

100 Things Not to Forget

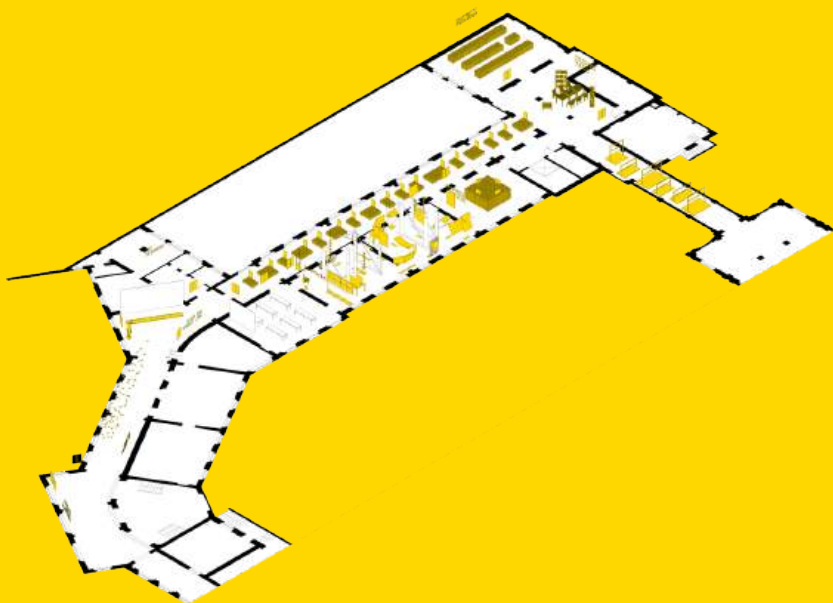
Editors

Massimiliano Cason Villa

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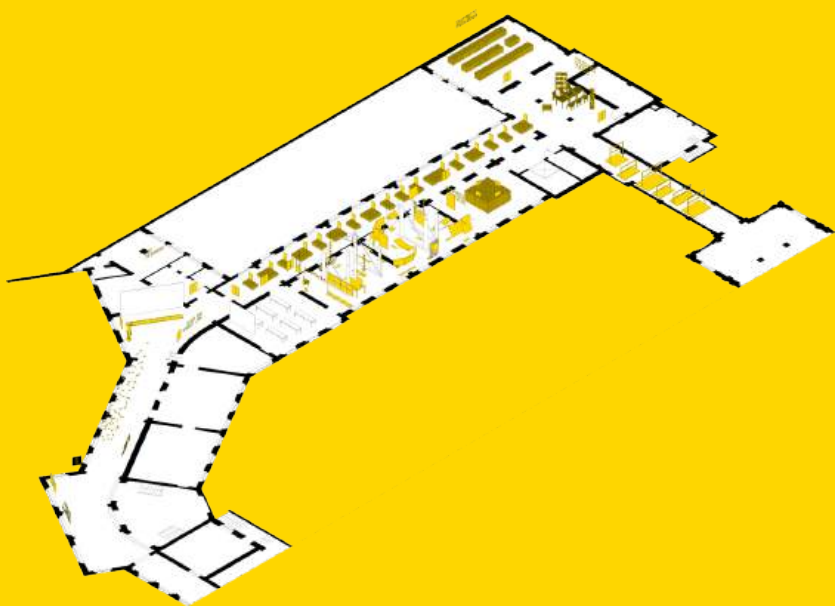
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Milan Design Week at the time of Liberation

*100 cose da non dimenticare - Repubblica del Design, Milano Design
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Department of Culture del Progetto

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Milan Design Week at the time of Liberation

100 cose da non dimenticare - Repubblica del Design, Milano Design Week 2026

For over thirty years, Milan Design Week, with its ‘Fuori Salone’, has served as one of the most acute barometers of changes in contemporary design. Originally conceived as a cultural extension of the Salone del Mobile, it has gradually moved beyond the boundaries of industrial design to become a widespread urban platform, in which the city is transformed for a few days into a laboratory for experimentation and public debate. It is, however, an event structured around the presentation of the new, and in such a context, memory tends to occupy a marginal position. The 2026 edition, however, was marked by an exceptional circumstance: the overlap between Milan Design Week and the celebrations marking the anniversary of Liberation Day. This was an unprecedented event in the history of Milan Design Week, which also sparked some criticism regarding the appropriateness of such a coincidence (Marani, 2026). It was against this backdrop that the idea arose to transform the overlap of the two anniversaries into an opportunity to celebrate the centenary of the school building on Via Bodio, which was inaugurated in 1926 (Repubblica del Design, 2026). Thus, *100 cose da non dimenticare* took shape, a project that treats memory as its very subject matter.

Fig. 1. Permanent exhibition at Rifugio 87, Milan 2026. Photo: Marco Merati

Organised by Repubblica del Design - the cultural association that has been bringing the permanent district of Bovisa, Dergano, Lancetti and Affori, in Municipal District 9, to life since 2019 - in collaboration with the design studio Ghigos (Sky Arte, 2026), the project begins with the reopening of Second World War shelters and bunkers, transforming them into contemporary cultural spaces: not merely places of remembrance, but active spaces capable of hosting exhibitions, research and design practices, returned to the city as civic infrastructure (Repubblica del Design, 2026). The number '100' functions here as a curatorial framework. It coincides with the building's centenary and runs through the entire exhibition, but does not denote a fixed list: rather, it is a collective exercise in selection, an exploration of what deserves to be passed on and what risks being lost. To understand what is at stake, we need to reconstruct the historical context from which the project draws its inspiration. In the interwar period, Italy, like much of Europe, focused on organising the protection of civilians from air raids, developing shelters and 'gas mask' facilities, primarily made of reinforced concrete; the Spanish Civil War (1936–1939) had already demonstrated how easily the air force could strike populated areas (Breda, 2015). However, Italy's entry into the war on 10 June 1940 found the country unprepared in terms of passive defence. It was only towards the end of that year that the Municipality of Milan had dozens of public air-raid shelters built in a matter of weeks, converting mainly school buildings for this purpose. On 5 October 1940 - the date that gives its title to Maria Antonietta Breda's study - a booklet was presented containing 135 entries on the same number of public air-raid shelters in Milan, the first comprehensive catalogue of that underground heritage (Breda, 2015). During the war, a total of over five hundred such shelters were built in the city (IoArch, 2026).

It is within this underground landscape that the project selects two case studies, and the choice is no coincidence: working simultaneously on Shelter 87 and the Breda Bunker provides a complementary insight into the forms of protection adopted during the war. Shelter 87 is a neighbourhood civil defence shelter: an underground structure built beneath the primary school in Via Bodio - opened in 1926 as 'Rosa Maltoni Mussolini', renamed 'Giacomo Leopardi' after the war and now part of the 'Ermanno Olmi' Comprehensive School - with a floor area of approximately 1,200 square metres, making it one of Milan's largest civilian shelters (Repubblica del Design, 2026). Hundreds of people found shelter there, and among the neighbourhood children who lived through those bombings was the future film director Ermanno Olmi, who would go on to dedicate the novel

Ragazzo della Bovisa (Olmi, 2004) to his childhood in nearby Bovisa, and after whom the school is now named.

The Breda Bunker, on the other hand, reflects the industrial and manufacturing side of that same period. Built of reinforced concrete in 1942, the air-raid shelters of Breda's 5th Aeronautical Section were intended to protect the factory's workers from bombing raids and are situated in the eastern part of Milan's Parco Nord; today, as part of the Milan North Metropolitan Urban Ecomuseum, they house a permanent exhibition which, through sounds, images and testimonies, transports visitors back to the experience of taking shelter (Parco Nord Milano, n.d.; Repubblica del Design, 2026). When considered as a whole - the school and the factory, the working-class neighbourhood and the manufacturing hub - the two shelters illustrate two sides of the same necessity: the protection of the civilian population and that of the workforce. It is this transition that the project places at its heart: the shift 'from air-raid shelter to cultural refuge'.

The project does not treat the two spaces as relics to be preserved, but reinterprets them as civic infrastructures capable of reigniting contemporary questions, envisioning them as forms of 'contemporary refuge' to be reimagined in light of environmental and climatic changes (Repubblica del Design, 2026): a shelter whose significance shifts from the threat of war to that of the environment, linking historical memory and the climate crisis. The exhibition itinerary follows this trajectory, organised into narrative sections: 100 Valori da ricordare, which translates the principles of the Resistance into the civic lexicon of design; R-esistenza, a transgenerational narrative developed in collaboration with the ANPI based on the material traces of the sites; *100 salti nel tempo*, Survival Design, Distretti Resilienti, Verso un Lettering Civile and TechnéTECA (Repubblica del Design, 2026).

It is here that the project breaks away from the ephemeral nature of Design Week. Repubblica del Design, which presents itself as a Distretti Resilienti in the outskirts of Municipality 9, conceives the project not as an isolated event but as an initiative that aims to leave a legacy in the local area (Repubblica del Design, 2026): the temporary aspect is intended to act as a catalyst for lasting transformation. This ambition is reflected in the funding model, which combines public and private resources. On the public side, the main sources of funding are Call for Proposals 57 from Fondazione di Comunità Milano and the Civic Crowdfunding Call for Proposals from the City of Milan (City of Milan, 2026). For *100 cose da non dimenticare*, the campaign aims to revitalise Rifugio 87 and the Breda Bunker through workshops, a permanent exhibition dedicated to the archives of

the Resistance, and a landscaping project at Parco Nord, culminating in a final exhibition at Milan Design Week 2027 (IoArch, 2026; Artribune, 2026a).

On the private sector front, there are a range of events and technical sponsorships. As part of Paper Week - the event organised by Comieco and dedicated to the paper industry - workshops were held from 14 to 19 April in the run-up to Design Week, including Stratigrafie di cartone, which uses modular elements as exhibition and educational displays (Repubblica del Design, 2026). Technical sponsorship from recycling companies - such as the Saviola Group and Gees Recycling - also provides the materials for the installations, in line with the eco-design and reuse approach that runs through the entire project (Repubblica del Design, 2026). It is this funding structure - rather than the individual installation - that lends credibility to the aim of transforming a temporary event lasting just a few days into a permanent cultural hub.

Discussing 'Liberation' during Design Week does not, therefore, introduce a theme unrelated to the project: it brings it back to its roots. Much of Italian design culture, in fact, took shape during the material and social reconstruction of the post-war period, when the need to imagine new ways of living and producing defined design as a tool for transforming reality; it is no coincidence that the Survival Design section explores precisely those industrial reconversions which, rising from the rubble of the conflict, paved the way for the 'economic miracle' (Repubblica del Design, 2026). From this perspective, memory is not a passive archive but an active resource, and design acts as a mediator between different forms of knowledge, actors and timeframes. The project has attracted the attention of the specialist press: Sky Arte has included it amongst the essential exhibitions of the edition, interpreting it as an exploration of the intersection between historical memory and sustainable urban regeneration (Sky Arte, 2026), whilst Artribune listed it among the notable events, whilst also highlighting the risk that the proliferation of events might end up diverting attention from the civic significance of 25 April (Artribune, 2026b). The underlying insight remains: to innovate does not mean to forget, but to build new possibilities based on what a community decides not to let go of.



Fig. 2. Rifugio 87, Milan 2026. Photo: RDD



Fig. 3. Rifugio 87, Milan 2026. Photo: RDD



Fig. 4. Close-up of an embroidered bomb, Breda Bunker, Parco Nord, Milan, 2026.
Photo: Gianmarco Volpe



Fig. 5. Close-up of an embroidered bomb, Breda Bunker, Parco Nord, Milan, 2026.
Photo: Gianmarco Volpe

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A Subtractive Approach to Exhibition Design

M. Cason Villa | IUAV University of Venice
Department of Culture del Progetto



A Subtractive Approach to Exhibition Design

The Design Approach to the Exhibition “100 Things to Forget”

Contemporary exhibition design is often based on a logic of accumulation: each exhibition introduces new media, structures, surfaces, and technological systems intended to have a very short lifespan, to be dismantled or disposed of once the event is over. This results in an obvious contradiction: devices designed to convey cultural content end up generating high consumption of material and energy resources. This is a contradiction that exhibition design has been slow to acknowledge; while architectural and urban design have long been working toward sustainable and circular construction paradigms, exhibit design has only recently integrated these aspects into its creative and managerial frameworks (Crippa et al., 2022; Trivellin, Mancini & Crippa, 2025).

Faced with this situation, *100 Cose da Non Dimenticare* takes a clear stance, which gives this chapter its title: designing through subtraction. Subtraction is neither renunciation nor formal austerity, but a critical exercise that distinguishes what is indispensable from what is superfluous. Designing thus becomes a matter of selecting, establishing connections, and attributing meaning, rather than multiplying objects and devices: the quality of the experience does not de-

Fig. 1. Photograph of the installation process for “Custodire l’invisibile,” Bunker Breda, Parco Nord Milano, MDW 2026. Photo: RDD

pend on the quantity of elements introduced into the space, but on the relationships that can be built between content, places, and people. It is the practical application of the principle of “doing more with less and better,” which runs through the entire project.

This approach finds a particularly suitable setting in Rifugio 87 and Bunker Breda. These are spaces with a strong material and symbolic identity, where the architecture is already part of the narrative: the reinforced concrete walls, the watertight doors, the original numbering and the traces of time all tell a story that predates any exhibition intervention. The exhibition design therefore stems from a principle of listening to the space and deliberately eschews invasive scenographic elements: the shelter is not reduced to a mere container, but recognised as an active participant in the experience, and its material memory becomes a design resource in its own right.

In terms of methodology, the project drew on the expertise of a research initiative arising from a TOCC call for proposals - the PNRR programme dedicated to the Digital Transition of Cultural and Creative Organisations - and, in particular, the supervision of the NSBVN Cluster – Sustainable Exhibit, an inter-academic research group promoted by the IUAV University of Venice in collaboration with the Politecnico di Milano and coordinated by Davide Crippa and Barbara Di Prete (IUAV University of Venice, 2023). The cluster approaches sustainability not as a technical constraint but as a driver of cultural innovation, and considers the entire life cycle of an exhibition installation: from the choice of materials to logistics, from modularity to dismantling, right through to the reintegration of structures into new supply chains (Crippa & Palomba, 2025). From this perspective, reuse and sharing become genuine paradigms of exhibition practice (Crippa & Di Prete, 2025a).

Consequently, most of the installations were not built from scratch, but were created through the NonSiButtaViaNiente sharing platform, by reusing existing furniture, supports, bases, cables and lighting fixtures that had been put back into circulation, including the panels from the Venice Pavilion at the Biennale, which were donated to the platform by the Venice Foundation (NonSiButtaViaNiente, n.d.). The platform - a benefit corporation conceived by Davide Crippa, with artistic direction provided by Studio Ghigos, the same studio overseeing the project - functions as a shared archive of exhibition structures that can be hired and relocated from one institution to another (Artribune, 2022). Drawing on the experience of circular architecture, digital reuse platforms now represent one of the most promising avenues for building low-impact exhibition supply

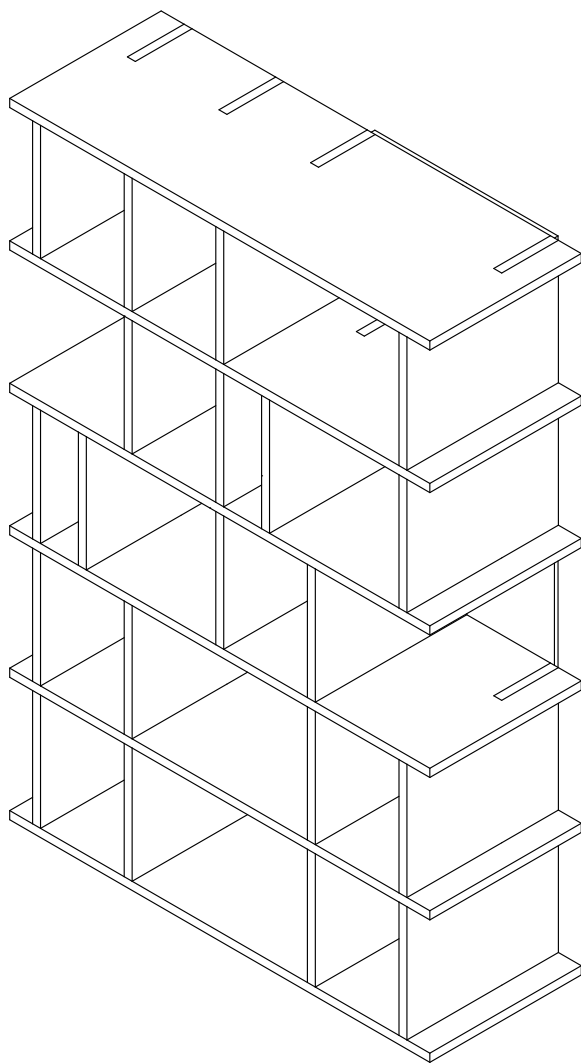
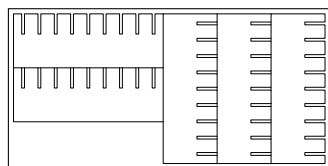
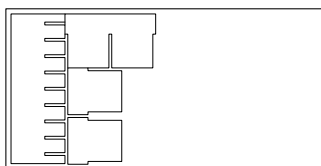


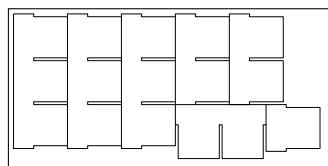
Fig. 2. Axonometric view of the TechnèTECA bookcase. Image: Ghigos



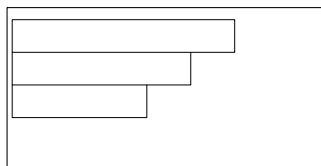
Panels 1250x2500 mm



Panel thickness: 22 mm



Panel thickness: 22 mm



Panel thickness: 10 mm(for bracing)

Fig. 3. Components for building a bookshelf using recycled materials from the Saviola Group and Gees Recycling. Image: Ghigos

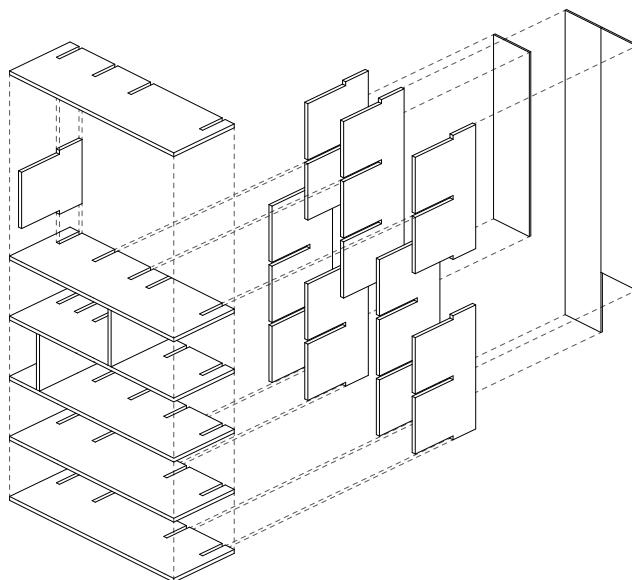


Fig. 4. Axonometric exploded view of the components of a bookshelf made from recycled materials by the Saviola Group and Gees Recycling. Image: Ghigos

chains (Crippa et al., 2022).

New structures have been built only where strictly necessary, though they have been designed to last well beyond the event. Three examples illustrate this. The TechnéTECA section, an archive of techniques, materials and solutions for sustainable design, is conceived to remain as a permanent archive (Crippa, Cimaglia & Palomba, 2026). The projects funded by Comieco's Paper Week - 100 Salti nel tempo and 100 Valori da ricordare - will remain at the school in Via Bodio to form a circular playroom, intended to host the workshops of the Civic Crowdfunding call for proposals. Finally, once the event has concluded, the furnishings designed for the sponsoring companies will be channelled into the 'NonSiButtaViaNiente' platform, thereby entering the reuse cycle themselves. In all cases, the design takes a long-term approach: durability and the possibility of disassembly become construction criteria even before they are aesthetic ones (Crippa & Di Prete, 2025a).

The idea that constraints can be generative is not new in design culture. Many memorable exhibition designs have emerged precisely from conditions of scarcity and limited resources: the history of Italian exhibition design - from Albini to Scarpa, from the Castiglioni brothers to Fronzoni - is largely a story of

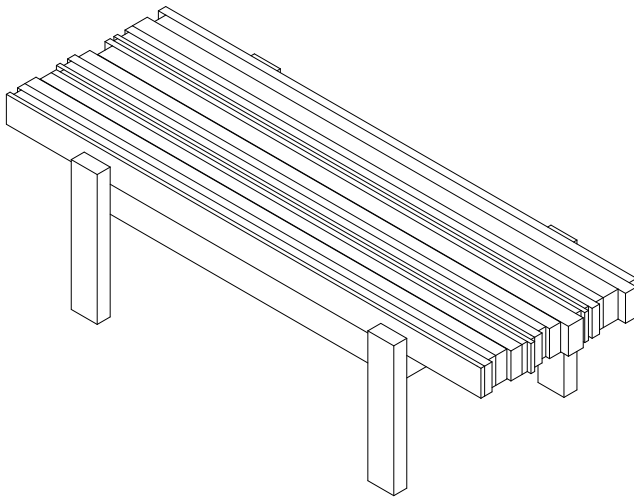


Fig. 5. Axonometric view of the bench made from recycled materials by Gees Recycling. Image: Ghigos

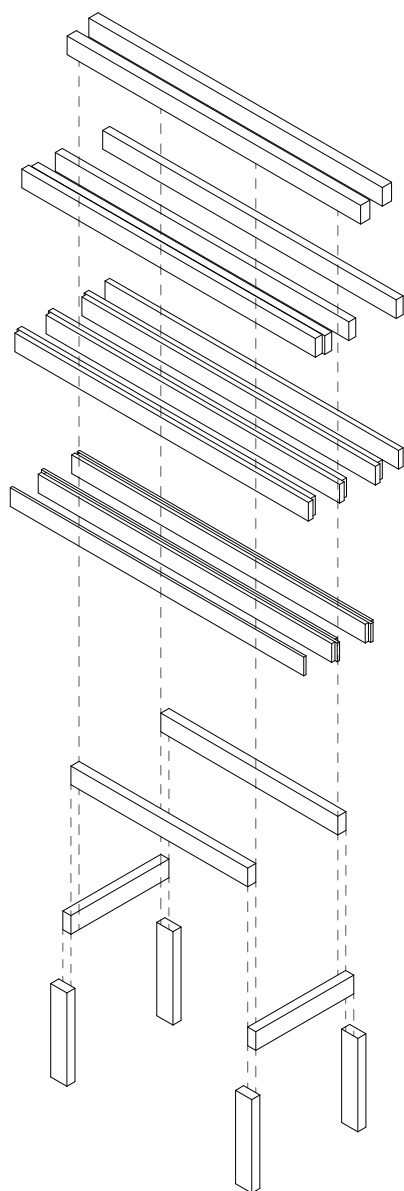


Fig. 6. Axonometric exploded view of the Gees Recycling bench components.
Image: Ghigos

lightness, simplicity and constructive ingenuity (Polano, 2000; Crippa, Cimaglia & Palomba, 2025). It is to this tradition that the cluster looks when it reinterprets the masters through the ‘codes of exhibition design’ - the codes of the backdrop, the object and the apparatus, to which the environmental code is now added - as a framework for jointly assessing the quality and sustainability of an exhibition (Crippa, Botta & Di Prete, 2025). The scarcity of resources, already at the heart of *The Limits to Growth* (Meadows et al., 1972), is thus not viewed as an obstacle to creativity, but as a condition that stimulates new forms of it. Hence the central issue of this chapter: exhibition design is not a technical shell for the content, but is itself content. Choices regarding materials, construction systems, reuse and end-of-life management concretely express the values promoted by the exhibition and foreshadow a new professional role: the eco-exhibitor,

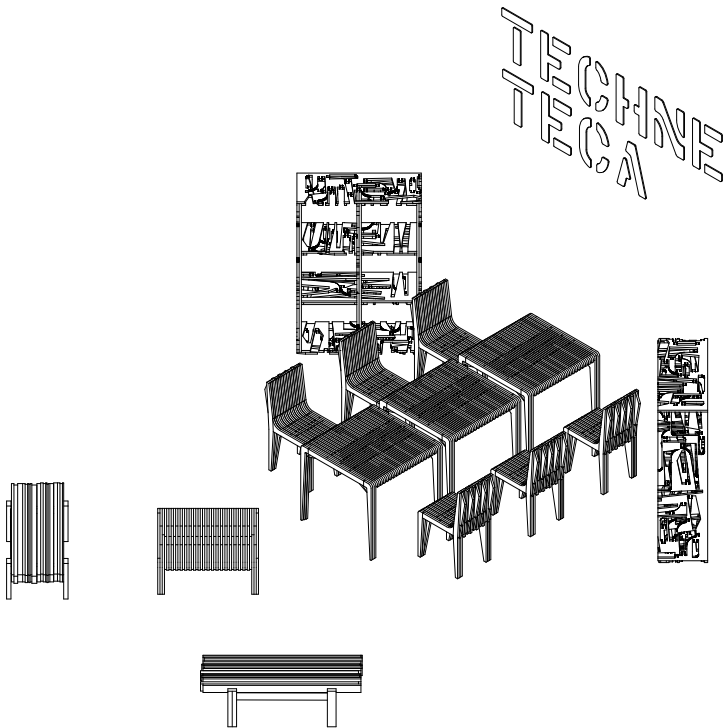


Fig. 7. Axonometric view of the TechnèTECA consultation area. Image: Ghigos

tasked with translating narrative and curatorial requirements into design choices capable of reducing impacts, waste and costs (Crippa & Di Prete, 2025b; Crippa & Palomba, 2025; Di Prete & Ratti, 2025). In this transition, sustainability ceases to be a represented theme and becomes a practised approach: exhibitions are designed through subtraction, not to show less, but to convey more.



Fig. 8. Materials for the “100 cose da non dimenticare” exhibition, Rifugio 87, Milan MDW 2026. Photo: RDD



Fig. 9. Installation in the “Distretti Resilienti” section using cardboard sheets, Rifugio 87, Milan MDW 2026. Photo: RDD



Fig. 10. Materials for the “Custodire l’invisibile” exhibition. Breda Bunker, Parco Nord Milano MDW 2026. Photo: RDD



Fig. 11. Installation structure for “Custodire l’invisibile” using cardboard boxes from Fenicetek. Bunker Breda, Parco Nord, Milan, MDW 2026. Photo: RDD

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Section



1.

Learning from History

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Learning from History

What is a shelter?

It's a seemingly simple question, one that appears to have a straightforward answer: a place intended to protect against danger. Yet, when we look at the shelters that have marked the history of cities, something more complex emerges. Shelters originate as emergency structures, designed to exist in the suspended time of a crisis. They are spaces conceived for waiting, for uncertainty, for survival. And yet, very often, they outlive the crises that gave rise to them. They remain in their surroundings as silent presences, stripped of their original function but not of their meaning. They continue to challenge the present, asking us what a community chooses to protect, what values it considers essential, and how it transforms the memory of a wound into an opportunity for learning. Learning from history perhaps means starting precisely from here: not from the accumulation of dates, events, or celebrations, but from the ability to listen to what places continue to tell us long after their function has ended. It means recognizing that history is not a static repository of concluded facts, but a continuous practice of interpretation through which societies attribute meaning to their own experience and build tools to face the future.

Milan's air-raid shelters are a prime example of this dynamic. As Breda (2015) describes, during World War II, Milan developed a dense civil defense network

consisting of public shelters, converted cellars, underground spaces, and structures specifically designed to house the population during bombings. The city effectively doubled in size. Alongside the above-ground Milan - a hub of daily life and productive activities - an underground Milan took shape, invisible yet essential. It was an alternative geography made up of routes, waiting times, and forced proximity. Similar phenomena also affected the major industrial hubs of the metropolitan area: Piria (2013), in reconstructing the history of the air-raid shelters at Breda Aeronautica in Sesto San Giovanni, shows how civil defense infrastructure was an integral part of the region's productive and social organization, helping to define new forms of relationship between work, safety, and daily life. The shelters were not monuments. They were ordinary spaces. Schools, public buildings, private homes, and existing infrastructure were repurposed to address a state of collective vulnerability. The technical specifications documenting capacities, ventilation systems, wall thicknesses, and access points reveal much more than just efficient administrative organization: they reflect a city's attempt to care for its inhabitants through design.

Learning from history, then, also means learning from everyday life. It means understanding that crises do not merely bring about destruction, but redefine the way people inhabit places, build relationships, and assign value to their surroundings. Memory is not preserved exclusively in institutional archives or commemorative monuments. It survives in the subtle traces left by the practices of communal life. While Maria Antonietta Breda (2015) brings to light the historical reality of shelters, Gaston Bachelard (1957/2006) allows us to grasp a deeper dimension of them. In *La poetica dello spazio*, the author observes how human beings continually construct places of protection: nests, shells, dens, secluded corners, homes. Even before serving as a technical response to threat, the refuge constitutes a fundamental figure in the human imagination. It represents the universal need to define a safe space in which to recognize oneself and inhabit the world.

The home, writes Bachelard (1957/2006), is our first universe. It is the place where the images that will accompany our existence take shape, storing memories, desires, and fears. The spaces we inhabit thus become emotional archives. We do not merely recall events: we recall rooms, smells, hallways, lights, and seemingly insignificant details. Places hold a part of our identity. Through this lens, even the bunker can be reinterpreted. No longer merely military infrastructure or a testament to war, but an ambiguous place where fear and protection, vulnerability and care intertwine. An architecture born of threat that, precisely

for this reason, reveals one of the deepest aspects of dwelling: the desire to find shelter together with others.

Memory thus takes on a dual nature. On the one hand, it is a collective experience, a shared heritage that contributes to the construction of civic identities; on the other, it is an intimate experience, made up of emotions and subjective perceptions that each person reinterprets according to their own personal history. There is no single, definitive memory, but rather a plurality of perspectives that coexist and transform over time. For this reason, preservation does not mean immobilization. Designating a place as heritage does not equate to removing it from living life and placing it in an exclusively contemplative dimension. On the contrary, it means creating the conditions so that it can continue to generate relationships, interpretations, and meanings. This perspective emerges particularly clearly in international efforts to revitalize sites marked by conflict. The case of Kinmen - an island that for decades has been at the center of tensions between China and Taiwan - shows how bunkers and fortifications can be transformed into cultural platforms dedicated to art and experimentation (Cai, 2006). Places originally designed for defense become spaces for encounter, education, and collective imagination.

