initiatives of the movement towards a wide range of disciplines. In reference to architecture, he emphasised that Bauhaus aimed to create "a clear, organic architecture whose inner logic will be radiant and naked, unencumbered by lying facings and trickery," an architecture that would be in line with the "world of machines, radios and fast cars, (...) with the increasing strength of the new materials – steel, concrete, glass – and with the new audacity of engineering, the ponderousness of the old methods of buildings is giving way to a new lightness and airiness"[12] (Gropius 1919).
In the attempt to reconcile with the idea and importantly with the expansion of the machine – prerequisite of the modern era – Martin Gropius outlines the desired characteristics of a building, in tune with its temporal, yet cultural, surroundings. Morphological characteristics such as "lightness" and "airiness" resemble the attributes of a dress – a structure made of fabric – rather than of building materials. Undoubtedly, with the spreading of emerging technological innovations, craft sources of textile structures, such as weaving, knitting, knotting and interlacing, are configurative principles (of two- and three-dimensional classes) with architectural potential[13] (Rivka and Robert Oxman 2010). Testament of this multidisciplinary exchange, which reveals the interrelationship between architecture and fashion design practices, are a series of "woven" buildings such as: the Spanish pavilion for the Expo 2010 in Shanghai (EMBT with MC2 2010), the Centre Pompidou in Metz (Ban 2010) and the Beijing National stadium (Herzog and De Meuron 2008). These buildings originate from the embracement of craft techniques, thoroughly used in the fashion fields, interpreted through the prism of contemporary digital media and advanced engineering. Analogically, if in the sector of architecture a tendency towards techniques that are mostly met with dress creation is observed, then in the fashion design field one may discern methods that have been widely associated with building construction.

In the beginning of the twentieth century, fashion designer/journalist Rosa Genoni, like Wright, foresaw the use of the machine, in the future activities of fashion design. During an era that the means of dress conception and creation were taking advantage of the emerging materials, techniques and mass-production methods, Genoni, in 1908, affirmed that "the machine will not be an obstacle to the production of these stylish and beautiful articles; far from it!" while supporting that "in the realm of the industries that are ancillary to the garment industry, the docile, obedient, fast machine will be able to reproduce and distribute in an incalculable number the creations of the artist and craftsman/woman (...) it will mould and shape raw materials according to the decorative motifs that the modern Italian genius has imagined"[14] (Genoni 1908). Observing the fashion design products such as the red plastic bodice, based on a cast of the human body (Miyake AW/1980), the fiberglass and resin moulded (in a specially designed cast) Airplane dress (Chalayan 2000), or the more recent, aerodynamic, moulded latex dresses of the Inertia collection (Chalayan SS/2009), one may observe a similar mechanical process to the one described by Genoni as able to "mould and shape

[12] "(...) architecture in the last few generations has become weakly sentimental, aesthetic and decorative. (...) this kind of architecture we disown." Martin Gropius, in CURTIS, W.J.R. *Modern Architecture Since 1900*. London: Phaidon, 1996, 194.
[13] REITZ, J. and D. BAERLECKEN, "Interlacing Systems." in GENGNAGEL C. *Proceedings of the Design Modeling Symposium*, Berlin: University of Arts Berlin (2009): 281-90, in OXMAN, R. and R. OXMAN, "The New Structuralism: Design, Engineering and Architectural Technologies." *Architectural Design*, **80**:4 (2010), 14-23.
[14] GENONI, R. "Vita d'Arte nella moda." *Vita Femminile Italiana,* (1908): 1102-8, in PAULICELLI, E. *Fashion Under Fascism: Beyond the Black Shirt*. London: Berg, 2004, 31.

raw materials"[15]. In the present pole, garments are placed in a constant dialogue with architectural practices; as an example, they are borrowing the logic of concrete moulded buildings and are embedding technology in a way that marks the abolishment of traditional cutting and sewing methods on the threshold of an, exclusively, digital era.

