# The Aesthetic Dimensions of Sustainability in Design Culture.
## Insights from Four Case Studies

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*Abstract*

Exploring new aesthetic dimensions in the sustainable transformation of the environment is one of the prerogatives of the New European Bauhaus (NEB) campaign. Design disciplines offer the ideal framework to investigate how performative requirements admitted in the construction industry provide inputs to the manifestation of contemporary urban aesthetics. Firstly, the paper introduces the discourse on architectural aesthetics recalling prominent positions sedimented since the 20th century, providing the theoretical framework to discuss how canons and codes of beauty are shifting according to current sustainable agendas. Secondly, it showcases peculiar design attitudes connecting buildings' aesthetics and ecologies, referring to four case studies. The methodology discusses the extent of design choices driven by different declinations of sustainability, which include the production of clean energy, circular economy, and carbon capture. The results portray a horizon of new aesthetics emerging from the advocated ecological transition that contributes to renegotiating the idea of beauty as intentional senses of figuration and sensory experiences.

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*Introduction. Sustainable is (?) beautiful*

The current era is featured by the desperate necessity of reshaping the way we inhabit Planet Earth. The move means thoroughly addressing fundamental aspects like inverting the trends of carbon emissions, rethinking transitions between natural-rural-urban domains, mitigating social inequalities worldwide, and designing for resiliently absorbing unexpected shocks, such as those experienced in the last years (UNFCCC, 2015; UN-habitat et al., 2018). The domain of sustainability today covers technological and humanistic aspects. As the main responsible for accelerating climate change (European Environment Agency, 2019), the construction industry is in the spotlight and calls for multidisciplinary stimuli to shift from a resource consumer to a neutral metabolic agent. Indeed, the objectives set by government agendas address the scope of sustainability to a broad extent (UNS, 2015), which goes far beyond the adoption of merely environmental technology criteria and the correctness of their execution. For instance, defining advanced planning tools and policies (Bulkeley, Betsill, 2003), implementing nature-based solutions and improving ecosystemic services (Kabisch et al., 2018; Mahmoud et al., 2022), identifying strategies for buildings and infrastructures recycling (Fabian, 2017), and many others, appear unavoidable approaches and create space for the materialization of new aesthetic values. Under these auspices, Ursula Von der Leyen launched the New European Bauhaus (NEB) campaign in 2019 to connect "the European Green Deal to our living spaces and experiences."[1] She invoked the necessity of "making tangible the comfort and attractiveness of sustainable living" (European Commission, 2020a) and declared that:

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> The European Green Deal must also – and especially – be a new cultural project for Europe. Every movement has its own look and feel. And this systemic change needs its own aesthetics - blending design and sustainability. […] The New European Bauhaus should trigger a similar dynamic. It should show that the necessary can be beautiful at the same time, that style and sustainability go together (European Commission, 2020b: 2).

1 – New European Bauhaus, ***beautiful | sustainable | together*** [Online]. Available at: https://europa.eu/new-european-bauhaus/index_en [Accessed: 25 July 2022].

Von der Leyen's call puts architectural and urban projects at the center of a transdisciplinary debate on the aesthetics emerging in the contemporary era. A recent Festival brought to international attention the state art of ongoing NEB-related research projects[2]. In the meantime, correspondences between immersive spatial experiences and sustainable urban transitions have been recently observed as a sensorial-oriented aestheticism (Berlingeri, Valente, 2021). While research on sustainable materials and techniques usually finds validation or denial in quantitative measurements, the word beauty represents an epistemological issue for design disciplines. The impossibility of objectively detecting and measuring beauty is one of the reasons why the word beautiful, to which design is implicitly subjugated, is rare in architectural research's vocabulary. The most publicly welcome definitions of beauty often come from successful architects and planners, who indulge in these topics strongly relating to (their) subjective ways of understanding reality. These forms of reduction are inevitable also in academic research, as encompassed in Snyder's definition of "systematic inquiry directed toward the creation of knowledge" (1984: 2), especially when the research object is not a finite field, like in this paper. Wang and Groat's assertion on research as "making assumptions about the nature of the world and how knowledge is generated" (2013: 10) and the equivalence they assign to research and design (21) bring us closer to the question posed by this paper, which puts aesthetic values and sustainable agendas not in a cause and effect relationship but in a mutual influencing one. Already in the 1980s, Nigel Cross pinpointed that design disciplines follow peculiar patterns of production and knowledge that require the constant negotiation of goals, methods, techniques, and expressivity. With all due exceptions, the irreproducibility of the architectural phenomenon – and, subsequently, of its architectural aesthetics – has facilitated the definition of tools oriented more to qualitative interpretation rather than quantitative measurement (Cross, 1982: 221). Along this path has also moved a research line keen to introduce the technological culture in the design theory and practice. The work by Eduardo Vittoria was a

