

Review Papers

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POSTDIGITAL FASHION: EMERGING PARADIGMS FOR HYBRID BODIES.

*Postdigital Fashion:
Paradigmas emergentes para cuerpos híbridos.*



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ABSTRACT

The Digital era ended bequeathing remarkable technological advancements and numerous queries related to the critical evolution between productive activities and the survival of human beings on planet Earth. In a scenario where the fashion industry is considered one of the relevant players, postdigital fashion emerge with interesting design strategies and fabrication tools that open up new possibilities for more equal and sustainable development.

To outline desirable future directions, the research PostDigital Manufacturing Processes. Body Hacking for Productive Systems has examined fifty designer cases studies. In these selected design studios, computational design, wearable technologies, biomaterials, and virtual interfaces are involved in redesigning the fashion role and the whole concept of the human body as a hybrid in the intersection between physical and digital realms.

KEYWORDS

Digital Fashion; Computational Design;
Wearable Technologies; Hybrid Bodies;
Postdigital.

RESUMO

La era digital terminó legando notables avances tecnológicos y numerosos interrogantes relacionados con la evolución crítica entre las actividades productivas y la supervivencia del ser humano en el planeta Tierra. En un escenario donde la industria de la moda se considera uno de los actores relevantes, la moda postdigital emerge con originales estrategias de diseño y herramientas de fabricación originales que abren nuevas posibilidades para un desarrollo y sostenible.

Para esbozar las direcciones futuras deseables, la investigación PostDigital Manufacturing Processes. Body Hacking for Productive Systems ha examinado cincuenta estudios de caso. En estos estudios de diseño seleccionados, el diseño computacional, la fabricación digital, los biomateriales y las tecnologías vestibles participan en el rediseño del papel de la moda y del concepto del cuerpo humano como un híbrido en la intersección entre el ámbito físico y el digital.

PALAVRAS-CHAVE

Moda Digital; Design Computacional;
Tecnologias Vestindo; Corpos Híbridos;
Pós-Digital.



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1. THE POSTDIGITAL SHIFT.

The planetary crisis concerning the survival of many living species due to the industrialization of human activities does not leave the fashion system indifferent. As a consequence of this emergence, the second most polluting industry on the planet is called upon to reconsider its role and the processes through which it acts.

As a premise for a real change, fashion strategies must face two simultaneous trends: the increasing products customization and the technological acceleration of tools and productive systems.

Supporting these two tendencies, the gradual appearance of computational design tools, advanced manufacturing processes, wearable technologies, and virtual interfaces can open up new opportunities for the entire field to re-code itself towards a more sustainable and at the same time original production.

In strict connection with the human body, the research *PostDigital Manufacturing Processes. Body Hacking for Productive Systems* starts from this double perspective. The project, funded under the *VALERE Program* of the University of Campania Vanvitelli, is a theoretical-applicative study investigating the digital technologies experimentation in the intersection of fashion, design, and technology toward a new consciousness. The research connects heterogeneous knowledge, also far from design - such as biology, neuroscience, materials and process engineering - and examine the possibility of configuring sustainable manufacturing systems through the hybridization of cutting-edge digital tools.

The project is started in 2020 under the scientific coordination of the researcher Chiara Scarpitti with the support of a research group consisting of Patrizia Ranzo, Rosanna Veneziano, Michela Musto, Claudio Leone, in partnership with the Department of Architecture and Industrial Design. The research aimed to highlight the emergence of technology-driven sustainable scenarios by interrogating the relationship between body and technology in the different process stages, from the envisioning to the final product.

In such a complex contest, fashion and other design sectors seem to pursue a digital hybridism that defines a new intimacy and personal space capable of generating a disruptive change in the relationship with the objects. As Testa says, “garments and accessories bring technology into an intimate connection with the physical body to the point of becoming an aesthetic and functional extension of itself.” (Testa, 2019, p.42).

As a result of the close interference between these two elements - the organic body and the digital technologies - we can say that the traditional digital phase is over. Back in 1990, Negroponte stated that the end of the digital revolution would happen when we would become aware of the digital through its absence and not by its presence.

Following this evolutive direction, the postdigital shift appears the most suitable plane of conjunction for a mature awareness of advanced digital technologies and their ongoing processes. By identifying this mutation, the research critically analyzes productive fashion systems through new 4 paradigms, consolidated enough to be explored and codified under a new lexical.