What is striking about these experiences is not the erasure of trauma. The bunkers remain bunkers. They retain the weight of their history and the memory of the fears that once permeated them. Yet, precisely through artistic and participatory practices, they acquire new possibilities for use. Younger generations are involved in the reinterpretation of these spaces; heritage ceases to be a relic and becomes an opportunity for dialogue. Learning from history, then, means recognizing that the past is never truly over. Its traces continue to live on in these places and can be continually reactivated through new cultural practices. Places of war can become places of peace; the architecture of survival can be transformed into civic infrastructure; spaces of emergency can teach new forms of coexistence. This is perhaps the most radical lesson that shelters offer us. They show that resilience does not simply consist of withstanding crises, but in the ability to attribute new meanings to the experiences we have gone through. Each generation inherits places, objects, and stories created by those who came before; what changes is the way it chooses to interpret them. From this perspective, memory is not merely a nostalgic exercise focused on the past. Rather, it constitutes a design skill. It requires the ability to select what deserves to be passed down, to make the often-invisible traces of history legible, and to transform them into tools for navigating the present.

The four sections that make up *Learning from History* stem from this conviction and represent four different aspects of it. *100 Volori da ricordare* explores what a community considers important to preserve and pass on, transforming memory into a collective act of taking a stand. “*100 Leaps Through Time*” uses play as a tool for intergenerational transmission, demonstrating how learning can occur through the body, participation, and imagination. *R-esistenza* brings to light the tangible and intangible layers of places, building an open archive of traces and testimonies. Finally, *Custodire l’invisibile* addresses the most intimate dimension of loss and permanence, reflecting on how the project can give form to what normally eludes representation. These experiences do not propose a linear narrative of history nor do they claim to offer definitive interpretations. Rather, they invite us to pause and reflect on the questions: What do we choose to protect? What values deserve to be passed on? How do objects and places influence the way we remember? How can we transform heritage into a living resource for communities?

Perhaps learning from history means precisely this: accepting that the past cannot be changed, but recognizing that the meaning we ascribe to it remains open to reinterpretation. These shelters, having survived the emergencies that gave rise to them, continue to remind us that every society is called upon to build its own forms of protection and care - not only to defend itself against threats, but to safeguard what makes communal life possible.

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1.1.

100 Valori da ricordare

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100 Valori da ricordare

An exhibition that introduces the exhibition itinerary through an installation comprising hundreds of paper aeroplanes. A reminder of an impending danger, etched into the memory of those who found refuge here, and at the same time an opportunity for reflection for those visiting these places today. Fifty students explore - and invite the public to explore - the fundamental values and lessons that should be preserved in the collective memory.

‘100 Valori da ricordare’ introduces the exhibition as a fragile and diffuse constellation: each paper aeroplane carries a word, a principle, a trace. The chosen form is deliberately simple and recognisable. The aeroplane evokes the threat of bombing that led to the construction of the shelter, whilst the paper belongs to the realm of everyday life, school and childhood. Between these two meanings - opposite yet inseparable - the installation’s significance is constructed: the memory of what happened is transformed into a question about what still deserves to be protected.

Fig. 1. Photograph of the exhibition “100 Valori da ricordare” Rifugio 87, MDW 2026. Photo: Marco Merati

Through augmented reality, this light fleet comes to life and entrusts the visitor with thoughts in motion, ready to settle in their gaze and consciousness. The technology expands the content of the objects without replacing their physical presence: every fold retains the gesture of the person who made it, whilst every word opens up a possible path of interpretation. This multitude does not produce a definitive list, but an open collection in which different values coexist and mutually reinforce one another.

In uncertain times, when words such as freedom, dignity, justice and solidarity - rooted in the history of the Resistance and still alive in the present - seem to falter, the installation becomes a collective gesture: a collective flight that attempts, once again, to chart the course of the future. Situated at the start of the exhibition, it invites the public to embark on the journey with a fundamental question: what do we choose not to forget? Memory is not presented as a mere preservation of the past, but as a shared responsibility and as the ability to transform a historical legacy into a tool for interpreting the present.

Notes

¹ The selection of video content can be viewed at <https://repubblicadeldesign.it/mdw-2026/>, where you'll find descriptions and a repository of the 100 values to remember. A small selection from the repository is also available in the book via the QR codes on the following pages.



Fig. 2. Close-up photograph of the “100 Valori da ricordare” exhibition, Rifugio 87, MDW 2026. Photo: Marco Merati



Fig. 3. Close-up photograph of the “100 Valori da ricordare” exhibition, Rifugio 87, MDW 2026. Photo: Marco Merati



Fig. 4. Close-up photograph of paper airplanes, “100 Valori da ricordare” exhibition, Rifugio 87, MDW 2026. Photo: Marco Merati



Fig. 5. Close-up photograph of paper airplanes, “100 Valori da ricordare” exhibition, Rifugio 87, MDW 2026. Photo: Marco Merati



QR. 1. "Ambizione" da un discorso
P. Crepat



QR. 2. "Ammirazione" da un discorso
P. Crepat



QR. 3. "Angolazioni" da un discorso
R. Benigni



QR. 4. "Giustizia Sociale" da un
discorso S. Pertini



QR. 5. "Autenticità"



QR. 6. "Rinascita"



QR. 7. "Bellezza"



QR. 8. "Dedizione"



QR. 9. "Determinazione"



QR. 10. "Devozione"



QR. 11. "Difficoltà"



QR. 12. "Entusiasmo"



QR. 13. "Felicità"



QR. 14. "Integrità"



QR. 15. "Libertà"



QR. 16. "Magnanimità"



QR. 17. "Autostima"



QR. 18. "Responsabilità"



QR. 19. "Onore"



QR. 20. "Ossessione"



QR. 21. "Padronanza"



QR. 22. "Passione"



QR. 23. "Percezione"



QR. 24. "Perseveranza"



QR. 25. "Preparati"



QR. 26. "Riconoscere"



QR. 27. "Maturità"



QR. 28. "Sacrificio"



QR. 29. "Motivazione"



QR. 30. "Volontà"



QR. 31. "Coraggio"



QR. 32. "Imparare"

1.2.

100 salti nel tempo

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100 Salti nel tempo

Within 100 Salti nel Tempo, history is not presented as an ordered sequence, but as a discontinuous fabric, made up of digressions, flashbacks and overlaps. The exhibition stems from the idea that the time of memory is not linear, and that the way we view the past always depends on how we relate it to the present.

The exhibition itinerary is constructed through a constellation of images and documents linked to the Resistance, juxtaposed according to a logic of montage rather than reconstruction. Photographs that are distant in terms of context, location or historical moment enter into direct dialogue, generating shifts in meaning and opening up new interpretations. It is not a matter of following a narrative, but of moving through a series of situations in which time bends, is interrupted and resumes elsewhere. This structure creates a state of instability: what seems familiar is called into question, whilst seemingly distant elements find unexpected connections.

Visitors are invited to navigate this tension, without a prescribed route, forging personal connections between the images. Rather than recounting the Resistan-

Fig. 1. Photograph of the installation “100 salti nel tempo”, Rifugio 87, MDW 2026. Photo: Marco Merati

ce, the exhibition explores the way in which we view it today. The past is never fixed once and for all, but is continually redefined through a contemporary lens. In this sense, the 'leap' is not merely a formal device, but a stance: avoiding continuity to reveal complexity, freeing history from a single interpretation to restore its open-ended nature.

The playful dimension of the title also introduces a different way of approaching history. To jump means to change one's point of view, to interrupt a predictable trajectory and to discover relationships that a linear narrative would tend to conceal. The exhibition experience therefore does not reduce the past to a lesson already concluded, but presents it as a collection of fragments still capable of challenging the viewer.

100 Salti nel Tempo thus offers an experience in which time is not the backdrop to the narrative, but its true subject: something that can be manipulated, interrupted and reassembled, and which, precisely for this reason, continues to produce meaning in the present.



Fig. 2. Invitation letter to one of the 100 artists selected to decorate toy frogs for a fundraiser for social projects. Photo: RDD



Fig. 3. Artistic photographs of frogs, "100 salti nel tempo", Rifugio 87, MDW 2026. Photo: RDD



Fig. 4. Artistic photograph of a frog, "100 salti nel tempo", Rifugio 87, MDW 2026. Photo: RDD

1.3.

Custodire l'invisibile

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Promosso da
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Custodire l'invisibile

The Breda bunker, built to protect lives during one of the darkest periods of our history, welcomes us today like an open wound. A wound that no longer bleeds, but continues to speak. Just as when we lose a loved one, war too leaves a mark that does not fade: a gash in the collective memory that returns, that makes itself felt, that demands to be transformed.

Within this space of earth and silence, the cinerary urns become small earthly constellations. Not mere containers, but presences that gather what remains of life and return it as a belated light. Just as in mourning, what once was does not die entirely: it changes form, reconfigures itself, becomes another presence. A light which, though it comes from what no longer exists, continues to reach us.

The lives lost in war and the lives enshrined in the urns share the same inner dynamic: both ask not to be erased, but to be transformed. For grief that remains unspoken chains us to the past; a memory that finds a voice, on the other hand, becomes a possibility. It becomes life-giving force. The memory of wars, like that of our individual bereavements, can be what extinguishes us or what kindles us: it

Fig. 1. Photograph of the installation "Custodire l'invisibile," Bunker Breda, Parco Nord Milano, MDW 2026. Photo: Gianmarco Volpe

depends on how we inhabit it.

In this bunker, past and present meet at a fragile yet vital point. The urns engage in a dialogue with the history these walls have held within them: the fears, the lives cut short, the breaths hidden beneath the earth. And in their very presence, they suggest to us that nothing is truly processed unless it finds meaning, a path to transformation. That the pain of the individual and the wound of the community are healed in the same way: by allowing them to become light.

Custodire l'invisibile is, then, an exercise in metamorphosis. The design object does not erase absence, but offers it a form through which it can be recognised and embraced. In the relationship between matter, space and memory, preservation does not amount to an attempt to hold on to what is lost: rather, it becomes a gesture of care directed towards that which continues to influence the lives of those left behind.

Not to forget the war or to soften the loss, but to allow their memory to become a source of strength: a return of light, the same as that of dead stars, which illuminates the path of those who come after. Remembering what has been does not keep us trapped in the past: it prepares us, profoundly, to live the future.



Fig. 2. Photograph of the installation "Custodire l'invisibile," Bunker Breda, Parco Nord Milano, MDW 2026. Photo: Gianmarco Volpe



Fig. 3. Close-up photograph of the Fenicetek cinerary urns, “Custodire l’invisibile,” Bunker Breda, Parco Nord Milano, MDW 2026. Photo: Gianmarco Volpe

1.4.

R-esistenza

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VIETAT
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AL GARINE

R-esistenza

Two images, side by side: on the one hand, war; on the other, everyday life. Not as opposites, but as a shared reality. It is from this contrast that *R-esistenza* takes shape, an exhibition that juxtaposes photographs linked to the Resistance with scenes of apparent normality - simple gestures, moments of social interaction, fragments of life that continue to exist even in the midst of conflict.

The images on display do not construct a linear narrative, nor do they follow a narrative hierarchy. The exhibition unfolds through direct juxtapositions, in which photographs that are distant in terms of context or intensity enter into dialogue with one another. It is in the transition from one scene to another that meaning is activated: in the distance, in the discontinuity, in the possibility of interpreting multiple conditions simultaneously.

This visual approach captures the complexity of the experience lived through during the Second World War, avoiding a one-dimensional representation of the Resistance. Alongside images of struggle, danger and sacrifice, moments emerge in which everyday life persists: relationships, small gestures, forms of normality that do not erase the conflict, but reveal a deeper dimension of it.

Fig. 1. Photograph of the “R-esistenza” installation, Rifugio 87, MDW 2026. Photo: RDD

The coexistence of these registers generates a continuous tension. The images do not merely document; they become active elements, capable of challenging the viewer's perspective. What appears familiar becomes laden with ambiguity, whilst what seems distant suddenly feels close. The montage does not reconcile these differences but keeps them visible, inviting the audience to linger in the space that opens up between one photograph and the next.

In this sense, *R-esistenza* is not an exhibition about the Resistance, but a framework that questions the way we represent and understand it today. The past is not presented as a closed sequence, but as an open field, in which images continue to produce meanings. Memory is not merely the preservation of documents: it takes shape in the relationship that each generation builds with them. The title itself suggests a plural interpretation: not a single Resistance, but many forms of resistance - material, human, everyday - that span time. The exhibition thus invites us to shift our gaze, to recognise complexity and to linger in that zone of tension where meaning is not given, but is constructed.



Fig. 2. Photograph of the “R-esistenza” installation, Rifugio 87, MDW 2026. Photo: Marco Merati



Fig. 3. Close-up photograph of the “R-esistenza” installation, Rifugio 87, MDW 2026. Photo: Marco Merati



Fig. 4. Close-up photograph of the “R-esistenza” installation, Rifugio 87, MDW 2026. Photo: Marco Merati



Fig. 5. Close-up photograph of the “R-esistenza” installation, Rifugio 87, MDW 2026. Photo: Marco Merati

Section



2.

Learning from Resistance

Self-sufficiency, independence, and resilience

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Learning from Resistance

*Self-sufficiency, independence, and resilience*¹

There is a substantial difference between resisting and surviving. According to the Treccani Dictionary, to survive means “to continue living after an event that could have caused death or destruction,” whereas to resist means “to oppose a force, pressure, or external action without yielding” (Istituto della Enciclopedia Italiana, n.d.). Survival is a biological fact, an instinctive response to threat. Resistance is a projective act: it implies a choice, a direction, and the capacity to construct conditions of possibility even when resources become scarce. This distinction runs through the three exhibitions gathered in this section - *Tecnética*, *Resilient Districts*, and *Survival Design* - and gives the word “resistance” a meaning that extends far beyond its historical usage, placing it firmly at the heart of contemporary design practice.

Within design culture, the term has a long and not always linear history. In architecture, it refers to the structural capacity of a material to withstand the forces that deform it. In physics, it measures opposition to the flow of electric current. In politics, it denotes organized action against an oppressive regime. All three meanings converge on a precise idea: resistance is not passivity, nor is it inertia. It is activation. It is the capacity of a system - material, social, or territorial - to respond to a stimulus without collapsing, transforming pressure into productive energy.

The project 100 Things Not to Forget chose to situate this reflection within two structures that were, by definition, built to resist: Shelter 87 on Via Bodio and the Breda Bunker in Sesto San Giovanni. These spaces were designed to protect human bodies from bombs, constructed according to the logic of the last stronghold, the threshold beyond which destruction should not pass. Today, those same spaces function once again as civic infrastructures - not to provide protection from wartime violence, but to produce culture under conditions of scarcity, to activate memory as a critical tool, and to keep design thinking open even when external conditions appear to close off every horizon. Their reuse is not an exercise in nostalgia. It is an exercise in applied resistance.

This theme has a relevance that extends well beyond the boundaries of this project. In recent years, the word “resilience” has colonized the vocabulary of design, urban planning, and environmental policy. Too often, it has become an empty container, a superficial term that transforms the capacity to adapt to crises into a passive virtue: to resist comes to mean bending without breaking, absorbing without transforming. Yet the design tradition that inspires this section is different. It emerges from the post-war period, from the design of reconstruction, from the Italian industrial districts that repeatedly reinvented themselves through successive crises, and from the ingenuity of those who transformed constraint into method. It derives from a conception of limitation not as an obstacle, but as a generator of form. In the original formulation proposed by Holling (1973), resilience did not coincide with simple passive adaptation, but rather with the capacity of a system to absorb disturbances while maintaining its essential functions and, at the same time, reorganize itself through change.

Survival Design explicitly constructs this parallel. The exhibition begins with a limiting condition - scarcity - and treats it not as a state of exception but as a structural condition of design. This is what ENEA and the Energia Fatta ad Arte project bring to the fore: the energetic dimension of objects and spaces, normally invisible, is made perceptible and transformed into material for reflection. Working with scarcity is not an intellectual exercise; it is a concrete response to an energy system under strain, to resources that are not unlimited, and to environmental crises that cannot be ignored. The post-war period and the present mirror one another - the same urgency, a different scale, and the same imperative: finding solutions with what is available.

This logic has deep roots in Italian manufacturing culture. The concept of bricolage theorized by Claude Lévi-Strauss in the 1960s already described the

mindset of those who build with available materials rather than with those ideally required - a mode of thinking that has always been constitutive of Italian productive districts, where craftsmanship has never been merely a technique but rather a system of shared knowledge, adaptive capacity, and distributed intelligence. Resilient Districts works precisely on this theme: it shows how productive territories such as the Murano glass sector and the Venetian lighting industry have confronted the pressures of economic crisis, digital innovation, and the energy transition not as passive subjects, but as systems capable of reorienting themselves without losing their identity. LUMINA and Murano 3D are case studies, but also models of a way of engaging with transformation that Italian design knows well: not resisting change, but bending it toward new productive and cultural configurations. The figure of the bricoleur described by Lévi-Strauss (1962) does not operate from ideal resources but constructs new configurations using what is available. In this sense, bricolage anticipates many contemporary practices associated with sustainability, reuse, and the circular economy.

The problem of exhibition design has always been, to some extent, a problem of resistance. An exhibition must withstand the duration of the event, public use, wear and tear, and the necessity of being dismantled. Yet it must also resist something less tangible: superficiality, the rapid obsolescence of languages, and the tendency to consume attention without producing meaning. Technéteca addresses this problem directly. It constructs a living archive of materials, techniques, and solutions for sustainable design, organized according to three temporalities - past, present, and future - that interact with one another rather than succeeding one another linearly. The autarkic materials of the post-war period, the experiments of contemporary companies, and the research conducted by seven Italian universities are brought together not to produce a historical narrative, but to construct a shared grammar: a repertoire of possibilities from which design can draw rather than beginning anew each time. As Munari (1981) argued, design methodology does not serve to limit creativity but to make it repeatable, shareable, and transmissible. From this perspective, design knowledge becomes a collective heritage that can be continuously updated and reactivated.

The idea of grammar - in the sense of a system of rules capable of generating infinite possible combinations - is perhaps the most precise metaphor for describing what resistance produces in design. Not a definitive answer, but a set of tools, attitudes, and principles that enable responses to new stimuli without

losing internal coherence. This is what the great masters of post-war Italian design understood: Bruno Munari, Enzo Mari, and the avant-gardes of a movement that made necessity into a method. Mari (2001) theorized with remarkable clarity the relationship between constraint and creativity: limitation is not the enemy of design; it is its condition of possibility. Without resistance, there is no tension. Without tension, there is no form. For the Italian designer, the quality of a project emerges precisely from the capacity to operate critically within given conditions, transforming necessity into an opportunity for invention.

Today, this principle has assumed new dimensions. The climate crisis, pressure on resources, the fragility of global supply chains, and the technological acceleration that renders seemingly definitive solutions obsolete within a few years: all these forces are producing a design environment that increasingly resembles that of the post-war period. Not, one hopes, in the scale of destruction, but in the quality of urgency and the need to reinvent the basic conditions of making. The spaces hosting these three exhibitions - built to protect against war - speak to this reality with a concreteness that few other exhibition devices can achieve.

Reinforced concrete, beams, thick walls, and emergency exits: everything communicates resistance as a physical fact before it becomes a concept.

The project to reactivate air-raid shelters as centres for memory and the promotion of the circular economy - supported through the City of Milan's civic crowdfunding programme - demonstrates that this form of resistance responds to a tangible social demand. It is not merely an elite cultural initiative; it is the response of a community that recognizes in these spaces something necessary, something worth collectively financing. The transition from wartime shelter to productive cultural space is not a metaphor: it is urban regeneration, the application of circular economy principles to buildings, and resistance in its most literal form - something that does not yield, that persists, and that finds new functions instead of being abandoned.

Design has long maintained a relationship with resistance as a form of practical hope. Not hope as the passive expectation of a better future, but as the capacity to act under adverse conditions while still building something. As early as the 1970s, Viktor Papanek (1971) identified this ethical dimension of design. He argued that design should be evaluated not by its capacity to produce formal novelty, but by the concrete contribution it makes to people, communities, and ecosystems. Design that truly matters is not that which responds to the desires of the market, but that which responds to the real needs of people and territo-

ries. Fifty years later, that position has not become less urgent - it has become more urgent. The crises we face do not permit purely aesthetic responses. They require solutions that endure over time, that are rooted in place, and that can be transmitted and reproduced.

Technéteca, Resilient Districts, and Survival Design converge on this point from three different directions. The first works on knowledge as a shared infrastructure - building an archive of expertise that does not depend on a single actor, that survives beyond the event, and that becomes a common heritage. The second focuses on productive systems as living organisms capable of learning from crises and transforming them into opportunities for reinvention. The third addresses energy as a cultural dimension, exploring the possibility of making visible what usually remains hidden within materials, objects, and spaces.

Together, the three exhibitions advance a thesis: resistance is not an exceptional response to crises, but a structural mode of contemporary design. It is not something activated only when everything collapses, but a permanent disposition, a way of engaging in practice that takes into account the fragility of systems, the finiteness of resources, and responsibility toward future generations. Learning from resistance does not mean commemorating those who resisted before us; it means understanding what they understood, how they worked, and with what tools they transformed scarcity into invention, and then bringing that understanding into the present.

In this sense, design resistance does not coincide with the conservation of what already exists, but with the capacity to imagine continuity within transformation, turning every limitation into a resource and every crisis into an opportunity for learning. Ultimately, a shelter is always a temporary device. It is not designed to last forever; it is designed to provide protection long enough to allow a new beginning. The exhibitions it hosts - like the bunker that contains them - resist insofar as they produce forms of thought that survive the event, move beyond the exhibition space, and continue to operate. This is where the resistance of design can be measured: not in the solidity of concrete, but in the persistence of ideas.

Notes

¹ This essay is the result of a joint research project carried out by the authors. Paragraphs 1 through 7 were written by Massimiliano Cason Villa, and paragraphs 8 through 14 were written by Davide Crippa.

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3.

DISTRETTI RESILIENTI

Production Areas: Between Memory and Transformation

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DISTRETTI RESILIENTI

Territori produttivi tra memoria e trasformazione¹

Production territories are not merely geographical concentrations of businesses, but complex systems built over time through relationships among companies, skills, institutions, infrastructure, and communities. Their identity depends as much on the products they produce as on the tacit knowledge, design languages, and collaborative networks that enable a supply chain to function: this is the now-classic lesson from studies on Italian industrial districts (Becattini, 1998). When these balances are challenged by economic, environmental, energy, or industrial crises, the capacity to adapt concerns not only individual organizations but the entire regional ecosystem.

Within *100 Cose Da Non Dimenticare*, Distretti Resilienti examines precisely this condition. This section explores the transformations of Italy's manufacturing regions and the role that design can play in bridging the gap between tradition and innovation, connecting businesses, universities, and research centers. More than a collection of products, it offers a narrative on the contemporary conditions of making, in which energy, environmental, and production constraints can become opportunities to rethink materials, processes, and organiza-

Fig. 1. Photograph of the "Distretti Resilienti" exhibition, Rifugio 87, MDW 2026.
Photo: RDD

tional models (Repubblica del Design, 2026).

To understand what it means today to make a productive region resilient, it is worth recalling where its strength lies. Looking at the manufacturing clusters in England in the late nineteenth century, Alfred Marshall recognised in the agglomeration of small, specialised firms an efficient alternative to the large integrated factory, based on ‘external economies’ external to the firm but internal to the region: a skilled workforce, the rapid circulation of knowledge, and that ‘industrial atmosphere’ which enables the trade to be learnt almost by osmosis (Marshall, 1920). From the late 1970s onwards, Giacomo Becattini reinterpreted this insight in the light of the Italian experience, defining the district as the active interplay between a community of people and a network of enterprises, where history, shared languages and norms of reciprocity become productive factors in their own right (Becattini, 1979). It is on this model - spatialised by Arnaldo Bagnasco in the ‘Third Italy’ of the North-East and Central regions (Bagnasco, 1977) - that the competitiveness of ‘Made in Italy’ has been built up over decades.

That model, however, has not remained static. The intensification of global competition and the organisation of production into global value chains have, since the 2000s, triggered a profound process of selection: closures and relocations have thinned out the fabric of local relationships, whilst value has become concentrated in a small number of leading firms, some of which have grown to become ‘pocket-sized’ multinationals. To describe this discontinuity, there has been open talk of the ‘collapse’ of the canonical Marshallian district (De Marchi & Grandinetti, 2014). ‘Collapse’ does not, however, mean disappearance: many firms have reinvented themselves by focusing on niches, branding and quality, and figures have emerged who are capable of mediating between global circuits and the local context - cognitive interfaces, knowledge brokers, knowledge-intensive services - who reabsorb external knowledge and transfer it back to the local area (Grandinetti, 2025). A district’s ability to withstand shocks depends increasingly on the presence of these connection hubs.

This economic transformation has been accompanied by a territorial metamorphosis. The depopulation of many industrial areas has left behind derelict warehouses and brownfield sites which, albeit sporadically, are now being repurposed as innovation laboratories – hybrid spaces combining production, research, culture and training – right through to digital innovation hubs that disseminate Industry 4.0 skills beyond the confines of large corporations (Ostanel, Panozzo & Tosi, 2019). Thus, a laborious transition is taking place from geographies of

abandonment to local development strategies, in which the physical reuse of spaces matters less than the ability to 'create a network' amongst different actors. Indeed, as the data show, the districts have demonstrated substantial resilience even during the decade of the crisis, albeit following trajectories that vary greatly from district to district (Lombardi & Magliocchi, 2016).

This heterogeneity also has a geographical dimension. Alongside the 'classic' districts of the North-East and Central Italy lie the southern districts, long regarded as an anomaly or an example of 'light industrialisation', often arising from the endogenous initiative of artisans and traders rather than from institutional support (Viesti, 2000). The textile hub of San Giuseppe Vesuviano, the largest in the South, is a prime example: a 'molecular capitalism' of micro-enterprises that survives thanks to adaptive resilience - informal and at times at odds with institutional governance - now called upon to tackle the twin ecological and digital transitions (Amato, 2026; Russo, 2026; Corbino & Sacco, 2026). It is precisely the governance dimension - the presence of shared bodies, agreements and support services - that proves decisive in explaining the varying performance of Italian districts (Pastore & Tommaso, 2013; Giordano et al., n.d.) - whilst sustainability tends to yield the best results when it is not tackled by individual firms, but as a collective strategy capable of harnessing the interdependencies and trust that bind a supply chain together (De Chiara, 2017).

The term 'resilience' often refers to a system's ability to absorb a shock and return to its previous state; when applied to productive regions, however, such a definition proves inadequate. In the face of structural transformations, returning to the original situation is not always possible or desirable. Rather, resilience implies the ability to recognise change, reorganise available resources and establish new balances without losing the wealth of knowledge and relationships that characterise a place: not preserving the past unchanged, but making it available to tackle new circumstances.

From this perspective, productive memory takes on a planning value. Techniques, practices and organisational forms that have become established over time are not merely a heritage to be safeguarded, but a foundation upon which to build technological and social innovations. Resilient solutions do not necessarily arise from replacing what already exists with entirely new systems: they often emerge from the reinterpretation of established skills, their hybridisation with contemporary tools, and the ability to transfer them to new contexts.

This continuity is not, however, automatic. Many Italian industrial districts are today facing growing vulnerabilities: rising energy costs, shortages of raw

materials, difficulties in generational succession, the loss of specialist skills, international competition, and new environmental and digital standards. Small and medium-sized enterprises, whilst possessing highly specialised technical knowledge, rarely have the resources on their own to sustain ongoing research. Resilience thus becomes, first and foremost, a matter of relationships: universities, businesses, associations and institutions can build collaborative infrastructures through which to share knowledge, technologies and experimental capabilities. Within this framework, design fulfils a function that goes beyond the formal definition of objects - it makes needs explicit, translates different disciplinary languages, and constructs shared scenarios - and establishes itself as a practice of mediation and connection (Manzini, 2015), capable also of making resources and flows - starting with energy - perceptible, which normally remain invisible (Boffi et al., 2023; Di Prete et al., 2024).

Distretti Resilienti thus views the crisis not as an exceptional event, but as a planning framework. Contemporary pressures reveal the limitations of established models and bring to light dependencies that normally remain in the background: the energy required for production, the origin of raw materials, the availability of skills, the functioning of infrastructure, and the distribution of value along the supply chain. Examining a product through the lens of the territory that produces it means reconstructing this web of relationships and recognising that every artefact is also the outcome of an economic, cultural and environmental system.

This section forms part of the exhibition's curatorial framework, which reimagines Rifugio 87 and the Breda Bunker, transforming two sites of wartime defence into contemporary cultural spaces. Spaces originally created to respond to an extreme crisis become venues in which to examine the vulnerabilities of the present and the forms of protection that a society can build through design. Here too, memory is not a static repository, but a critical tool for identifying resources, values and knowledge useful for guiding change. Manufacturing districts, after all, are themselves a form of collective memory, entrusted not to archives but to the practical transmission of skills: when this transmission is interrupted, it is not merely a craft that is lost, but an entire system of relationships between people, tools and territories.

The research projects brought together in this section translate this reflection into concrete cases, across different scales and districts. *Murano 3D* turns its attention to one of the country's oldest and most fragile districts, that of Murano's artistic glassmaking, where sky-high energy costs, difficulties in generational

succession and international competition are putting at risk a heritage of skills that would otherwise be irreplaceable. The project explores the convergence between the expertise of handcrafting and digital and additive manufacturing technologies: not to replace the artisan's craft, but to complement it. 3D printing becomes a tool for prototyping, formal study and the transmission of knowledge, whilst the mastery of the master glassmaker remains at the heart of the process. Resilience, in this context, lies in the ability to keep a centuries-old technique alive by integrating new tools into it, making it accessible and transferable to a new generation without losing its identity.

