

In 2018, scientists from the Soft Active Materials Laboratory at the Massachusetts Institute of Technology developed the first *living tattoo*.<sup>1</sup> It is a wearable device designed from a soft polymeric material known as a hydrogel, a stretchable and flexible substance capable of incorporating large volumes of water. The device was 3D-printed using an optimized ink formulation that can be molded and hardened into any desired shape, all while hosting and nourishing a live culture of genetically engineered bacterial cells. Systems in which living organisms, often genetically engineered, are incorporated into nonliving artificial structures are commonly known as *biohybrid materials* or *living materials*. These new materials are gaining increasing popularity in robotics and wearable technologies due to their capacity to selectively respond to a large set of stimuli and self-sustain over extended periods of time. When in contact with the human body, the living tattoo is programmed to sense the presence of specific substances on the skin of the wearer and to respond by exhibiting fluorescence. Printed in the shape of a futuristic hybrid between a tree and a computer chip, this second living skin promises to monitor crucial health parameters in real-time, without requiring any source of external energy.

Among the most cutting-edge developments in materials science and technology, I have been fascinated by the concept of *smart skins*: prosthetic devices that can be directly applied to the surface of the body for health monitoring or remote interaction with the digital world. The living tattoo is one among several examples of devices capable of transforming human skin into a unique and unexplored technological space. Technologies such as SkinMarks,<sup>2</sup> developed by Google, and DuoSkin,<sup>3</sup> researched by Microsoft in collaboration with MIT, explore the possibility of extending the remote control of electronic devices by employing high-tech temporary tattoos. The research project DermalAbyss,<sup>4</sup> developed at MIT's Media Lab, focused on incorporating biosensors in traditional tattooing techniques, producing permanent tattoos capable of changing their colour in response to physiological modifications in pH, glucose and sodium concentrations in the body.

The reason why I believe smart skins to be an especially interesting technology from a speculative perspective is related to a scientific and philosophical concept very familiar to all of us, but to which we rarely attribute the complexity it deserves. I am referring to the concept of *the interface*, which I would define as the space of interaction between human and technological bodies. Throughout the last two decades, our relationship with technology has been shaped by a single, specific kind of interface. The *screen* has become so pervasive that it has become the universal paradigm of what any technological interface should look like: flat, hard, and so thin and unobtrusive that it becomes almost invisible. Any Google Images search with the keyword "technology" should be sufficient aesthetic proof that the hegemonic cultural vision of the future is populated with ghostly and immaterial interfaces floating in the air like evanescent holograms and radiating an aseptic, bluish glow. But is this truly the only possible future for the interfaces to come?

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<sup>1</sup> Xinyue Liu et al., 3D Printing of Living Responsive Materials and Devices, *Advanced Materials* 2018, 30, 1704821.

<sup>2</sup> Martin Weigel et al., SkinMarks: Enabling Interactions on Body Landmarks Using Conformal Skin Electronics, *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*, 3095–3105

<sup>3</sup> DuoSkin research project website: <https://duoskin.media.mit.edu/>

<sup>4</sup> DermalAbyss research project website: <https://www.media.mit.edu/projects/d-Abyss/>

Being trained as a chemist, and having worked extensively in the field of materials science, I have learned to think of interfaces differently. In chemistry, the interface, far from being a merely virtual surface, is first and foremost a material space where different bodies can actively interact to transform each other.<sup>5</sup> Think of a drop of oil in a glass of water. The oil forms a spherical surface in contact with the water, but adding soap to the water will dramatically change the behaviour of the oil, breaking its surface into smaller droplets until an entirely new phase of matter - an emulsion - is formed. As the soap molecules migrate to the interface between oil and water, new properties emerge, to the point where the identity of either of the two starting materials - the oil droplet and the water - is entirely transfigured. Soft and biohybrid technologies such as the living tattoo capture this material and transformative dimension of the interface, in which the surface of our bodies is transfigured through the productive encounter between human and nonhuman, living and nonliving, natural and artificial materials.

This model of the interface as a space for the production and cross-contamination of materials and identities is particularly relevant to our relationship with contemporary technologies. After all, our physical bodies and cultural identities are in a state of constant and dynamic evolution in the face of our increasing promiscuity with technological artefacts. I find it surprising that the skin, our primary and most sensitive interface with the world, has been so far almost entirely overlooked in the design of electronic interfaces, which in turn seem to increasingly favour visual perception to produce a disembodied experience of the digital world. This digital disembodiment appears to me as a radically political issue, as it artificially reproduces the fiction of a universal human subject while excluding the diversity of our material bodies from the space of technology.

Tattoos, make-up, jewellery, and body modifications, both physical and digital, technological and traditional, are certainly superficial adornments, but their superficial nature should not be misinterpreted as insignificance. A materialist, relational-ontological view of interfaces should teach us that the skin is not the passive envelope of a pre-constituted subject, but an active carrier of identity and meaning. To imagine new ways in which our skin can be transformed into a technological interface is to open ourselves to the possibility of redefining how we inhabit digital spaces. As augmented reality has become an increasingly familiar experience, I have been fascinated by the ambiguous potential of AR digital filters to either conform our image to patriarchal and colonial beauty standards or transform our bodies into surfaces of aesthetic experimentation. At its core, this is a conflict between two opposing views of the interface: on one hand, the interface as a passive surface, designed to enforce pre-established identities; on the other hand, the interface as an active material space of self-actualization and expression. Artificial Intelligems' work with *Ornamutations* and *Ornamisms* moves precisely in this latter direction. Their hybrid approach to digital technologies interrogates the ability of interfaces to redefine the boundary between materiality and

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<sup>5</sup> This view of the interface as a space of ontological openness nourished by difference that sustains identities as an emergent property of relations was presented by philosopher Branden Hookway in his 2014 essay *Interface*. "A preliminary definition of interface might then be as follows: the interface is a form of relation that obtains between two or more distinct entities, conditions, or states such that it only comes into being as these distinct entities enter into an active relation with one another; such that it actively maintains, polices, and draws on the separation that renders these entities as distinct at the same time as it selectively allows a transmission or communication of force or information from one entity to the other; and such that its overall activity brings about the production of a unified condition or system that is mutually defined through the regulated and specified interrelations of these distinct entities" (Branden Hookway, *Interface*, MIT Press, Cambridge, 2014, p. 4).

virtuality, opening a productive space of creative intervention between our bodies and their cultural meanings.

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