2. DICHOTOMIC BODIES: A METHODOLOGY.

“Now, at this moment, suspended between a before and an after, our bodies seem to lose consistency. They are deprived of confrontation, of the life around them, of the meeting places where promiscuity is exercised, of the desire that throbs in looking and being looked at”. (Frisa, 2020, p.92). Our natural bodies are tied to their irreducible organic substance, composed of fluids, breath, touch.

Concerning the feeling our physicality, two simultaneous phenomena have reduced this perception: the covid-19 Pandemia and digital acceleration. Both have pushed the human being into another dimension, the virtual one, by compensation. As a result, the virtual being belongs to us, entirely absorbed into our lives.

In this perspective, the postdigital is configured as the space where the transition occurs. A space which welcomes the hybrid dimension and the actual mixing of the physical and the immaterial, the organic and the artificial (Florian, 2014; Alexenberg, 2011; Bolognini, 2008). The dichotomy between matter and digital certainly has been the most relevant aspect observed during the first stages of the research.

About the methodology, the study started from conspicuous bibliographical research, through both technical-scientific texts, close to design and new technologies, and more strictly humanistic texts. The reasoned selection of the fields' heterogeneity allowed us to reflect on the theme's multidisciplinary nature critically. Together with this, since the beginning, the research has started to build a database of case studies to formulate future scenarios related to fashion and design. This database proved essential for the restitution of systemic patterns, which, in outlining trajectories, made it possible to trace the evolutionary directions of the design studios examined from 2000 until 2021. The collected case studies coincide with 50 national and international designer studies, selected through specific analyses. Subsequently, for each case study they are analyzed three specific projects, consolidating the designer as a pioneer in this hybrid field.

The survey has identified and mapped the selected projects through specific criteria and cataloging parameters. Precisely, the guidelines that led to a classification of the fifty case studies and one hundred fifty selected projects were the following:

- Temporal: project conception after the 2000s;
- Semantic: close relationship with the human body;
- Technological: compresence of several technologies;
- Transdisciplinary: hybridization between more disciplinary fields.

With such criteria, the database has collected the most relevant information, and it has been used as the primary methodological tool and critical evaluation analysis for the entire investigation (Fig.1).