The chapter devoted to *LUMINA*, on the other hand, shifts the focus to the Veneto lighting industry cluster and the models through which a region can foster collaborative innovation. Promoted by the Rete di Imprese Luce in Veneto as part of the Venetian Smart Lighting Regional Innovation Network, the project brings together companies with diverse identities - technical and decorative lighting, craftsmanship, industrial production, smart systems - not to standardise them, but to transform their differences into a shared resource. Light is understood here not merely as a product, but as an integrated system encompassing architecture, energy, technology and wellbeing, and resilience is equated here with the ability to develop a system without disrupting its cultural continuity.

The two perspectives operate on different scales - one focusing on the hybridisation of artisanal know-how and digital manufacturing, the other on organising relationships between producers - but they converge in moving beyond a notion of innovation based solely on novelty. A more efficient object or a more advanced technology is not enough unless it is embedded in a system capable of understanding, producing and making it accessible; likewise, the mere preservation of traditions does not guarantee the continuity of a district if skills are not adapted to new needs and conditions. Resilience lies precisely in this tension: preserving what still holds value and transforming what no longer does, in a selective process that requires distinguishing the resources to be passed on from the models to be overcome.

In the exhibition, this reflection takes concrete form: the objects on display are not autonomous entities, but testimonies to processes, and they reveal the supply chains, energies and skills that gave rise to them. Ultimately, *Distretti Resilienti* proposes an interpretation of the project as an infrastructure linking memory and the future, resources and needs, research and production. Design does not eliminate constraints, but makes them legible and translates them into

areas for action; and in an era marked by overlapping crises, resilience is not a return to a supposed normality, but the ability to build new conditions of continuity, using existing knowledge as the starting point for transformations that are still possible.

Notes

¹ This essay is the result of a joint research project carried out by the authors. Paragraphs 1 through 7 were written by Davide Crippa, and paragraphs 8 through 14 were written by Massimiliano Cason Villa.



Fig. 2. Photograph of the “Distretti Resilienti” installation, Rifugio 87, MDW 2026.
Photo: RDD



Fig. 3. Photograph of the “Distretti Resilienti” installation, Rifugio 87, MDW 2026.
Photo: RDD



Fig. 4. Close-up photograph of the “Distretti Resilienti” installation, Rifugio 87, MDW 2026. Photo: RDD



Fig.5. Close-up photograph of the “Distretti Resilienti” installation, Rifugio 87, MDW 2026. Photo: Marco Merati

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3.1.

Murano 3D

Innovation and Sustainability in Art Glass

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Murano 3D

*Innovation and Sustainability in Art Glass*¹

The Project and Its Ecosystem

Among the sections of *100 cose da non dimenticare*, Distretti Resilienti brings together projects that illustrate the ability of complex industrial regions to withstand and adapt to the transformations of the present. As the section's curator, Davide Crippa, summarizes, these districts express the determination of often fragile regions not to give in to the challenges of the contemporary world. At Rifugio 87, the section brings together two Venetian districts - the glass district and the lighting district - united by their search for new balances between artisanal know-how, business, and digital technologies. It is within this framework that *Murano 3D* is situated, a research initiative that explores the future of Murano's artistic glass.

Murano is a resilient district almost by definition. Added to the historical difficulties of producing on an island are today's high energy costs, competition from low-cost industrial products, and, above all, the gradual disappearance of certain skilled trades. This is the case with mold makers - the artisans capable of crafting

Fig. 1. Photograph from the "Murano 3D" project, "Resilient Districts," Rifugio 87, MDW 2026. Photo: RDD

the pear wood or iron molds on which glassblowing has relied for centuries: a specialized and unassuming skill that is increasingly rare today. The crisis facing this seemingly marginal link in the supply chain threatens not merely a technical detail, but the very possibility of passing down a craft in which material, hand, and form coexist in a delicate balance (Barovier Mentasti, 2015).

Addressing this fragility requires action not just at the level of individual workshops, but across the entire production ecosystem. *Murano 3D* – Innovation and Sustainability for Artistic Glass was created with this goal in mind: funded by the Veneto Regional ESF+ Program 2021–2027 and promoted within the framework of RIR Euteknos - the Regional Innovation Network for Venetian Artistic Craftsmanship - the project brings together some of Murano's leading glassworks, including Barovier & Toso, Lavai, Wave Murano Glass, and Siru - along with two universities playing complementary roles: the IUAV University of Venice, responsible for the design sector under the guidance of Davide Crippa, and the University of Padua, which, under Paolo Colombo, oversees additive manufacturing and materials science. The choice of the European Social Fund Plus is no coincidence: in addition to applied research, the project invests in training, consulting, and outreach, recognizing that a district's transition depends first and foremost on the skills of the people who live there.

Moreover, a broader network of stakeholders - ranging from the Veneto Region to industry associations - operates around the glassworks and universities. In recent years, this network has been called upon to address very real emergencies, starting with the high cost of energy, which particularly affects a sector reliant on furnaces that run continuously. In this context, *Murano 3D* does not present itself as an isolated solution, but as a building block of a shared transition strategy, in which research, training, and business work together to create the conditions for the district's survival and revitalization.

Murano 3D is not starting from scratch. It builds on the results of the previous D3VeRo project, which between 2020 and 2022 - as part of the Veneto POR-FESR and in collaboration with the University of Padua - explored for the first time the use of 3D printing in the artistic glass supply chain (University of Padua, 2022). Building on that foundation, the new project sets more ambitious goals: to enhance the sector's competitiveness, integrate artisanal tradition with digital technologies, introduce production systems consistent with the principles of the circular economy, train glassworks personnel, and open up new segments for complex and customized products. The fundamental question, however, remains cultural rather than technical: how can the introduction of digital techno-



Fig. 2. Image of the 3D-printed mold, the field test at the Lavai kiln, the construction of milling molds, and the results of their use. Photos: D. Rolli, D. Crippa, et al.

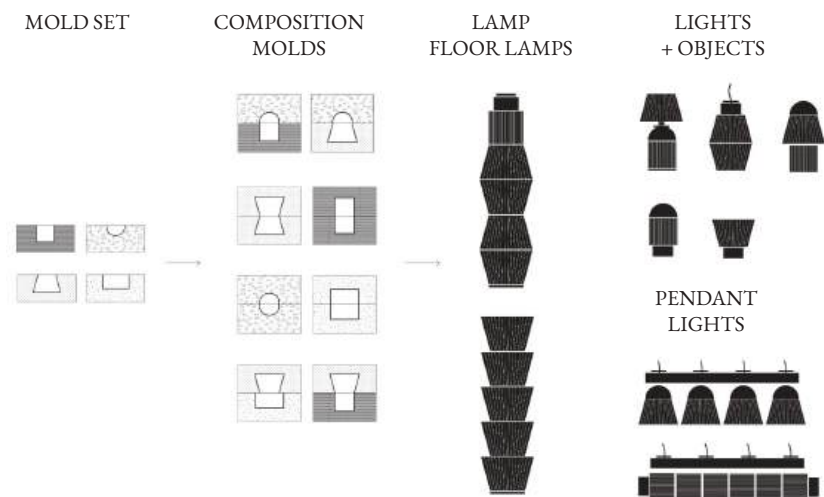


Fig. 3. Study of a system of composite molds created using 3D printing to bring innovation to the Murano tradition. Photo: D. Crippa, D. Rolli

logy strengthen - rather than distort - a craft rooted in the gestures and memory of the master glassmaker?

The Project and Its Innovative Aspects

Murano 3D's solution focuses on a specific and strategic element: the mold. Traditionally made of wood or metal, molds define the physical relationship between the master glassblower's breath and the molten glass, translating that gesture into form. But they are tools with a limited lifespan, rising costs, and are difficult to produce in complex geometries; above all, they depend on mold-making skills that are becoming increasingly scarce. Intervening here means addressing the very point where formal innovation in glass is currently most constrained.

The project developed a new generation of molds produced using additive manufacturing and finished with computer numerical control (CNC) machining. The process was documented step by step: it begins with a casting mold featuring a PLA counter-mold created via 3D printing; a release agent is applied; the glass is blown so that it adheres to the mold walls; and finally, the form is removed. Initial tests revealed predictable challenges - excessive weight and volume, uneven surfaces, and defects at the junction of the two halves - which the research team addressed one by one: by modifying the material mixture to reduce weight and volume, introducing a CNC milling finish to correct irregularities, and experimenting with different release agents until a satisfactory result was achieved. The result is a mold comparable in quality to a traditional one, but lighter, more economical, and producible in significantly less time (IUAV University of Venice, 2025; Rolli, 2025).

Equally significant is the material innovation. The molds are made from an innovative, environmentally friendly material - a geopolymer with high thermal resistance derived from inert waste - which links process innovation to a specific ecological goal. The ability to produce molds of varying sizes at sustainable costs is what makes this leap truly significant: it makes even small batches and one-of-a-kind pieces economically viable, restoring to Murano glass a freedom of customization that the industrial logic of traditional molds made difficult to sustain (*Murano 3D*, 2025).

Building on this foundation, the design research took a further step by developing a composite, multi-material mold. By combining different materials in the

two parts of the mold, it is possible to achieve different impressions and textures on the same glass surface; this modularity, in turn, allows for the creation of a set of interchangeable matrices. From just a few molds, an entire family of artifacts - floor lamps, pendant lamps, and other objects - is thus created through combination and variation: each piece is both mass-produced, because it derives from the same mold system, and unique, because each blowing process introduces micro-variations in curve, thickness, and surface. The minor imperfections caused by the resolution of 3D printing, rather than being flaws to be hidden, become an aesthetic potential: the visible trace of the process.

The transition from the mold to the furnace proved to be a decisive test. The composite materials - lighter and more sensitive to thermal shock than wood or iron - reacted to heat in new ways, producing micro-irregularities, bubbles, and surface variations; above all, they required the master glassblowers to adapt their techniques, modifying established timings and movements. It is in this dialogue between the hand and the new tool that the project found its most vibrant expression, demonstrating how technology does not replace artisanal knowledge but rather spurs it to evolve. The first series of modular lamps, developed in collaboration with the glassworks, made this principle tangible: digitally generated forms that, when shaped by the breath of the glassblower, once again bear the unique imprint of the artisan's touch.

This freedom to combine elements is not arbitrary, but stems from a systematic interpretation of tradition. The research team has created a veritable visual dictionary of Venetian chandeliers, breaking down historical types - from the Rezzonico model to multi-arm, cascade, and pastoral chandeliers - into recurring morphological elements, such as the cup, drop, flower, Baroque curl, sphere, bell, ring, and leaf. This "grammar of forms" is complemented by a mapping of the main Murano glass-making techniques, ranging from surface decorations (*reticello*, *zanfirico*, *balloton*) to color combinations (*sommerso*, *incalmo*, *incamicciato*, *lattimo*), and including internal decorations such as *murrine* and *millefiori*. It is starting from this framework of forms and techniques that the project seeks to envision the future forms of Murano glass: not an imitation of the past, but a reinterpretation of it through contemporary tools, capable of creating a dialogue between historic chandeliers and the design languages of 20th-century and contemporary glass.

The innovation of *Murano 3D* is therefore technical, environmental, and social. On the environmental front, the use of waste materials for molds, their durability, and the reduction in production time, energy consumption, and the number

of molds required outline a process consistent with the principles of the circular economy. On a social and economic level, this innovation paves the way for a new role - a “digital” artisan capable of designing and producing molds - who can re-enter the supply chain precisely where traditional skills are being lost. This is a delicate yet decisive point: technology does not diminish the role of the master glassmaker, but rather complements it, expands their repertoire, and creates the conditions for manual expertise to continue being passed down. Consistent with this approach, the project adopts a collaborative and open method: glassworks are asked to propose pieces to be created using the new molds, while designers and creatives are invited to experiment with their possibilities, in a contest that transforms research into a shared endeavor among businesses, universities, and designers.

Conclusions

The initial results of the project were presented at a study day as part of The Venice Glass Week 2025 (The Venice Glass Week, 2025) and are now on display, as part of Distretti Resilienti at Rifugio 87. Here, molds, prototypes, and lamps are not displayed as finished objects, but as traces of an ongoing research process: working tools, experiments, surfaces marked by heat. This curatorial choice is consistent with the spirit of the project, in which value lies not so much in the object itself as in its process of becoming. The journey, after all, does not end with Design Week: it is set to continue toward the Glass Museum and toward a concluding event scheduled for the 2026 Salone del Mobile.

Viewed as a whole, *Murano 3D* demonstrates that the technological transition in glass does not involve the replacement of tools, but rather the transformation of relationships: between universities and glassworks, between designers and master glassmakers, and between research and production. From this perspective, sustainability is not measured solely in terms of energy efficiency or material recycling, but also in the ability to regenerate knowledge, skills, and local ties. The future of the district will depend not so much on the introduction of higher-performance technologies as on the commitment to keeping alive an ecosystem of knowledge in which craftsmanship and research can grow together.

Precisely for this reason, the most important legacy of *Murano 3D* is not a single product, but a transferable method: a way of working that combines digital design, artisanal knowledge, and principles of sustainability - and that can be repli-

cated in other artistic manufacturing districts facing the same challenges. The reduction in the number of molds and their reusability, the ability to produce small batches and one-of-a-kind pieces, and the training of new professional roles are all elements that shape a production model that is more streamlined, adaptable, and rooted in the local community.

In this sense, the project restores design's role as a mediator: a tool that does not impose forms, but rather builds processes of continuity and adaptation between the master's craft, the material, and new digital languages. Like the other projects featured in *Distretti Resilienti*, *Murano 3D* tells the story of a region that chooses not to lose its knowledge but to reinterpret it: a manufacturing sector that does not fear innovation because it recognizes it as part of its own history.

Notes

¹ La stesura del paragrafo dal 1 è da attribuire a Alessandra Neri, del paragrafo 2 è da attribuire a Davide Crippa e del paragrafo 3 è da attribuire a Gaia Marchionni.



Fig. 4 Detail photograph of the “Murano 3D” project, “Distretti Resilienti,” Rifugio 87, MDW 2026. Photo: RDD



Fig. 5. Detail photograph of the “Murano 3D” project, “Distretti Resilienti,” Rifugio 87, MDW 2026. Photo: RDD



Fig. 6. Detail photograph of the “Murano 3D” project, “Distretti Resilienti,” Rifugio 87, MDW 2026. Photo: RDD



Fig. 7. Detail photograph of the “Murano 3D” project, “Distretti Resilienti,” Rifugio 87, MDW 2026. Photo: RDD

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3.2.

LUMINA

Light and Research for the Transformation of Industrial Areas

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Sponsored by
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In collaboration with
Rete di imprese Luce in Veneto (RIR
Venetian Smart Lighting): Ailis Srl,
And Costa Srl, Elesi Luce Srl, Engi
Srl, From Lighting Srl, Multifforme
Sas, Olev Srl, Patrizia Volpato Srl,
Vetrart Snc
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Lipparini Riccardo, Mangoni
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Daniela, Lupo Miriana, Pioli Irene,
Rellini Sara, Robin Elisa, Soro Erika,
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Exhibition design
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Technical partners
Design Differente



LUMINA

*Light and Research for the Transformation of Industrial Areas*¹

In *100 Cose Da Non Dimenticare*, LUMINA is featured in the “Resilient Districts” section, which focuses on the transformations of industrial regions and their ability to respond to economic, environmental, and industrial crises through research, cooperation, and project-based initiatives. The Veneto lighting sector serves as the focus of observation and experimentation: a production system in which design acts as a mediator between material culture, technological innovation, and regional development (Rete di Imprese Luce in Veneto, 2025).

The project is promoted by the Veneto Lighting Business Network - the legal entity of the Venetian Smart Lighting Regional Innovation Network - as part of the Veneto ERDF Operational Program 2021–2027, and involves the IUAV University of Venice, the University of Padua, and a group of companies from the regional lighting supply chain (Veneto Region, 2024). Its starting point is a shift in perspective: light is not considered an attribute of a single product, but rather a component of a system where technology, architecture, energy, sustainability, and the quality of the experience converge. Embedded within the object, it shapes the perception of spaces, influences people’s well-being, and contributes to the

Fig. 1. Detail photograph of the “LUMINA” project, “Distretti Resilienti,” Rifugio 87, MDW 2026. Photo: RDD

energy performance of buildings: designing it means balancing form, performance, and conditions of use.

The Evolution of Lighting Design (2000–2025)

The analysis carried out in the first work package traces the aesthetic and technological evolution of the sector over the last quarter of a century (Bassi et al., 2025). In the early 2000s, design was still linked to formal experimentation and materials research: products such as Marc Sadler's Mite and Tite for Foscarini demonstrate how technical materials can generate new structural and perceptual qualities, whilst Konstantin Grcic's May Day for Flos translates simplicity and adaptability into an object capable of responding to different uses. It was with the gradual improvement in LED efficiency, between 2005 and 2010, that the technology began to profoundly alter the form of the product: light sources became compact, necessitating a rethink of thermal and optical management, and ceased to be concealed within configurations inherited from traditional lamps.

With the full establishment of LED technology, the luminaire can be reduced to the essentials, allowing the lighting effect itself to define the environment; the same technology thus produces contrasting outcomes - objects with a strong material presence or those that tend to fade into the background - because it does not impose a single, unambiguous language, but rather broadens the range of possibilities. In the years that followed, sensors, interfaces and control systems transformed the lamp into a responsive device, capable of altering its configuration according to its use, whilst in decorative lighting, light merged with artistic experimentation. Finally, between 2020 and 2025, sustainability, personalisation and wellbeing emerge strongly: in particular, Human Centric Lighting considers light not only in relation to visual ability, but also to its physiological and emotional effects on people, using variations in intensity and colour temperature throughout the day as a tool to create environments consistent with circadian rhythms. This shift from the lamp to the lighting system broadens the very scope of the project: it is no longer merely a matter of defining the form of an artefact, but of managing the relationships between light sources, optics, sensors, software, surfaces and users, with expertise spanning design, engineering, technical physics and electronics. Yet technological transformations do not negate the importance of materials: in the Veneto region, innovation continues to engage with a manufacturing culture rooted in glass and metalworking, where tradition is not a static repertoire of forms, but a heritage of knowledge that can be reinterpreted

through new light sources and new processes.

A collaborative model of innovation

It is precisely this complexity that makes the relationship between businesses and research so strategic. The network of partner companies consists mainly of firms operating in the residential, hospitality, contract and bespoke sectors; few have a formalised research and development department, and innovation focuses primarily on products and processes (Bassi et al., 2025). This is a typical situation in clusters of small and medium-sized enterprises, where a high degree of specialisation does not go hand in hand with the ability to undertake structured research independently: networking and collaboration with universities therefore become tools for sharing knowledge, reducing the risks of experimentation and accessing expertise that would be difficult to integrate within a single organisation. This is all the more true given that the market is unstable - following the post-pandemic recovery, the project's data show a further decline in turnover and exports in 2024 and the first quarter of 2025 - and the response cannot be limited to more efficient light sources: it must encompass durability, component replaceability, maintenance, disassembly and end-of-life, integrating efficiency, light quality and circularity right from the earliest stages of the project.

The distinctive feature of *LUMINA* lies precisely in the creation of a shared process. Universities do not merely transfer knowledge to businesses, nor are businesses passive recipients of ready-made solutions: research arises from the interplay between production needs, scientific expertise, market shifts and design possibilities. The first work package interwove four perspectives - aesthetic and design evolution, market analysis, assessment of companies' needs and exploration of emerging technologies - to view innovation as a situated process, in which a technology is valuable not simply because it is new, but because of its ability to take root in companies' expertise and respond to real needs.

The companies involved reflect the diversity of the Veneto lighting sector, and *LUMINA* embraces these differences as a resource rather than reducing them to a single model. In the field of technical and architectural lighting, we find Ailis, which interprets light as a presence to be calibrated to the actual needs of the space, and From Lighting, which combines technological research and manufacturing quality within international design networks; AndCosta and Engi operate at the intersection of product design and bespoke projects, the latter interwea-

ving electronics with the artisanal skills of glass, ceramics and metalwork. A second group bases its work on material culture: Elesi Luce hand-assembles lamps designed with the maintenance and care of the object in mind, whilst Patrizia Volpato and Vetrart draw on the tradition of Venetian and blown glass to create customisable systems - such as the Orbite and Stone projects - that straddle the line between decoration and architecture. Finally, OLEV focuses explicitly on the relationship between light and wellbeing: the Tee product, on display at the exhibition, interprets light as a dynamic phenomenon that echoes the variations of natural light, integrating smart control and Human Centric Lighting. Joining these companies as an external participant is Multiforme, presenting the portable, rechargeable Apollo 9 lamp, in which minimalist geometry meets Murano glass craftsmanship.

Within this framework, workshops, questionnaires and experimental activities serve as a means of translation: they help companies to articulate the expertise embedded in their daily practices and enable researchers to test their hypotheses against technical and commercial constraints. Design becomes the shared language through which different needs can be represented, discussed and transformed into design possibilities.

LUMINA's presence in the exhibition brings this process to light. The products are not merely displayed as commercial outcomes, but as manifestations of a productive and cultural system: behind each luminaire lie skills, supply chains, materials and local connections. Its placement in Rifugio 87 intensifies this interpretation, because in a building designed for emergencies, light takes on an essential role in providing orientation, safety and habitability: exhibiting these products there serves as a reminder that light is not merely a decorative element, but an infrastructure that makes the space navigable and liveable.

The companies participating in the exhibition “100 cose da non dimenticare”

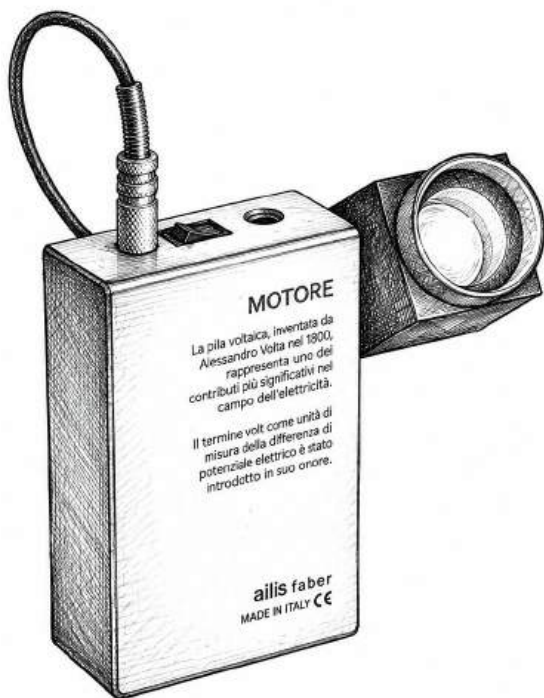
Nella mostra vengono così presentati i primi risultati della ricerca e gli esiti dei workshops organizzati all'Università IUAV di Venezia nel settembre 2025 in occasione del quale oltre 60 studenti hanno elaborato alcune soluzioni di concept di prodotti sostenibili, le aziende hanno elaborato un prototipo. In particolare, sono

visionabili all'interno del Rifugio le soluzioni proposte da: Ailis Srl, &' Costa Srl, Elesi Luce, Engi, From Lighting, Olev, Patrizia Volpato e Vetrart, offrendo una lettura concreta dei risultati raggiunti.

AILIS - Dado 33 Motore

AILIS develops lighting systems based on wireless technologies and smart control, designed to reduce energy consumption and promote efficient energy management.

With Dado 33 Motore, available in three versions, the company offers a modular and autonomous solution also designed for exhibition and museum settings, where lighting must adapt to constantly changing configurations. The system combines lighting precision with flexibility of use, transforming the light fixture into a discreet design element capable of interacting with the space without imposing itself, thereby restoring the focus to what it illuminates.



Costa SRL – Vitreo

Andcosta develops architectural lighting solutions in which design, manufacturing, and research coexist within a single production system rooted in the Veneto region. The company

combines artisanal and engineering expertise, working with architects and designers to create catalog products and custom solutions that engage with space, function, and time.

The Vitreo project is part of this approach as an expression of precise and thoughtful design, in which

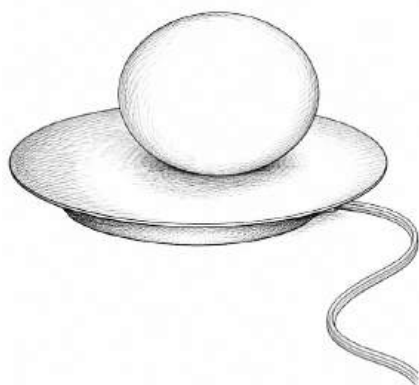
construction quality, material selection, and architectural integration become tools for creating reliable, durable, and contemporary lighting solutions.



Elesi Luce SRL – Bianca

With Bianca, available in three different colors, Elesi Luce has created a piece that focuses on the relationship between form, material, and light quality. The lamp combines metal elements with a blown-glass diffuser, striking a balance between industrial precision and artisanal sensibility.

The project is part of a production approach that emphasizes “Made in Italy,” direct control over the supply chain, and product durability, integrating high-efficiency LED technologies with design solutions aimed at ensuring light quality, ease of maintenance, and a long service life for the system.



ENGISRL - Novella, Amalia

With the Novella and Amalia lamps, ENGI combines its expertise in technical lighting with a design approach that focuses on the narrative value of the object. Created in collaboration with master artisans from the Veneto region and characterized by the use of materials such as ceramic, glass, wood, and metal, the lamps integrate LED technology with traditional craftsmanship.

The forms, often inspired by anthropomorphic figures, convey a more intimate and relational dimension of light, in which the design becomes an expression of the region, its traditions, and the centrality of the human dimension even within an advanced technological context.



FROM LIGHTING – Satellit

With Satellit, FROM Lighting presents a linear pendant lamp that interprets light as a dynamic and adaptable element within a space. The glass diffuser, which can be rotated 360

degrees, allows the user to alter the lighting atmosphere with a simple gesture, making the user an active part of the design.

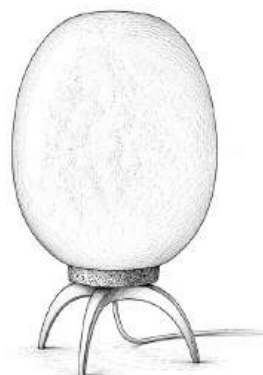
The design reflects an approach that combines contemporary technology with a more poetic dimension of design, where essential forms, interaction, and precision in construction converge to create iconic objects designed to stand the test of time.



PATRIZIA VOLPATO – Orbite, Stone

Patrizia Volpato develops decorative lighting systems that combine the tradition of Venetian glass with a contemporary design approach. With Orbite and Stone, the company offers solutions in which materials such as glass, metal, and mineral surfaces interact with efficient technologies, creating objects capable of defining space through light.

The project reflects a production system that integrates craftsmanship and innovation, with a focus on quality, durability, and the sustainability of processes. Light is thus interpreted as an architectural element, capable of forging connections between objects, the environment, and perception.



OLEV – Tee

With Tee, available in three versions, OLEV has developed a lighting system based on smart technologies designed to promote personal well-being. Light is not conceived as a static element, but as a dynamic phenomenon capable of reproducing the natural variations of sunlight throughout the day.

By integrating technological research with a focus on the perceptual dimension, the project interprets light as an active tool for improving the quality of spaces and physical and mental well-being, introducing advanced features that expand the traditional role of lighting.

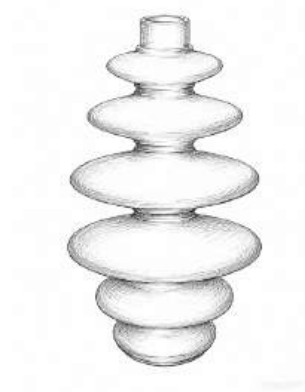


VETRART - Sospensione, Ricaricabile

Vetrart develops lighting solutions drawing on a deep understanding of the Venetian glassmaking tradition, which is rooted in entirely artisanal processes of mouth-blowing and handcrafting.

The lamps are one-of-a-kind pieces in which the material quality of the glass and the expertise of master glassmakers come together to create objects that blend tradition with the evolution of design, helping to build lighting systems that interact with the space and the identity of their surroundings.

Complementing these is the participation of the lighting company Multifforme, with its Apollo 9 lamp, made available to visitors as they explore the exhibition



Conclusions

LUMINA is therefore a project in the lighting sector, but also an exploration of the ways in which a region generates innovation. The evolution over the last twenty-five years reveals a lighting sector profoundly transformed by LEDs, digitalisation and connected systems: the lamp has moved away from being a mere housing for the light source to become a system that interacts with architecture, users and energy infrastructure. Sustainability and Human Centric Lighting further broaden the scope, rendering a model of innovation based on the isolation of individual actors increasingly ineffective.

What the project urges us not to forget is that every technological transformation takes place within a specific region and a productive culture: light sources,

materials and digital systems acquire meaning through the people and businesses that know how to interpret them. From this perspective, a district's resilience depends not only on the quality of its products or the introduction of new technologies, but on the presence of networks capable of linking different skills, resources and stakeholders; and design does not merely influence the form of the lamp, but the system of relationships that makes innovation possible. To innovate, then, means creating the collective conditions for established knowledge and new possibilities to come together.

Notes

¹ Paragraphs 1, 3, 6, 7, and 11 were written by Davide Crippa; paragraphs 2, 4, 5, 10, 12, and 13 were written by Massimiliano Cason Villa; paragraph 8 was written by Gaia Marchionni; and paragraph 9 was written by Daniele Rolli.



Fig. 2. Detail photograph of the “LUMINA” project, “Distretti resilienti”, Rifugio 87, MDW 2026. Photo: RDD



Fig. 3. Detail photograph of the “LUMINA” project, “Distretti resilienti”, Rifugio 87, MDW 2026. Photo:Marco Merati



Fig. 4. Detail photograph of the “LUMINA” project, “Distretti resilienti”, Rifugio 87, MDW 2026. Photo: RDD



Fig. 5. Detail photograph of the “LUMINA” project, “Distretti resilienti”, Rifugio 87, MDW 2026. Photo: RDD

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4.

SURVIVAL DESIGN

Designing Under Conditions of Scarcity

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Sponsored by
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economico sostenibile – ENEA
Regione Emilia Romagna
Design Differente

Exhibition design
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Gaia Marchionni, Daniele Rolli

Technical partners
Design Differente



SURVIVAL DESIGN

*Designing Under Conditions of Scarcity*¹

Within *100 Cose Da Non Dimenticare*, the Survival Design section emerges from the intersection between the memory of the venues hosting the exhibition and certain pressing issues of the present. Rifugio 87 and Bunker Breda are architectural structures born of extreme circumstances, designed to protect life through a minimal use of space, materials, and resources. Their reactivation as cultural devices draws a parallel between two historical moments: on the one hand, the postwar period, marked by the material necessity of reconstruction; on the other, contemporary environmental, energy, and social crises, which compel us to rethink the ways in which we produce, consume, and live.

