THE FOUR ELEMENTS OF FASHION

Edited by
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I U A V

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The *Four Elements of Fashion* brings together international scholars to rethink fashion through the prism of the archetypal elements of earth, water, air, and fire. Emerging from a conference held at the Università Iuav di Venezia and curated by Anneke Smelik and Alessandra Vaccari, the volume offers a new perspective on fashion studies at a time of profound ecological and cultural change. The Book aims to investigate new paradigms of fashion cultures through those elements of matter as they are intertwined in the clothes we wear. The research papers shift the attention towards the material and sensory aspects of fashion. This approach fits in with the 'material turn', inspired by a re-centring of matter and the materiality of things, objects, technologies, and bodies. In readdressing fashion and its histories through the lens of new materialism, the authors envision possible future fashions in multiple ways: from contributing to an environmentally and socially aware fashion to disseminating good practices in the field of fashion design.

3 · 5 THE INVISIBLE FUNGI

GROWING FASHION AS METHOD FOR HUMAN/NON-HUMAN COLLABORATION

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1. INTRODUCTION: DESIGN FOR THE SIMBIOCENE

Fungi are small and marginal organisms whose significance has long passed secondary (Rigotti, 2017), nonetheless they are unsettling today's culture and imaginary due to the increasing popularity within the literary debate – not restricted to the world of fashion. The growing interest in fungi by emerging fashion brands, designers, and research centres, inspired my ongoing doctoral research on which this contribution is rooted. The specific focus here is on mycelium-based applications, to analyse the renewed relationship instituted between designer and dress directing towards sustainability. Fungi are protagonists of a growing trend fascinated by smart and sustainable manufacturing that utilise biological growth to upcycle agricultural and forestry residues into cost-effective, highly versatile materials (Srubar III, 2020; Gandia et al., 2021). They are organisms part of a kingdom on their own ① whose hidden, invisible roots constitute the mycelium: an entangled web of generations that potentially make fungus immortal. Despite humans, for whom identifying the border where the individual stops and another starts was given for granted before medical artificial implants, fungi are born of continuity (Sheldrake, 2020, p. 22). Mycelium, in mycorrhizal relationships, allows fungi's reticular hyphae system ② to connect to certain types of higher plants in order to mutually exchange nutrients – but not only or always. Within the current existential and economical crisis, characterised by the scarcity of resources, fungi are taken as the representation of the natural element of the earth. They are seen as a living, concrete example of the possibility to destroy but also to reconstruct from the rotten, inspiring alternative practices of interspecies interaction. Fungi seem able to contrast what Albrecht (2019) defines as the epoch of *solastalgia*, marked by highly individual experiences in dealing with climate disorders, where many primitive emotions

long suppressed struggle to re-emerge. These consist of the *psychoterratic* emotions or *eco-emotions*. As a consequence, to the extent of healing the pathologies of our century, Albrecht substitutes the term Anthropocene with Symbiocene: an invitation for the humanity to reconcile the separation with nature. Whereby items made of alive matter appear to play a central role.

The contribution adopts the theoretical approaches of posthumanism and new materialism to re-define the role of materials. The first paragraph focuses on the main philosophies sprouting from the posthumanist trend, which de-construct the imaginary of individual to introduce the concept of symbiosis and interspecies design, drawing a specific notion of sustainability. The second focuses on the new materialist turn and its implications, by examining and re-elaborating the notion of growing design. The objective is to investigate how the use of mycelium in fashion influences primarily the design process and secondarily the items perception, as it requires dealing with living organisms and their life cycle. Nonetheless, to probe limits and potential of interspecies collaboration, in order to demonstrate if we can talk about mycelium for fashion in terms of productive and (mainly) cultural sustainability, by applying the notion of *growing fashion*.

2. POSTHUMAN FASHION: TOWARDS CULTURAL SUSTAINABILITY

Posthumanist philosophies offer the possibility to review the way of studying and making fashion going beyond its traditional anthropocentrism. In this direction, the contribution aims to demonstrate how fungi are capable of triggering the overcoming of individuality in favour of collaborative, interspecies systems. The discourse on the posthuman was initially translated into fashion studies by Smelik (2020; 2021) and Vänskä (2018). Unlike the two scholars, who focus respectively on the human-technology

and human-animal relationship, the posthuman tends here towards a communion with the organic, inanimate world. Recalling the definition of Symbiocene, derived from the concept of symbiosis coined by biologists Margulis (2008) and Gilbert et al. (2012), it implies the association or coexistence of different species. According to the endosymbiosis theory, some forms of life do not only live next to us but inside of us, blurring the distinction between host and parasite (Margulis, 2008). Haraway reworks this concept as *sympoiesis*, featuring shared configurations called *oloents* (Timeto, 2019). Hence, the urgency also for fashion design to welcome forms of living or organic otherness, usually unfamiliar, in order to establish an ecology of intimacy (Moradei, 2023).

