INTERNATIONAL CONFERENCE

LIVING ECOSYSTEMS

CLIMATE, ECOLOGY, FOOD AND WELL-BEING

AGRIGENTO

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MUSEO ARCHEOLOGICO REGIONALE "P. GRIFFO"

LIVING ECOSYSTEMS

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Valley of the Temples Archaeological and Landscape Park

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FOOD, CULTURE AND SYSTEMIC DESIGN

Preface

Dario Russo

This volume collects the proceedings of Living Ecosystems: Climate, Ecology, Food and Well-being, the international conference held in Agrigento on 11 and 12 March 2026, in the Zeus Hall of the "Pietro Griffo" Regional Archaeological Museum, within the Archaeological and Landscape Park of the Valley of the Temples

The setting was not chosen by chance. There is a certain irony in debating ecological limits a few hundred metres from a row of Doric temples raised, two and a half millennia ago, to defy time – and in discussing the future of the planet in the city of Empedocles, the philosopher who first imagined the cosmos not as a machine but as a living organism, held together by Love (*Φιλότης*) and pulled apart by Strife (Νεῖκος). The temples have outlasted the civilisation that built them; we, for our part, are learning that our own artefacts may outlast us in the worst possible way, like the plastic that refuses to decompose. To meet in Agrigento was therefore to stand between two lessons at once, one in permanence and one in impermanence.

The guiding question of the conference was deceptively simple: how do we orient technology – and the design that shapes it – towards care rather than domination? Ecology, in these pages, is not nostalgia for an untouched nature that never existed. It is a problem of making: of how we produce, use, and discard things, and of the cultural and systemic conditions that make those gestures possible. The human being is, after all, the only animal that cannot exist without its technical supplements; the question is never whether to use them, but to what end.

The volume follows the two sessions of the conference. The first, Framing the Theme, sets the conceptual and scientific coordinates: the planetary boundaries within which agriculture and the food system must remain (Butera); the disorientation of design in a condition of permanent transition, and the opportunity for its redefinition (Valušytė); and the techno-anthropological circle through which nature, technology, and spirit continually pass into one another (Russo).

The second session, Food, Culture and Systemic Design, brings the argument down to the table. Food is the most ordinary of things and the most revealing: it is where ecology, culture, technology,

and well-being meet three times a day. A comparison of Italian and Japanese food cultures (Anzai), the multisensory science of gastrophysical design (Langella), the relationship between food, ageing, and the construction of value (Bisson), and the proposal of a hyper-local material loop for the Sicilian agri-food heritage (De Ponti) describe, between them, a single system observed from several altitudes. The day was opened by Fausto Giambra's account of the Formare al benessere project: a reminder that all of this begins, in practice, with education.

A word on what these texts are and are not. As the opening of the conference made clear, a meeting of this kind is a space for dialogue, not for the transmission of settled knowledge. Every form of scientific knowledge is a provisional synthesis, open to revision; the contributions gathered here should be read as stimuli and hypotheses, to be discussed and, where necessary, contradicted. The reader – and the student in particular – is invited to take an active part.

It remains to thank those without whom neither the conference nor this volume would exist. Living Ecosystems was organised by the Accademia di Studi Mediterranei of Agrigento together with AssoIdea, with the support of the University of Palermo, the Archaeological and Landscape Park of the Valley of the Temples, the Regione Siciliana (Assessorato dei Beni Culturali e dell'Identità Siciliana; Assessorato dell'Istruzione e della Formazione Professionale), the Ufficio IV – Ambito Territoriale di Agrigento, and the partners Eco Promotion and Formare al benessere. Thanks are due, too, to the Scientific Committee, for shaping the programme; to the authors, for their contributions and for their patience with editorial requests; and to all those who took part in the discussion.

If the temples of Agrigento were built to last forever, these pages are content to last a little while – and to be of some use while they do.

Santino Lo Presti

Direttore dell'Accademia di Studi Mediterranei

Good morning to all the authorities in attendance, and in particular to the Prefect of Agrigento, Dr Salvatore Caccamo, and to the Head of Office IV – Territorial District of Agrigento, Dr Alberto Petix. My greetings to all the speakers, Italian and international, who have accepted our invitation to take part in this international conference. I should like to thank Professor Dario Russo, of the University of Palermo, the driving force behind the conference, and architect Fausto Giambra, representing Eco Promotion, who will share with us these two days devoted to the themes of climate, ecology, food and well-being. Our thanks are due also to the Archaeological Park, in the person of the architect Roberto Sciarratta, ever willing to host our initiatives.