A fundamental characteristic of fashion is its attribute of never being entirely new or old, neither detached from the manifestations of its era and the milestones of its course; fashion is rather a combination of different elements bearing details of the past intermingled with the needs, tastes, technology, experiments in fabric and design of the present (Paulicelli 2004), producing appropriate items. Through this prism, the garments featured in the Voltage haute-couture collection (Iris van Herpen 2013) mirror the development of digital technologies, on one hand and its collaborative force with the design engineering field, on the other. The three-dimensional printed dress, designed in collaboration with architect Julia Koerner (with Materialise), for instance, reflects the experimentation with digital fabrication (laser technology): the latter is employed for the achievement of a lace-like texture, following the philosophy of an organic architecture. More specifically, the dress reveals "a highly complex, parametrically generated, geometrical structure," composed by multiple layers of thin woven lines that animate the body in an organic way. Koerner notes that via this collaboration the computational boundaries in combination with emergent technologies (selective laser sintering) were exploited, resulting in a flexible, new material, which induces "enticing effects" in the fashion design field.

The garments comprising Voltage haute-couture collection (Iris van Herpen 2013) drew upon the "electricity of the body", resembling abstractly the embodiment of movement, power and speed in the latex dresses of the Inertia collection (Chalayan SS/2009). The translation of the notion of "electricity" into tangible elements is evident throughout the work of the Futurists, for their admiration of speed, technology and the machine was vividly embodied into material substance, whilst revealing their holistic intentions for "a total universe". As in the case of Herman van de Velde, Josef Hoffmann, and Peter Behrens garments, interior furnishings, and architecture created a *gesamtkunstwerk* – a total work of art (Scheerbart 2001). The examples, cited in this pole, apart from the conceptual connotations of mechanical notions – that link them to the Futurists' era –, carry new possibilities in the fashion design and production processes, promoting responses to the current social and environmental rising issues. Indicatively, they introduce elements such as the elimination of cuts and seams, the more accurate calculation of material usage (diminishing waste) and a seamless achievement of the desired result, the nature of which may vary from its static to interactive state, a design aspect which will be discussed below.

Interactive Behaviours: From Architectural to Sartorial Façades

According to Giacomo Balla, dress should equally adjust to its environment and to the mood of the bearer, potentially altering its form from daytime to nighttime. In his *Vestito Antineutrale* manifesto (September 1914), he proposed terms such as: arrogant, festive, amorous, daring that could accompany and characterise pieces of clothing and the way they were worn[16]. He supported that the garments he had designed could prompt the user not only to modify his/her mood, but to even invent a new dress for a new mood at any instant, supporting that "the Futurists want to liberate our race from every neutrality, from the nostalgic, romantic and spineless inertia"[17]. Following the notions expressed by Balla, Filippo Tommaso Marinetti in his essay *Piaceri Latini per la Mente* (1935), also promoted the establishment of a "tactile resonant metaphorical dress tuned to the hour, the day, the season and the mood"[18]. If the previous two poles focused on the substance and structure of dress – in dialogue with architectural practices –, then the present pole is concerned with its behavioural counterpart, under the influence of advanced digital media.

In being highly representative, in terms of human identity, fashionable dress bears a significant "psychological link" along with the potential to form a personal identity[19] (Sparke 2008). Roland Barthes, in *The Language of Fashion,* highlights the representational role of dress and its ability to project qualities of character (intellectual, young, extrovert), profession (uniforms, suits) or state/situation (mourning, joy, professional) (Barthes 2006). Dress can be considered as a platform of self-expression, a symbol of personal identity and quotidian conveyance of one's personality: as Marjan Colletti observes, "personality does certainly come across in fashion design" (Colletti 2010). In the contemporary context of technology, attention is being drawn on the surface of dress, accentuating even more, its

[15] A similar abolishment of the traditional cutting and sewing techniques was, also, traced in the cases of A-POC and 132 5 projects by Issey Miyake), as mentioned in the first pole of this paper.
[16] WOLLEN, P. *Addressing the Century: 100 Years of Art and Fashion*, Berkeley: University of California Press, 1998, 82.
[17] PAULICELLI, E. *Fashion Under Fascism: Beyond the Black Shirt*. London: Berg, 2004, 34.
[18] LEE, S. *Fashioning the Future: Tomorrow's Wardrobe*, London: Thames and Hudson, 2005, 115.
[19] SPARKE, P. *The Modern Interior*, London: Reaktion Books, 2008, 73.