In the saturated debate on the issue of fashion industrial unsustainability, it is fundamental to underline the relevant role played by material experimentation. Badalucco and Cristofoli Ghirardello (2020, p. 30), agreeing with Ricchetti (2017), assert how the growing sensitivity towards the environmental impact of fashion has determined a renewed interest in the exploration of innovative fibres and materials. Demonstrating how simple ingredients can be alternative solutions to overcome costs, time, massive production (Pylkkänen et al., 2023, p. 10). To be noted, however, how on the one hand fungi seem to introduce new positive practices – as demonstrated by Tsing (2015) in her anthropological studies linked to the matsutake picking – while on the other they could become the new fast fashion of materials, leading to unsustainable drifts of this resource. In this particular frame fashion, which has more or less consciously used natural resources and fibres since its origins, thanks to the use of organisms like fungi becomes a key to criticising cultural and design historical anthropocentrism by de-centring the human and re-centring interspecies relationships. The posthuman condition is an opportunity to encourage the search for alternative patterns of thought,

knowledge, and self-representation to the dominant ones, necessary to face a profound transition (Braidotti, 2020, p. 18). These thoughts open to a perspective oriented towards an interspecies design practice (Roudavski, 2021), strongly entangled with interspecies art forms (Mohajer va Pesaran, 2017). Interspecies is a term used in biology to define a relationship between organisms belonging to different species that share the same ecosystem, to be distinguished from the term multispecies, which indicates something that is aimed at multiple species. ③

The inflation in the use of the term sustainable makes it essential to explain that the vision of sustainability embraced here is strongly connected to the cultural dimension. Cultural sustainability is the fourth pillar of the sustainable development plan, as from the World Commission on Culture and Development 1995 report. ④ Linked to this notion is the idea of sustainability as ethics of care, drawn by Smelik from the feminist studies of the nineties on the politics of interdependency. ⑤ In this direction, it is eye-opening the on-going testing of an engineered mycelium 3D printing system to create living complex materials able to self-repair, regenerate, and adapt to the environment (Gantenbein et al., 2023). Similarly stimulating is the project *Mending with mycelium* by researcher Emma Huffman. The act of design for care aims at the recovery of worn out shoes, mended by the growth of mycelium inside sole-shaped moulds ⑥ as well as the workshop entitled *Moda interspecie. Progettare con i funghi* (20 October-24 November 2022) held at Università Iuav di Venezia as part of my PhD investigation, which explored the parallelism between a collaborative fashion design approach using fungal material and the engagement in mycelium cultivation.

3. NEW MATERIALIST DESIGN: GROWING FASHION

The overcoming of anthropocentrism advocated by posthuman studies appears possible through the reinterpretation of what Deleuze and Guattari (2007) defined as *becoming*, more specifically *becoming-animal*. Concept that Haraway (2019) develops in *becoming-with* that is to *become-with-the-other*, indicating an interactive rather than transformative form of entanglement. These notions are paraphrased in *growing-with*, a process which stands for to *grow-with-the-other*. This is made real through unprecedented experiences featured within the debate on *growing design* (Ciuffi, 2013; Camere & Karana, 2017). Growing design is defined as the manufacture of materials and products from living organisms, frequently according to do-it-yourself type of practices (Karana et al., 2015); often generically associated with biodesign (Myers, 2012, p. 8) or bioart (Myers, 2015). Similarly, professor and practitioner Collet (2017; 2021) theorises *biotextiles* or *grow-made textiles*. In general, the notion of growing design appears to be addressed as a design procedure, hence a gap in the theoretical contextualisation that this investigation intends to fill. Through the case study, the notion of growing design is re-elaborated into growing fashion. In this context, advanced fashion experimentation is seen as trailblazer in the primary translation of solutions for the industrial supply chain and in challenging the cultural paradigm.