Scarcity is the curatorial starting point for this section, but it is not intended as mere deprivation. In design, limitation can serve a generative function: it narrows down possibilities, forces us to distinguish the necessary from the superfluous, and spurs new relationships between resources, technologies, and behaviors. Constraint does not equate to the impossibility of designing, but can guide innovation toward more appropriate and responsible solutions.

The relationship between crisis and innovation runs through the very history of

Fig. 1 Entrance to the “Energia fatta ad arte” exhibition area in the Survival Design section, MDW 2026. Photo: RDD

the discipline. In periods of emergency and reconstruction, design has often been called upon to operate with limited materials, resources, and infrastructure, and necessity has fostered simplification, adaptation, and unconventional uses of existing resources; the post-World War II design culture, in particular, transformed the demands of reconstruction into an opportunity to redefine objects, spaces, and ways of living. It was in this vein that, as early as 1971, Victor Papanek called attention to the social and environmental responsibility of design, advocating for a design capable of responding to real needs rather than fueling consumption (Papanek, 1971).

Contemporary crises, however, are of a different nature. Scarcity does not merely coincide with the immediate absence of goods, but with the awareness of the unsustainability of a model based on the apparent unlimited availability of materials and energy: resources distributed unequally, often used inefficiently, and embedded in linear systems that accelerate their transformation into waste. The limit no longer manifests itself only in emergencies but becomes a structural condition. It is here that the concept of “design for survival” takes on a broader meaning. Designing for survival is not limited to devices intended for disasters or exceptional situations, but encompasses the need to address the many crises that threaten the continuity and quality of life. Lucia Pietroni defines it as a systemic and interdisciplinary field of design, oriented toward the protection of human and non-human life in the face of environmental, health, social, and technological threats, where survival does not mean mere biological persistence, but the preservation of dignified and safe living conditions (Pietroni, 2025; Pietroni & Turrini, 2025). Survival Design therefore does not propose an “aesthetics of emergency,” nor does it view precariousness as a virtuous condition: scarcity produces concrete and unequal consequences across territories and communities. Taking it as the subject of a design project means critically examining how resources are extracted, transformed, and made accessible. Limitation thus becomes a tool for understanding, revealing what remains hidden in ordinary systems: the dependence of daily life on complex material and energy infrastructures.

ENEA and a Culture of Energy

It is within this context that ENEA, the National Agency for New Technologies, Energy and Sustainable Economic Development, operates. Through the National Agency for Energy Efficiency, it carries out research, provides technical and

scientific support, and delivers information and training aimed at institutions, businesses and citizens. Its remit encompasses both energy technologies and the dissemination of knowledge capable of supporting the transformation of individual and collective behaviour.

This approach recognises that energy efficiency is not solely a technical issue. Improving the performance of buildings and replacing energy sources are essential components of the transition, but they are not sufficient: for change to be effective, energy must also be understood as a cultural, social and everyday dimension, linked to the way in which people inhabit spaces and use objects (Boffi et al., 2023). The national 'Italia in Classe A' programme, implemented by ENEA's National Agency for Energy Efficiency, operates precisely in this direction, moving energy away from a specialist framework and bringing it back into the sphere of everyday habits and responsibilities (ENEA, n.d.).

Research carried out in this field shows that the transition requires collaboration between different fields of knowledge - engineering, architecture, design, social psychology and communication. The book *A.A.A. Humanising Energy*, the result of a collaboration between ENEA, the Politecnico di Milano, the University of Milan and the IUAV University of Venice, interprets the transition as a process that must simultaneously engage, empower and mobilise people: raising awareness, transferring skills and encouraging forms of active citizenship (Boffi et al., 2023).

Humanising energy means bringing it back to the scale of experience: not merely a physical quantity or an economic figure, but a factor that affects health, comfort, mobility, work and the quality of spaces. In this mediation between scientific knowledge and everyday experience, design and the arts can influence the 'soft' components of the transition - behaviours, languages, cultural models - alongside the 'hard' components of energy sources, networks and technologies (Di Prete et al., 2024).

Part of this initiative is *Energia fatta ad Arte*, a project by ENEA and the Emilia-Romagna Region that brings together art, design and the production system to explore the energy embodied in objects and materials. By reinterpreting components, technologies and industrial waste, it translates otherwise invisible energy processes into works of art and narrative devices: matter appears as the result of a sequence of transformations - energy, labour, infrastructure, knowledge - and the object loses its apparent autonomy to be repositioned within the system of relationships that makes it possible. This is all the more necessary given that energy tends to become perceptible only when it is lacking.

Finally, building a culture of energy requires moving beyond an exclusively centralised and technocratic vision of the transition. Energy communities and distributed production models introduce collaborative configurations in which citizens and local areas take on an active role: a transformation that Davide Crippa and Massimiliano Cason Villa interpret through a parallel with the history of computer networks, contrasting the centralised logic of the client-server model with the distributed configurations of peer-to-peer networks (Crippa & Cason Villa, 2024). The transition thus takes on not only a technological dimension, but also a social and political one.

Conclusions

Throughout the exhibition, Survival Design brings scarcity back to its material, energetic and cultural dimensions. The shelter, designed to protect life in extreme situations, becomes a place in which to reflect on the fragility of the systems on which contemporary life depends, and on the forms of protection required in the present. This section demonstrates how design can transform limitation into a space for exploration: its potential lies not in deprivation itself, but in its capacity to generate knowledge, responsibility and new possibilities for action.

Survival design broadens this responsibility by situating design within a system of interdependent crises and calling upon it to focus on prevention, adaptation and transformation (Pietroni & Turrini, 2025). Designing in the face of scarcity therefore does not merely mean learning to live with less, but learning to see more clearly what sustains daily life: the energy embodied in objects, the value of materials, hidden infrastructure, and the capacity of communities to organise themselves. The limit thus becomes a threshold: beyond it, innovation does not mean adding products or technologies, but building more conscious and equitable relationships between materials, energy and society - and necessity can once again be transformed into vision.

Note

¹ Paragraph 1.3 was written by Davide Crippa, and paragraph 2 was written by Massimiliano Cason Villa.



Fig. 4. Photograph of the installation “Verso un lettering civile,” MDW 2022. Photo: Ghigos



Fig. 5. Photograph of the installation “Verso un lettering civile,” MDW 2022. Photo: Ghigos

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4.1.

Verso un lettering civile

Reuse, Typography, and Rights in Public Spaces

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In collaboration with
Comune di Milano - Municipio 9
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in Classe A

Project
Design Differente con Davide Crippa,
Massimiliano Cason Villa, Davide
Stanga.

Partners tecnici
Design Differente
Non Si Butta Via Niente

PEACE

TO ALL
RIGHT DEMOCRACY

Verso un lettering civile

Reuse, Typography, and Rights in Public Spaces

Letters are never neutral. They are created to communicate, guide, identify, and distinguish; in the urban space, they signal activities, build recognizability, and transform names and brands into visual presences. Signs, logos, and typefaces contribute to the city's daily definition and become embedded in the memory of those who pass through it. When a business closes or changes its identity, these signs lose the function for which they were created and become remnants of a bygone landscape.

Verso un lettering civile takes its starting point precisely from this abandoned heritage. The project recovers letters from old signs, logos, and advertising displays and strips them of their function as corporate representations: characters that differ in font, size, color, material, and origin are brought together in new compositions, in which the visual language of commerce is transformed into a tool for public communication. Reuse, therefore, concerns not only the material but the very meaning of the signs and the possibility of entrusting them with a different responsibility.

Normally, lettering serves to make a brand recognizable, to distinguish it from

Fig. 1. Photograph of the installation "Verso un lettering civile," Rifugio 87, MDW 2026. Photo: Marco Merati

competitors, and to associate certain values with a product. Here, this function is reversed: the letters no longer construct a private identity but are reassembled into words linked to human rights and the principles of coexistence. The transition is at once material, graphic, and cultural - what once served to sell returns to the public sphere to speak of peace, freedom, equality, education, dignity, and justice.

The installation comprises thirty compositions, one for each of the articles of the Universal Declaration of Human Rights (United Nations, 1948). The words do not literally translate the articles but condense their content into immediate terms capable of establishing a direct connection with the public: the Declaration thus becomes a visual and luminous landscape - not a document to be read sequentially but a constellation of values to be physically traversed.

Every word is constructed from disparate elements. Some letters retain the colors and shapes that made them recognizable in their original context, while others bear the marks of wear, erasure, and the passage of time. These differences are not corrected to achieve a homogeneous composition: they remain visible and become part of the work's language. The result is an irregular typography, in which unity does not stem from the similarity of the parts, but from their ability to contribute to a shared meaning - a distinct civic dimension, in which coexistence is not represented by a uniform form, but by the juxtaposition of different identities. The letters retain their own characteristics and, precisely because of their differences, make the word possible: a visual metaphor for society as a shared structure that does not erase singularities but recomposes them into a collective project.

The original memory of the signs also remains active. The letters are not rendered anonymous and do not entirely cease to refer to the signs from which they originate: their former commercial affiliation remains perceptible as a trace, in a tension between old and new meanings. It is in this gap that much of the project is concentrated - the sign is not replaced but reinterpreted, and its material past is not hidden but incorporated into the present message.

The recovery of these signs thus takes on a significance beyond simple recycling. It is not merely a matter of avoiding the production of new elements or extending the life of materials destined for disposal: the design process intervenes on the cultural structures associated with the objects and demonstrates how reuse can also be semantic, in line with a broader culture of not discarding what already exists (Crippa, 2023). A letter has material value, but it also carries a visual identity, an imagery, and a communicative function: reusing it means working

on all these levels together.

Light completes the transformation. When the compositions light up, the words take on a physical presence, and energy becomes the condition that allows the message to manifest itself. The term “energy” does not appear among the words in the installation: its presence remains silent, embodied in the very act of illumination. In the book *A.A.A. Humanizing Energy*, the work is interpreted precisely through this relationship - energy enters terms such as “peace,” “equality,” and “education” via an “E” that becomes a common and symbolic element, linking the technical dimension of lighting to human and collective values (Boffi et al., 2023).

The installation is in fact part of the DE-Sign research initiative, promoted by ENEA’s Energy Efficiency Unit as part of the “Italia in Classe A” program, which approaches the energy transition not only as a technological issue but as a cultural process requiring new languages and forms of awareness. Verso un lettering civile does not provide data on consumption nor describe infrastructure: it operates on another level, establishing a connection between energy and values. Light is not merely a resource to be used efficiently, but the condition that makes a message visible, and energy consumption takes on a symbolic and relational dimension.

This approach is consistent with the concept of “humanizing energy,” according to which the transition must involve technical, cultural, and behavioral components alike. Design and the arts influence the ways in which energy is perceived and communicated, building a vocabulary capable of bringing people closer to complex phenomena: innovation concerns not only energy sources and infrastructure but also the meanings that a society associates with energy (Di Prete et al., 2024).

First presented in the Bovisa neighborhood during Milan Design Week 2022, the project returns in 2026 as part of *100 cose da non dimenticare*, and its new location at Rifugio 87 profoundly alters its interpretation. The words dedicated to human rights are placed within a space built during World War II to protect the civilian population from bombing: terms such as freedom, dignity, peace, and equality thus enter into dialogue with the material memory of the shelter and with the events that led to its creation.

This place makes it clear that rights are neither abstract concepts nor definitive achievements: their formulation stems from concrete historical experiences, from conflicts and hardships that have made common principles a necessity. In the shelter, the Universal Declaration appears not merely as an institutional

reference but as a cultural and political response to a reality marked by violence, fear, and loss; and the luminous words establish a connection between that memory and the present, reminding us that civic values require care, interpretation, and constant renewal.

It is no coincidence that the installation brings the Rifugio 87 exhibition route to a close: the words guide the visitor towards the exit and become the last thing they encounter before returning to the city. The end of the exhibition does not mark a halt to the narrative - the transition from the underground space to the urban environment transforms the visitor into a potential bearer of the values they have just encountered. The lettering thus returns to its original function of wayfinding, but its purpose changes: it does not indicate a shop or a service, but symbolically guides behaviour and offers a lexicon through which to interpret collective life.

This is the meaning of the expression 'civil lettering': not designing the corporate identity of an institution, but exploring the possibility that the tools of visual communication might assume a public responsibility. Shapes, typefaces and signs are not merely aesthetic surfaces: they help to construct the collective imagination and can either reinforce or challenge the values that permeate society. Within the context of the exhibition, the project thus engages with a dual memory: on the one hand, it preserves and reactivates fragments of the commercial landscape, rescuing from oblivion signs destined for the scrap heap; on the other, it evokes words and principles that cannot be taken for granted once and for all. Matter and language are preserved through transformation, not through immobility - and reuse becomes a form of rewriting: the letters survive the disappearance of the activities for which they were created, but their future is not determined by the past. A new combination allows them to take on a different meaning; the project suggests that the same possibility applies to the languages of the city - visual systems created for consumption that can be reactivated to foster awareness, memory and collective responsibility.



Fig. 2. FPhotograph of the installation “Verso un lettering civile,” Rifugio 87, MDW 2026. Photo: RDD



Fig. 3. Photograph of the installation “Verso un lettering civile,” Rifugio 87, MDW 2026. Photo: RDD

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4.2.

Energia fatta ad arte

The Energy History of Matter

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Repubblica del Design

In collaboration with
Agenzia nazionale per le nuove
tecnologie, l'energia e lo sviluppo
economico sostenibile – ENEA
Regione Emilia Romagna



Nuovi sguardi per la transizione energetica

MISSIONE DEL PROGETTO

Creare e diffondere nuovi modelli energetici che integrano l'energia rinnovabile con l'uso di tecnologie innovative e creative, e la produzione energetica privata, attraverso la gestione innovativa delle risorse, la riduzione dei costi e la valorizzazione degli spazi.

CONVULSIONE CREATIVA E DELLE IMPRESE

Implementare modelli innovativi di produzione energetica, basati su tecnologie innovative e creative, e la produzione energetica privata, attraverso la gestione innovativa delle risorse, la riduzione dei costi e la valorizzazione degli spazi.

MISSIONE CULTURALE

Creare e diffondere nuovi modelli energetici che integrano l'energia rinnovabile con l'uso di tecnologie innovative e creative, e la produzione energetica privata, attraverso la gestione innovativa delle risorse, la riduzione dei costi e la valorizzazione degli spazi.

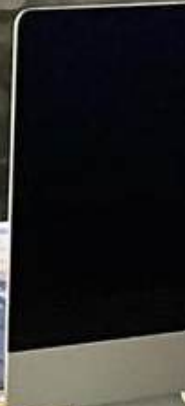
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Energia fatta ad arte

The Energy History of Matter

Energy runs through every object, yet it rarely allows itself to be observed. It is needed to extract and transform raw materials, to power machines, to transport components, to make the use of products possible; and yet, when we stand before a finished artefact, the network of processes that brought it into being tends to disappear. Matter presents itself as a stable, self-sufficient presence, while the energy embodied in its production remains in the background.

Energia fatta ad Arte arises from the intention to make this hidden dimension visible. Conceived and produced by the Emilia-Romagna Region and ENEA, in collaboration with Art-ER and the regional network of the Clust-ER and of the Responsible Innovators, the competition is part of the agreement between the Region and ENEA for the promotion of sustainability and the energy transition, completing the Regional Energy Plan (ENEA, 2026; Regione Emilia-Romagna, 2026).

Through an open call launched in October 2025, the project invited artists and designers under 40 to work with objects, technologies and materials made available by local companies: hemp fibres, recycled plastics, eco-resins, electronic

Fig. 1. Photograph of the “Energia fatta ad arte” installation, Rifugio 87, Milan MDW 2026. Photo: RDD

components, hospital gowns, keyboards, washing-machine parts, fluorescent lamps, technical instruments and other production residues or semi-finished goods. A jury selected twenty-one finalist projects, which were then developed into completed works, awarding seven of them during Arte Fiera 2026 in Bologna (ENEA, 2026).

The energy biography of matter

The collaboration with companies is not merely a way of sourcing materials. Every object made available carries with it a productive sector, a function and a set of technical processes: it is not handed to the authors as a neutral surface, but with a history and an already-given relationship with energy, which the artistic intervention takes up as material for interpretation.

Antonio Disi, head of the ENEA Laboratory for the promotion of energy efficiency, describes objects as bearers of a genuine “energy biography”: the resources extracted, the production processes, the digital networks and the waste that accompany their life. These are passages that normally remain invisible and that, according to Disi, art and design have the capacity to make perceptible and close to experience (ENEA, 2025).

The expression changes the way an artefact is observed. A biography implies a succession of events and transformations: the object, too, has a before and an after - it comes from extracted and processed materials, passes through plants and infrastructures, is transported, used and finally discarded, recovered or disposed of. Energy is not an attribute added from the outside, but the thread connecting these passages.

The exhibition brings this history to the foreground without turning it into a captioned sequence. The works are neither technical illustrations of consumption nor quantitative diagrams: they act through form, matter and experience, inviting the public to recognise in objects a complexity that everyday use conceals. Energy can be measured, but it must also be imagined, and it acquires cultural relevance when it is connected to behaviours and to the material consequences of choices (Boffi et al., 2023; Di Prete et al., 2024).

The title itself sums up this encounter: *Energia fatta ad Arte* can be read as the transformation of energy into a work of art, but also as an acknowledgement of the energy required to make art. Artistic production is not foreign to material systems - it uses resources, technologies, transport, display devices - and the

project does not place art outside productive processes, but invites it to interrogate the conditions that make its own existence possible.

The works thus emerge from a collaboration on several levels: companies provide materials and know-how, energy specialists accompany the authors, and artists and designers produce interpretations that return the complexity of matter to the public. Science, production and creativity thus converge in reading the challenges of the present: at the awards ceremony, the Vice-President of the Emilia-Romagna Region, Vincenzo Colla, pointed precisely to the fusion of science, enterprise and art as a way of recounting the transformations of our time (ENEA, 2026).

The variety of materials feeds the plurality of the works: natural fibres and recycled plastics refer back to the cycles of matter, electronic components and hardware reveal the physicality of digital infrastructures, hospital gowns and appliance parts introduce objects bound up with care, labour and domestic life. Shifted from the productive context to the exhibition one, these objects become legible in a different way - no longer only for what they allow us to do, but for the resources they contain and for the end-of-life scenarios they open up. The artistic operation slows the gaze and interrupts the automatism with which objects are used and replaced.

Inside Rifugio 87, within Survival Design

In Rifugio 87, *Energia fatta ad Arte* becomes part of the Survival Design section, in dialogue with the theme of scarcity and with the parallel between post-war reconstruction and contemporary crises. The space that hosts the works is itself the product of a limit-condition: an architecture built to protect the civilian population in a situation of emergency. The contrast is significant, because industrial materials and contemporary technologies are exhibited in a place where the availability of light, air and energy could not be taken for granted.

Energy, today perceived as a continuous and invisible service, here returns to being a fundamental condition of habitability; the shelter reminds us how quickly what seems ordinary can become scarce. The project does not, however, construct a catastrophic narrative: it takes the crisis as an occasion to recognise resources and to imagine different possibilities. The residues made available by the companies are not only evidence of the environmental impact of production, but materials capable of entering new cycles of meaning - proof that change can begin with a different interpretation of what already exists.

This perspective links *Energia fatta ad Arte* to the broader theme of design for survival. Designing within scarcity does not mean only reducing the quantity of matter or energy employed, but learning to recognise its value, making dependencies visible and building systems capable of adapting; and creativity becomes a tool for questioning the apparent inevitability of the linear processes of production, consumption and waste. What emerges is a form of energy literacy grounded in experience, in which the visitor is called not merely to understand that every product requires energy, but to recognise it in the concrete features of matter, in the traces of processes, in the transformations carried out by the authors.

Within *100 cose da non dimenticare*, what is preserved is therefore not a single object, but an awareness of its history. To remember the energy biography of matter means recognising that no artefact comes from nothing, and that no act of disposal entirely erases the resources used to produce it. *Energia fatta ad Arte*, ultimately, presents the transition as a question also of cultural imagination: new technologies, efficiency and renewable sources remain indispensable, but they must be accompanied by a different capacity to see objects and the systems that generate them. To make energy visible means also to make visible the responsibilities, the possibilities of transformation and the ties between production, the environment and everyday life.



Fig. 2. Photograph of the “Energia fatta ad arte” installation, Rifugio 87, Milan MDW 2026. Photo: RDD



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Fig. 4. Photograph of the “Energia fatta ad arte” installation, Rifugio 87, Milan MDW 2026. Photo: RDD

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5.

TECHNÉTECA

A repository of expertise for sustainable design

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NonSiButtaViaNiente

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From the Materioteca to the Technéteca

A Repository of Expertise for Sustainable Design - Rifugio 87, Milan Design Week 2026

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Fig. 2. Photograph of the “Technéteca” installation, Rifugio 87, MDW 2026. Photo: Marco Merati



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5.1.

PASSATO

Autarky, Scarcity, and Invention: An Archaeology of Material Culture

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PASSATO

La base dell'economia circolare affonda le proprie radici in condizioni di necessità, generate dalla carenza di risorse che ha segnato i primi decenni del Novecento. In questo contesto emergono i materiali autarchici, espressione di una risposta progettuale capace di trasformare la difficoltà in opportunità, attraverso ingegno, adattamento e sperimentazione.

All'interno di TechnéTECA, questo passaggio storico è evocato attraverso materiali visivi e documentali che restituiscono un episodio significativo della cultura produttiva italiana, mettendo in luce come pratiche nate da una condizione di scarsità anticipino i principi oggi riconducibili all'economia circolare.

SENTE

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e di racconto tra
e pratica, rendendo
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la spazialità più
e responsabile.

GRUPPO "SARDELLA"



PASSATO

Autarky, Scarcity, and Invention: An Archaeology of Material Culture

The temporal narrative of the Technéteca sets out from the past and, in particular, from a circumscribed and in many respects controversial episode in Italian industrial history: the autarkic season running from the early 1930s to 1944. The choice does not respond to a merely chronological need nor to antiquarian curiosity, but to a precise affinity of problems. Autarchy represents, in fact, the moment in which Italian design culture systematically experimented with scarcity as a generative condition, transforming the constraint on raw materials into a research programme on materials, processes and supply chains. It is a question that returns today with urgency, though for profoundly different reasons: the climate crisis, geopolitical instability, the fragility of supply chains and the progressive depletion of resources once again compel design to operate within limits, to substitute what is scarce, to valorise what is locally available and to reduce waste. As Federica Dal Falco observes in the volume *Prodotti autarchici 1930–1944. Architettura, design, moda*, taken here as the principal reference, the interest of this perspective does not lie in a nostalgic re-reading of the historical period, but in the possibility of observing how design confronted problems that return today to the

Fig. 1. Photograph of the “Passato” section at “Technéteca,” Rifugio 87, Milan, MDW 2026. Photo: Marco Merati

centre of the debate on sustainability, on the availability of resources and on the resilience of productive supply chains. Reconsidering that material legacy does not, however, mean rehabilitating its political context: the autarkic season was traversed by profound contradictions and unfolded within a totalitarian regime, a war economy and, from 1938, the promulgation of the racial laws, which drove many scholars away from scientific and technical research. The aim is rather to isolate a methodological core - the relationship between constraint, innovation and matter - that retains a surprising relevance. It is no coincidence that some recent studies have re-read autarchy as an “involuntary laboratory of the green economy”, in which solutions born of contingent necessity anticipated, in form if not in intention, principles today associated with the circular economy.

On the historical level, autarkic policy had its roots in the early 1920s - with land reclamation and the “battle for grain” - but underwent a drastic acceleration after the economic sanctions resolved by the League of Nations on 11 October 1935, following the war in Ethiopia. From that moment the regime aimed at rigorously national production, to be achieved by working on two fronts: the consolidation and strengthening of existing goods, and the experimentation with new products capable of substituting the scarce raw materials. In his speech of 23 March 1936, Mussolini summed up the programme in a single postulate: to achieve in the life of the Nation, in the shortest possible time, the maximum of economic autonomy and, consequently, of political autonomy.

The cardinal principles on which that programme was founded are striking for their assonance with the contemporary lexicon of sustainability: the saving and rationalisation of consumption, the reduction of dependence on fossil sources such as coal, the recycling of public and private waste, energy efficiency, food sovereignty, the recourse to renewable raw materials and energies, the use of natural fibres, electric mobility and energy self-sufficiency. Between 1923 and 1940 the electrified railway network grew from 700 to 5,200 kilometres, powered by the national hydroelectric basins precisely in order to reduce coal consumption; in the chemical and mining industries, substitute fuels were studied, alloys derived from bauxite to replace copper, and the use of pyrite ash and national ferrous minerals. Alongside this economic programme came a cultural and aesthetic dimension: the appeals of Gio Ponti and Piero Bottoni in favour of a modern national production - capable of equipping Italian homes with materials, furnishings and finishes on a par with foreign ranges - met the regime’s political choice, giving form to what Dal Falco calls an “autarkic aesthetic” destined to last until the end of the war.

The most tangible effect of this season was an extraordinary proliferation of materials derived from the resources of the territory. From the pumice deposits of Canneto-Lipari came pumice-cement agglomerates; from the Sardinian cork forests came insulating materials, flooring and linoleum; from the bauxite mines of the central Apennines, Istria and Abruzzo came the light alloys intended to replace scarce copper; from the sands of the Grosseto area came glass materials; from the sawmills of the Alpine valleys came wood and its derivatives such as Masonite, Buxus and Plymax; from the liquorice roots of Calabria and Sicily came organic coatings such as Maftex. On the textile front, milk derivatives provided wool substitutes - first among them Lanital, a protein fibre obtained from casein - while hemp, broom, esparto and sisal agave fed the production of fibres, flanked by cellulose-based Rayon; completing the picture, plasters, paints and enamels of new formulation.

Behind this list one recognises a recurrent design logic: to identify a national resource or an available by-product and bring it back to a material capable of substituting an import. Linoleum, obtained by binding cork powder and linseed oil, translated an abundant renewable resource - Sardinian cork - into a resistant and hygienic flooring; Lanital converted a derivative of the dairy industry into a textile fibre; Masonite and the other derived panels returned value to wood waste and semi-finished products. It is significant that linoleum itself, the autarkic material par excellence, shares with many plastics of the period the same ambition - to replace noble and costly materials with compounds obtained from local resources - albeit starting from an organic rather than a synthetic base. Dal Falco describes this dynamic through an effective metaphor: there exists a "Darwinism of materials", a capricious selection in which some products disappear and others - substitutes in particular - evolve into new genera, constituting an uninterrupted chain in continuous transformation. It is precisely this chain that the *Tecnéteca* intends to make legible.

Observed from this perspective, autarkic materials dialogue in a surprising way with the experiments documented in the sections devoted to the present and the future. The gesture of linoleum - making a building material out of a local and renewable resource - returns in the radiant panels of MAARMO, which recover waste marble dust from stone processing and, in the UbriAAco and AArtichoke variants, combine it with grape pomace and artichoke waste; the same principle animates the Pannello Ecologico of the Gruppo Saviola, obtained 100% from post-consumer wood, and the recovery practices of Gees Recycling or Coffee-from, which set out respectively from plastic waste and coffee grounds. Where

autarchy valorised a national deposit, contemporary research valorises a waste stream: in both cases a marginal or residual material becomes a design resource. The substitution of textile fibres offers a second parallel. To Lanital and the fibres from hemp, broom and agave correspond today the surfaces of Highsociety Studio, which employ hemp, tobacco and grape pomace while keeping visible the traces of the biomass of origin, and the Algi-Yarn threads based on sodium alginate produced with open-source desktop machines. Similarly, the reconstituted-wood panels of the 1930s - Masonite, Buxus, Plymax - are echoed by the industrial-scale regeneration of post-consumer wood, while the pumice-and-cement agglomerates can be set beside contemporary mineral composites: from the cold-produced panels of MAARMO to the Lithos bio-leather, developed from basaltina and travertine powders in biopolymer matrices, to the rock wool of the Rockfon acoustic systems.

The comparison, however, must also hold firm to the discontinuity. The autarkic substitute was born of a logic of national self-sufficiency and military preparation, within a closed market, and often took the form of a fallback with inferior performance compared to the material it replaced. The contemporary circular neo-material, by contrast, sets out from an ecological responsibility and measures itself against requirements of compostability, recyclability and second life, within open, collaborative and sometimes open-source supply chains. What the two seasons share is therefore not the end, but a way of thinking about matter: no longer the arrival point of a process aimed at optimising its efficiency, but rather - to use the words of Ezio Manzini recalled in the introduction to the section - “itself matter for invention”.

To begin from the past, then, means recognising a genealogy. The technical literature of the period - manuals, specialised journals, advertising inserts - constitutes, according to Dal Falco, a kind of “deposit of material culture” from which to draw in order to carry out surveys on the history of things. The Technéteca gathers this legacy and relaunches it: it preserves not objects, but the conditions that made their realisation possible, so that today’s experiments can be observed, compared and assessed within a wider temporal arc. The “Darwinism of materials” described by Dal Falco has not stopped: it has continued, changing sign, from the scarcity imposed by war to the scarcity imposed by planetary limits. The section devoted to the past does not ask us to return to autarchy, but to learn its most enduring lesson - that constraint, far from being merely an obstacle, can become the principal engine of material invention - and to transmit it to the two temporalities that follow.

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5.2.

PRESENTE

Materials and processes for a circular design - Rifugio 87, Milano
Design Week 2026

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GRUPPO SAVIOLA

Gruppo industriale articolato in quattro business unit: legno, ceramica, arredo e packaging. Integra aziende nazionali e internazionali all'interno di un modello produttivo basato su sinergie verticali e orizzontali.

Riconosciuto tra i principali player mondiali nel ruolo del legno per la concezione dell'Agape in sistema sostenibile, orientato alla generazione della materia, trasformando le foreste in nuove risorse produttive. La sua filosofia si fonda su una visione etica e ambientale della produzione. In cui il recupero dei materiali diventa principio generatore per nuovi usi e forme della materia.