2 - The Festival of the New European Bauhaus has been organized by the European Commission from 9 to 12 June 2022. See: https://new-european-bauhaus-festival.eu/home. [Accessed: 24 August 2022].

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pioneering example of an architect crossing Modernism committed to conjugating concepts of technology with innovative fabrication processes tailored to propel a new environmental quality (Nunziante, Perriccioli, 2018). On another side, Thomas Maldonado brought themes related to ecology into universities' curricula, with the launching of an "Environmental Design" course and in cultural elites, especially during his leadership of Casabella from 1977 to 1982. In recent times, Stefano Boeri has explored strongly interdisciplinary approaches to design, enucleating concepts of urban biodiversity and forestation that are reshaping design criteria and policy formulation internationally. On these bases, the paper aims to discuss how aesthetics in architectural and design cultures have assimilated and, at the same time, nurtured sustainable concepts. First, the research domain and key question are framed, recalling key theoretical positions solidified since the 20th century. Second, four case studies are selected to show how new aesthetics have emerged in responding to the contemporary sustainable agenda. These examples adopt ecological-oriented architectural and urban design strategies in different ways and scales, resulting in a sample pool more complementary than comparable. The outcomes suggest the endeavor to meet sustainable goals is propelling new expression modalities and a profound re-negotiation of the idea of beauty as an intentional sense of figuration.

The paper aims to discuss how aesthetics in architectural and design cultures have assimilated and, at the same time, nurtured sustainable concepts.

*Literature review. Interpretative keys to decipher aesthetics*

Like other forms of art, architecture has historically materialized socio-cultural values by exposing distinctive aesthetic systems over time. From Vitruvius to Alberti and further, they have repeatedly been the object of attempts of canonization and codification. We briefly recall some milestone positions enucleated after the first industrial revolution to frame the research question. At the dawn of the 20th century, Alois Riegl coined the term *kunstwollen* to indicate the will to art of a peculiar time. Overcoming teleology and historicistic positions, he played a crucial role in deciphering art figuration values as coherent characteristic formal values readable in contingent spatio-temporal coordinates (1901). Moreover, his

sharp distinction between historical and age values paved the way for a possible appreciation of fine arts based on objects' perception. Aesthetics, even when isolated from a theoretical reflection tailored to rebuild the socio-cultural context, could provide access to subjective emotions through the sensorial manifestation of time. Another key statement was formulated in 1957 by Alvar Aalto who, in a famous aphorism, asserted that "the ultimate goal of the architect [...] is to create a paradise. Every house, every product of architecture [...] should be a fruit of our endeavor to build an earthly paradise for people" (Aalto, 1978). The term paradise enlarges the extent of the aesthetic experience, evoking the peacefulness and delight of all senses. It effectively symbolizes the dual nature of something that is the unattainable idealization *par excellence* and, simultaneously, something which Fallen Men had experienced and lost after the original sin. The (lost) Paradise's biblical metaphor paves the road to the possibility of its reconstruction via the project of the everyday. At the same time, this archaic dimension became the object of a theoretical reflection associated with the social, economic, political, and cultural context around the architectural project. Rykwert's compendium of the first house or primitive hut (1972) uncovers a plethora of primordial design attitudes in realizing suitable living conditions where, for instance, Nature is alternatively mother in cohabitation to figuratively imitate and stepmother from which to shelter. The origin's construction forms also allude to the first canons of beauty materializing under distinctive environments. Rykwert's approach finds correspondences among philosophical circles, where aesthetics do not represent an object's superfluous connotations but belong to the sphere of human necessities. Scruton's definition of architecture as a "useful art" (1979; 2011: 15) emphasizes the indissolubility of the relationship between utility and beauty. In regard to this, Chiodo demonstrated the profound significance of the Latin word *decorum*, a term entailing both ethical and aesthetic resonance in the construction of human habitats (2015). Emanuele Severino denounced how the spreading and predominance of the τέχνη (téchne) has shifted the reciprocal roles between figuration and func-