A first translation into fashion studies of the new materialist approach is again provided by Smelik (2018), who inscribes fashion within the current *material turn* referring to Barad (2003) – a movement which touches multiple disciplines. For the purpose of the research, it is relevant to remark the possibility that fungi offer to go beyond the iconographic representation to establish an intimate experiential connection between body and dress. In contrast with the example provided by the work of designer Iris Van Herpen,

limited to drawing pure inspiration from the fungal world for her *Roots of rebirth* 2021 collection. The new materialist perspective includes the vital and *vibrant* components of matter proposed by Bennet (2010), which recognise the performative autonomy of both humans and non-humans (Barad, 2017). Alive matter finds an interpretation in the concept of *neomateria*,⑦ derived from the contraction of the Italian words new and material, which indicates the object of a renewed modality of interaction with material resources (Baldelli et al., 2023). It outlines a perspective aimed at re-balancing the relationship between designer and nature, where the material becomes the starting point and centre of attention.

4. FASHION MYCELIUM-BASED APPLICATIONS

Despite the craze for fungi in academic and non-academic environments, the studies carried out on fungi-based fashion applications are still scarce, incomplete, and sometimes imprecise. Therefore, the relevance of this contribution. This paragraph presents an overview on contemporary uses of mycelium in the fashion industry. It shows the overall advancement of the main technologies and identifies its players in the worldwide panorama.
In the fashion industry and research fungi are transformed into faux hide made of mycelium or of parasitic fruiting body, and used as natural ink. Among the pioneers of mycelium leather are the R&D centres: Bolt Threads with *Mylo*,⑧ MycoWorks with *Reishi*, Mogu with *Ephea*™, Ecovative with the AirMycelium technology using solid state fermentation.⑨ Their final products are very similar to synthetic leather from petrol, even if their characteristics and composition may vary.⑩ Except for Mogu, based in Milan (Italy), all the rest are based in the USA (the first two in California, the second in New York State). *Mylo* was first adopted in 2020 by Adidas for the iconic *Stan Smith* model,

and by Stella McCartney for a selection of garments and accessories.
A further development of *Reishi*, called *Sylvania*, in 2021 took the form of the Hermès *Victoria* bag, which remained only in prototype stage (Lottersberger & Celeste, 2021). *Ephea*™ has been used for outerwear and accessories by Balenciaga for the Fall/Winter 2022-23 collection. From a material perspective, mycelium leather constitutes a material made mostly – but not always only – of a compound of lignocellulose substance derived from fungus enzymes action of soil degradation (Jegadeesh et al., 2022, p. 2; Kumla et al., 2020). As their cell-wall components are not constant, atmospheric agents can provoke degradation; therefore, processes of plasticising,⑪ coating, crosslinking, and other applications are fundamental but should be compatible with mycelia biomaterials (Jegadeesh et al., 2022, p. 15).
It must be pointed out the difficulty in collecting technical material information and TRL⑫ data from producers and suppliers, due to the industrial secrecy characterising material R&D working environments. At a pilot scale, is VTT Technical Research Center of Finland primed technology for the production of a continuous mycelium film using submerged fermentation inside bioreactors, process that takes about six days (Vandelook et al., 2021), which results into a material similar to a latex membrane. Meanwhile, Neffa in the Netherlands has introduced an innovative technology to 3D model mycelium for clothing, avoiding seams and material waste. On the more experimental side, mycelium opens to the opportunity of dealing with a living organism – as previously illustrated – for potential surface repairs or sizing adjustments. Even if these examples present solutions that cannot yet be scaled, they are significant in this context, as demonstrated by the following case study.

5. THE CASE OF PAULA ULARGUI ESCALONA

Paula Ulargui Escalona (hereinafter referred to as U. E.) is a Spanish designer, whose work is exemplary of how a living organism can collaborate to generate garments and accessories. [13] She studied at IED University in Milan and Madrid. Currently, she is engaged with personal fashion and textile research projects, besides working as sustainability consultant for the industry. Even if in my research I have noticed some recurrences, apparently there is no linkage for the designer's work to be set in Spain. [14] The interview allowed collecting qualitative data regarding the grass-germinating pieces developed with Loewe for the Spring/Summer 2023 menswear runway show held at Paris Fashion Week 2022, under the creative direction of Jonathan Anderson (Fig. 1), which have made her internationally known. Plus, it allowed investigating on her independent mycelium *Mutualist nature* project (Fig. 2). By seeing her early works on living garments, Loewe proposed her a collaboration that lasted about four months before getting to the catwalk – considered the conspicuous trials supported by a gardener (Figs. 3-4). These one-of-a-kind grass-germinating pieces weren't meant to go into production, as stated by U.E. (personal communication, February 3, 2023): "[…] when we talk about natural living materials, we can't speak in terms of usability or production". As I tried to check what happened to those pieces after the show – if they had been planted, sold as limited editions, archived, or thrown away – it was interesting to learn how she was not aware of it. She explained how she kept some pieces for herself, but being living garments after a few weeks they dried and died. She answered this question showing a picture of a pair of grass-dried Loewe sneakers. Most surprisingly for me, she seemed to find neither my query, nor the process of archiving such pieces particularly significant. The same reason why she has

been reticent to share pictures of their current state to be inserted into this article.