COFFEFRON

Il Coffeefron è un contenitore per caffè, realizzato in legno, che si apre a 180° e si trasforma in una tazzina. È un oggetto che unisce la funzionalità e l'estetica, e che è stato progettato per essere utilizzato in modo sostenibile.

BUCKFRON

Il Buckfron è un contenitore per buck, realizzato in legno, che si apre a 180° e si trasforma in una tazzina. È un oggetto che unisce la funzionalità e l'estetica, e che è stato progettato per essere utilizzato in modo sostenibile.

PIREXAS

Il Pirexas è un contenitore per pirex, realizzato in legno, che si apre a 180° e si trasforma in una tazzina. È un oggetto che unisce la funzionalità e l'estetica, e che è stato progettato per essere utilizzato in modo sostenibile.

HIGH SOCIETY STUORO

Il High Society Sturo è un contenitore per sturo, realizzato in legno, che si apre a 180° e si trasforma in una tazzina. È un oggetto che unisce la funzionalità e l'estetica, e che è stato progettato per essere utilizzato in modo sostenibile.

FUTURE

Il Future è un contenitore per future, realizzato in legno, che si apre a 180° e si trasforma in una tazzina. È un oggetto che unisce la funzionalità e l'estetica, e che è stato progettato per essere utilizzato in modo sostenibile.

SPICE MIXTOLING

Il Spice Mixtoling è un contenitore per spice, realizzato in legno, che si apre a 180° e si trasforma in una tazzina. È un oggetto che unisce la funzionalità e l'estetica, e che è stato progettato per essere utilizzato in modo sostenibile.

PRESENTE

Materials and processes for a circular design - Rifugio 87, Milano Design Week 2026

The section devoted to the Past showed how, in the Italy of autarchy, the scarcity of raw materials had transformed a constraint into an involuntary laboratory of innovation: substitutes, plant fibres and reconstituted materials born of the need to do without what was not there. The Present of the Technéteca takes up the legacy of that gesture and relocates it within a radically different horizon. Today the impulse to reinvent materials arises not from the isolation of a closed economy nor from a logic of national self-sufficiency, but from ecological awareness: from the need to reduce the extraction of virgin resources, to close productive cycles and to return value to what supply chains normally discard. The thread linking the two temporalities is the same - making a resource out of a waste - but its reasons, its tools and its scale change profoundly.

To speak of “the present”, in an exhibition built around memory, does not mean confining oneself to displaying the products of the moment. It means identifying the threshold at which research on materials ceased to be a laboratory promise in order to become a productive practice: the point at which innovation measures itself against industrial volumes, environmental certifications, verifiable technical

Fig. 1. Photograph of the “Presente” section installation, “Technéteca,” Rifugio 87, Milan, MDW 2026. Photo: Marco Merati

performance and real markets. It is an operative dimension, made of consolidated processes more than of prototypes, and for this reason entrusted predominantly to the account of companies - because it is in the enterprise that circularity, in order truly to make an impact, must become a system.

The experiences gathered here return a deliberately heterogeneous panorama: socially oriented start-ups and large industrial groups, research studios and historic manufacturing firms, bio-based materials and technical systems for construction. What they have in common is neither size nor sector, but a way of interpreting the ecological transition in concrete terms, translating the idea of circularity into measurable objects - panels, compounds, modular systems - many of which find application precisely in the exhibition-design sector, the very one the exhibition calls into question when it asks how to exhibit sustainably.

Many of these materials, moreover, are not only the object of the exhibition: they are potentially its very matter. Regenerated panels, recycled composites and re-configurable modular systems respond directly to the question that runs through the entire exhibition project - how to install sustainably, doing more with less - and make the Technéteca not a showcase of products, but an operative repertoire on which exhibition design can draw (Repubblica del Design, 2026).

It is in this passage that the traditional materials library, understood as a sample book of surfaces and test pieces to touch, is transformed into a Technéteca: no longer merely an archive of materials, but an archive of processes, supply chains and knowledge. What these companies bring to the exhibition is not simply a finished material, but the chain of technical, environmental and economic choices that makes it possible. From this perspective design does not merely draw the form of a product, but acts as an infrastructure of connection between research, industry and design practice (Manzini, 2015), making legible what normally remains invisible: the provenance of the matter, the energy it embodies, its end-of-life destiny.

Documenting these practices is not a neutral gesture. In an exhibition that makes memory its critical instrument, recording what industry is already doing means removing innovation from the logic of the isolated episode and transforming it into shared heritage: making visible the processes that normally remain hidden, putting competences into circulation, creating the conditions for a solution tested by a single firm to become a reference for others. It is in this sense that the Present of the Technéteca looks as much to today as to tomorrow.

All the experiences gathered share one and the same reversal of gaze: waste is not an arrival point, but a starting point. Whether it be coffee grounds, marble dust,

thermosetting plastics, discarded wood or agri-food residues, the waste matter is brought back to the beginning of a new cycle, following the logic by which the product of one process becomes the nourishment of another (McDonough & Braungart, 2002). From this common principle, however, a plurality of strategies branches out - synthesis of bio-based compounds, mechanical recycling, large-scale industrial regeneration, cold aggregation - which it is worth anticipating, before the individual data sheets supply their figures and details.

It is not incidental that almost all of these experiences are rooted in Italian territory, distributed across Lombardy, Veneto, Friuli and Alto Adige. The variety of the waste streams from which they set out - the coffee of a metropolis, the marble of a stone district, the wood of furniture, the grape pomace of a winery, the composites of an industrial supply chain - returns, in backlight, the productive geography of the country, its manufacturing excellences and, together with them, its residues (Marchi & Nardin, 2008; Giordano et al., 2016; De Marchi et al., 2017; Ostanel et al., 2019). To recover a waste also means to recognise and valorise the territory that generates it.

A first group of experiences sets out from organic and agri-food waste. Coffee-from transforms industrial coffee grounds - one of the most widespread organic residues in the world - into bio-based thermoplastic compounds, capable of substituting a share of fossil-origin plastics and of building, around an everyday waste, an entirely Italian supply chain. Highsociety Studio works instead on bio-masses such as hemp, tobacco and grape pomace, developing materials in which the traces of origin remain deliberately visible: the fibrous green of hemp, the brown hues of tobacco, the deep shades of grape pomace become a narrative of provenance, and the waste becomes a bearer of territorial identity even before performance.

A second group arises from mineral matter. Maarmmo recovers the marble dust produced by stone processing and, through a cold process that requires no firing, transforms it into low-energy radiant panels, entirely re-grindable at end of life; in the UbriAAco and AArtichoke experiments it pushes recovery beyond the stone sector, contaminating marble with grape pomace and artichoke waste. Rockfon, part of the Rockwool group, brings into the Technéteca the rock wool of its acoustic systems: with the Canva range it combines high sound absorption, 100% recycled-polyester facings and PVC-free aluminium frames, within a system conceived from the outset to be disassembled, replaced and recycled.

A third group addresses waste on a fully industrial scale. The Gruppo Saviola has, for over sixty years, founded its production on the recovery of post-consumer

wood - discarded furniture, pallets, packaging, demolition materials - which a network of over thirty centres collects and regenerates: its Pannello Ecologico, made 100% from recycled wood, is one of the first industrial examples of complete valorisation of wood waste on a large scale (Mancini, 2024; Elle Decor Italia, 2024; Civita, 2025). Gees Recycling tackles instead one of the most difficult frontiers of recycling, that of thermosetting plastics and composites - fibreglass, polyurethane, expanded PVC and PET - notoriously hard to reuse: its Recomplax is a panel obtained predominantly from recycled materials and itself entirely recyclable, documented by an environmental product declaration (Gassmann, 2021; Polimerica, 2025).

Set in a row, these six experiences trace the map of the roads already passable: not prototypes confined to the laboratory, but certified materials, produced and placed on the market, capable of substituting virgin resources in fields ranging from furniture to construction, from acoustics to exhibition design. They demonstrate that circularity is not only a horizon to be awaited, but an industrial practice already under way, with its figures, its standards and its economies. The data sheets that follow recount in detail their processes, applications and environmental results; taken together, they constitute the bridge between the lesson of the Past - scarcity as an involuntary engine of invention - and the research of the Future, in which experimentation once again pushes beyond the threshold of what is already productive, towards the materials and living systems of tomorrow.

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5.2.1. Gruppo Saviola

Year of foundation

1963

Location

Viadana (Mantua), Italy

Profile

Gruppo Saviola is one of the leading European players in the wood-furniture sector and represents one of the most advanced examples of circular economy applied to industrial production. For over sixty years the company has developed a production model founded on the recovery and regeneration of post-consumer wood, transforming materials destined for disposal into new resources for the furniture and interior-design sector. Through an integrated system that comprises collection, sorting, transformation and production activities, the Group has built a circular supply chain capable of combining industrial innovation, environmental sustainability and design quality.

Activity and process

The Group's activity is based on the recovery of post-consumer wood deriving from discarded furniture, pallets, crates, packaging, industrial offcuts, demolition materials and other selected wood waste. Through a network of over thirty centres distributed across Italy and Europe, the material is collected, separated from metals and other components, cleaned and subsequently transformed into wood particles intended for the production of new panels.

Fig. 1. Pannello Ecologico®. Foto: Gruppo Saviola



This process makes it possible to extend the life cycle of wood while avoiding recourse to new virgin raw material. Each year the Group recovers around 1.65 million tonnes of post-consumer wood, contributing to the saving of millions of trees and to the reduction of the emissions associated with the production of furniture materials. The production model is conceived as a circular system in which the material, once transformed into a panel and subsequently into a finished product, can be recovered again and reintroduced into the industrial cycle.

Materials and applications

The company's emblematic product is the Pannello Ecologico® (Ecological Panel), made 100% from regenerated post-consumer wood. It is a material intended for the furniture and interior-design sector that represents one of the first industrial examples of complete valorisation of wood waste on a large scale. The panel is available in numerous technical variants, including fire-retardant and water-repellent versions, and forms the basis for a wide range of semi-finished products, melamine panels, laminates and cladding systems.

The design dimension of the material is of particular relevance. The Pannello Ecologico® is in fact available in over a thousand decors and numerous finishes inspired by woods, stones, marbles, fabrics and other material surfaces, making it possible to integrate environmental performance with the aesthetic needs of contemporary architecture. The main fields of application include residential furniture, the contract and Ho.Re.Ca. sector, offices, commercial spaces and exhibition installations. Thanks to the traceability of the supply chain, the environmental certifications and the possibility of being recycled again at end of life, the Pannello Ecologico® configures itself as a material that concretely interprets the principles of the circular economy within the design and furniture supply chains.



Fig. 2. Mauro Saviola, the eco-friendly panel. Photo: Saviola Group

5.2.2. Gees Recycling

Year of foundation

2010

Location

Pordenone, Italy

Profile

Gees Recycling is a company specialised in the recovery and valorisation of thermosetting plastic waste. Founded in Pordenone in 2010, it operates in the circular-economy sector, developing solutions for the treatment and transformation of composite and polymeric materials that are difficult to recycle. In collaboration with Area Science Park in Trieste, the company has developed and patented a technology that makes it possible to reintroduce such materials into new production chains, contributing to the reduction of landfill disposal and to the valorisation of highly complex waste streams. In 2014 it was the first European entity to obtain the CSI “Recycled Composite” certification, while since 2018 it has operated through a pilot plant authorised by the Friuli Venezia Giulia Region with a recovery capacity of around 9,000 tonnes per year.

Activity and process

Gees Recycling’s activity focuses on the recovery of thermosetting plastic and composite materials deriving from industrial processes, including fibreglass

Fig. 1. Photograph of the custom design production process. Photo: Gees Recycling



(CFR), rigid expanded polyurethane, expanded PVC and expanded PET. These materials, traditionally difficult to recycle on account of their chemical structure and the limited possibilities of reuse, undergo a proprietary mechanical process that enables their transformation into new resources for the manufacturing sector.

Alongside its recovery activities, the company offers a technical-consultancy component aimed at businesses, supporting them in the analysis of waste streams, in the optimisation of internal logistics and in the development of recycling and valorisation strategies. The process comprises the characterisation of the materials, the design of pre-treatment and compaction systems, the recovery of the waste and its transformation into new semi-finished products. The approach adopted aims not only at the downcycling of materials, but above all at the generation of higher-value-added applications through upcycling processes.

Materials and applications

The main outcome of the process developed by Gees Recycling is Recomplax, a panel obtained predominantly from recycled materials and itself completely recyclable. The composition of the material is adapted according to the characteristics of the recovered matrices and the performance required by the final application, making it possible to modulate density, mechanical properties and aesthetic characteristics.

Recomplax finds application in the construction, prefabrication and furniture sectors, where it can substitute traditional materials such as water-repellent woods and synthetic stones. The panel can be worked using common carpentry techniques, including cutting, milling, screwing, lamination and painting. Among its main characteristics are resistance to humidity, dimensional stability, the absence of formaldehyde and resistance to bacterial proliferation in damp environments. The material is also accompanied by an Environmental Product Declaration (EPD) compliant with the ISO 14025 standard, which documents its environmental performance throughout the life cycle.



Fig. 2. Panels made from recycled composites. Photo: Gees Recycling



Fig. 3. Cutting board made from recycled expanded plastic composites. Photo: Gees Recycling

5.2.3. Coffeefrom

Year of foundation

2021

Location

Milan, Italy

Profile

Coffeefrom is an innovative, socially oriented start-up that develops bio-based materials through the valorisation of industrial coffee grounds. The company works with the aim of transforming one of the most widespread organic wastes worldwide into a new resource for the materials sector, building an entirely Italian supply chain that connects the food industry, research, design and manufacturing. Through a model of industrial symbiosis, Coffeefrom promotes the shift from a logic of disposal to one of valorisation, in which the residues of one supply chain become raw material for new production processes.

Activity and process

The company's activity focuses on the recovery and transformation of coffee grounds deriving from industrial processes. Coffeefrom manages the entire waste-valorisation chain, from the collection and logistics of the material to the development of new bio-based thermoplastic compounds intended for the manufacturing industry. The approach adopted aims to substitute a significant share of

Fig. 1. Photography barretta Coffeefrom bio based. Foto: CoffeeFrom



the fossil raw materials used in the production of plastic materials, integrating up to 30% of recovered coffee within polymer matrices of biological origin. Research also extends to the development of new high-value-added applications based on the nanocellulose extracted from coffee grounds, with the aim of obtaining materials characterised by improved technical and environmental performance. Through this model, the coffee ground is reinterpreted not as organic waste to be disposed of, but as a resource capable of feeding new production chains and contributing to the transition towards a circular bioeconomy.

Materials and applications

The materials developed by Coffeefrom are bio-based thermoplastic compounds obtained from the combination of polymer matrices and recovered coffee grounds. These materials can be employed in the production of objects, components and products intended for the packaging, design and industrial-application sectors. The use of coffee gives the materials a strong material identity and contributes to reducing the use of fossil-origin plastic.

The company's approach is founded on building a new material infrastructure based on organic waste, in which technical innovation, environmental sustainability and social inclusion converge within a single production model. Coffeefrom currently valorises around 700 tonnes of coffee grounds per year, avoiding land-fill disposal and contributing to the reduction of the emissions associated with their decomposition. According to company data, this process makes it possible to avoid around 350 tonnes of CO₂ per year and to reduce the carbon footprint of the final products by between 20% and 35% compared with alternatives based exclusively on fossil plastic.

estratta dai fondi di caffè, con l'obiettivo di ottenere materiali caratterizzati da migliori prestazioni tecniche e ambientali. Attraverso questo modello, il fondo di caffè viene reinterpretato non come rifiuto organico da smaltire, ma come una risorsa capace di alimentare nuove filiere produttive e contribuire alla transizione verso una bioeconomia circolare.

Materiali e applicazioni

I materiali sviluppati da Coffeefrom sono compound termoplastici bio-based ottenuti dalla combinazione di matrici polimeriche e fondi di caffè recuperati. Questi materiali possono essere impiegati nella produzione di oggetti, componenti e prodotti destinati ai settori del packaging, del design e delle applicazioni industriali. L'impiego del caffè conferisce ai materiali una forte identità materica e contribuisce alla riduzione dell'utilizzo di plastica di origine fossile.

L'approccio dell'azienda si fonda sulla costruzione di una nuova infrastruttura materiale basata sugli scarti organici, in cui innovazione tecnica, sostenibilità ambientale e inclusione sociale convergono all'interno di un unico modello produttivo. Attualmente Coffeefrom valorizza circa 700 tonnellate di fondi di caffè all'anno, evitando il conferimento in discarica e contribuendo alla riduzione delle emissioni associate alla loro decomposizione. Secondo i dati aziendali, questo processo consente di evitare circa 350 tonnellate di CO₂ all'anno e di ridurre l'impronta carbonica dei prodotti finali tra il 20% e il 35% rispetto alle alternative basate esclusivamente su plastica fossile.

5.2.4. Highsociety studio

Year of foundation

2020

Location

Alto Adige (South Tyrol), Italy

Profile

Highsociety Studio is a design and research studio specialised in material innovation and in the development of sustainable products based on resources of biological origin. Through an approach that integrates material experimentation, product design and environmental sustainability, the studio investigates the potential of agri-food waste as raw material for new applications. Its research focuses on the transformation of agricultural and organic residues into bio-based materials capable of substituting conventional, high-impact resources, promoting production models oriented towards circularity and regeneration. The studio's activity sits at the intersection of design, agriculture and material innovation, with the aim of strengthening the bond between people, environment and production processes.

Activity and process

Highsociety Studio's activity is founded on the valorisation of by-products and residues deriving from local agri-food supply chains. Through research and deve-

Fig. 1. Set Highlight. Photo: Highsociety studio



lopment, the studio has elaborated Agrimat, a family of biocomposites obtained from the combination of plant matrices and recovered agricultural waste. The material arises from the will to attribute new value to biomasses generally considered residual, transforming them into resources for the design and furniture sector.

The production process favours low-environmental-impact techniques, based on low-temperature pressing powered by energy from renewable sources. This approach makes it possible to reduce energy consumption and to preserve the chromatic and material characteristics of the plant fibres employed. The research is not limited to the substitution of conventional materials, but explores the expressive potential of waste, valorising its textures, colourings and territorial identities as design elements.

Materials and applications

The materials developed by Highsociety Studio derive from the recovery of different agri-food by-products, including industrial hemp residues, tobacco leaves and stems, grape pomace from winemaking, coffee silverskin and spent brewer's grains. Each biomass gives the material specific aesthetic and perceptual qualities, generating surfaces characterised by natural hues and unique textures.

The Highlight and Agriluma collections represent the principal applications of this research. The lamps are made using Agrimat and transform local agricultural residues into lighting elements intended for residential, commercial and professional environments. The various material variants keep visible the traces of the biomass of origin: hemp generates green tones and fibrous surfaces, tobacco produces brown and irregular hues, while grape pomace returns deep shades that recall the world of winemaking.

Sustainability constitutes a structural element of the project. The materials comply with European compostability standards and the products' components are designed to be recycled at end of life. Through these experiments, Highsociety Studio proposes a vision of design in which agri-food waste is not simply recovered, but becomes a bearer of territorial identity, productive knowledge and new applicative possibilities, contributing to the construction of more resilient and sustainable local supply chains.

5.2.5. Maarmo

Year of foundation

2016

Location

Vittorio Veneto (TV) – Villotta di Chions (PN), Italy

Profile

MAARMO is an Italian company specialised in the development of heating furnishing elements made from the recovery of marble dust deriving from the waste of stone processing. Founded with the aim of valorising the production residues of the principal Made-in-Italy supply chains, the company has developed a proprietary technology that makes it possible to transform stone waste into radiant panels and furnishing complements characterised by low energy consumption, cold production processes and complete recyclability at end of life. MAARMO's research sits at the intersection of circular economy, product design and technological innovation, proposing solutions that integrate environmental sustainability, living comfort and aesthetic quality.

Activity and process

MAARMO's activity is based on the recovery of the dust generated during the cutting of marble in quarries and stone-processing workshops. The material is obtained through a cold-aggregation process that requires no firing: the powders

Fig. 1. Close-up of marble dust, a byproduct of stoneworking. Photo: Maarmo



are mixed with water and natural components until a paste is obtained, which is poured manually into moulds and left to consolidate through a phase of natural curing. Once dried, the products are finished and hand-painted with water-based products. This production system significantly reduces energy consumption and makes it possible to keep circular material flows active, since the products can be re-ground and reintroduced into the production cycle at the end of their useful life.

In parallel, the company develops research paths that explore the integration of residues deriving from other Italian production chains, broadening the concept of recovery beyond the stone sector alone. It is within this perspective that the UbriAAco and AArtichoke experiments are situated, placing recovered marble in relation with by-products deriving respectively from the wine and agri-food supply chains.

Materials and applications

The material developed by MAARMO derives principally from the recovery of waste marble dust, transformed into composite panels through cold processes and subsequently employed in the production of radiant systems for interior architecture. The surfaces obtained retain a strong link with the material culture of natural stone, reinterpreting its aesthetic and sensory qualities through different textures, finishes and workings.

The main applications concern the radiant-heating and interior-design sectors. MAARMO panels are available in various formal and technological configurations and can be integrated into residential, commercial and hospitality environments as elements that are both functional and decorative. Alongside standard production, the company develops experimental materials obtained from the cross-contamination of different waste streams. The UbriAAco project combines marble dust and grape pomace from local wineries, giving rise to surfaces characterised by natural colourings and by an olfactory dimension linked to the wine supply chain. The AArtichoke project, developed in collaboration with Circular Fiber, integrates instead flours obtained from artichoke waste, introducing new material properties and valorising agricultural residues generally excluded from production processes. Through these experiments MAARMO demonstrates how waste deriving from different supply chains can converge into new materials and products, transforming industrial and agri-food residues into design resources capable of generating environmental, cultural and economic value.

3.2.6. Rockfon (Gruppo Rockwool)

Year of foundation
1960s

Location
Denmark (Italian headquarters in Milan)

Profile

Rockfon is part of the ROCKWOOL Group, an international company specialised in the development of rock-wool solutions for construction and interior architecture. Founded in the early 1960s, the company designs acoustic systems intended to improve comfort, safety and well-being in built spaces. Over the course of its evolution, Rockfon has broadened its offering by integrating its technical performance with growing attention to aesthetic and design aspects, developing products that combine acoustic quality, design and sustainability.

Activity and process

Rockfon's activity focuses on the design of acoustic solutions for workplaces, education, healthcare, hospitality and public spaces. The products are based principally on the use of rock wool, a material obtained from natural resources and characterised by high performance in terms of sound absorption, durability and fire safety.

Among the most recent solutions developed by the company, the Rockfon Canva range explores the integration of technical performance and aesthetic customisa-

Fig. 1. Dettaglio pannelli acustici Rockfon Canva. Foto: Rockfon (Gruppo Rockwool)



tion. The system consists of modular panels for walls, ceilings and partitions that combine a sound-absorbing rock-wool core with an aluminium structure and a customisable textile surface. The possibility of intervening on colours, textures, images and spatial configurations makes it possible to adapt the system to the functional and identity needs of very different contexts, transforming the acoustic element into an active component of the architectural project.

Materials and applications

Rockfon Canva is composed of a high-acoustic-performance rock-wool core, an aluminium frame and a textile facing made from 100% recycled polyester. The system is designed to ensure high sound absorption (Class A), fire resistance and durability over time, while at the same time retaining a high degree of compositional and design freedom. The fabrics are removable, washable and replaceable, allowing the aesthetic appearance to be updated without intervening on the entire product.

The range includes wall panels, suspended elements, mobile dividers and ceiling acoustic islands, configurable in different formats and dimensions. The modular approach makes it possible to create customised installations that contribute both to acoustic quality and to the visual definition of the space. Particular attention is devoted to the circularity of the system: the components are designed to be easily separated, replaced and recycled at the end of the life cycle, while the frames use high percentages of recycled aluminium and do not employ PVC in their construction.

5.3.

FUTURO

University Research and the Materials of Tomorrow

M. Cason Villa | IUAV University of Venice
Department of Culture del Progetto

D. Crippa | IUAV University of Venice
Department of Culture del Progetto

UNIVERSITÀ FEDERICO II DI NAPOLI

HYBRID DESIGN LAB

L'Hybrid Design Lab, fondato e coordinato da Carla Langella, si occupa di design bio-ispirato e indaga le relazioni tra design e scienza. Trasferisce le conoscenze delle bioscienze in soluzioni innovative e sostenibili, avvicinando ricerca e società.

Esplora nuove intersezioni tra cultura progettuale e sapere scientifico, sviluppando progetti in risposta ai bisogni contemporanei legati alla crescente complessità tecnologica e sociale, che orienta verso artefatti compositi, multifunzionali, interattivi, reattivi e mutevoli.

Sito web:
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FUTURO

University Research and the Materials of Tomorrow

If the Present of the Technéteca gathered the solutions that have already crossed the threshold of production - certified materials, manufactured, placed on the market - the Future shifts the gaze one step further, to where research once again precedes industry. It is not a matter of predicting which materials we will use tomorrow, but of showing the places in which that tomorrow is today imagined and tested: the laboratories, the research groups and the materials libraries of Italian universities, where matter is at once an object of study, a critical instrument and a field of experimentation.

The change of voice, with respect to the previous section, is not incidental: if the present dimension was entrusted to the account of companies, the future one is entrusted to the universities. Where the enterprise brings products, consolidated processes and figures, research brings questions, methods and visions. The contributions gathered in this section do not describe materials ready for the shelf, but ways of thinking about matter: contemporary materials design, after all, produces knowledge through direct engagement with matter, rather than starting from predefined forms or functions (Karana et al., 2015).

Fig. 1. Fotografia allestimento sezione “Futuro”, “Technéteca”, Rifugio 87, Milano MDW 2026. Foto: Marco Merati

This shift brings with it a different relationship with time. The time of the enterprise is that of the market, marked out by performance, costs and deadlines; the time of research is longer and freer, and can afford to explore what is not yet economically sustainable, to follow uncertain paths, even to fail. It is in this margin that the hypotheses destined, perhaps, to become the supply chains of tomorrow come to maturity: the Future of the Technéteca gathers precisely this preliminary work, made of prototypes, experimental processes and still-open questions.

It is here that the deepest nature of the Technéteca becomes explicit. More than an archive of materials, it is an infrastructure of knowledge: a device that gathers and makes shareable experiences, processes and practices that would otherwise risk being dispersed along with the temporary nature of the exhibition and of the experimental episode. To bring together the research of eight universities means transforming a set of isolated experiences into a common heritage and recognising that the future of materials is not an arrival point, but a network of ongoing trajectories.

Read in continuity with the previous sections, this third temporality completes an arc. The Past showed scarcity as an involuntary engine of invention; the Present documented circularity become industrial practice; the Future explores what is not yet a supply chain: materials that grow, waste that becomes relationship, territorial knowledge that returns to producing. What changes above all is the relationship with matter, no longer considered merely as a resource to be selected or optimised (Ashby & Johnson, 2010), but as a living, ecological and cultural system with which to enter into dialogue.

It is no coincidence that most of these contributions arise around a materials library or a research laboratory. University materials libraries - long-standing tools for the cataloguing and selection of materials - are changing their nature: from collections of samples to platforms of experimentation, documentation and transfer, in which the material is studied together with its processes, its impacts and its stories (Doordan, 2003). The Technéteca, in this sense, is also a materials library of materials libraries: a place in which these distributed archives meet and make themselves mutually visible.

The research gathered here can be read along three lines. The first concerns the materials library itself as an instrument of research and design. The Politecnico di Torino presents MATto, materials library of the Department of Architecture and Design, where the choice of material is not an executive moment but the fulcrum of the design act; the University of Genoa brings the NeoMaterioteca DAD, which rethinks the materials archive through the notions of care and of

situated circular practices; the MakingMaterials group of the Politecnico di Milano, at the intersection of design and materials engineering, works on product and material innovation for the circular transition. In all three cases the archive is not a depository, but a laboratory: a place where materials are produced, tested and narrated, even before they are catalogued.

A second line pushes the material towards the living. Dai Materiali ai Sistemi Viventi [From Materials to Living Systems] (Politecnico di Milano) sets out from biodesign and regenerative ecologies, considering matter not as a resource to be extracted but as a starting point for rethinking the way things are made, lived and returned to ecosystems (Rognoli et al., 2015; Duarte Poblete et al., 2024); the Ibridazioni materiche [Material Hybridisations] of the Hybrid Design Lab explore biological inspiration and the cross-contamination between disciplines, generating objects and surfaces from natural data, biomasses and waste brought back to new life; Innovation Across Matter, of the Sapienza MaterialdesignLab, places design within the conditions of the Anthropocene - from microplastic pollution to resource depletion - in the face of increasingly complex, interconnected and dynamic systems. Matter, here, ceases to be inert and becomes process.

A third line brings materials back to territories and to the relationships they activate. Scarti come risorse progettuali [Waste as Design Resources] (Università Iuav di Venezia) reads second-generation materials as an occasion for a cultural change even before a technical one (Manzini, 1986; De Giorgi et al., 2020); Materiali come attivatori di relazioni [Materials as Activators of Relationships] (University of Florence) proposes an eco-social and technological perspective in which matter is not only to be consumed, but to be understood as an element of bonding between people, communities and environment; Nuovi Utensilia© (Politecnico di Bari) works on the reactivation of the material knowledge of the Mezzogiorno and of its deterritorialised textile supply chains; and Tessili oltre la moda [Textiles Beyond Fashion] (Politecnico di Milano) shows how textile research has by now become a cultural device capable of orienting innovation well beyond clothing.

Just as in the Present the variety of waste streams traced a productive geography of the country, here the plurality of universities - from Turin to Bari, from Genoa to Venice, from Milan to Rome and Florence - traces a geography of research, distributed and interconnected. Many of these laboratories, moreover, recognise themselves in the community of the SID Design4Materials group - an inter-university network founded in 2017 and, since 2023, a bottom-up group of the Italian Design Society - which brings together Italian academics engaged on the

relationship between design and materials and promotes their methodological exchange, in a perspective that places scientific research and design culture in dialogue (Carullo et al., 2017). What runs through it is a shared epistemology: a knowledge that does not precede matter, but is born of working it, of cultivating it, of contaminating it, often in dialogue with companies, artisans and territories. Materials design thus confirms itself not as a choice downstream of the project, but as a practice that generates knowledge at the very moment it gives form to matter.