communicational potential. As Dani Cavallaro and Alexandra Warwick point out, "dress as an image, or representation, operates as a screen on different levels. It is capable of acting as a sort of field, a structure indicating and determining a division or separation, and, at the same time, as a surface onto which other images may be projected"[20] (Cavallaro and Warwick 1998). Similarly, Judith Clark discusses the role of digital media in the presentation and representation of fashion, which can be interpreted as a "layering of information on top of a strictly sartorial working out of shape and form" (Clark 2010). The information transmitted via the surface, or the substance, of clothing varies and the information triggered by a certain stimuli (emotional or environmental) is of particular interest in the interactive potential of dress within a technological perspective. If Marinetti envisioned a "tactile resonant metaphorical dress tuned to the hour, the day, the season and the mood," then projects such as the Brain Coat (Diller and Scofidio 2002) and the One Hundred And Eleven collection (Hussein Chalayan 2006) can be appreciated as the tangible counterpart of Marinetti's vision.

To illustrate more specifically this interaction, the Brain Coat – an inextricable part of the Blur building (Swiss Expo 2002 centerpiece pavilion) – was a uniform worn by each of the visitors of the pavilion and carried interactive, wireless technology, that allowed them to "communicate" with each other, indicating positive affinity via changes of color and sound, inscribed the white surface of the garment. Since a cloud of man-made fog surrounded the pavilion, this white uniform acted also as a technologically enhanced raincoat. Jonathan Hill, in his book *Immaterial Architecture*, describes the ritual of visiting the pavilion: "before leaving the land, each visitor completed a character profile stored electronically in a hooded "intelligent" white raincoat (...)," which "provided protection from the wet environment and communicated with the Blur building's computer system" (Hill 2006). Here, one may observe a dynamic relationship between building and dress – one complementing another; the building was composed of water drops, while the uniform was waterproof. Yet, the garments bore an additional feature: they could express and transmit signals. Hill describes relevantly: "as visitors wandered past one another, their coats compared character profiles and blushed in response, changing color to register either red for desire or green for no interest, the colors standing out in the white environment" (Hill 2006).

The expressive character of the Brain Coat is reminiscent of physiognomical qualities, and particularly of the qualities of skin, the most profound thing about the human element and "an interface of pains and pleasures (...) blushing, blanching, sweating like the eyes and the mouth, (...) a medium and a means of communication"[21] (Querzola 1979). The visitors of the pavilion, upon entrance, put on an additional skin, part of a wider complex system, the distinct members of which are programmed to intercommunicate. Via the employment of interactive, wireless technologies, a mechanisation of clothing – and thus, of the body – can be traced, here, introducing new performative features that balance between human and technical notions. Olivier Burgelin stresses that "it is deemed imperative to "mechanise" bodies, to make them spell out an order. The same goes for clothing as for skin: we encounter the same double category of instruments – clothing is both tool and body"[22] (Burgelin 1979). This dual nature is clearly illustrated in Elizabeth Diller's words: "we wanted to synthetize architecture and technology in a way that each would exchange the characteristics of the other, that is to say, dematerialize architecture and to materialize technology"[23] (Diller 2002). Along with the materialisation of technology, the "mechanisation of the body" may be extended to a wider context, consisting of digital fashion examples, which incorporate technology. The manipulation of the outward appearance of the human body, in such a way as to produce signs, can be also traced in the vivid interest of architects, such as Richard Neutra, in the function of human nerves, and particularly in "how the inner nerves of the body might deal with the outside, and in how the outer nerves provided by technological systems might reconfigure the body"[24] (Wigley 2007).

The "reconfiguration" of the corporeal contour – through the employment of digital media – is the key concept of the One Hundred And Eleven (SS/2007) collection of fashion designer Hussein Chalayan, realised in collaboration with design engineer Moritz Waldemeyer and the conception-creation firm 2D:3D, directed by Rob Edkins. Six gowns

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[20] CAVALLARO, D. and A. WARWICK. *Fashioning the Frame: Boundaries, Dress and Body*, Oxford: Berg, 1998, 47.