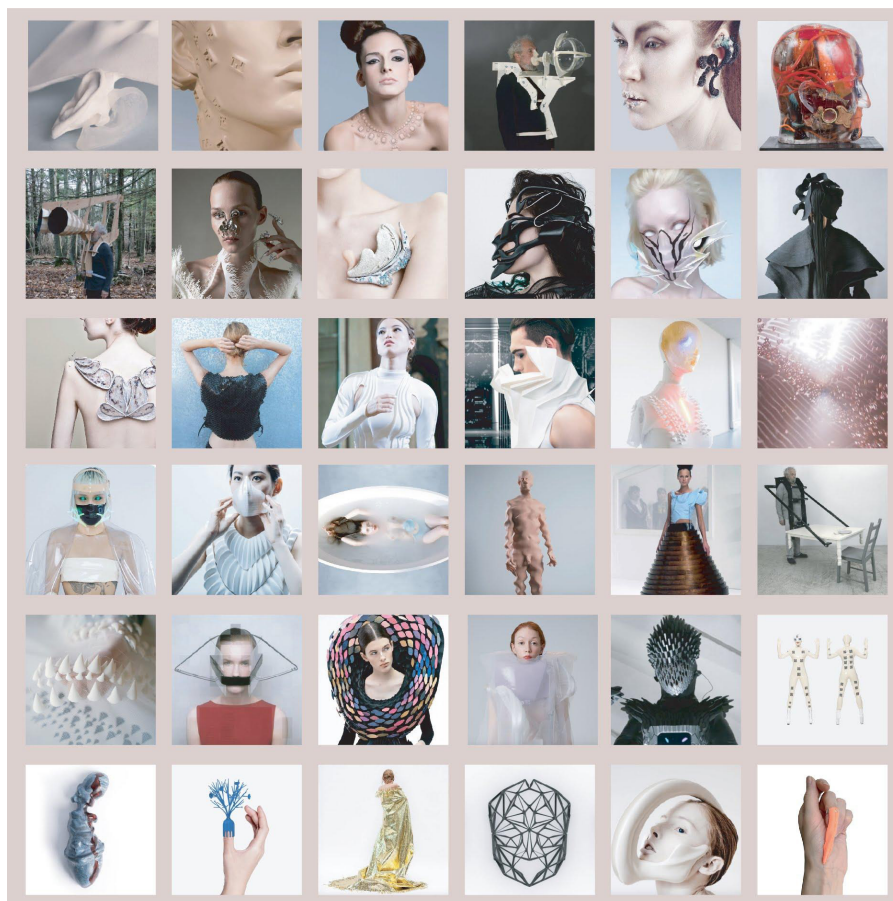


Fig. 1

Cases Study Database (a selection), 2000-2020. Source: ...

The database of references thus obtained is made up of 50 critically chosen authors on the basis of the contribution of their works to the themes of post-digital and the body. For each of the case studies, specific data were collected which were subsequently used for the processing of the analyzes carried out as part of the research.

String 1: Lesley Ann Daly_Enhanced hearing sculpture | Peter Allen & Carla Ross Allen_Brand X | Peter Allen & Carla Ross Allen_The New Adornment | Allan Wexler_Glass : Wear | Amy Congdon_Biological Atelier #02 | Richard Dupont_Object Ritual.

String 2: Allan Wexler_Cones of Vision | James Merry_Tungljurt nosepiece | Amy Congdon_Biological Atelier #03 | Nikita Replyanski_Digital Telepathy | Nikita Replyanski_Neuro Tiger | Jeanne Vicerial_Dans le tourbillon du tout-monde.

String 3: Amy Congdon_Biological Atelier #01 | Clara Davis_3d Printed Top | Jun Kamei_WIM | Jasna Rokegem_Exaltation | Jasna Rokegem_(Re)Connect | Nerifuture_In Bloom.

String 4: Nikita Replyanski_Superb Bizarre | Jun Kamei_Amphibio | Clara Davis_Calgina Bodysuit | Richard Dupont_Out of Hand: Materializing the Postdigital | Hussein Chalayan_Afterwords | Allan Wexler_One Table Worn by One Person.

String 5: Jasnarok_(Re) Connect | Hussein Chalayan_Ice Queen | Behnaz Farahi_Iridescence | Ying Gao_Possible Tomorrow | TiffanyTrenda_Small_Ubiquitous States | TiffanyTrenda_Small_Body Code.

String 6: Darja Popolitova_Metanoia XIII | Studio Lanzavecchia-Wai_Metamorfofi Percettive | Studio Lanzavecchia Wai_Space Quilt | Ana Rajčević_Biometrical | Ana Rajčević_Animal The other side of evolution | Darja Popolitova_Silicon Nail for Touching Screen.

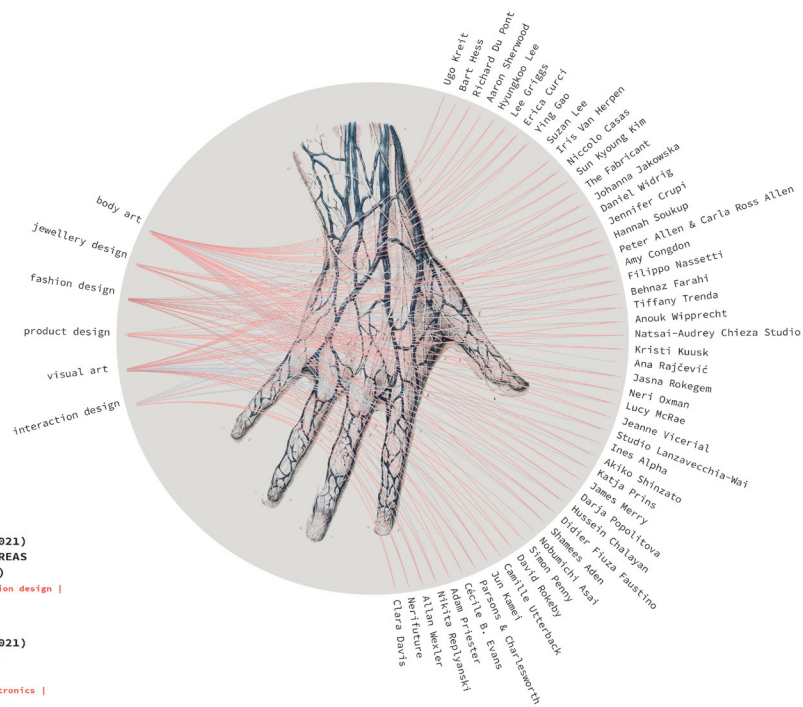
Research has always been kept central to the body theme in its dichotomic meaning, physical and digital. This tool has been crucial to relating and combining information with an increasing level of complexity, drawing a more accurate picture of the art state concerning the current relationship between these design experiences and the technology use.