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tionality (2003). Immutable or long-term canons of beauty had progressively given way to the pursuit of increasing comfortability and performativity to be available in every moment and place. Nicola Emery advocated for the professional world to realize the importance of taking care of the territory in a broad sense, as a routinary part of existence. He retraced Heidegger's philosophy (Heidegger, 1976: 108) and, recalling the artwork of Beuys "7.000 oaks" for Kassel's Documenta of 1982,[3] put forward the concept of "spostamento proporzionale" (proportional shift) as the unique possible declination of beauty today (Emery, 2007: 214). On another side, written contributions to architectural phenomenology and hermeneutics have solidified across research lines that envision architecture as indissolubly entangled with subjective cognition and physical experience. For the sake of the first, we can consider the exercise Moneo went intensively through contemporary colleagues' theoretical anxieties and design strategies (Moneo, 2004b). The observation of others' work has propelled an architectural discourse leveraging interpretation (Snodgrass, 2006), particularly on the gaps between architects – and what they imagined for their projects' life - and buildings that put the latter in a solitary condition (Moneo, 2004a). For the second sake, we consider architecture a sensorial experience beyond the tyranny of ocularcentrism (Dewey, 1934; Pallasmaa, 1996; 2009). This research line envisions architectural aesthetics as a dimension transcending the definition of the form, where reality can be understood only through a cognition process involving all senses. Allegedly, the most notable example comes from Peter Zumthor. In the sensorial experience of space, he sees the delight of a successful project, where beauty materializes in the peculiar modalities human *bodies* react to architectural *bodies* (Zumthor, 2006; 2010). The interesting point is that Zumthor's sensory perception of objects in space is not only related to their superficial connotations or their Aristotelian μορφή (morphé). He indeed is keen to explore the "hard core of beauty" as a "concentrated substance" (Zumthor, 2010: 27), which seems to be a more ontological aspect related to the platonic εἶδος (èidos). His architecture arrives at a formal definition, not after a process of immaterial manipulation

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3 – Documenta (1981), *Retrospective* [Online]. Available at: https://www.documenta.de/en/retrospective/documenta_7 [Accessed: 8 August 2022].

but after answering basic questions “which at first had no visual content” (ibid.: 29).

*Methodology*

The paper discusses sustainable associated aesthetics emerging from four singular case studies. These are instrumentally selected to examine heterogeneous situations which are not comparable. Rather than completeness or exhaustiveness, the goal is to critically portray a complementary panorama, spanning from the scale of the building component to the overall urban strategy (Table 1). What matters here is how ecological issues are transferred into the project in the form of architectural aesthetics and how they operationalize explorative design thinking grounded on transdisciplinarity. The thorough design process is read as the catalyzer between the keywords “sustainable” and “beautiful.” The four projects have been selected because of their trailblazing design attitudes in translating global sustainable goals into specific briefs. They unpack an array of peculiar relationships materializing between aesthetic and cultural paradigms, renegotiating the spheres of influence of subjects – the Cartesian ego – and objects, intended as otherness in a broad sense. The first case study, the Brisa Coordination Center, comes from the early 2000s and shows how a common technological component has been used to define the image of the building. Cases two and three were presented at Glasgow’s COP26 and address climate-related challenges in two ways. One exposes the prototype for cheap and quickly realizable housing modules, while the other offers an urban scenario where green technologies reshape entire portions of cities. Following a gradient of scale, the last case shows the green strategy for Genova (Italy), a designing and planning tool recently adopted by the local administration. Each case study is introduced and discussed, emphasizing its sustainable and aesthetic contents.

| Title | Author | Site | Year | Type | Program | Client | Aesthetic value |
|---|---|---|---|---|---|---|---|
| Brisa Coordination Center | João Luís Carrilho da Graça | Carcavelos, Lisbon | 2002-2004 | Realized project | Offices, Control Center | Brisa | Use of a specific component |
| TECLA | MCA + WASP | - | 2021 | Prototype | House | - | Construction technology and material |
| Urban Sequoia | SOM | New York City | 2021 | Urban concept | Urban adaptation | - | New symbiosis |
| Genova Green Strategy | Openfabric | Genova | Since 2022 | Strategic design | Urban landscape | Genova City Council | Use of green |

Table 1. The four case studies.