[21] QUERZOLA, J. "Le silicium a fleur de peau." *Traverses*, 14/15 (1979): 163-173, in DILLER, E. and R. Scofidio. *Flesh: Architectural Probes*, New York: Princeton Architectural Press, 1996, 12.

[22] BURGELIN O. "Les outils de la toilette ou Ie con trale des apparences." *Traverses*, 14/15 (1979): 25-42, in DILLER, E. and R. SCOFIDIO. *Flesh: Architectural Probes*, New York: Princeton Architectural Press, 1996, 12.

[23] Elizabeth Diller, in HILL, J. *Immaterial Architecture*. London: Routledge, 2006, 95

[24] "In imagining the built environment as "an organically possible extension of ourselves," he argued in 1954 that the designer deals primarily with nervous systems, and he caters to them." NEUTRA, R. *Survival Through Design.* New York: Oxford University Press, 1954, 21 and 197, in BURKE, A. and T. TIERNEY. *Network Practices: New Strategies in Architecture and Design*. New York: Princeton Architectural Press, 2007, 47.

were smoothly transformed, in real-time, into garments of diverse eras – morphing through the temporal span from 1900 to 2007 – and their outward shape was adjusted accordingly, together with the natural female corporeal contour. The dresses, apart from advanced technologies, integrated Chalayan's unique graphic language and vision of the past, but above all they expressed his aim to create "prototypes for the future," and precisely, "clothes that change form depending on the occasion". On the technological counterpart of the six dresses, Moritz Waldemeyer describes that "the real challenge lies in keeping the integrated technology lightweight, yet strong enough to maneuver different fabrics and materials". The subtle and detailed sartorial transformation – from 1906, to 1916 and then to 1926, in the case of the first dress, for instance –, could be regarded as tangible evidence of the cohesive collaboration potential between fashion and technological practices.

In this sense, the designer is equipped with new creative media that enable him to free the realisation process of his visions and, in this case, proceed with the abstract interpretation of an hourglass New Look silhouette (Christian Dior 1950s) and its transformation to a metallic dress of futuristic aesthetic (Paco Rabanne 1960s) or of an airy gown and its integration into a hat, completely exposing the natural human silhouette. In the first case, the transformation process was "precontrolled on a microcontroller, on a timed sequence" (Edkins), activated right before the female model's appearance on the catwalk; at the appropriate moment the gown's skirt demonstrated a sequential change of shapes. In the majority of transformative garments, in this collection, underneath their external layers, and sewn onto a basis (corset), a complex system of cables, battery packs, controlling chips and geared motors (all in tiny dimensions) was found, allowing for the movement – lifting and releasing – of the electronically-driven sub-parts. The transformable garments of Chalayan, as featured in the One Hundred And Eleven (SS/2007), or in the recent Rise (AW/2013), collection, are indicative of a "new species"[25] of fashion; a species that encompasses technology for its interactive performance[26]. One of the first key pieces of hybrid nature, which combined fashion and technological characteristics, is Bubelle (Philips 2007): a dress of a bubble-like form that illuminates according to the corporeal, motional and thermal, signals. In Bradley Quinn's description, "the individual glowing areas create abstract patterns that morph into new configurations each time they detect movement or a change in surface temperature. The effect creates a visual representation of physical states; when emotions can be identified as a physical response, the dress would create a display that signified emotional states" (Quinn 2010).

Lying on the intersection of human and digital substance, the discussed fashion examples with embedded computation and communication technologies, create intimate spaces that introduce computation to the respective field, in order to enhance its ordinary activity (Fox and Kemp 2009). Apart from the physical/emotional stimuli, originating from the human element, examples of responsive garments to environmental and natural elements have begun to prevail; the Living Pod and Walking City dresses (Ying Gao 2009) change form according to the perception of light and air, in resembling a breathing organism. Likewise, but on the architectural counterpart, the project Metamorphosis (Philips 2010) is a conceptual definition of a residential unit that integrates natural characteristics (such as daylight, air and sound) and notions (such as constant change and unpredictability) in order to propose a space, in tune with its natural surroundings, meant to enhance well-being. In correspondence with the responsive dresses aforementioned, architectural examples such as the kinetic façades of Institut du Monde Arabe and Brisbane Domestic Terminal Car Park or the electronic façade of Kunsthaus Graz[27], create a common platform of virtual and physical characteristics, whilst demonstrating a series of advantageous features. Taking into consideration the above, architecture can be regarded "as an agile, responsive, and evolving system like any other to be found in the natural world" (Wigley 2007): a system that could influence, accordingly, elements in the fashion field. According to Lucy Bullivant, guest editor of the *4dspace: Interactive Architecture* issue of Architectural Design, "in the future, interactive architectural design, assisted by a wider recognition of its value as an emerging hybrid discipline, will enable the relationship between