Taken together, this research offers not a catalogue of future materials, but a map of approaches: design as a practice that produces knowledge through matter and that knows how to mediate between laboratory, industry and society (Manzini, 2015). If the Present demonstrates that circularity is already possible, the Future reminds us that it is also, and above all, an open question: a field of experimentation in which universities, companies and territories are called to build together the materials - and the ways of thinking about them - that we will need. This is the knowledge that the Technéteca does not want to disperse, but to transmit.

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5.3.1.

Textiles Beyond Fashion

*Integrating New Technologies and Sustainable Practices Through
Textile Design*

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Textiles Beyond Fashion

Integrating new technologies and sustainable practices through textile design

Textile research nowadays represents an essential foundation for design in the fashion field, positioning itself not only as a technical–productive domain, but as a true cultural and design device capable of driving innovation.

Fashion has long since exceeded the purely functional dimension of clothing to become an object of complex theoretical analysis within sociological, anthropological and cultural studies. This theoretical approach, influenced by cultural studies and post-structuralism, highlights how fashion (Calefato, 2021) is not merely an aesthetic phenomenon, but a dispositif that contributes to the construction of individual and collective identities.

In a context marked by increasing awareness of the environmental impact of the textile and fashion industry, material research for fashion design assumes a strategic role in guiding the transition towards sustainable models, intervening in processes, resource use, and product life cycles (Niinimäki et al., 2020). Moreover, in a contemporary scenario in which anything can ideally be framed as “fashion”, textile materials, the investigation of their physical and technical performance, and finishing processes aimed at modifying or extending intrinsic functionalities remain a particularly compelling and challenging field of inquiry.

This is the perspective adopted in textile research within the Final Synthesis Stu-

dio in Design for the Fashion System – Crafts at the School of Design, Politecnico di Milano: the aim is not merely to support the development of a fashion collection, but to redefine assumptions of use and functionality, and to understand how these parameters influence formal, functional, and ethical choices, without neglecting the scale of application.

In parallel, the evolution of technologies and materials has significantly broadened the field of application of textiles, making them key actors in a transformation that transcends the traditional boundaries of apparel. As Quinn notes, “textiles are evolving from passive surfaces to active and intelligent systems” (Quinn, 2010), and the introduction of innovative fibers, high-performance yarns, and advanced manufacturing processes has conferred unprecedented properties on textile materials—such as conductivity, enhanced mechanical resistance, thermal insulation, and water repellency—making them competitive with other material classes and opening up new design opportunities while reshaping scales of application. Garments but also textile walls, coverings, tensile structures, insulation systems, textile façade claddings or interior acoustic panels are today among the most advanced fields in which textile research both looks and intervenes. In this scenario, as Fletcher underscores, “materials are not neutral elements, but carriers of environmental and social values and implications” (Fletcher, 2014); even techniques with a long craft tradition, such as knitting, are reinterpreted in the light of their potential in terms of flexibility, adaptability, and waste reduction, as well as through the new technical capabilities enabled by contemporary hardware and software for knit programming, which together contribute to a redefinition of productive and design paradigms.

Drawing on Julie Thompson Klein’s concepts of “boundary work” and “boundary crossing” (Klein, 1996), disciplinary borders become a research zone in which a complex process of translation, negotiation, and confrontation between different logics unfolds. Within fashion design projects, textile research thus takes shape as a space for experimentation and innovation, capable of integrating competencies ranging from computational design to digital fabrication and materials engineering, thereby redefining the boundaries of contemporary material design and implying increasingly close collaboration among diverse disciplines (Karana et al., 2015). Within the didactic space of the studio, fashion design students are challenged to mobilise their disciplinary skills while engaging with fields that may even radically differ from their own, not with the aim of becoming textile designers or textile engineers, but rather to develop an approach capable of answering flexibly to contemporary needs. This integration has enabled the development

and prototyping of advanced design solutions in which the textile is no longer a passive tool but an active component that determines the performance, aesthetics, and sustainability of the final product. At the same time, the consolidated competences of the fashion designer frame these experimentations within aesthetic and communicative universes that give value to the relevance of the solutions developed and make them more understandable and desirable.

Among the projects developed, for instance, “Visco Armour” is informed by materials engineering to explore the use of non-Newtonian fluids, which harden when hit and thus provide immediate impact protection, integrated through pneumatic elements within knitted structures featuring specifically engineered hollow sections. This transfer of knowledge and technology makes it possible to investigate strategic solutions whose applications may range from travel accessories to sportswear garments, up to upholstery and coverings for furniture for the elderly, in which blows or falls may constitute high-risk events for a person’s health.

During early childhood, cognitive and sensory development reaches its peak, yet learning difficulties such as specific learning disorders (SLD), ADHD, or other cognitive disorders are increasingly reported. In dialogue with this phenomenon, the “WoolNest” project reinterprets textile techniques such as felting not from a merely decorative standpoint but as sensory and educational tools, hybridising them with craft-based techniques such as embroidery and advanced manufacturing techniques, such as 3D printing, to generate textile surfaces capable of supporting emotional, cognitive, and motor development. By employing regenerated wool sourced from local Italian production, whose fiber thickness makes it unsuitable for conventional fashion applications, the project assigns a new purpose to a co-product generally treated as waste, thereby fostering sustainable development. In doing so, children can be reconnected with the material authenticity of fibres and fabrics, promoting inclusion and well-being and making touch their primary channel for learning and empathy.

The “Second Skin” project, instead, offers a provocative reflection on post-apocalyptic scenarios in which the climate crisis and a hypothetical scarcity of resources demand a return to craft practices and render industrial production less feasible or even incompatible. The project thus engages in a dialogue with nature by drawing inspiration from its micro-textures through a biomimetic approach, as well as from traditional textile archetypes such as the Turkish kepenek, to generate protective clothing solutions against climate extremes. Through the recovery of waste materials, once again including local wool, and through the reinterpret-

tation of craft textile techniques such as felting, knitting and beeswax coating, textiles in this project provide water repellency, wind resistance, and thermoregulation suited to extreme climatic conditions.

These examples are the outcomes of a design studio that, as argued by Eleonora Fiorani (2021), identifies in creative processes characterised by flexibility the possibility of considering multiple solutions to a problem, starting from the fluidity of possible responses and from the elaboration and refinement of an effective strategy that evaluates different opportunities. This leads to a design approach in which material, with its requirements, constraints, and potentials, becomes a generator of both form and function, contributing to the construction of new relationships between body, object, and environment.

Within this framework, textile research assumes a dual role: on the one hand, it is called upon to respond to urgencies related to sustainability by reducing the use of non-renewable resources and promoting circular economy practices; on the other, it operates as a driver of innovation, capable of expanding the field of fashion towards new application domains and new modes of production. Considering textile research as a basis for fashion design therefore means recognising its strategic value in building a more conscious, responsible, and future-oriented design system, in line with Gwilt's assertion that "the future of fashion depends on the capacity to integrate sustainability and innovation from the earliest stages of the design process" (Gwilt, 2020).



Fig. 1. *Bouncy mushroom patch*, felting techniques. WoolNest Project, KintDesign PoliMi



Fig. 2. *Tactile cone trail*, felting techniques. WoolNest Project, KintDesign PoliMi



Fig. 3. *Frame 22*. Project Second Skin, KintDesign PoliMi

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5.3.2.

MakingMaterials per la transizione circolare

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MakingMaterials for the circular transition

The MakingMaterials research group is part of the Department of Chemistry, Materials and Chemical Engineering “Giulio Natta” at Politecnico di Milano and operates at the intersection of design and materials engineering. The group focuses on research, design and experimentation in the field of product and materials innovation, adopting an integrated approach that combines CMF design, perceptual-behavioural analysis and system thinking. Its activities are aimed at defining sustainable solutions, assessed through LCA studies, and at enhancing the aesthetic, sensory, functional and communicative qualities of materials and products.

Within this framework, a significant part of the group’s activities concerns the experimental development of polymer-matrix composite materials obtained through the valorisation of industrial residues, with particular attention to the agri-food, fashion and furniture sectors. This research line supports the circular transition by acting as a concrete strategy for transforming production residues into resources within local production systems (Santi et al., 2025), addressing the structural difficulties of fragmented production contexts (Hobson, 2020) and the lack of shared operational tools for implementing circular economy principles within businesses and society (De Jesus & Mendonça, 2018). Through the transformation of latent resources into new material solutions, the group explores their

properties and possible applications for reintegration into their original supply chains, enhancing their potential for environmental and social sustainability. The aim is to connect producers and communities, technical knowledge and design visions, contributing to the revitalisation of local economies (Magnaghi, 1998).

MakingMaterials Methodological Approach

MakingMaterials applies a cross-cutting methodology, structured to respond to different design projects regardless of the sector of reference. The different steps of the methodological process are outlined below.

- a. Identification of the residue and study of the supply chain. The starting point is the identification of a specific residue from supply chains of interest, analysing its processing stages, physicochemical characteristics, collection methods, and logistical or regulatory criticalities. The more a residue can be understood as a latent resource, endowed with specific properties but at the same time associated with issues of management, valorisation or end of life, the more relevant it becomes for our research.
- b. Formulation and Material Testing. The experimental phase begins with the Application study. The analysis of the context from which the residue originates makes it possible to guide subsequent design choices. Through the analysis of the literature, case studies and the supply chain itself, possible application scenarios are outlined and performance, perceptual and functional targets for material development are defined. Depending on the nature of the project, whether more exploratory or more directed, this step may lead to the definition of specific targets or leave greater room for open-ended experimentation. In this sense, the process may take on a material-driven design orientation (Karana et al., 2015), when the emerging properties of the material guide the identification of applications, or a design-driven material orientation (Ferrara & Lecce, 2016), when a defined design or application need guides the development of the material.
- c. Material formulation and experimentation. The experimental phase starts from the study and characterisation of the residue and develops formulations that combine it with matrices and binders compatible with the available processing technologies — either in the laboratory or in the company under study — typically: extrusion, injection moulding, additive manufacturing and low-tech processes. Experimentation always starts from a defined application perspective, with the aim of developing a solution for a concrete use, guiding

formulation choices, technologies, and optimisation and scalability parameters.

- d. Characterisation and validation. The materials are subjected to characterisation: mechanical, thermal and aesthetic testing, life cycle assessments (LCA), and checks on end-of-life reprocessability. The set of analyses validates a performance profile consistent with the target application, provides reliable data to industrial stakeholders, and guides any subsequent design iterations.
- e. Reintegration into supply chains and application scenarios. The material is reintegrated into its original supply chain or into related supply chains, validating the application scenarios hypothesised in point b. and implementing them through the technical, aesthetic and perceptual knowledge derived from experimentation. The main sectors of collaboration in recent projects range from packaging to furniture, from fashion to specific territorial contexts involving social cooperatives and local production entities.

Research Lines and Case Studies Presented in the Exhibition

The materials displayed in TechnéTECA are the result of funded projects: BOOMERANG (PRIN), REMODEL (PRIN, PNRR), Fast4C (PNRR MICS project), and the Bioloop and Bioloop Factory projects funded by the Polisocial Award of Politecnico di Milano (5x1000 IRPEF funds). Other cases presented emerged from experimental and thesis-based pathways that, in some instances, anticipated or accompanied these projects. The case studies represent the outcomes of distinct yet methodologically coherent research paths, united by the approach described above and organised into three thematic areas according to the different ways in which the research has developed in terms of process, scale and impact.

Agri-Food Waste and Biocomposites for Packaging. The first thematic area brings together projects that transform agricultural and agri-food by-products into composite materials mainly intended for packaging. BOOMERANG valorised rice and wheat straw in biodegradable composites, exploring their processability through both conventional and emerging technologies: extrusion, injection moulding and additive manufacturing. A further line of experimentation involved the development of biodegradable polymer-matrix composite materials reinforced with hazelnut shell powder, which were characterised mechanically,

thermally and through LCA, providing robust data for circular end-of-life scenarios. This section concludes with three materials that have demonstrated how agri-food residues can become secondary raw materials for the development of packaging for the same supply chain from which they originate: POMOPLA², Aspago and Citrus Gel. The first, a thesis project predating the funded projects mentioned above and developed in collaboration with IIT, the Italian Institute of Technology, incorporates tomato peel residues into a PLA matrix plasticised with substances derived from linseed oil; the second and third materials, developed within the REMODEL project, are respectively a cold-extruded filament with fibres from Cantello asparagus shoots and a translucent film developed with fibres and peels from Garda bitter oranges.

StrawLife and NOStraw, based respectively on rice straw and wheat straw, are materials developed within the Polisocial Bioloop project through low-tech processes that are also accessible in non-industrialised contexts. These materials stand out for their explicit use in social inclusion projects. They were in fact developed in parallel with the activation of circular, inclusive and local supply chains, involving social cooperatives and local communities. Their context of use was co-defined with local stakeholders, making the production process an integral part of the value generated.

Textile Waste, Upcycling and New Application Scenarios. The third thematic area explores textile residues and processing by-products in fields such as fashion, leather goods and technical sportswear. FIBER2FILAMENT transforms pre-consumer cotton waste into a composite patented by the research group, demonstrating that recycling from the textile supply chain can be qualitatively complemented by upcycling practices. Upcycled PET, with the same approach, develops a thermoformed composite made of PET and natural fibres derived from pre-consumer polycotton waste, with potential application in protective sportswear, a technical context rarely associated with recycled raw materials. Venice Flex is obtained from leather powder — a residue from buffing — and combines traditional aesthetics with technical versatility for applications in the fashion and interior design sectors. HazeLeather, made with Roman hazelnut shell powder, is designed for small leather goods: the raw material comes from a sector different from that of the final application, creating a scenario of cross-sectoral symbiosis that broadens the scope of the circular strategies explored by the research group.

Conclusions

The case studies presented, despite their variety in terms of formulations, sectors and operational scales, show significant affinities. In all projects, production residues represent the starting point for new materials: their physical, chemical and territorial nature becomes both a design constraint and a resource. The value of the material is measured not only in terms of technical or aesthetic performance, but also includes systemic dimensions: compatibility with the supply chain, reduction of environmental impact through the replacement of an existing alternative, replicability of the process, and the ability to involve local actors. The experiments do not remain confined to the laboratory scale but are connected to companies, cooperatives, communities and specific places. Each material thus becomes an opportunity to rethink not only a product, but a model: of production, consumption and end-of-life management.

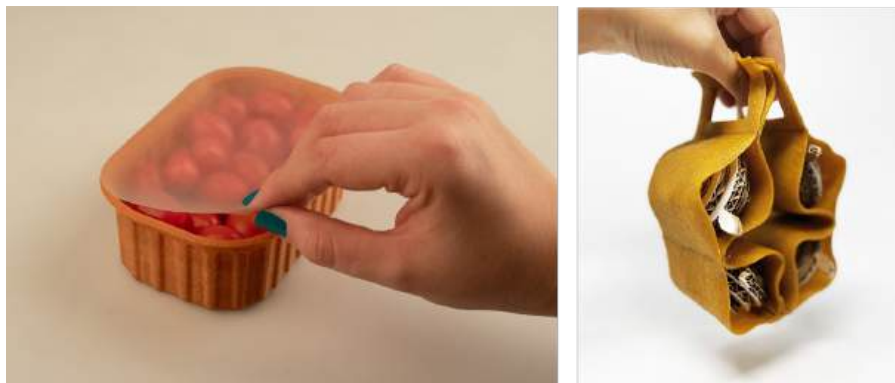


Fig. 1. Packaging prototypes made with POMOPLA² and Citrus Gel. Photo: Benedetta Rotondo, Sara Valassina



Fig. 2. Prototypes made from StrawLife and NOStaw. Photo: Manfredi Schembri, Marco Arioli

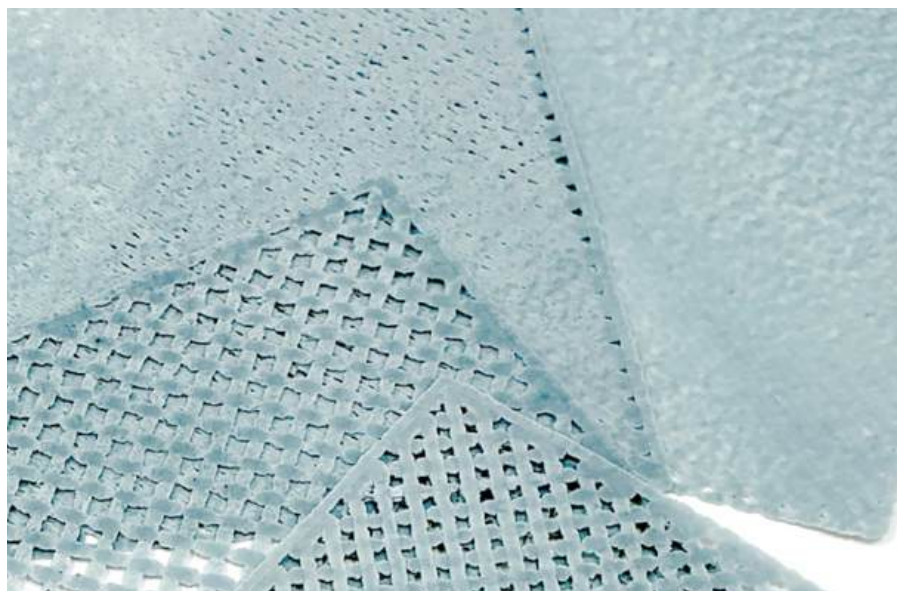


Fig. 3-4. Prototypes made from FIBER2FILAMENT and Velice Flex. Photo: Flavia Papile, Sara Valassina

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5.3.3.

From Materials to Living Systems

Biodesign and Regenerative Ecologies

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From Materials to Living Systems

Biodesign and Regenerative Ecologies

Design today is increasingly called to engage with matter not only as a resource to be selected or optimised, but as a starting point for rethinking how things are made, experienced and returned to ecological systems. Materials carry environmental histories, technical possibilities, sensory qualities and cultural meanings; working with them means questioning extraction, use and regeneration.

Contemporary Materials Design produces knowledge through direct engagement with matter. Rather than starting from predefined forms or functions, the process can begin by observing how materials behave, transform and suggest uses. Making and tinkering thus become ways of thinking through material transformation (Barati & Karana, 2019).

This contribution presents the work of B.Lab & Materials Design for Transition (Madetrans), the Biodesign laboratory and research group of the Department of Design at Politecnico di Milano. Bringing together researchers, PhD candidates and students, the group investigates ecological transition and regenerative ways of making through Materials-Driven Design, DIY-Materials, Biodesign and bio-tinkering. The four projects presented in Techneteca: ReFabBio, Myco-tensions, Beyond Ceramics and Echoing Matter, are prototypes and artefacts that trace a

shared research culture placing materials and living systems at its centre.

Research lines and methodological approaches

The research developed by B.Lab & Madetrans connects Materials Experience, Materials-Driven Design, DIY-Materials, Materials for Transition, Biodesign and regenerative ecologies (Karana et al., 2015; Rognoli et al., 2015; Parisi et al., 2017; Rognoli & Ayala-Garcia, 2021; Duarte Poblete et al., 2024; Karana et al., 2023). Rather than treating these areas separately, the group explores how materials are experienced, self-produced, biofabricated and used within circular and regenerative transitions.

Direct experimentation is central to this work. Making is a way of producing knowledge. Through hands-on exploration, designers observe behaviours, test processes, compare variations, and understand the expressive, sensorial, technical and ecological qualities of materials. Figure 1 illustrates this practice-based knowledge through biofabricated samples.

Within Biodesign, this approach engages with living systems and biological processes (Collet, 2020; Myers, 2018; Pollini & Rognoli, 2024). Working with organisms or biologically derived matter means learning from growth, adaptation, decay, symbiosis, and transformation. Living matter is approached as a collaborator, introducing its own temporalities, needs and limits into the process. This opens a more-than-human perspective, in which design considers the conditions for materials, organisms and ecosystems to coexist (Karana et al., 2023; Rognoli et al., 2026). Figure 2 shows an example of this perspective.

This becomes evident with unconventional resources such as organic waste, biomasses, textile residues, minerals, microorganisms, algae, bacterial cellulose, and mycelium. Designers often encounter a certain material disobedience, i.e., these materials do not always respond to industrial logics, nor can they be fully controlled or predicted. Thus, experimentation, failure and documentation become tools to understand relationships between composition, process, form, performance, experience and life cycle (Rognoli et al., 2023).

Documentation is therefore essential. Recipes, process notes, samples, visual records, and reflections transform trials into shareable knowledge. Journals and notebooks record outcomes, variations, unexpected behaviours and failed attempts (Figure 3). By documenting uncertainty, processes and possibilities become transferable; a form of material activism (Ayala Garcia & Rognoli, 2018).

This trajectory has recently found a dedicated infrastructure in B.Lab, the Biodesign laboratory of the Department of Design at Politecnico di Milano.

Experiments presented in the exhibition

The projects presented in the Techneteca emerge from the research ecosystem developed by B.Lab & Madetrans, in dialogue with different research and educational activities carried out within Politecnico di Milano and POLI.design.

Two of the selected projects are closely connected to the creation and development of B.Lab as a space for experimental research with emerging and living materials. The first, ReFabBio, developed within the FasT4C project of MICS, combines textile waste and bacterial cellulose to create biofabricated composites for fashion applications. The project brings together discarded textile fibres and microbial cellulose grown through biological processes, opening possibilities for circular and regenerative accessories. Developed by PhD candidate Ziqian Yu, the materials raise questions about the sensory, expressive, and cultural acceptance of biofabricated matter, especially when its appearance and behaviour differ from conventional industrial aesthetics.

Looking ahead

I progetti presentati nella mostra rappresentano solo una piccola parte della più ampia traiettoria di ricerca sviluppata dal B.Lab & Madetrans, essi rendono visibile un approccio in cui i materiali sono intesi come sistemi di indagine in continua evoluzione, punti di partenza per mettere in discussione processi, applicazioni, esperienze e implicazioni ecologiche.

Guardando al futuro, il B.Lab & Madetrans mirano a rafforzare ulteriormente il Materials Design e il Biodesign come pratiche per la transizione ecologica e i futuri rigenerativi, ciò significa espandere le collaborazioni tra la scienza, ingegneria, industria, artigianato ed educazione, continuando al contempo a interrogarsi su come i materiali vengono percepiti, accettati e valorizzati, la sfida non è solo quella di sviluppare alternative a minor impatto, ma di coltivare nuove relazioni materiali basate sulla cura, sulla circolarità, sulla rigenerazione e sulla co-evoluzione. The second project, Myco-tensions, investigates the potential of mycelium-based bio-hybrid artefacts through the use of a tension bioreactor. By combining soft moulding, steel cores and organic waste substrates, Francesco Cianfano and Sofia Soledad Duarte Poblete explore organic forms that are circular, customisable

and designed for disassembly. Here, the design process is shaped by the growth behaviour of mycelium and by the technical constraints of tension-based fabrication. The artefacts are therefore not simply designed and then materialised; they emerge through a dialogue between biological transformation, structural logic and design intention.

Beyond Ceramics: Low-Impact Alternatives for Urban Reef, by Carola Castiglione, explores mineral materials that can harden without firing, proposing alternatives to conventional ceramic processes. Developed in relation to architectural-scale 3D printing, the project investigates low-impact material systems for urban reef applications. Its relevance lies not only in the search for less energy-intensive processes, but also in the possibility of connecting additive manufacturing, ecological thinking and regenerative urban scenarios. Castiglione developed the project in collaboration with Urban Reef, after attending the Materials for Transition course within the POLI.design Specializing Master in Design for Sustainability & Regeneration, where the research group contributes through courses, seminars and workshops on Materials Design.

Similarly, *Echoing Matter*, by Francesca Ercolini, was developed in collaboration with Mogu after her participation in the Materials for Transition course within the POLI.design Master. During her internship at Mogu, Ercolini investigated regenerative design solutions for acoustic comfort using recovered mycelium-based biocomposites and plant fibres. The project transforms organic imperfection into aesthetic and sensorial value, imagining low-impact applications for shared working spaces. It shows how acoustic performance, environmental responsibility, and material experience can be brought together, and how biofabricated materials can generate new languages of comfort, care and perception.

All the projects presented by B.Lab & Madetrans are developed under the scientific guidance of Valentina Rognoli, head of the research group, whose long-standing expertise in Materials Design has shaped a collective research trajectory centred on matter as an active, evolving and relational system.



Fig. 1. Mycelli project, Mycelium Leads. Linking Roots and Wings. Project by Golab Aminialiabadi, Rocco Carraro, Brigitte Guarneri, Keren Karsa, Shyam KS, Elena Pellegrin. Materials Disobedience archive 2025.



Fig. 2. [B]ac-Kitchen. Bacterial Cellulose project by Ana Salvado, Duru Kalay, Francesca Cetrullo, Luciano M. Lettieri, Yozlem Gyuney. Materials Disobedience archive 2025.



Fig. 3. Material samples and biofabricated surfaces. Project by Antonia Moraca, Benedetta Riboni, Anna Pustizzi, Clara Scoltore and Yiran Wang, Materials Disobedience archive 2025..

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5.3.4.

Research with and for Materials: From the Local Level to the European Context

*Innovative Materials for the Project: The Activities of the MATto
Materials Library*

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Research with and for Materials

From the Local Area to the European Scene

Innovative Materials for the Project:

The Activities of the MATto Materials Library

In the contemporary design landscape, where technological innovation and environmental challenges demand a continuous redefinition of creative and industrial processes, the choice of materials is not limited to the execution phase but becomes the very core of the design process. It is within this context that MATto, the materials library of the Department of Architecture and Design (DAD) at the Polytechnic University of Turin, finds its place. MATto is not merely an archive of samples, but a research center structured to stimulate, support, and guide product and process innovation. With a constantly updated database of over a thousand new-generation materials and semi-finished products, the materials library operates along three fundamental lines: academic and strategic research for the business world, ongoing support for teaching students and undergraduates, and a commitment to disseminating and communicating the potential of innovative materials to the general public. Technological rigor and humanistic sensitivity make the materials library a key partner for the local community, through consulting services such as “MATto_STANDARD” and “MATto_PREMIUM.”

For those interested in learning more about the Materials Library (www.matto.design) and its services, MATto also opens its doors to designers and companies for a coffee together during “Materials&Coffee” - informal gatherings to explore what’s on offer, discover the latest developments, and exchange ideas with the re-

search team. Each meeting is dedicated to a different theme, inspired by the latest trends, and serves as an opportunity to meet design professionals and companies while envisioning new research projects. Other opportunities for communication and engagement with the world of materials include international events, such as the European Researchers' Night, and national ones, such as Techneteca and Science Week.

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Doctoral Research, Networking, European Projects, and Future Prospects

Since 2019, MATto has been part of the "Design4Materials" network alongside

Italy's leading material libraries, which have come together to map and explore contemporary trends in design as they relate to materials, territories, sustainability, and digitalization. Among the most recent research projects undertaken by the Turin-based group are those funded by national and European programs, as well as those conducted as part of doctoral programs.

During the COVID-19 pandemic, the materials library experimented with new ways to communicate about materials without the ability to see or touch them in person. The challenge was met through the MATto x Terra Madre project, which organized and promoted webinars and seminars between December 2020 and April 2021 dedicated to the relationship between research, design, and the agri-food supply chain. The initiative, born out of a collaboration with the Turin Chamber of Commerce, fostered new synergies and cross-pollination in design.

Between 2020 and 2021, again in collaboration with the Turin Chamber of Commerce, MATto was involved as a partner in the Savor Piemonte project, dedicated to agri-food and beverage companies interested in expanding into foreign markets. Through training, networking, and virtual showcases, the initiative highlighted Piedmont's excellence and fostered new international collaborations.

In the following years, the research project *"Flowpack – The Maximum with the Minimum"* investigated the role of flexible packaging in creating more sustainable production systems. The study analyzed the entire flowpack supply chain, highlighting its advantages in terms of lightweight design, waste reduction, safety, and distribution optimization. Presented to the Chamber of Deputies in October 2023, the resulting white paper fosters dialogue among researchers, businesses, and policymakers to guide future sustainability strategies in the packaging sector.

The research group is also involved, alongside the Department of Applied Science and Technology (DISAT) at the Polytechnic University of Turin, in research activities at the European level, including the *AI-TranspWood* project (AI-driven multiscale methodology to develop Transparent Wood as a sustainable functional material) and the *BIOMAPS project (Bio-Intelligent Manufacturing of Multifunctional Bio-Based Polymer Systems)*.

AI-TranspWood (www.ai-transpwood-project.eu) will conclude at the end of 2026 and involves an international consortium of universities, research centers, and companies from 10 European countries, coordinated by VTT Technical Research Center of Finland Ltd. The project aims to create a multiscale metho-

dology based on artificial intelligence for the design and production of new wood-based functional composites, in line with the European “Safe and Sustainable by Design” (SSbD) framework.

The BIOMAPS project (www.biomaps-project.eu), running from June 2025 to May 2028, brings together universities, research centers, and companies from 11 European countries to address microplastic pollution: biodegradable plastics of biological origin, such as polyhydroxyalkanoates (PHA), offer a solution to this problem. In fact, the project addresses the feasibility of bioplastic production - and thus their availability - through biofabrication and the systematic integration of digital tools across all stages of production. The goal is to explore innovative approaches to controlling the processability of PHAs, thereby increasing their versatility and functionality.

The materials library, in both European projects and as is often the case in previous ones, serves as a hub and support tool for stakeholder engagement, as well as a catalyst for building an active and informed community - understood as civil society - centered around innovative materials. In particular, outreach and communication activities are often based on the perceptual aspects of the respective innovations, investigated through focus groups and surveys. The large-scale data collected aims to stimulate reflection on the actual perceived identity of biomaterials under development, as well as to understand the attitudes and predispositions of potential end consumers, thereby supporting strategies for promoting innovation and its potential industrial exploitation.

Between 2021 and 2024, the materials library supported the doctoral research of Eva Vanessa Bruno (Turin Polytechnic, 36th Cohort), who explored the role of design - and in particular strategic design - within changing business models, with the aim of proposing that manufacturing SMEs producing components or semi-finished products adopt design-driven and design-oriented strategies for industrial reconversion or production diversification. The project aimed to achieve a new market positioning in B2C markets by updating and expanding the company's product portfolio. The doctoral research thus provided theoretical and practical tools to support designers, manufacturing companies, and local authorities in integrating design into corporate strategies. In addition, the research contributed to the cross-disciplinary debate within the scientific communities of design and innovation management, highlighting new terms and concepts that connect these fields through the “Culture of Design.”