*Results. A panorama of sustainable-oriented design attitudes*

The Brisa Operation and Coordination Center was realized in 2004, following the winning entry for the relative competition of 2002 by João Luís Carrilho da Graça. It is located near the highway to Cascais, in the proximity of the Carcavelos' toll booth. The building has a rectangular layout and a small courtyard surrounded by a continuous wall. Partially underground, the discrete volume rises for approximately five meters. The center serves to monitor the situation on Portuguese highways and orchestrate any sort of operation. Hence, the principal space is the control room: a 500 square meters large and 8 meters high and dark room equipped with multiple screens. The reason for considering this building is the cladding. Except for the north elevation, which is finished with dark and porous volcanic stone, the other three façades expose "energetic" walls made of black solar panels. Each of the three surfaces is detached from the structural wall and sustained by a metal frame. Together with those laid on the roof, these solar panels produce hot water and provide thermal control for the overall building through an absorbing cooling circle. They also contribute to ventilating the control room, becoming *de facto* the principal technological innovation. Solar panels are standard components made of blu cells and aluminum frames, usually put in place following the basic rules of solar radiation. In this case, the solar panels assume an aesthetic role in overcoming the function-

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al task. Hence, they have been studied and fabricated to compose the image of the whole building. The glittering cells have been painted black to create a dark surface that captures sun rays and generates iridescent reflections, seizable at a glance to those driving cars (Fig. 1). As Graça Dias (2005) noted, the presence of solar panels in this architecture conjugates utility and figuration, achieving a distinctive aesthetic dimension.

Fig. 1 - Operation and coordination Centre of Brisa, Carcavelos, Joao Luis Carrilho da Graca, 2004. Courtesy of Carrilho da Graça Arquitectos.

The first of the two projects presented at the COP26, the Conference of Parties held in Glasgow in November 2021, is a dwelling prototype based on circular economy principles. Indeed, Tecla, an acronym for Technology and Clay, focuses more on its realization process than the formal outcomes, aiming at eliminating waste along the building life cycle. The project is the result of a collaboration between Mario Cucinella Architects (MCA), the School of Sustainability (SOS) founded by him, and World's Advanced Saving Project (WASP). Tecla is realized using Crane WASP, "a collaborative 3D printing system" able to pour earth-based

materials, concrete mortar, and geopolymers.[4] This prototype was built in Massa Lombarda (Ravenna, Italy) using rammed earth collected on site. Employing two arms, Tecla has been printed in two hundred hours by laying 350 strata of 12 mm for a total amount of 60 cubic meters of natural materials.[5] Tecla has been conceived as a response to the climate crisis and to provide decent housing and basic services inclusively, aligning with the 2030 Agenda for Sustainable Development.[6] From the outside, the building looks like a shell generated by a Boolean encounter between spherical caps (Fig. 2). There are only three openings in correspondence with the entry and the two skylights. Internally, the module features a curved environment, with an area identifiable for living and another for sleeping and hygienic purposes. There are no walls or roofs. A unitarian envelope equipped with natural ventilation pipes encloses the space. The material appearance of rammed earth gives a peculiar architectural atmosphere and character to interior surfaces. For instance, the sequence of layers creates tridimensional and tactile textures hosting playful chiaroscuro effects. Cucinella himself suggested that "the aesthetics of this house are the result of a technical and material effort; it was not an aesthetic approach only. It is an honest form, a sincere form."