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[25] "Every tool, from simple "lever" to "electronic tube" was an "organic" and "evolutionary" step toward a "new species", as he put it in a 1940 essay on industrialization for Fortune." FULLER B. "U.S Industrialization." *Fortune,* **21**:2 (1940), in BURKE, A. and T. TIERNEY. *Network Practices: New Strategies in Architecture and Design*. New York: Princeton Architectural Press, 2007: 47

[26] "Chalayan is largely credited as being fashion's technological avant-garde using his collection's finale as the event of the event: the models perform the clothes and the clothes perform themselves perform." CLARK, J. "Exuberant Couture." *Architectural Design*, **80**:2 (2010): 40-43.

[27] The south façade of Institut du Monde Arabe (Nouvel 1987) is covered with hundreds of solar-activated mechanical diaphragms which provide shifting patterns in accordance with the available light, evoking traditional Arabic designs as well as providing active sun shielding for the interior. The Domestic Terminal Car Park (Kahn and UAP 2012) entire exterior face appears to ripple fluidly, resembling a sheer fabric, as the wind activates 118,000 suspended aluminium panels on its surface. The Kunsthaus Graz Austria (Cook and Fournier 2003) eastern façade is covered by a part-transparent, part-opaque electronic membrane (Bix Matrix) n which low-resolution images, films and animations are presented.

building and program to become a much more subtle and communicative process, embracing a wider, personalized set of functions, desires and experiences"[28] (Bullivant 2005).

Significantly, fashion practices gradually adopt technological techniques in order to establish a domain of responsive sartorial behaviour, promoting unique and customised features that are generated and regenerated by a wide range of stimuli, triggered by human (emotional or physical), natural (sun, air, water), environmental (temperature, pollution) or precontrolled mechanical factors. The paradigms employed for this analysis, represent and promote a cohesive relationship between design and technology, one with discreet, nearly invisible, seams, unifying the two entities. It is true that "the integration of novel materials and material technologies as elements revoking the gap between artifact and gadget"[29] (Coelho, et al. 2007) has been recurrent objective of the cross-disciplinary, contemporaneous design discourse, bringing together traditionally distant disciplines, while aiming to shape a meaningful environment, in line with the given human needs (individual or collective). Design elements, as the aforementioned, reflect the ability of fashion garments to respond adequately to a given situation, defined by diverse stimuli, while drawing attention to the interactive connotations of dress, verifying that "there is another, hypothetical existence of the gown, not to do with its design but its behaviour"[30]. If we consider the behaviour of interactive garments as able to constitute a new language, then in today's context that science and technology multiply rapidly, "the languages we speak and think" are proliferating and apparently, there are two options "either we use these languages, or we remain silent" (Ballard 1974).

Architecture and Couture 2.0: On the Threshold of a New Nature

At a time that technology progresses rapidly and updated versions of digital media succeed one another, it seems fruitful to include, a number of theoretical references, especially from an era that was passionately envisioning the shape of things to come. This theoretical *corpus* feeds into the cross-disciplinary narration of technological innovations (and their use in fashion and architecture practices), whilst tracing relevant correspondences to precedent notions, since "things are only contemporary by composition, and some parts are always related to memory and the past" (Serres 1995). Moreover, the juxtaposition of former theories with current practices provides a reinterpretation of the present (architectural and fashion) design scene, as if the past was revisiting the future, in shedding light on the road that has been travelled from imagination to realisation. This road has led to the (actual) recognition of a second nature: a nature consisting of the digits and characters of a computational code. As graphic designer/typographer Otl Aicher noted in *Analogous and Digital* (1994), "we are already incapable of extricating ourselves from the constraints of the digital method," since "the change in our culture, in our behaviour, in our understanding of the world is impressive," taking into consideration that "almost everyone already has a second nature, his existence as a quantity of numbers and values" (Aicher 1994). This observation can be applied to the design disciplines discussed throughout this paper, since their products – contemporary buildings and dresses – are defined by digital characteristics: distinct elements that have determined their form and function to a greater or lesser extent.