For the *Mutualist nature* project that resulted in a mycelium corset, an agronomist engineer supported her. The project took place in a dedicated room in her studio in Madrid. The process of environment sterilisation, the inoculation of the fabric, and the mushroom cultivation were very delicate (Figs. 5-6). The full project included the numerous testing, took approximately four months: It was a big challenge. "Anything, at every single stage, could have affected the whole project" she remarked. They tested two types of mushroom but the only one that worked was Oyster mushroom selected for two main reasons: it is one of the strongest species, and it is quite common in Spain. An overall important aspect that emerges from dealing with living textiles is the choice of the base fabric. Its fibres need to provide enough air and humidity to the guest organism, while the nutrients have to be necessarily inoculated. "In *Mutualist nature* the big challenge was not only growing the mycelium, but to make it grow inside the selected textile" explained U. E. She also clarified how the corset will not completely biodegrade because of the mix of fibres composing the fabric layer contained inside. This aspect opens to a contradiction, partially justifiable due to the highly experimental degree of the project. To the question regarding further development of the idea, she replied that the corset needed much engagement, however, "This is just the start, my goal for the mycelium textile is to manage the growth of multiple types of exotic mushrooms, more appealing for colours and shapes. Talking as a designer of course". To be noted here the distinction that she sets in her hybrid nature of designer/material scientist, whereby the challenge to overcome the aesthetic limits of mycelium. Nonetheless, U. E. does not only refer to the aesthetic factor, but intends to exploit fungal medical properties for curing common human-fungi diseases: "This could open to

a new parameter for clothing design that includes healing". She worked on the mycelium project during the pandemic, which was a useful moment for investing on experimentation but limiting to reach an audience. Only a girl tried the corset on when it was already dry, so there are no relevant proofs of wearing experience. As for the Loewe pieces, I checked the current state of the corset. In a former email she wrote that it dried and shrunk (personal communication, September 19, 2022, 09:22am), in the interview she hesitated, explaining that it was still in her studio but significantly damaged (personal communication, February 3, 2023. Following quotations *Ibidem*). Thus, considering that the garment would not have been shown at its best condition, she preferred again not to share images, limiting my research but stimulating my thoughts. In fact, a relevant aspect is evidenced: the disinterest and/or difficulty to display, preserve, and unveil the whole lifecycle of living garments, to witness their status beyond the luxuriant sprouts.

Some questions were then posed to investigate the kind of relation she institutes with her living textiles, for example, if she felt at ease or frustrated during these interspecies collaborations. U. E.:

> *"[laughs] Actually, every time I am invited for a talk I tell about this fact. All researches I held on the topic of growing materials have been very intense on a personal level and very important for my life. Because in the end, what I am trying to communicate with these pieces is to connect humans and nature, to make humans understand how to take care and be part of it. By spending hours checking each plant, each stem, being careful to water them well, controlling their life cycle… paying attention to all these details really made me develop a third sense".*

By reconnecting with nature she refers to what our ancestors used to do through animist practices that enabled them to decode the Earth signals. It seems that her commitment has been to create garments with a soul – her soul and the plants'. As a consequence, it is evident that the relationship established with the garments through the manipulation of living organisms generates a strong and affective bound; demonstrating a nexus to the notion of cultural sustainability as ethics of care, as well as to the natural element of the earth. Discussing the added value of using living organisms for fashion products she said: "I would never consider them products. Besides, my concept of design is to see myself not much as a creator but as nature's collaborator. This is how I work: I help nature to reveal its inner beauty". Positively surprised by the general growing sensitivity, U. E. reported: "One day, during a lecture, I mentioned the *Mutualist nature* project. Suddenly a girl asked if I considered myself a murderer – as if fungi were animals!" Fungi, in fact, can be cultivable or wild, thus subject to harvesting in their fruiting excretions. It is worth spending a reflection on the expression "mushroom hunting" as an alternative to "mushroom picking" (Hadke, 2015, p. 9), which by recalling animal hunting supports the breakdown of the hierarchies between animate and inanimate.