**4 – 3dwasp, *Stampanti 3d* [Online]. Available at: https://www.3dwasp.com/stampante-3d-per-case-crane-wasp/ [Accessed 10 August 2022].**

**5 – 3dwasp, *Tecla* [Online]. Available at: https://www.3dwasp.com/casa-stampata-in-3d-tecla/ and https://www.mcarchitects.it/tecla [Accessed: 10 August 2022].**

**6 – United Nations Department of Economic and Social Affairs (2015), *2030 Agenda* [Online]. Available at: https://sdgs.un.org/2030agenda. [Accessed: 10 August 2022].**

The second project presented at COP26 is Urban Sequoia by SOM. Since the construction industry is considered the principal pollutant agent responsible for the most significant carbon emissions quotas, the concept moves from a provocatory question, which is to imagine urban environments able to capture carbon in the atmosphere. Indeed, according to Chris Cooper, a partner at SOM, carbon neutrality represents today an outdated goal, and it is necessary to envision the construction industry as "part of the solution" by designing to sequester carbon according to a circular economy scheme.[7] The first step is conceptualizing a tower's prototype, where the metaphor of buildings acting like trees is extended to that of cities acting like forests. The project employs ecological materials like biobrick, hempcrete, timber, and biocrete to minimize the carbon impact. It is estimated that the same tower realized with concrete or steel would double the amount of carbon emission just in the construction phase. At the same time, the use of algae can complete "the carbon cycle (…) forming the basis of a new carbon-removal economy" and "turn the building into a biofuel source that powers heating systems, cars, and airplanes; and a bioprotein source usable in many industries."[8] In this case, technology empowers nature-based solutions to turn a building into a device redeeming urban pollution and carbon emission. Evoking the well-known Lecorbusiean allegory, buildings like machines will expose vegetation not as decoration but as effective propellants for greener metabolisms (Figure 3). Even though the inspiration comes directly from natural ecosystems, the proposed urban image rejects the picturesque figuration of a fake natural forest. On the contrary, nothing more than artificial leaks from Urban Sequoia renderings, reclaiming the possibility of architectural expressions using greenery – in a broad sense – as building components able to form new languages.
A new relationship between nature and cities is the central focus of the Genova Green Strategy as well, a long-term strategic document formalized by Openfabric and delivered to the municipality in 2022. The object is the system of urban green networks and infrastructures, and the principal objectives are to intensify trees and vegetation, redefine public spaces, improve the capacity to deal with climate chang-

**7 – SOM (2021). *At COP26, SOM Unveils Urban Sequoia, a Proposal to Transform the Built Environment into a Network for Absorbing Carbon* [Online]. Available at: https://www.som.com/news/at-cop26-som-unveils-urban-sequoia-a-proposal-to-transform-the-built-environment-into-a-network-for-absorbing-carbon/. [Accessed: 10 August 2022].**

**8 – Ibid.**

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Fig. 2 - TECLA – Technology and Clay designed by MCA – Mario Cucinella Architects e WASP – World Advanced Saving Project, 2021. Photo by Iago Corazza. Courtesy of MCA - Mario Cucinella Architects.

Fig. 3 - Urban Sequoia, vision, Skidmore, Owings & Merrill (SOM), 2021. Courtesy of SOM - Miysis.

es, mitigate environmental risks, and increase the ground's permeability. Openfabric's founder Francesco Garofalo explained that the strategy mainly consists in defining guidelines and pilot projects to enhance interactions between man, nature, and a resilient city which, in the case of Genova, means considering vulnerabilities induced by climatic stresses. The document envisioned actions in the short and long term. For instance, it was estimated that it would be enough to convert just ten percent of existing parking lots to realize generous tree-lined streets (Barletta, 2022). To address more structural projects, Openfabric envisioned an operable interpretation of the city, proposing six urban categories emerging as a mosaic across the territory or as a "tribute to its complexity" (Silvestrini, 2022). Such a categorization renders guidelines immediately implementable. The strategy also includes a number of portals between the domains of the sea and the mainland that will synergically recompose urban identities and water management. As remarked by the town councilor for urban planning Cenci, the document paves the road for strengthening urban green as an ecologic, aesthetic, and cultural value.[9]

**8 – Comune di Genova (2022), *Genova green strategy, le sei versioni di Genova per combattere la CO2* [Online]. Available at: https://smart.comune.genova.it/comunicati-stampa-articoli/genova-green-strategy-le-sei-versioni-di-genova-combattere-la-co2 [Accessed: 12 August 2022].**


Fig. 4 - Genova Green Strategy, Genova, Openfabric, 2022. Courtesy of Openfabric.