If for Lisa Iwamoto, the architectural project is a form of applied design research, and the architect seeks to achieve a certain perceptual, spatial, and formal effect via the employment of digital design and manufacture, then the same rule exists for the fashion project/designer dipole. Therefore, dress can be regarded as an autonomous element, even if in the case of the Futurists it was inextricable part of the "total art" aspiration: one that illustrated their vision for establishing a new relationship between the spheres of art and life. Remarkably, this vision would clearly express the innovative and ever changing spirit of their time, encompassing diverse elements from a wide variety of the quotidian universe. In the same period (1919), the first Bauhaus proclamation came to light, calling attention to a similar reflection, conveyed with the use of a different artistic syntax, referring to the "ultimate aim of the visual arts: the complete building". In summarising the movement's initiatives, Gropius expresses his enthusiasm for the conception of "the new building of the future that will bring all into one single integrated creation: architecture, painting and sculpture rising to heaven out of the hands of a million craftsmen, the crystal symbol of the new faith of the future"[31]

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[28] BULLIVANT, L. "4dspace: Interactive Architecture." *Architectural Design,* **75**:1 (2005), 7.

[29] "We identify such materials as Transitive Materials, in that they are able to create and contribute to truly ubiquitous and cohesive computational systems extending invisibly across different scales of function and context." COELHO, M. et al. "Transitive Materials: Towards an Integrated Approach to Material Technology." *9th International Conference on Ubiquitous Computing: Ubicomp* (2007).

[30] And she goes on by questioning: "what if were to move, be lit and so on, in these ways? What if gravity were removed? What if a lightshow were projected on to the model as she walks?" (Clark 2010), thus outlining aspects of the collaboration potential between fashion and digital media.

[31] Martin Gropius, in CURTIS, W.J.R. *Modern Architecture Since 1900*. London: Phaidon, 1996, 184.

(Gropius 1919). Today, "the hands of a million craftsmen" can be equated to the widespread digital practices, and precisely the computer-aided design and manufacture (CAD/CAM) tools, as it is extremely rare to detect a contemporary architect or fashion designer who is using, exclusively, analog methods of design/production. More widespread in architecture, and less integrated in the fashion territory, new technologies are altering the nature of the present design scene, "achieving unprecedented visual, material and formal results" (Iwamoto 2009), regarding the inherent elements of a given product.
As described in the main body of this paper, architecture and fashion practices may exchange attributes, techniques and characteristics, embodying the holistic approach of a "total work of art". Whilst sir Norman Foster unveils his plans of building structures on the moon (February 2013), architect/designer Neri Oxman collaborates with fashion designer Iris van Herpen on the occasion of Voltage haute-couture collection (SS/2013), and the intersection point of the two initiatives is found at the three-dimensional printing methods employed for their creation. Ranging from the architectural shells to the sartorial ones, and from industrial design objects to shoes, common digital fabrication methods are being used for the realisation of a given product, pointing attention to the simultaneous computational practices across diverse disciplines. If one acquires a distance from the "digital present to detail how the past presses its nose up against the glass of the future" (Friedberg 2006), considering the simultaneous features and tendencies of multiple design elements, then s/he might reach the conclusion that we are heading towards the definition of a new interpretation of *gesamtkunstwerk*, as if verifying the vision of Vincenzo Fani (Volt), in *Manifesto della Moda Femminile Futurista* (1920), that "every woman will be a walking synthesis of the universe"[32].