As a conclusion, it must be noted how even if the work of U.E. proves the potential of interspecies exchange and the added value of designing with living organisms in light of cultural sustainability, the sustainable aspect strictly connected to materiality slips into the background. Living textiles appear to be considered only at their fully living stage, while what happens after germination is secondary. Design for circularity in the industry is full of obstacles due to the complexity of the supply chain, but within research this should be an alarm to implement efficiency on the small scale. In the frame of this contribution, it appears fundamental to recognise to the process of degradation the

same importance as to its conception. This issue could be addressed to the traditional rush that nurtures fashion, its constant search for novelty, for life, manifesting – on the contrary – the urge to a shift of pace to re-tune on deeper cultural and emotional values.

CONCLUSIONS

Comparing the primary thoughts elaborated from posthumanism and new materialism with the information collected in the interview on the notions of cultural sustainability and growing fashion, a few connections as well as some contradictions upraise. Recalling the initial query, aimed at probing limits and potential of interspecies collaboration through living textiles to understand if (and how) we could talk about mycelium for fashion in terms of sustainability, a gap emerges: a short circuit prevents living materials to comply with the concept of productive circularity, hindering the full management of the process from germination to the end of life. The risk of this phenomenon is to confine experimentation into a pure paradigm of spectacle. On the contrary, the role of symbiosis is enhanced by U.E., who insists on the cultural and affective value of living textiles in inspiring more intimate relationships between wearer and garment, and most importantly during the design process. The invisible fungi addressed in the title of the paper, the mycelium, are brought from the dark of the subsoil to the surface of the debate, stimulating a multifaceted challenge. It is not a matter of mere substitution of materials and objects, nor it is enough or necessary to imitate nature; it is rather vital to reconfigure fashion traditional anthropological parameters by revising the perspective on the binomial human/non-human, and this is made possible thanks to fungi.

FIGURES

Fig. 1 *Germinating fleece trousers* by Loewe during the show. The visible humidity due to watering enhances the living nature of the garment (Courtesy Paula Ulargui Escalona).

Fig. 2 *Mutualist nature mycelium* corset photographed in her studio (Courtesy Paula Ulargui Escalona).

Fig. 3 Ingredients to grow plants on Loewe textiles (Courtesy Paula Ulargui Escalona).

Fig. 4. Grass cultivation on Loewe sneakers (Courtesy Paula Ulargui Escalona).

Fig. 5 Process of sterilisation and inoculation of the mycelium textile (Courtesy Paula Ulargui Escalona).

Fig. 6 Mushroom growth on the mycelium textile compound (Courtesy Paula Ulargui Escalona).

NOTES

①: Since 54 years fungi are no more considered plants but constitute a separate reign, including moulds and yeasts (Whittaker, 1969).
②: A social network defined in the nineties as *wood wide web* (Simard, 2021).
③: Tsing (2015) introduces the idea of *multispecies landscapes* in relation to the partnership between matsutake, pickers, and trading system.
④: Further information in Kangas et al. (2017).
⑤: The idea emerged in the seminars cycle *Fashion Matters: Beyond the Canon of "Made in Italy"* held by Anneke Smelik at Università Iuav di Venezia, 2-30 March 2022.
⑥: Further information in Huffman (2022)
⑦: The concept was conceived in the multidisciplinary PhD seminar *Green Studies: Traiettorie di ricerca* held at Università Iuav di Venezia, 13-14 June 2022.
⑧: Which has recently quitted the production due to a financial investment shift, event that for some marks the failure of next-generation materials (Bittau, 2023).
⑨: Further information on solid and liquid fermentation in: Gandia et al. (2021).
⑩: Further information in: Hakansson et al. (2023).
⑪: The most commonly used natural plasticising agents are glycerol, polyethylene glycol, PEG 400, mono/di/oligo-saccharides, lipids, and lipid derivatives (Janjarasskul et al., 2010).
⑫: Technology Readiness Level.
⑬: It is worthy a note that she repeatedly made a quite common yet significant mistake by referring to mushrooms as to plants.
⑭: The reference is to the project *Be grounded* by Lara Campos, Argentinian living in Spain. Who graduated at Fabricademy Barcelona, an institution strongly committed to biodesign.

AUTHOR BIOGRAPHY

Clizia Moradei's (PhD in fashion at Università Iuav di Venezia) research themes include sustainable fashion practices with a focus on biomaterials at the intersection with botany, biology and new ecologies; the educational aspect intertwining visual arts, product, and fashion design; the relationship between design, craftivism, and industrial production.

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