Noemi Emidi's doctoral research (Turin Polytechnic, 38th Cohort) is also nearing completion; it investigates the strategic role of design as a catalyst for the

manufacturing sector's transition toward the circular economy, focusing on the valorization of circular materials. Using a Research-through-Design methodology, the study aims to overcome the current operational barriers that are slowing down its large-scale adoption. Validated through action research involving Piedmontese startups and SMEs in the textile (Biella) and polymer (Turin) manufacturing sectors, the project led to the design of a multi-criteria research tool and a methodological metamodel to enhance the adoption of circular materials within existing production systems. These outputs provide practical support for corporate self-assessment, technology transfer between academia and industry, and local ecological transition policies.

MATto has proven to be a dynamic and constantly evolving organization. At the heart of every research project is a strong drive to explore innovative materials and their sustainability - not only from a technical perspective but also from a sensory and perceptual one - investigating their qualities through both quantitative and qualitative methods. Current development priorities highlight an inter- and transdisciplinary approach oriented toward ecological transition. Reflected in the group's various specializations, the key principles guiding a broader transformation process are integrated into international research projects, satellite projects, and doctoral research ranging from communicating innovation to a broad public to disseminating it to various stakeholders, with a particular focus always on topics such as material sensoriality, industrial diversification, and the circular economy. This approach ensures that MATto is not only capable of identifying forms of change - even latent ones - in the realms of design and manufacturing, but can also serve as a catalyst for bottom-up change, fostering open and co-constructive dialogues among academia, industry, and society at large. Finally, by sharing stories of material innovations through social media channels and dedicated blogs, the materials library also serves as a digital space for spreading material culture beyond physical boundaries.

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5.3.5.

NeoMaterioteca DAD

Materials, Care, and Situated Circular Practices

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NeoMaterioteca DAD

Materials, Care, and Situated Circular Practices

The current ecological and environmental crisis necessitates a critical reconsideration of the productive and design models that have characterized industrial development over recent decades. The increasing scarcity of resources, the impact of extractive processes, and the systemic production of waste call for a reflection on the role of design and on the ways in which materials, processes, and supply chains are conceived and structured (Ashby, 2012). Within this theoretical framework, design transcends its merely formal and functional dimension, incorporating ecological, territorial, and social concerns. Materials cease to be understood solely as technical-performative factors and instead evolve into dynamic agents of co-design. In this regard, Ezio Manzini (1986) emphasizes that materials no longer constitute merely the endpoint of a development process aimed at optimizing efficiency, but rather become “matter of invention” in themselves. Consequently, materiality emerges as a critical lens through which to investigate new balances between production, ecosystems, and society.

From this perspective, the NeoMaterioteca project at the Department of Architecture and Design of the University of Genoa detaches itself from the primacy of form and function, initiating research from matter itself. Within the context of this transition, the university is configured as a space in which to experiment with new methodologies, fostering contamination and exchange among scienti-

fic research, education, and interdisciplinary practices. By promoting approaches oriented toward sustainability, circularity, and regeneration, the NeoMaterioteca becomes a site of dialogue among students, researchers, professionals, industry stakeholders, and territorial institutions, establishing itself as a space for research, experimentation, and education focused on emerging materials and ecological transition.

The Epistemology of “Neo”: Beyond Cataloguing

The prefix “neo,” which defines the semantic identity of the NeoMaterioteca, surpasses the traditional logic of mere cataloguing and instead constitutes the core of an epistemological reflection on the concept of innovation applied to contemporary design research. The term assumes a dual strategic value. On the one hand, it introduces a taxonomic innovation through the mapping and categorization of new material families: bio-based materials, ex novo materials, and neo-classical materials. On the other hand, it promotes methodological innovation by activating unprecedented modes of learning, co-design, and experimentation in the production of knowledge, thereby transforming the space into a transdisciplinary hub.

The NeoMaterioteca therefore positions itself as a hybrid and collective space in which the investigation of matter becomes the catalyst for redefining synergies among the university institution, the local territory, industry, and research centers. The exhibited and catalogued samples are not static display objects; rather, they are central nodes within complex supply chains intersecting productive processes, geographical specificities, and networks of heterogeneous actors.

Methodological Approaches: Hands-On Practices and the Paradigm of Care

Building upon this taxonomic articulation, the core foundation of the NeoMaterioteca lies in the definition of educational and research innovation models grounded in empirical experimentation and direct interaction with matter. Its educational and operational structure develops through specific methodological devices, including hands-on approaches and practices developed within Bio-Labs. In this context, the dimension of “making” regains epistemological centrality, configuring itself not merely as an applied activity but as an authentic design-research

practice. Direct manipulation of materials enables the observation and understanding of the intrinsic behaviors of matter, the dynamics of biological transformations, and the constraints related to production processes, thereby rendering visible systemic relationships that are often marginalized within traditional design education. Such an approach is consolidated through cooperative and interdisciplinary devices, including workshops and experimental laboratories conceived as open, iterative, and collaborative spaces in which scientific knowledge, material research, and design practice develop synergistically. These workshops engage a plurality of actors: students, researchers, designers, companies, citizens, third-sector organizations, makers, and professionals, fostering forms of horizontal learning and bottom-up exchange processes. Within this perspective, care, beginning with knowledge itself, assumes a central methodological role, configuring itself as attention to processes, materials, and the ecological and social relations that traverse them. The process begins with a preliminary phase of scouting and co-design involving researchers, designers, enterprises, and local communities. During this phase, waste streams, material resources, territorial expertise, and emerging needs are identified, constructing a shared framework of objectives and research questions. Funded and structured as instruments of technology transfer, these laboratories exceed the exclusively educational dimension to assume the form of relational services and collaborative infrastructures extending beyond the purely academic sphere. Through co-design practices, students and researchers operate synergistically with professionals and local productive realities, activating processes of shared experimentation and situated innovation.

The NeoMaterioteca thus extends its original function, configuring itself as a platform for consultancy and strategic dialogue for the local entrepreneurial fabric, supporting the integration of innovative material solutions and circular economy models into production systems. In this sense, shared experimentation restores agency to the territories and communities involved, while the NeoMaterioteca defines itself as an operational space in which design does not merely select materials but constructs relationships among matter, place, and practice. It therefore emerges as an environment that works through the accumulation of experiences and knowledge, transforming conditions of scarcity into opportunities for ecological, cultural, and social regeneration. Recognizing materials' right to identity, continuity of use, and a "second chance" implies a radical ethical and operational shift: materials can no longer be considered passive and consumable resources within a linear economy, but rather subjects within a relationship founded on care, responsibility, and reciprocity (Rau, 2019). From this perspective emerges the need

to critically rethink the traditional diapositives of the materioteca, overcoming its static and consultative dimension in favor of models capable of placing materials into active relationships with territories, communities, and processes of knowledge production, while above all conceiving them as open-source, hackable, and customizable resources responding to the needs of contemporaneity.

Within this vision, the territory assumes a determining role, influencing both the selection of materials and the modalities of visualization and design activation.

A situated and vernacular form of design practice thus emerges, in which the designer's attention is oriented through the staging of matter and the valorization of local resources, short supply chains, and direct relationships among research, production, and design. Materials are therefore investigated not exclusively as technical entities, but as narrative, cultural, and systemic nodes embedded within specific socio-ecological ecosystems (Papanek, 2022). Within this theoretical and operational framework, care is interpreted as a collective and situated practice. It represents not only an ethical value, but also a design methodology capable of constructing connections among materials, territories, communities, and processes of knowledge production. Care manifests itself through practices of territorial listening, interdisciplinary co-production, attention to material life cycles, maintenance of experimental processes, and responsibility toward local supply chains. Drawing upon Donna Haraway's concepts of making-kin and making-with, care is adopted as a methodological lens through which to activate relational processes among human and non-human actors within specific territorial contexts, fostering practices of interdisciplinary collaboration and ecological coexistence (Haraway, 2016).

Hybrid Networks and Future Perspectives: The Network of Material Libraries

Alongside the strictly physical dimension of the laboratory space and active archive, the scientific activity of the group expands and consolidates itself through the codification of structured networks and platforms dedicated to the open sharing of knowledge.

The strategic interconnection between the tangible material archive (presented within the exhibition project) and digital ecosystems opens unprecedented perspectives for the capitalization and dissemination of sustainable practices, enabling the traceability of experimental flows and the mapping of supply-chain

transformation processes from a circular perspective. In conclusion, the NeoMaterioteca cannot be reduced to the necessary classification of innovative material samples alone; rather, it qualifies itself as a cultural and epistemological platform within which to validate new methodologies of investigation, education, and cooperation. In a historical moment marked by the imperative to re-establish the relationships among design culture, ecosystems, and manufacturing systems, this approach transforms matter, territories, and shared knowledge into strategic vectors for the co-design of ecological transition scenarios.

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5.3.6.

Material Hybridism

Research and Experimentation in the Hybrid Design Lab

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Material Hybridism

Research and Experimentation in the Hybrid Design Lab

The evolution of technosciences is currently progressing at an unprecedented pace, generating new knowledge, tools, and design opportunities. Within this scenario, design is called upon to interpret and leverage these transformations, translating scientific and technological advancements into products, services, and experiences capable of responding to the needs of contemporary society (Ran-zo & Langella, 2012). The Hybrid Design Lab (HDL), a laboratory within the Department of Architecture at the University of Naples Federico II, was established with the aim of exploring the intersections between design and biosciences (Langella, 2007). Its activities focus on the transfer of knowledge from fields such as biology, biomaterials, medicine, neuroscience, bioinformatics, and psychology into the design of innovative artefacts oriented towards sustainability and well-being (Langella, 2019). Through research, education, and experimentation, the HDL promotes a vision of design as an interdisciplinary practice capable of bringing scientific research closer to daily life and contributing to the construction of a more conscious society. The laboratory's activities are supported by national and international research projects and collaborations with innovative enterprises, whilst its results are disseminated through publications, conferences, workshops, and exhibitions.

Designers in Lab

The HDL adopts a perspective founded on the mutual cross-pollination between design and science. Scientific knowledge becomes a source of inspiration for new design scenarios, while design helps to translate research into concrete applications and into communication and visualisation tools capable of making it accessible to society (Langella, La Tilla, & Perricone, 2019). To foster this integration, the laboratory has developed a hybrid design methodology in which the leadership role shifts dynamically between designers and scientists, depending on the expertise required in the different phases of the project. Among the methodological tools adopted are science sketching, which uses drawing as a shared language between different disciplines, and relational maps, employed to bring to light interests, skills, and cultural affinities. The Designers in Lab methodological approach involves immersing designers within scientific laboratories and experimental research contexts. Through this direct experience, designers acquire not only technical knowledge but also an understanding of the practices, relationships, and human dimensions that characterise scientific work. The documentation and interpretation of results take place through visual models, storytelling, prototypes, videos, and relational maps. The research developed within the HDL ranges from biomaterials to health, and from sustainability to science communication, yet shares a common goal: to explore the potential of the encounter between design and science as a generative space for cultural, social, and technological innovation.

Material Anticipations

Materials represent one of the primary fields of experimentation for the HDL (Langella, 2003). The laboratory explores the role of design as a mediator between scientific research, material innovation, and society, investigating biomaterials, regenerated materials, and regional material systems. Design activities are carried out within chemistry, material science, and engineering laboratories. In these contexts, designers participate in research processes by introducing perspectives linked to user needs, lifestyles, and market dynamics. A further contribution concerns the application of biomimetic strategies inspired by natural systems, such as stratification, material heterogeneity, interactivity (Rognoli et al., 2025), and hierarchical porosities (Migliore et al., 2024). Many HDL projects are dedicated to

waste management and the valorisation of waste (Langella, 2022). From this perspective, upcycling is not merely a technical process of material regeneration, but also a cultural and communicative action. Waste remains visible and recognisable to promote greater awareness regarding the use of resources and the possibility of reintegrating them into new life cycles. The materials developed by the laboratory diverge from the notion of a perfectly homogeneous material typical of traditional engineering, instead valuing inclusions, visible fibres, chromatic variations, and irregularities. Waste becomes part of the material's expressive language, inviting the user to reflect on the origin of the matter and the transformation processes that have rendered it usable once more.

Divergent Wood

The *Divergent Wood* project, developed within the framework of FoRWARD – Furniture Waste for Circular Design (MICS–NextGenerationEU), explores new ways to valorise post-production and post-consumer wood waste. The objective is to transcend traditional, low-value recycled materials by creating “divergent woods”, obtained by combining joinery waste with bio-based matrices. These materials possess unexpected characteristics such as softness, translucency, elasticity, lightness, as well as distinct tactile and luminous properties. To support their application, the DW toolkit was developed, intended for co-design activities involving designers, artisans, and companies. The material is interpreted as a device capable of representing manufacturing and cultural identities, whilst communicating its sustainable origin. With the same aim, the *Material Match toolkit* (Fig. 1, Fig. 2) was developed, which links samples of innovative materials with potential applications in interior design. The lamp (Fig. 3) made from soft wood represents a significant example of this approach, transforming the material into an atmospheric, sensory, and narrative device.

Marea

In the Marea project, material narrative takes on an environmental and bodily dimension. The jewellery collection is parametrically generated from environmental data relating to the sea, and is crafted using plastics recovered from coastlines and marine waste from the catering industry. Data concerning wave motion, ocean

sounds, rising sea levels, and the presence of anthropogenic residues are translated into forms, textures, and material inclusions. The jewellery renders visible and wearable environmental phenomena that are often difficult to perceive directly, turning the wearer into the bearer of an ecological narrative where aesthetics, environmental data, and awareness converge into a single experience (Fig. 3).

Education in Circular Materials: WasToy

The PRIN 2022 project *WasToy – Waste Was, Toys Will Be* addresses the transformation of agro-food waste into biomaterials for the toy sector. The project interprets the toy as a cultural device capable of educating on sustainability through experience. The research identified biomasses such as grape pomace, hemp, citrus fruits, hazelnut shells, coffee grounds, and mozzarella whey. This work led to the creation of *GO – Guess the Origin*, a game-based sample kit (Fig. 6) inspired by Montessori principles, which invites children to recognise the origin of biomaterials through touch, observation, and comparison. The device promotes a new aesthetic of sustainability founded on irregularities, chromatic variations, and unconventional textures.

A second project is *Sound Nuts* (Fig. 7, Fig. 8), a multi-sensory game made with hazelnut processing waste embedded in bio-based matrices such as soy resin, natural latex, and PLA. The resulting elements produce different acoustic responses, allowing children and adults to experiment with rhythms and musical combinations, thereby fostering listening, coordination, and collaboration. Lastly, the *Biomaterials Matching Toolkit* (Fig. 9, Fig. 10) transfers the concept of the interactive sample kit to the co-design phase with companies, linking sensory qualities, functional requirements, and toy typologies. Through *WasToy*, the material becomes a true mediator of learning, capable of stimulating curiosity, imagination, and environmental awareness.

Conclusions

Taken together, the projects developed by the HDL outline a shared methodological approach. The process begins with the identification of target users and the definition of innovation and awareness objectives. This is followed by the mapping of available resources and *material tinkering*, through which formulations, matrices, and processes are explored using material prototypes. The materials are then subjected to an experiential characterisation that evaluates their sensory

aspects alongside performance metrics. The emerged qualities are translated into design functions, behaviours, and narratives, and subsequently validated through workshops, living labs, and collaborative activities involving users and stakeholders. This approach positions the laboratory within a perspective where design does not merely intervene in the final stages of material application, but becomes a tool for exploration, orientation, and knowledge production, capable of guiding the very development of material innovation.

Notes

¹ Progetto di Rilevante Interesse Nazionale PRIN 2022 WasToy: was Waste, will be Toy Combining design and material science to develop made in Italy toys from organic waste through a bioeconomy approach.

Progetto finalizzato all'integrazione di principi di ecodesign, bioeconomia circolare e biomateriali per lo sviluppo di giocattoli sostenibili e rinnovabili ottenuti dall'upcycling di scarti agroalimentari, con l'obiettivo di introdurre i bambini ai temi della sostenibilità e della circolarità.

²Politecnico di Milano: Valentina Rognoli (coordinamento scientifico), Carlo Vezzoli, Gaia Crippa. Università degli Studi di Napoli Federico II: Carla Langella (responsabile scientifico di unità di ricerca), Massimo Perriccioli, Ivo Caruso, Giovanna Nichilò, Clarita Caliendo.

Istituto per i Polimeri, Compositi e Biomateriali (IPCB-CNR): Giovanna Gomez d'Ayala (responsabile scientifico di unità di ricerca), Donatella Duraccio, Luca Gargiulo.

5.3.7.

Innovation Across Matter

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Innovation Across Matter

MaterialdesignLab - Sapienza Università di Roma

Contemporary ecological, technological, and cultural transformations are profoundly redefining the relationship between design and matter, leading design to grapple with increasingly complex, interconnected, and dynamic systems. The conditions of the Anthropocene—from microplastic pollution to the depletion of water and energy resources, to biodiversity loss and climate change—highlight how every design action is embedded within ecological, productive, and social networks that transcend the dimension of the object and involve relationships between humans, the environment, technologies, and living systems (Crutzen & Stoermer, 2000; Rockström et al., 2009).

In this scenario, matter takes on a renewed centrality: not merely as a physical component of artifacts, but as a relational and performative system through which design constructs meanings, initiates transformations, and negotiates conditions of coexistence. From this perspective, the word “matter” takes on a dual meaning: it refers to matter as a physical substance and, simultaneously, to the issues that permeate contemporary design. We can speak of “hypermatter” (Battistoni & Rotondi, 2024)—an expansion of the traditional notion of material and the result of a complex set of interactions endowed with its own agency. Material research thus transcends the modern paradigm of design “information” (Flusser, 2003)—where the material is a passive substrate of form—in

favor of a matter that actively participates in the processes of producing reality (Barad, 2017; Bennett, 2010), interrogating the relationships between bodies, environments, infrastructures, data, and living organisms. Consequently, the project takes on a dialogic dimension: the designer establishes conditions within which matter cooperates, reacts, and transforms itself through intra-actions between human and non-human elements, in line with a post-anthropocentric perspective that is increasingly recognized today (Forlano, 2017; Morton, 2018). Within this framework, bio-digital practices open up a fertile space of convergence, where the physical, digital, and biological integrate, transferring the generative and performative qualities of the living to the artifact (Rotondi, 2023; Lucibello & Rotondi, 2024).

It is within this theoretical framework that the main lines of research at Sapienza University of Rome's MaterialdesignLabi—a laboratory and research hub operating within the Interdepartmental Center Sapienza Innovation and Entrepreneurship Hub (SIEHii)—emerge and develop. The lab also oversees the MaterialdesignPoint, an evolving library of innovative and highly experimental materials. The laboratory supports educational and scientific activities, promotes collaborations with companies and institutions, and serves as an incubator for researchers and designers, with the goal of triggering *material-driven* processes of product innovation, while maintaining a constant focus on sustainability and technology transfer. The Center's anti-disciplinary environment (Ito, 2016) enables research that transcends disciplinary boundaries, involving biologists, engineers, and industrial partners in iterative processes of co-production of knowledge. Through a brief description of the projects on display at the Techneteca, this text aims to provide an overview of some of the avenues of experimentation pursued by the laboratory.

A first line of research stems from the conviction that designing with biological organisms—bacteria, mycelium, roots—implies co-authorship in the fullest sense, in which the designer does not control the outcome but negotiates the conditions under which biological processes can unfold their own logic. Living matter is explored as a vital process and co-actor, while simultaneously addressing the question of how to ensure the conditions for the reproducibility of life without reducing it to a mere resource and without delegating the meaning and ethics of any choice to technological power. Consequently, the approach to projects and experiments is always exploratory rather than merely practical, seeking to put into practice a dialogic attitude suited to granting equal dignity to every “agent” of the project. An initial demonstration of this can be found in *Continuities* (2023).

Discontinuities (2023–ongoing), where the focus is not so much on the study of ceramics as a potential bioreceptive medium for the growth of living organisms (Rotondi et al., 2024), but rather on recognizing the design value and “multi-agent” nature of the unexpected or the “defect” intrinsic to the production process: the irregularities, interstices, and discontinuities that emerge in the process are, in fact, signs of its agency and, if intentionally managed, can actively contribute to conditions favorable to biological colonization. The project operates on three scales within a holographic framework—from the microporosity determined by the material’s composition (clay mixed with pyrolyzable organic waste), to the mesoporosity generated by “defects” in the production processes, to the macroporosity defined by the overall geometry—with the goal of developing modular elements for urban regeneration through cyanobacteria-based biofilms. The same logic of reversal is found in *Bacterial Dyes* (2022), where the bacteria responsible for the biodeterioration of textiles become co-authors of the project by producing pyocyanin and metabolizing synthetic dyes directly on the fabric—a process in which the bacteria introduce their own temporality and variability, challenging the very foundations of design control. *Weaving the Future* (2025–26) shifts this logic into the morphogenetic dimension, exploring root systems as raw material for new experiments in the textile sector. At the heart of the project is the control of tropisms—the physiological responses that guide root development in relation to external conditions—which are modulated through three-dimensional PLA molds, with the aim of producing interwoven and reticular forms guided both by the desired structures (inspired by traditional crochet lace) and by the growth environment, which becomes an active structure capable of co-determining the final form.

A second direction stems from the conviction that matter is not merely what one works with, but rather the medium through which one thinks, feels, and constructs meaning.

Knowledge of matter is embodied and situated: cognition emerges from the dynamic relationship between body, mind, and “things” (Malafouris, 2013), and matter is a system of meanings constructed through bodily and cultural interaction (Fiorani, 2000). It is within this perspective that the research on auxetic geometries conducted in *Auxetic Behavior and Design* (2025–26) is situated: structures with a negative Poisson’s ratio that generate counterintuitive behavior, challenging the expectations shaped by ordinary experience with matter. Touching, deforming, and compressing these materials thus produces a form of knowledge that precedes any technical description, making direct experi-

mentation the very condition for understanding the qualities that matter can express—in technical, aesthetic, and perceptual terms alike.

A third direction recognizes *making* as a fundamental epistemological issue.

When matter is worked, it guides the project from within, and thought unfolds in the action itself rather than preceding it (Ingold, 2013): practical experimentation thus becomes the privileged site where original and situated knowledge is generated, rooted in direct experience and inseparable from it. Working with materials in a deeply experiential way also leads one to question their origin and ecological implications, opening the door to sustainable choices as a natural outcome of a conscious practice (Lucibello, 2018). The *Biovinile* phonographic record (2020–22) embodies this transition, reinterpreting classic vinyl as a bio-based system composed of 97.5% water and natural gelling agents, compatible with existing casting techniques and offering the same acoustic performance. In this project, the choice of biomaterial did not stem from a technical constraint but from a material-based practice that, starting from the sensory exploration of the casting process, revealed the possibility—and the cultural necessity—of substitution, transforming the record into a narrative device that translates an ecological choice into a tangible form.

This same approach informs the educational experiments of the Augmented Materials module (2024–26), undergraduate and graduate theses conducted through iteration and discovery, in which the production process serves as a tool for knowledge. *WoolBot* designs a print head with felting needles that transforms raw wool and textile scraps into hybrid, multi-material fabrics, translating artisanal techniques into an open-source, replicable device. *Algi-Yarn* explores the production of sodium alginate-based fibers using an open-source desktop spinning machine, adapting the system and iteratively reformulating the material until structurally stable, continuous yarns are obtained.

Lithos develops new composite materials from waste Roman stone powders (basalt and travertine) and biopolymer matrices, producing a coating for textile substrates that transforms waste into a resource of high technical and aesthetic value. In all three cases, the research moves from material to design, and knowledge emerges from the act of making rather than preceding it.

The projects exhibited at the Techneteca therefore had as their primary objective to demonstrate how “*across matter*” means engaging with a reality that is physical and cultural, technical and symbolic, biological and design-oriented—a reality whose multiplicity finds in design a privileged space for synthesis and meaning. Matter carries with it stories, relationships, and responsibilities, and if the

crises of the Anthropocene remind us that every material choice is embedded in networks of relationships that transcend it, the research of the Materialdesign-Lab works precisely on this awareness, seeking to transform it into a method, a teaching practice, and a design vision.

Notes

¹ In 2017, the MaterialdesignLab (<https://pdta.web.uniroma1.it/it/laboratorio-materialdesignlab> and <https://sieh.web.uniroma1.it/it/saperico-centre>) launched the Design4materials network, now also recognized as a research group of the SID, the Italian Scientific Society of Design (SID), which brings together 11 universities and approximately 80 Italian professors and researchers working in the field of materials for design, and connects private and public laboratories and research centers as well as several major museums. Team di ricerca: Sabrina Lucibello (resp.), Chiara Del Gesso, Giulia Farace, Giovanni Inglese, Elisa Pecci, Carmen Rotondi. Collaboratori: Diana Lai, Diana Ciufu, Lisanne Buik

²<https://sieh.web.uniroma1.it>



Fig. 1. Continuities & Discontinuities – Samples of bioreceptive ceramics with multiscale porosity obtained from pyrolyzable organic waste, undergoing colonization by a cyanobacterial biofilm.



Fig. 2. Bacterial Dyes - Fabrics dyed using bacterial processes: the microorganism *Pseudomonas aeruginosa* produces pyocyanin and metabolizes synthetic dyes directly on the fiber.



Fig. 3. Weaving the Future – Lattice structures created by guiding the root growth of grasses through PLA molds inspired by crochet lace patterns.



Fig. 4. Auxetic Behavior and Design – Samples of standard materials transformed using auxetic geometries: structures with a negative Poisson's ratio that change their mechanical behavior under stress.



Fig. 5. A bio-based phonographic disc composed of 97.5% water and natural gelling agents, compatible with traditional production techniques and offering acoustic performance equivalent to that of vinyl.



Fig. 6. Lithos – A composite bio-leather developed from waste basalt and Roman travertine powders embedded in biopolymer matrices, which can be applied to textile substrates using coating and casting techniques.

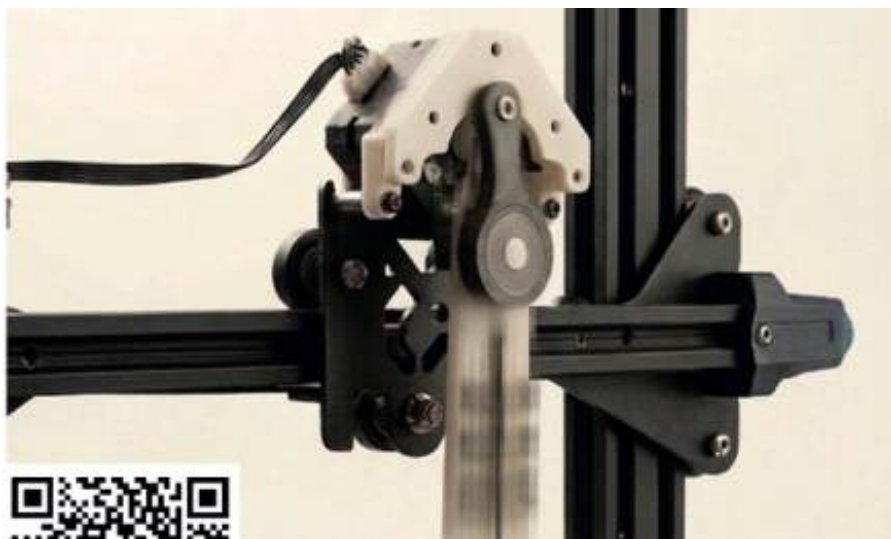


Fig. 7. WoolBot – Additive printing head with felting needles for the production of multi-material hybrid fabrics from raw wool and textile waste.



Fig. 8. Algi-Yarn – Continuous yarns made from sodium alginate, produced using an open-source desktop spinning machine through mechanical adaptations and iterative reformulations of the material.

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5.3.8.

Waste as design resources

Second-generation materials, territories and new circular supply chains

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Waste as design resources

Second-generation materials, territories and new circular supply chains

In a global context marked by the progressive depletion of resources, by the intensification of environmental crises and by the need to reduce dependence on linear extractive models, design is called upon to redefine its relationship with matter. The transition towards a truly circular society does not, in fact, concern only technological innovation or the introduction of new production processes, but implies a deeper cultural change, capable of calling into question the logics that separate resources and waste, value and refuse, production and regeneration (Banz et al., 2021; Franz, 2022). From this perspective, waste cannot be interpreted exclusively as the residual outcome of a production process, but as a resource potentially able to activate new material, economic and social cycles (Rau & Oberhuber, 2019). The emergence of the circular economy has helped to make evident how the closing of material cycles depends not only on the technical characteristics of resources and on industrial innovations, but also on individual and collective behaviours, on territorial infrastructures and on the cultural systems that attribute meaning to matter (Ceschin & Gaziulusoy, 2019). In this scenario, design assumes a strategic role not only as a discipline capable of intervening on artefacts, but as a critical practice able to orient cultural transformations, promoting more conscious and sustainable ways of life (Fagnoni, 2022). Among the various directions of research, materials design emerges as one of the

most relevant fields for addressing this transition. Materials do not constitute mere technical supports for design, but participate in the construction of the cultural and social values of a community, acting as veritable social actors (De Giorgi et al., 2020). They are interwoven with the history of territories, with productive knowledge, with local economies and with the forms of life that determine their use, in turn influencing practices, behaviours and imaginaries (Drazin & Kuchler, 2015). The designer is not limited to selecting existing materials, but can intervene directly in their design, contributing to defining their characteristics, meanings and possibilities of use (Manzini, 1986). Within this framework, neo-materials and second-generation materials, developed from residues, by-products and waste biomasses, acquire particular relevance (Clèries et al., 2020; Pellizzari & Genovesi, 2021). They represent not only a technical response to the scarcity of resources, but can be interpreted as devices of knowledge capable of making legible the transformations of matter over time (De Chirico, 2023). Every material in fact embodies relationships between resources, production processes, local competences, landscapes and communities, configuring itself as the expression of a specific territorial context (Bak-Andersen, 2021; Bassi, Calogero & De Chirico, 2021). To understand a material therefore means to understand the networks of relationships that make its existence possible.