CONCLUSIONS

At the present, advanced (in terms of technology) state of architectural and fashion design practices, along with the great freedom and precision[33] in achieving the desired result[34], new ways of design and manufacture are being proposed. In this perspective, it is considered essential to surpass the technological innovations *per se* and focus instead on their potential to address social and environmental issues. What should be our constant concern, is the ample potential of digital media to improve the relationship of a given product with the human element (individual or collective), as well as with the extended natural environment. Overall, technological advancements should traverse the entire body of design and equally influence its diverse branches, as in the discussed case of the architecture/fashion dipole, since "it is of no use to build houses of the kind that reduce labor, and make dresses of the kind that use up all the hours we have saved in our wise architecture" (Kaplan 1987). Throughout this paper, I drew attention to the sustainable, interactive and performative connotations of digital practices related to fashion, and secondarily to architecture, and analysed critically their im/material outcomes. Importantly, it has been observed that technologically advanced methods, as the ones dominating the current state of design[35], may "allow very poor designers to look as if they're doing something interesting" (since even someone untrained can produce impressive results) (Cook 2010), but at the same time, may catalytically assist the preeminent ones[36] "to (increase control over and) improve man's material environment, his clothing and his shelter" (Bush 1945). Considering the role technology plays in defining and refining our design culture, the boundaries among architecture, fashion, and other relevant design disciplines, emerge as permeable – leading to the definition of a cross-disciplinary kaleidoscope shaped by dynamic dialogues.

In *Future Revisited: Architecture and Fashion Through the Prism of a Digital Era*, I have investigated the nature of the relationship between the respective practices, in the age of advanced technological phenomena, in order to shed

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[32] "For Futurists both wearer and dress were active. (...) Futurists clothing had to be aggressive and dynamic, it had to be agile, simple and hygienic (...). It had vitally to be reactive, achievable with "modificanti" (fabric badges), applied to an outfit both to reflect the wearer's mood and to enhance its impact, using "war-hungry", "decisive" adjectives never before applied to dress." PAULICELLI, E. *Fashion Under Fascism: Beyond the Black Shirt*. London: Berg, 2004, 112.
[33] "Digital practices have the potential to narrow the gap between representation and building, affording a hypothetically seamless connection between design and making." IWAMOTO, L. *Digital Fabrications: Architectural and Material Techniques*. New York: Princeton Architectural Press, 2009, 004.
[34] "SC: If you'd had today's technology when you did Archigram, do you think things would have been different? PC: Probably, yes. It's amazing to think what one could have done. It's funny that the drawings are looked upon as art pieces, but if one had had the instruments, those art pieces could have realized differences of nuance which were difficult to do drawing by hand." CASCIANI, S. "Peter Cook - Stefano Casciani. Intervista/Interview 8." *Domus*, **942** (2010): 22-29.
[35] For Peter Cook, the curent state of architecture, which is supposed to be quite advanced in terms of technology and construction techniques is considered "an always happy coincidence" – rather than part of a social-historical evolution. CASCIANI, S. "Peter Cook - Stefano Casciani. Intervista/Interview 8." *Domus*, **942** (2010): 22-29.
[36] "(...) the Machine is, in fact, the metamorphosis of ancient art and craft; that we are at last face to face with the machine-the modern Sphinx-whose riddle the artist must solve if he would that art live – for his nature holds the key." WRIGHT, F.L. *The Art and Craft of the Machine*. Chicago: National League of Industrial Art, 1902.

light on their contemporary, and mainly future, attitudes. In providing the reader with a documentation of different aspects of their creative dialogue, I have outlined the collaboration potential between digital media and inextricable branches of the, current, digital design culture, pointing attention to its contribution to sustainable and anthropocentric performances. In addition, I have discussed the material, formal and substantial manifestations of the discussed disciplines, while mapping their parallel or intersecting paths, along with the intriguing possibilities that lie in the future of digital practices. Overall, I have reached the conclusion that the need for research practice is imperative; a practice that will, thoroughly, look into the emerging design sciences, that are the threshold to the revolution of architectural – as well as sartorial – technologies and material practices (Rivka and Robert Oxman 2010, emphasis mine). Fundamentally, one may object to the mannerism of architecture and fashion products, in the era of technological ubiquity, but "s/he can take no exception to their manner nor hide from their evident truth"[37] (Wright 1902).

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[37] "The tall modern office building is the machine pure and simple," affirmed Wright. WRIGHT, F.L. *The Art and Craft of the Machine*. Chicago: National League of Industrial Art, 1902.