Indeed, all the projects are selected for their double relationship with the body, their technological component's relevance, and their hybrid nature, satisfying all the selected criteria. Some of the productions are in experimental stages, while others are market-ready and available for home use; however, all reveal a different innovation that can take this sector forward. Through the chart, the final intersection of the fifty design perspectives provides a panoramic view of the developments that have already been realized and opens up future reflections on these achievements.

The diagram shows the correspondence between the selected case studies and the identified technological fields. For each case study collected, connections were hierarchized for the preponderance of one technology over the others. The technologies examined were: Augmented Reality, Bio Technologies, Electronics, Digital Fabrications, Handcraft, Artificial Intelligence. The goal was to observe the level of hybridization between the different technologies involved.

In a subsequent study, the degrees of hybridization between different disciplinary areas involved, are been processed through an algorithmic process. The disciplinary areas identified are been related to design, fashion, and art. Their order refers to a proxemic rule that defines their distance from the human body in terms of usability. In particular, the disciplines examined were: Jewellery Design, Body Art, Fashion Design, Interaction Design, Visual Art.

Fig.2
Transdisciplinary graph about the involved disciplines.
Source: ...
Diagram showing the correspondence between the selected case studies and the identified discipline areas. The connections have been hierarchized concerning the preponderance of one discipline over the others for each case study collected. The aim is to visualize the hybridization degree between the different technological fields.



Each selected designer has embraced at least three between these disciplinary areas. (Fig.2). As a final result, the study has highlighted the noticeable fluctuations between the speculative and functional nature of the projects investigated.

From a postdigital perspective, as instance, the notion of the organic body has been questioned for its ability to dialogue through digital garments or components. Returning to physical matter and the value of our corporeality -, one of the most exciting scenarios investigated by the Research has been adopting the single and physical individual as a point of departure

and arrival of the project (Scarpitti, 2019).

The combination of these parameters - transdisciplinary domains, technologies used, temporal progression - within the two infographic systems previously illustrated guided the subsequent phases of the project towards the definition of three conceptual dichotomies and four emerging trends.

The three identified dichotomies, coexisting in the four trends examined later, are: Internal Body - External Body / Physical - Digital / Speculative - Functional.

These dichotomies are a consequence of the methodological approach based on the two parametric diagrams. Establishing a mutual relation between body and technology, the Research has demonstrated that information can flow in both project directions: internal and external, physical and digital, speculative and functional. Reality extends its border, becoming a multiverse able to manifest itself beyond the matter. (Openshaw, 2015, p.22). Connecting to the three dichotomies, the Research has further delineated four trends intended as paradigmatic. The four scenarios able to identify and drive the creation of a postdigital fashion are: Generative Design, Wearable Technologies, Bio Couture, Virtual Fashion. All of them play a strategic role in hybridizing innovation and sustainability.

3. GENERATIVE DESIGN

The world of digital design software is witnessing the emergence of a new kit of computational tools conceptually closer to coding processes than Euclidean design instruments such as Computer-Aided Design. The adoption of algorithms and parameters as a base to investigate new design processes, able to generate any shape from logical-mathematical constructs, promises to become the most influential design approach in the next decade.

The use of processing methods through visual interfaces simplifies the achievement of endlessly editable shapes, achieving extensive catalogs of possible solutions (Quinn, 2012, p.42). In the fashion realm, this approach offers the possibility to tailor-made a garment for a single customer, influencing the paradigm of the good from fast consuming products to unique high technological artifacts. Computational Designers such as, for instance, Niccolò Casas, Daniel Widrig, and Arturo Tedeschi work more and more closely with advanced fashion designers to create artifacts that appear to trace the outline of a more responsible fashion system able to optimize materials, cost, and time of fabrication (Toeters, 2020, p.22). The generative design process allows pushing their design over the basic geometrical digital transcription and generates innovative formal and aesthetic solutions where technologies, creativity, and sustainability can inform and support each other. One of the reasons that led to the spread of algorithm-based design is the possibility to achieve bio-inspired morphologies, starting from the idea of post-natural overcoming traditional oppositions such as natural and artificial, material and digital, physical and virtual. The actual research describes how the methods and sensibilities of generative design can redefine the vision of the human body.