*Discussion. Aesthetics in sustainability*

The first two case studies showcase how technology can be used to generate the image of the building. In the Brisa Operation and Coordination Center, the architect uses a single component – the solar panel – to compose the system of facades, which works as a superficial layer detached from the body of the building. In this way, the project physically and metaphorically creates gaps between what the building is, what it does, and how it appears. The solar panel façade has no particular significance for the building's use. Any construction could employ it, and this makes it, willingly or not, a decisive aspect of this architecture, mainly as a phenomenic experience. One could even assume the architecture of the building consists of the façade's system. Conversely, in Tecla, the construction technology concerns the whole building concept and construction, affecting its structure, envelope, typology, and comfort. The building's *raison d'être* consists of the technological solution, and one could not even conceive a separation between architecture and technology. Here, the phenomenic experience is flanked by a sensorial one, mainly given by the use of earth as plotted material that offers a peculiar atmosphere in its concave and convex form. The goal for sustainabil-

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ity in Tecla fuels a paradigm shift that, reinterpreting vernacular tectonics, questions architecture's ontology, aesthetics, and authorship. The third and fourth case studies envision greenery as the principal agent for sequestering carbon from the atmosphere. In the Urban Sequoia, vegetation is intended as a reagent that requires specific architectural solutions to solve its task. The prototype's aesthetics resonates with that of machinery metabolically interacting with air. In this way, the tree's metaphor is not purely allegorical but has a functional meaning, given by the chemical interaction the building is able to foster with the exterior. The project is visionary and has the merit of raising the bar in soliciting an architectural reflection at 360 degrees that encompasses structure, type, and language. Conversely, Genova Green Strategy focuses on what can be labeled good consolidated practices of green implementation as a planning and designing tool (Lemes, 2019; 2020). The "Sponge City" (Hao, 2020) represents its ideal reference to steward water bodies and protect biodiversity. Green's ethics will cover requalifying public space, reassigning urban priorities, retaining water, and facilitating rural-urban relationships, among the main goals. Still, its aesthetic dimension is the real test bench on which the administration aims to raise awareness among citizens and improve public life. The way Openfabric detects and frames ontologies and phenomenologies of the contemporary city is the key to produce operable narratives of current urban conditions, even when they appear in hybridized forms. Rather than the rise of a style, these four case studies suggest that technological advancement requires the critical participation of design disciplines to combine contemporary global urgencies with site-specific cultural and aesthetic significance. In some cases, we can recognize attitudes focusing on language independence compared to utility or performance, like cases one and four. In others, like cases two and three, aesthetics assumes relevance only when associated with the buildings' conceptualization and functioning. These explorative paths underpin architectural aesthetic contents that overcome the mainstream superficial and commodified iconography, extending the boundary of design research toward new disciplinary interactions.

*Conclusions and openings*

Re-considering Riegl's seminal position, we may recognize in the NEB campaign an attempt to place sustainability as the *kunstwollen* of our times, where combating climate change and social inequalities can catalyze contemporary technological and artistic advancements. Disengaging from this epic challenge, which calls for both grassroots endeavor and strategic visions, to follow short-term development horizons means putting the same habitability of the planet at risk. Aalto's dream of building an earthly paradise has today an extended meaning that is even more salvific than in the past. As the heterogeneity of case studies here presented suggests, the more design integrates with other disciplines, the more it challenges the *status quo*. Which aesthetics will be associated with this paradigm shift is a central question not only inscribed in design disciplines but also considering the capacity such aesthetics will have to attract political and economic commitment, involving necessarily free market impulses. The case studies illustrate a dual attitude. One regards the optimization, systemic application, and adaptation of tested design strategies, as we saw in the first and fourth examples. Another envisions more experimental approaches eager to enact in the construction industry biotechnologies, unprecedented in the case of Urban Sequoia and pseudo-vernacular in the case of Tecla. The interest in these projects goes beyond the *tyranny of ocularcentrism*. Their contents involve ethical engagement, technological performance, and extended sensory experience that also renovates the corporeal relation between human and architectural *bodies*. It may be argued that some of the most explorative applications of the global sustainable agenda are finding parallelisms with the proportional shift mentioned by Emery and are paving the road to new synergies between people, natural resources, and living organisms. In turn, such applications are experimenting with aesthetics that may become canonized and codified in the future. Due to its explicit call for exploring new lexicons, interactions, and formal expressions to connect sustainability and aesthetics, the NEB initiative aligns with the reading of case studies illustrated here and contributes to renegotiate the boundaries of ecological-oriented design research.

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