It is within this perspective that the activity of CTRL + JUNK LAB is situated, a laboratory founded by Raffaella Fagnoni at the Università Iuav di Venezia, which takes systems of waste and refuse as its object of research, including the processes, products and services connected to them. Waste is interpreted not as a merely material category, but as a complex phenomenon involving resources, territories, people and systems of value. The research is therefore not limited to the technical valorisation of residues and by-products, but extends to the processes through which value and waste are culturally produced. In this sense, the laboratory considers waste as phenomena that are at once material and political, interrogating the dynamics that determine the exclusion of resources, practices, places and communities from the dominant systems of production and consumption. The activity of CTRL + JUNK LAB develops at the intersection of materials design, circular processes, bio-inspired systems, biomass valorisation, material archives and practices of territorial mapping. Among its principal objectives are the regeneration of the semantic value of waste, the construction of repertoires and archives of materials open to communities, the documentation of the experiential dimension of matter and the promotion of processes of ecological transition capable of valorising local resources and territorial competences. Reuse is not considered a

residual strategy, but a design logic that makes it possible to activate new cycles and new forms of relationship between matter, society and environment. The projects exhibited in the Technéteca return this plurality of approaches, showing how waste can become the starting point for building materials, processes, archives and practices of social innovation.

Material Exploratory, developed by Anna Paola Vacanti with Anna Bego, Pietro Costa, Davide Crippa, Michele De Chirico, Raffaella Fagnoni, Martin Romeo and Carlo Turri, addresses the theme of the knowledge and transmission of circular materials. The project proposes a mapping of materials developed in north-eastern Italy, building an archive that gathers data, processes, supply chains and material biographies. The objective does not consist in the simple cataloguing of materials, but in the construction of a tool capable of making legible the relationships between resources, territories, companies and processes of transformation. Through a Mixed Reality experience, created in collaboration with Metagate srl, the project integrates physical samples and digital content, fostering forms of learning based on interaction and on the direct exploration of matter. The archive is thus interpreted as a device of tangible memory and an instrument for the transfer of knowledge (De Chirico, 2023; Wilkes, 2011).

Mediterranean, developed by Iris Brucculeri, focuses on the transformation of environmental criticalities typical of the Sicilian territory into design resources. Through the use of algae deriving from coastal accumulations and of *Opuntia ficus-indica*, the project develops a sustainable bioplastic following the principles of Material Driven Design (Karana et al., 2015). The project is not limited to the definition of a new material formulation, but builds a system composed of samples, product models and experiential tools aimed at promoting practices of local self-production. In this way, the material becomes a device through which to re-read the environmental specificities of the territory and to imagine more responsible and distributed production models.

Melior de cinere surgo [I rise better from the ash], developed by Carmelo Leonardi, also works on the capacity of design to transform a condition of excess into a shared resource. The research proposes the development of MAGMA-lite, a material obtained from the reuse of the volcanic ash of Etna. Generally perceived as an environmental and management problem, the ash is reinterpreted as a secondary raw material for the prototyping of draining pavements inspired by Sicilian tradition. The project interweaves practices of upcycling, collective memory and territorial identity, showing how the valorisation of waste can contribute to the construction of new relationships between communities, resources and landsca-

pe.

No.Ve. Foam by Giulia Nocivelli addresses instead the theme of the valorisation of waste deriving from one of the most representative supply chains of the Venetian territory. The project explores the possibility of obtaining a foam glass composed of up to 99% of coloured Murano glass waste. Light, porous and insulating, the material arises from high-temperature expansion processes and presents properties suited to applications in design and architecture. The research places material experimentation, industrial symbiosis and the valorisation of local productive heritage in relation, demonstrating how the waste of a highly specialised process can be reinserted within new supply chains without losing the link with its context of origin.

The research project Pietraformare, developed by Davide Crippa and Gianluca Fabris, focuses instead on the valorisation of the sawing sludge deriving from stone processing. Through the experimentation of scalable neo-materials for furniture and urban space, the research addresses an often invisible waste stream, transforming it into a design resource. The project highlights the role of materials design in the construction of circular supply chains capable of generating environmental and economic benefits, contributing to the reduction of residues and to the creation of new applicative opportunities.

A different perspective is proposed by La Materia come Sistema [Matter as System], developed by Francesco Piccinonna in collaboration with the Basque Bio Design Center. The project explores a mode of design that is based not on absolute control of matter, but on the construction of conditions within which the living can express its own potential. Mycelium is taken as an enabling technology within a scalable design protocol, capable of integrating biological variability, growth and transformation. The acoustic diffusers exhibited constitute demonstrators of this approach, in which the designer assumes the role of orchestrator of a complex system rather than sole author of the final result.

Finally, with Recluse, developed by Rebecca Brusa in collaboration with Martina Gerardi, Yunus Muhammad and the Comunità Il Sorriso di Fontanelice, the theme of waste opens onto its social dimension. Through a participatory workshop process, the project involved the community in the creation of a sustainable fashion collection obtained from the recovery of textile waste, disassembled garments and remnants. In this case material recovery becomes an occasion to activate relationships, competences and pathways of inclusion, highlighting how circularity can be interpreted not only as an environmental strategy, but also as a social practice.

Taken together, these projects outline a common trajectory that considers waste not as a poor material to be ennobled through design, but as a privileged point of access for understanding more complex systems. Mediterranean biomasses, volcanic ash, the waste of artistic glass, the residues of stone processing, mycelium, textile waste and circular materials in fact recount territories, productive infrastructures, cultural practices, social relationships and possibilities of transformation. From this perspective, materials cease to be simple components of a product and become instruments through which to read and reinterpret the relationships between environment, society and production.

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5.3.9.

Materials as catalysts for relationships:

An Eco-Social and Technological Perspective on Materials Design

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Materials as catalysts for relationships

An Eco-Social and Technological Perspective on Materials Design

Materials have always been the resources through which human beings have been able to give concrete form to their world. As Ashby and Johnson (2010) argue, we live in a world made of materials, in which humans are able to conceive, design, and manufacture functional and symbolic objects. However, in the face of contemporary environmental and social challenges, it seems increasingly necessary to consider materials not merely as resources to be extracted, transformed, and consumed, but rather as elements that contribute to the construction of complex systems - relationships involving people, communities, ecosystems, productive infrastructures, and, last but not least, other living species.

The capacity of matter to act echoes Latour's (2020) theoretical reflections on distributed agency and aligns with the vision of complexity proposed by Morin (2015).

From this perspective, materials become active elements within the networks that constitute the world.

The Anthropocene has made this state of interdependence particularly evident. The spread of plastiglomerates along coastlines (Corcoran et al., 2014), the discovery of microplastics in Antarctic ice (Aves et al., 2022), and even in the human placenta (Ragusa et al., 2021), and more generally the fact that the mass of anthropogenic materials has surpassed that of all living biomass (Elhacham

et al., 2020), demonstrate how material flows continuously cross the boundaries between natural and anthropogenic systems.

Recent reflections in the field of design suggest, in fact, interpreting materials as relational devices. Pasini (2025) highlights how every material holds memories of extraction, transformation, and use, embodying cultural values, territorial knowledge, and social practices that shape collective behaviors and imaginaries. Materials thus become authentic “triggers for relationships,” capable of generating connections between people, territories, and production processes, transcending the traditional distinction between the technical-productive dimension and the social sphere.

This perspective is further developed in the concept of *Design Terroir* elaborated by Rigobello & Evans (2024). Drawing on the meaning originally associated with *culinary terroir*, the authors propose a vision of design based on the relationship between materials, territory, local knowledge, multispecies relationships, and situated ecologies. *Design Terroir* is conceived as an eco-social, relational, and bioregional approach (Fanelso et al., 2025) that recognizes the value of territorial networks and ecological specificities in defining design processes, opposing the consumerist logic that has characterized much of industrial production.

The reflections of Langella et al. (2017) further expand this perspective, highlighting how contemporary material design operates at the intersection of material, form, information, and process. Thanks to digital technologies - advanced digital modeling and additive manufacturing - materials become performative systems in which the relationships between structure, behavior, and functionality play a central role in defining the design.

The case studies presented in this chapter, and exhibited as part of the Techneteca exhibition project, fall within this theoretical framework.

On the one hand, *Outa* explores the role of seeds as biological and cultural infrastructures capable of fostering relationships between communities, biodiversity, and territories, promoting practices of care, conservation, and the transmission of ecological knowledge through the creation of a sculptural object designed using parametric design for the additive printing of ceramic materials. On the other hand, the *AERIAL* project addresses the issue of waste from the stone industry, reinterpreting “marmettola” - or marble slurry - not as mere industrial waste but as a resource for fostering new productive ecologies. Through biofabrication processes based on the use of photosynthetic microorganisms, the project transforms marble slurry into a new living material capable of connecting biological processes, scientific knowledge, production chains, and local resources.

Finally, the Morphological Protection project explores the potential of 3D-printed motorcycle protective gear. Using FDM technology, the component is reimagined: no longer a solid block of polyurethane, but a system of solid and hollow sections capable of delivering the same performance while using less material.

In the case of *Θuta* and *AERIAL*, materials thus become mediators of the local context - tools through which to imagine and build more sustainable ways of inhabiting the world. In Morphological Protection, on the other hand, materials act as mediators between the human and technological dimensions, demonstrating how the design of form and structure generates new relationships between performance, sustainability, and benefits for humanity.

All three projects demonstrate how material design can be interpreted as a practice for building eco-social and technological relationships. From this perspective, materials and technologies do not represent the end goal of the project, but rather the means through which to forge new connections between the human and the non-human, between culture and nature, and between production and regeneration.

AERIAL - Biofabrication Strategies for the Recovery of Stone Industry Byproducts

Marble quarrying and processing in the Apuan-Versilian district have significant environmental impacts. It is estimated that approximately 500,000 metric tons of marble dust are produced each year (Drysdale, in Piccini et al., 2019) - an impalpable powder that is as valuable as it is hazardous to the environment and human health, yet also a resource for the circular economy.

The *AERIAL*¹ project focuses on the process of recovering this waste to produce innovative bio-manufactured materials through the metabolic principle of biomineralization by photosynthetic microorganisms - Microorganism-Induced Calcite Precipitation (MICP) (Reali et al., 2022) (Fig. 1). The project implemented a design-driven, transdisciplinary methodology, involving collaboration among designers, biologists, and experts in agricultural and territorial microbiology (Marseglia et al., 2025), creating a disciplinary network of territorial knowledge and practices as an expression of the *distributed agency* described by Latour. The objective was to develop a material formulation for application in green building and design and to establish a pilot biotechnological plant for the processing of marble chips.

The technology developed during the project thus aims to regenerate the stone

extraction and processing sector by transforming a production district into a system capable of caring for the territory that hosts it, with direct benefits for the socio-ecological system that sustains this sector. The project aims to drastically reduce the environmental impact of local businesses and seeks to create a competitive advantage for the construction materials sector by providing new circular products and semi-finished goods with low environmental impact.

In this sense, *AERIAL*, with its pilot plant, aims to have a positive impact on the Apuan-Versilian socio-territorial system, as the pilot plant is distributed among the various companies that are part of the consortium, functioning as a shared production network.

The basic idea is to regenerate the supply chain by converting old quarries and problematic sites, in line with the principles of Regenerative and Restorative Design (Antonelli & Tannir, 2019), thereby creating social, environmental, and economic value (Armiero, 2021), and restoring resources, identity, and new relationships of coexistence to the terroir.

Θuta / thù-ta | A Project on Forms and Practices for the Collective Preservation and Living Memory of Seeds

*Θuta / thù-ta*² is dedicated to seed conservation and explores the relationship between matter, additive technologies, and eco-social practices for caring for living organisms. Building on the concept of “Seed Rematriation” - understood as the symbolic and material return of seeds to their places and communities of origin (DiCarlo, 2023) - the project interprets seeds as biological and cultural infrastructures capable of reactivating relationships between communities, biodiversity, and territories.

From this research emerges an installation designed to house and preserve seeds through differentiated microclimatic conditions. The system consists of a permanent structure (fig. 2) and two interchangeable capsules - one for conventional seeds and one for recalcitrant seeds - translating biological needs into a design solution based on clay, LDM (*Liquid Deposition Modeling*) 3D printing, and microclimatic control. Clay, linked to the earth and conservation practices, is reinterpreted through additive manufacturing as a meeting point between vernacular knowledge and technological innovation. The external structure experiments with TPMS (*Triple Periodic Minimal Surface*) lattices, featuring configurations

based on gyroid geometries: continuous, periodic three-dimensional surfaces that organize the ceramic material into an interconnected system of solids and voids (Gado, M. G. et al., 2024). Through porosity, thickness, and orientation, these minimal surfaces modulate light, air, water, and heat exchange. This approach limits direct sunlight, promotes natural ventilation and rainwater runoff, and - thanks to the thermo-hygrometric properties of clay - creates an internal microclimate suitable for seed conservation, without the need for active energy systems. Throughout the year, the collective opening of the capsules transforms preservation into a shared practice of care, memory, and giving back to the earth, strengthening the bond between community, biodiversity, and the local area.

Morphological Protection. Adaptive Protection System for Motorcyclists.

Il prototipo *Morphological Protection*³ (fig.3) It illustrates how the integration of digitization and sustainability - through the interaction between the human factor and additive manufacturing - is reshaping contemporary industrial design according to the paradigms of the circular economy. Developed using digital design and parametric modeling processes, the device was prototyped in polylactic acid (PLA) using FDM (Fused Deposition Modeling) technology. Using the Grasshopper graphical algorithm editor, integrated into Rhinoceros software, a cross-shaped geometric configuration was defined to optimize ergonomics and adaptability to the user's specific anatomical variables. In the field of product design, parametric modeling has driven a transition toward mass customization, enabling the production of unique morphological solutions derived from a common generative matrix and shaping a new aesthetic of complexity. Digital design thus introduces computational and artificial intelligence approaches to support the designer, whose role is evolving from direct formal modeling to the coding of a system of rules, parameters, and constraints. This algorithmic framework is capable of generating infinite coherent variations (Touloupaki and Theodosiou, 2017), allowing for the management of highly complex geometries that cannot be described using traditional representation methods. The convergence between humans and digital design thus elevates material to the status of a technical and social catalyst, fostering the creation of relationships that lead to new digital design languages at the formal, geometric, and material levels, with sustainability rooted in the systemic balance between algorithmic innovation and material culture.

Conclusioni

he design projects presented highlight how material design is gradually emerging as a relational practice, in which matter is no longer viewed as an inert resource but as a catalyst for eco-social and technological connections. From this perspective, materials become mediators between human and non-human systems, between territories, technologies, and production processes, contributing to the construction of new forms of coexistence. The case studies presented demonstrate how different approaches - biomanufacturing, parametric design, and the eco-social approach - share a common drive toward regenerative and context-specific practices, where technologies and biotechnologies amplify and transform relationships.

In this sense, material design can therefore be understood as an approach to systemic transformation, capable of generating technical, functional, cultural, and ecological value, and able to redefine the role of design as an active agent in the construction of a new paradigm that connects nature, culture, and technology.

Note

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² *Θuta / thù-ta* is a bachelor's thesis from the degree program in Product, Interior, Communication, and Eco-Social Design at the University of Florence. Advisor: Prof. Marco Marseglia (Associate Professor of Design); Co-advisor: Prof. Francesco Ferrini (Full Professor of General Arboriculture and Tree Cultivation); Students: Anna Gemmi and Francesco Vigilucci.

³ This is an experimental research project conducted by the Laboratory of Design for Sustainability (DIDA-LABS, UNIFI) and coordinated by Prof. Giuseppe Lotti (Full Professor of Design), with the following re-

search team: Gabriele Pontillo (Research Associate), Alessio Tanzini (Research Fellow in Design), and Claudio Catalano (Research Fellow in Design).

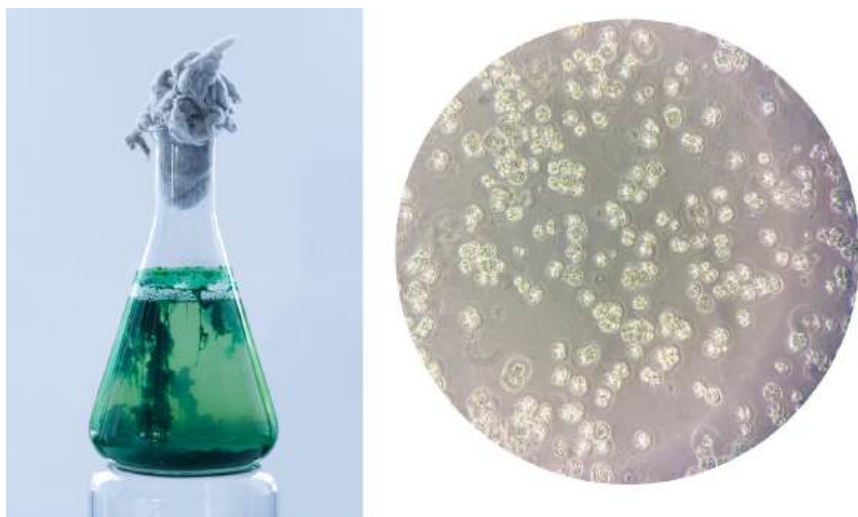


Fig. 1. AERIAL: On the left, a flask containing microalgae for material experiments. (Photo: Cristian Betti). On the right, a microscopic view of some of the microorganisms used in the project.



Fig. 2. Quta / thù-ta. The external clay structure features TPMS (Triple Periodic Minimal Surface) lattices, with configurations based on gyroid geometries designed to optimize light, air, water, and heat exchange.



Fig. 3. Morphological Protection. Prototype of an adaptive protection system for motorcyclists. Compared to traditional systems, it uses less material while providing the same level of performance.

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5.3.10.

Nuovi *Utensilia*© per nuovi processi produttivi a Mezzogiorno

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Nuovi *Utensilia*© per nuovi processi produttivi a Mezzogiorno

The deterritorialization of the traditional textile supply chains in Southern Italy - accelerated by the processes of production globalization in the second half of the 20th century - has led to a gradual breakdown of local production systems and a fragmentation of the tangible and intangible knowledge historically rooted in these territories (Scodeller & Mancini, 2023). This process has compromised - and continues to compromise - the mechanisms of cultural transmission that ensure continuity between production practices, collective memory, and artisanal knowledge, transforming the historic supply chains linked to the cultivation and processing of native natural fibers into standardized processes within global textile production chains. The revitalization of these supply chains aims to reestablish the link between technological innovation and the - often tacit - knowledge tied to specific territories and their communities, a link that lies at the heart of the very concept of “Made in Italy.” Such an endeavor takes the form of a design initiative - both ecological and cultural - aimed at opening up new scenarios capable of interpreting the future through informed ecological frameworks, and at promoting a critical reevaluation of dominant production models by examining the relationships between territorial scale, natural resources, materials, and local transformation processes.

It is within this context that the research activities of the INMATEX (Interaction, Material, Experience) laboratory at the Polytechnic University of Bari take place. The laboratory addresses these issues through several lines of research: the enhancement of the tangible and intangible heritage of tacit knowledge in these territories, beginning with the study of raw materials, fibers, and soils - the starting points for the transformation process of traditional textile manufacturing; the definition of scientific, technological, and transferable protocols for updating this knowledge through practices of use, reuse, and reinterpretation capable of engaging with the contemporary socio-technical and figurative context; and finally, the development of the potential of cultural heritage as a lever for sustainable emancipation, both culturally and economically. At the intersection of these research strands lies an investigation into the perceptual and sensory qualities of indigenous materials, understood as elements capable of reactivating the relationships between surfaces, production processes, and memory still preserved - albeit in a fragmentary manner - in the regions of Southern Italy.

This approach includes the design of sensory gradient scales that define relational taxonomies among material surfaces, shifting the focus from a logic of technical cataloging to one of conceptual categorization (Carullo, 2017). In this way, a different utilitarian and perceptual value is restored to historical fibers. Furthermore, INMATEX has more recently turned its attention to studying the technical methods through which to initiate this process of perceptual, tactile, and meaningful regeneration. It has done so by moving from the study of categorization processes to the design of actual production processes. This approach forms the basis for a remanufacturing initiative aimed at regenerating the textile supply chains of Southern Italy. Integrated strategies for the production, design, and post-production of textile surfaces have been launched, aimed at reactivating the cultural memory that characterizes them and, with it, the very value of “Made in Italy.”

The goal is to build, through the integration of research-driven design methodologies, archival practices, and digital tools, a strategic asset for the future of textile manufacturing. Textile archives are transformed into archives of tacit processes - forms of reverse engineering that play a central role in reactivating the tangible and intangible knowledge linked to specific territories (Carullo, Pagliarulo, Colabella & Leone, 2026) - true, scientifically determined mappings of historical Utensilia©, which are complemented on a case-by-case basis by the design of “new” Utensilia©: artisanal tools reinterpreted through hacking processes, aimed

at enhancing the design, production, and relational capacities of local community practices (Carullo, 2024).

The result of five years of field research has made it possible to define Utensilia© as true “proximity machines” (Carullo, 2023) - production modules with low infrastructure costs but high design and social value, as they enable the transformation of fibers in a manner closely tied to their places of production. These systems are capable of integrating Industry 4.0 technologies into the production and processing chains of local natural and/or animal fibers. They do so by modifying specific process stages that preserve fragments of that collective memory of craftsmanship, which contribute to the regeneration of these practices - not only from an ecological perspective but also through processes of customization and enhancement of the materials’ sensory and perceptual qualities, thereby reinventing the expressive languages of textile surfaces. From this perspective, it becomes possible to bridge the technological gaps that still hinder the reintroduction of historic textile supply chains into contemporary design, while simultaneously supporting young “Made in Italy” startups and promoting local production of natural fibers as an alternative to the globalization processes that have led to their gradual deterritorialization - with particular reference to processes related to silk and linen.

The Silk Industry in Southern Italy: Algorithms for New Sensory Metrics

One of the first experiments in this line of research stems from a collaboration with Nido di Seta (<https://www.nidodiseta.com/it>), a startup that has revived the historic silk production chain in Southern Italy by reintroducing *Bombyx mori* silkworm farming in the San Floro area of Calabria (Fig. 1). A study of the various stages of silk processing revealed a lack of tools suited to the scale of small, local supply chains: on the one hand, industrial systems require volumes incompatible with local micro-production; on the other, traditional tools rely on embodied skills that are difficult to transmit and standardize (Dei & Meloni, 2015). To address this challenge, the research team developed a system of “proximity machines” consisting of three modules - reeling, winding, and twisting - designed to restore control over the entire production process to local production communities without resorting to industrial infrastructure or the offshoring of manufacturing.

Developed in collaboration with experts in mechanical and computer engineering, these “new” Utensilia© reinterpret historical tools through “low-threshold” digital technologies. The reeling module integrates the boiling of the cocoons and the initial collection of the thread; the twisting module allows for the intertwinning of the thread and the removal of residual water; finally, the twisting process represents the intersection between the sensory and design dimensions. By controlling the speed and tension of the thread via an Arduino interface, this final module allows for the creation of different configurations of twisted silk and enables direct manipulation of perceptual qualities such as softness and roughness. This makes it possible to produce yarns with specific sensory characteristics and to develop types not yet codified by traditional manufacturing practices, yet rooted in historic local production traditions (Fig. 2). Concurrently, the research has developed a system of metrics capable of translating the perceptual qualities of silk into measurable and programmable parameters. By integrating perceptual tests with instrumental analyses of surface roughness conducted using a 3D optical scanner, a coding system based on grayscale gradients according to the NCS color model was developed. This representation allows for the communication and design of tactile qualities even remotely, establishing a shared language between sensory experience, design, and digital production control.

New Sensory Metrics in Changes of Material Domain: From Silk to Linen

The second experimental project focused on flax, drawing on the production experience of the Essenza di Puglia network of farms (<https://essenzadipuglia.it/>). Unlike silk, the flax supply chain is largely fragmented and must be reconstructed by gathering residual knowledge, observing existing practices, and conducting field experiments. The research began with the observation that flax currently lacks a shared classification of its sensory qualities (Fig. 3). A sample collection was therefore developed, consisting of five progressive weaves, characterized by different weave densities and corresponding to specific perceptions of softness and resistance to the touch. In this case as well, quantitative data were translated into visual gray gradients, making it possible to place each weave along an easily interpretable and communicable soft-to-stiff scale. At the same time, the research developed a system of “proximity machines” dedicated

to the main stages of linen processing. Their design stems from the urgent need to bridge a generational gap: practices such as scutching, combing, spinning, and winding onto bobbins survive today almost exclusively in the memories of the last custodians of this knowledge and in the archives of rural museums. As in the case of silk, the “new” Utensilia© were conceived as a series of production modules derived from the analysis of surviving fragments of local tacit knowledge. The de-stemming module automates the separation of fibers from the woody part of the stem, ensuring greater uniformity of the material; the combing module supports the operator through solutions that simplify its use and make the machine’s internal workings transparent. It is, however, in the spinning module that the sensory and design dimensions converge most clearly. Through humidity and pressure sensors, and digital control of twist parameters, the machine allows for the production of yarns with varying degrees of stiffness, irregularity, and texture, directly correlated to the data collected during the sensory analysis phase. The winding module concludes the process via an automated system for winding and distributing the yarn, controlled via a mobile app (fig. 4). In both case studies, the result is the establishment of a dynamic relationship between the enhancement of the territories’ tangible and intangible heritage - understood as the archiving and transmission of processes - and productive remanufacturing practices. This gives rise to scientific and transferable protocols that can be adapted to local specificities and are capable of integrating memory, tactile perception, and digital control within the contemporary socio-technical context.

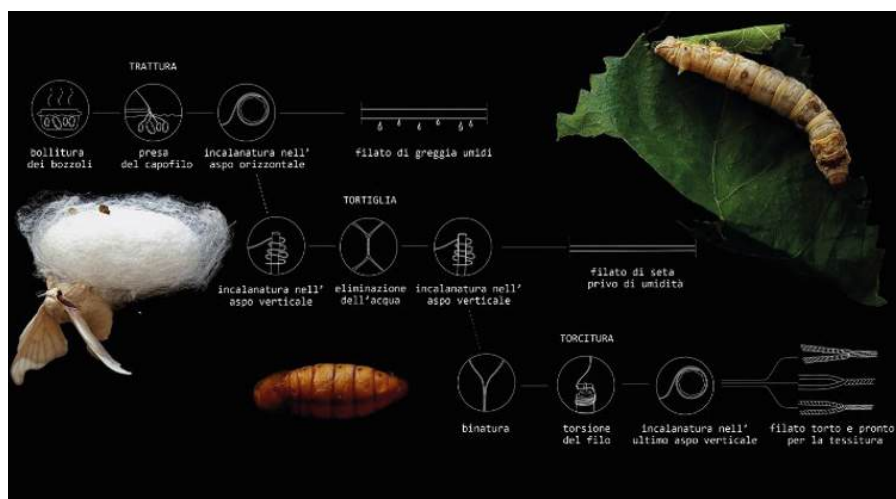


Fig. 1. The entire silk production process. From reeling to twisting

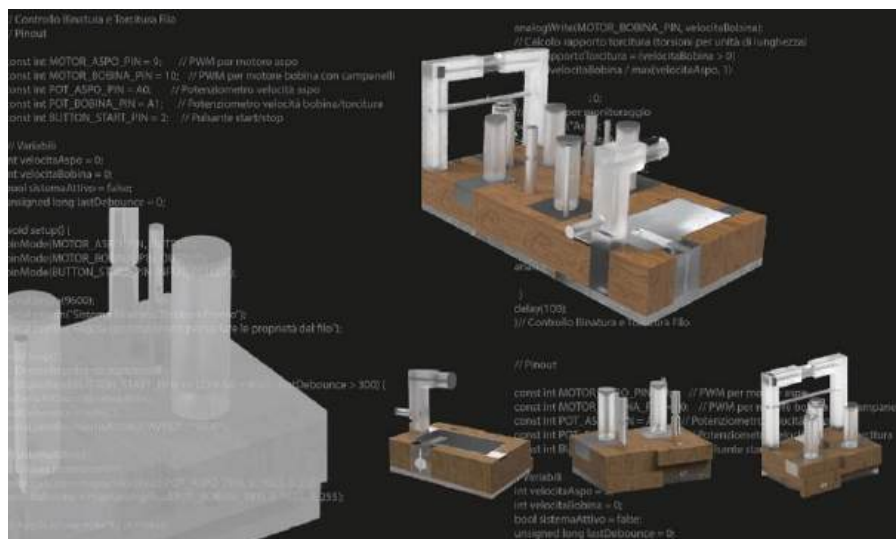


Fig. 2. The three components of the serum "proximity spot"

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For over thirty years, Milan Design Week has served as one of the most acute barometers of transformations in contemporary design. However, it is a platform built around the presentation of the new, and in such a context, memory tends to occupy a marginal position. *100 Things Not to Forget* overturns this perspective: it chooses to start from memory and to treat it as a genuine subject of design.

The book emerged from an exceptional circumstance—the 2026 edition, in which Milan Design Week coincided with the celebrations marking the anniversary of Liberation Day—and from the insight to transform that coincidence into an opportunity. Promoted by Repubblica del Design in collaboration with the Ghigos studio, the project opens two World War II air-raid shelters—Rifugio 87 on Via Bodio and the Breda Bunker at Parco Nord Milano—to return them to the city not as relics to be preserved but as contemporary civic infrastructure. The transition “from air-raid shelter to cultural refuge” becomes the critical framework through which to examine the present: what a community chooses to protect, what values it considers essential, and what risks being lost. A shelter whose meaning shifts from the threat of war to that of environmental crisis, linking historical memory and the climate crisis.

At the heart of the project lies a precise design approach that gives voice to the entire research: staging through subtraction. This does not entail formal austerity, but rather a critical exercise that distinguishes the indispensable from the superfluous, countering the logic of accumulation—and the high consumption of resources associated with ephemeral events—with an installation based on reuse, circular materials, and care. The quality of the experience does not depend on the quantity of elements introduced into the space, but on the relationships one chooses to build. Through its two sections—from “Learning from History” to “Survival Design,” and from “Resilient Districts” to the “Technéteca,” an archive of know-how for sustainable design—the book weaves together historical research, regional case studies, material experiments, and curatorial practices, interpreting design as a mediator between different forms of knowledge, actors, and temporalities. What emerges is the ambition to transcend the ephemeral nature of Design Week: to transform a few days’ event into a lasting cultural presence capable of leaving a legacy in the local area. Because innovation does not mean forgetting, but rather building new possibilities based on what a community decides not to let go of.