Nature becomes a mentor for new aesthetic expressions but especially inspires new optimization strategies and functional solutions to lead to more sustainable use of materials and resources. Biomimicry informs the design processes wider, influencing materials and structures and investigating their properties to enhance manufacturing fashion processes. Generative Design is the protagonist of advanced manufacturing processes combined with a digital fabrication process. Through 3D machines, designers can rapidly prototype fashion garments and accessories with sustainable materials and optimized their processes. In this sense, rapid prototyping, which makes it possible to produce made-to-measure garments, is broadly exploring new sustainable productive phases (Tenthof Van Noorden, 2015, p.19). In this perspective, some advanced manufacturing 3D printing processes can represent a zero-waste production system because the subtractive manufacturing allows also a material optimization.

Amongst the researches in this area, the work of Neri Oxman is one of the most visionary.

Since 2011, the Israeli designer and her team have run the Mediated Matter research group MIT Media Lab (Antonelli & Burckhardt, 2020, p.36), creating products and integrated processes in an environmentally aware direction with computational, form-generation tools and digital fabrication. At the heart of this practice is a radical shift in the world of 3D printing: machines become shape makers rather than shape replicators. For Oxman, 3D technology is not simply an endpoint that converts existing information into a single layer at a time but a way to manufacture small-scale, modular, and sustainable objects. Although the advantages of their use seem undeniable, the diffusion of generative processes linked to advanced manufacturing and digital fabrication is still facing significant challenges to finding a stable role in the fashion industry as we know it today (Pailes-Friedman, 2016, p.126). The final goal should be to create a more sustainable fashion system, able to bravely question the current productive system.

4. WEARABLE TECHNOLOGIES

By enabling everyday garments into smart devices, wearable technologies are the most explicit expression of FashionTech. It is estimated that the related market will grow from 20\$ billion to 70\$ billion in 2025 (Fortunati, Katz & Riccini, 2003). These trends enhance the rise of this business sector but also lay the foundation for a critical exploration of its role shortly. Wearable technologies are designed to favor new levels of communication and interaction through digital and virtual devices uses, enhancing the human body's capabilities and becoming its most powerful extension. Our senses are inputs and outputs tools; they are the information we give and receive about what is happening inside our bodies and outside our environment. (Pailes-Friedman, 2016, p.52). In a postdigital perspective, everything can be adopted as a parameter, from the air we breathe to the sound of the voice, from brain waves to facial expressions, from skin parameters until the specifics of each individual.

While the market is commercializing every kind of wearable device, many experiments occur among designers. In this realm, the Dutch school formed designers such as Iris Van Herpen, Anouk Wipprecht, Marina Toeters, and Daan Roosegaarde to explore the blurring boundaries between technology and design, detecting, analyzing, and transmitting information, features able to disrupt radically the fashion industry. The idea of incorporating digital devices into a garment is not only an aesthetic action but a radical change that also influences the meaning of that industry.

Many production strategies in this sense demonstrate that fashion cannot undertake its development as a fast-consuming industry. The works of Lucy Mc Rae (LeAmon, Lovell & Nash, 2019, p.78), for instance, result emblematic of the way technology and design are used. They create what is called body architecture, exploring the limits and adaptability of the human body and its emotional impact in the face of futuristic science and technology, renewing the interaction between the organic body and artificial representation of itself in the amplification of its virtual imaginary.

5. BIO COUTURE

Since 2000, with the increase of bio design exhibitions and projects (Myers, 2012), the productive fashion paradigm has strongly shifted towards a new horizon of living and circular manufacture. On the borderline between biology and technology, these fashion productions imagine and investigate new interactions with the concept of life, in its processes of cyclical genesis, according to a hybrid and transversal perspective.

With biotechnological advances comes material innovation. Bio-materials, as instance, are consolidating a new aesthetic and fashion paradigm. Practices such as these dismantle the feeling of separation and not-belonging between humans and nature.

The growing access to biotechnological information, the transdisciplinary overlap, and

the exponential spread of independent biohacking and bio labs are just some causes that increasingly determine the fashion and biology intersection. In the most advanced textile design laboratories, the production paradigm is letterly evolving towards a living manufacturing. (Lee, 2011). According to a hybrid and entangled design perspective, indeed, these innovative practices are rethought according to a different ethic, more akin to nature and its regenerative modes (Berry & Dieter, 2015, p.44), disrupting the traditional dynamics and processes of production. Bio design and bio couture lead to forms of awareness intimately connected with the living ecosystem to which humankind belongs together with other forms of life, pushing the fashion designer to the role of catalyst for a renovated sustainable and post-anthropocentric vision.

6. VIRTUAL FASHION

Devices that allow new synaesthetic perceptions, 3D wearables that enhance certain sensorial qualities, digital garments that transcend corporeality: the culture of virtual fashion adopts the human figure as a tool for a new perception. Virtual filters examine and reinterpret facial expressions, the desired aesthetic values, the details of each individual. The surrounding environment mutates according to a renewed interaction between the organic body and its digital representation: the body is reinvented in the amplification of its virtual imaginary. Among the various creatives working in this field, as instance, makeup artist Ines Alpha, filter creator Johanna Jaskowska, and fashion brand The Fabricant stand out. These transdisciplinary designers transcend the boundaries of graphic and 3D fashion, mixing them with visual art, parametric modeling, and motion graphics, always on the border between corporeal and incorporeal.

With the phenomenon of social media - amplified due to Covid-19 pandemic restricted conditions - the need for a virtual body increases exponentially. Real or fictitious, the body is configured now as a field of investigation both through new technological possibilities and personal interaction.

In this direction, Ines Alpha designs shape through the three-dimensional construction of wearable masks and 3D makeup, telling an illusory game made of fantastic worlds that anyone can wear through their online profiles. "A new cult is rising. Our bodies are becoming fluid, our money decentralized, new powers are being formed. Slowly we are moving into a non-dual operating system. [...] What can a body be when it is freed from physical restraints? What does identity mean when there are endless bits and bytes to express it? [...] We look for a connection in technology. It is our new religion." (Jaskowska, 2020).

In the dialogue between individual and space, through a series of technical devices such as creative coding (VR/AR) and algorithmic data, it is possible to stage different augmented experiences that influence the perception of natural environments where you can immerse yourself. Florian Cramer provides an interpretation of this fusion, describing it not as the end of the digital but as its progressive evolution (Cramer, 2014, p.13): a logical process that brings humans closer to a greater awareness of their contemporaneity.

7. CONCLUSIONS. EMERGING PARADIGMS

From the database 50 designer's analysis and the emergence of these four trends, the *PostDigital Manufacturing Processes. Body Hacking for Productive Systems* research reveals not a homogeneous panorama but rather a series of opportunities and sometimes contradicting orientations that can intersect and overlap. All these scenarios are dominated by a postdigital condition, intended as a new way of thinking and working with technologies.

In opposition to massification and fast consuming fashion (Remy, Speelman, Swartz, 2016), these alternative trends enable lower the unsustainable voracity of the market, both from an

environmental and social point of view. All the four scenarios shortly described are complices of this transaction, implementing different actions: the creation of a generative tailor-made fashion that follows the body's needs; the inclusion of electronic technologies; the spread of 3D fashion and its virtual interfaces; the introduction of biomaterials and sustainable manufacturing processes. A deep ecological spirit orients everything. (Morton, 2018). As a final result, in addition to the individuated trends, the analysis underlines how the ontological paradigm of the human body shifts inevitably to a new conception, placed in the intersection between its physical nature and digital representation. Influenced by all these simultaneous phenomena, the fashion system profoundly changes. The affirmation of these four design areas seems to guide this, silent and inexorable, transition.

NOTES

The authors shared the theoretical approach and the articulation of the contents of the paragraphs, even if the contributions are in particular attributed as follows:

Paragraphs 2 and 6: by Chiara Scarpitti

Paragraphs 3, 4, 5 : by Michela Musto

The introduction and the conclusions are written by both the Authors.

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