This conference was conceived by Professor Assuntina Gallo, who passed away a few months ago and who cared deeply about these themes, in order to educate us in respect for the environment and for personal well-being. To educate us, yes: for we have a duty towards the younger generations – but we adults must, first of all, respect the ecosystems of our planet, so as to become examples for the young to follow. From the industrial revolution to the present day, humankind has done, and continues to do, little to respect what has been "created". We certainly have the right to build a "home" of our own, but only while respecting the surrounding environment, where people, animals and plants live – and therefore without destroying the "home" of others.

To achieve all this, we must develop an environmental conscience, both individual and collective, and bring into being a worldwide movement that gives force to the idea of respect for nature, in the awareness that it is we who must adapt to nature, and not the reverse. The recent environmental disasters – caused by the climate change that our reckless exploitation of nature has produced – show how close we are to the breaking point of the now precarious balance between humankind and the environment, and how powerless we are before the immense force of nature.

Over the next thirty years, temperatures will rise by 1.5°C and rainfall will drop by 5–10%. Humanity will move towards an expansion of its desert regions; the glaciers will melt, raising water levels, and many lands will disappear.

With this conference, therefore – in the spirit of the thought of our honorary President, Assuntina, to whom we all express our gratitude for the cultural heritage she has handed down to us – the Accademia di Studi Mediterranei seeks to raise the awareness of all of us, adults and young alike, of an issue so pressing and so troubling that none of us can shrink from confronting it, if we wish to go on living on this beautiful "blue planet" that is our Earth.

The Prefect of Agrigento

Salvatore Caccamo

The international conference “Living Systems”, promoted by the Academy of Mediterranean Studies of Agrigento, represents a distinguished occasion for scientific, cultural, and institutional dialogue on themes that interrogate the present and implicate the future of our communities.

Climate and ecological issues constitute today one of the principal global challenges which, when referred to the province of Agrigento, take on a special significance considering the environmental characteristics and vulnerabilities of this territory.

The territory of Agrigento, marked by a delicate balance between the natural environment, agricultural activities, archaeological heritage, and urban settlements, is among those most affected by the effects of climate change. The reduction of water reserves, rising average temperatures, prolonged drought, and coastal erosion are already evident critical issues, with direct repercussions on the local economy – particularly agriculture and tourism – and on the quality of life of communities. Climate and ecological issues also call today for reflection on the relationship between risk prevention and territorial governance. Hydrogeological fragility, wildfires, and the sustainable management of natural resources require integrated policies grounded in scientific data, careful planning, and institutional collaboration. It is in this perspective that the contribution of the academic and research community assumes a strategic role, providing essential knowledge tools to guide public decision-making. Of particular importance, furthermore, is the cultural and educational dimension. Strengthening widespread environmental awareness means promoting responsible behaviour and greater attention to the safeguarding of the Agrigento territory, understood as a common good. Younger generations are called upon to be protagonists of an ecological transition that holds together tradition and innovation, enhancing local resources without compromising their balance.

Institutions, for their part, are called upon to support pathways of sustainable development capable of combining environmental protection, territorial security, and economic growth. In a province such as Agrigento, the climate challenge is not abstract but concrete and daily: it concerns water, soil, landscape, the safety of communities, and the conservation of a heritage that belongs to the entire country.

Ministry of Education and Merit Regional School Office for Sicily Office IV – Territorial District of Agrigento

Calogero Alberto Petix

The ecological transition is not a technical matter. It is, first and foremost, a cultural one: it requires a shift in the cognitive paradigms through which people interpret reality, make decisions, and construct meaning from their actions. For this reason, the school system is not a peripheral actor in this process; it is its principal institutional vehicle.

The Ministry of Education and Merit is legally mandated to fulfil this role. Law no. 92 of 2019 on Civic Education and Ministerial Decree no. 183 of 2024 define a clear mandate: cultivate complex thinking, integrate sustainability across curricula, and embed environmental care in school life. The 2022 constitutional reform – with the new third paragraph of Article 9 and the amended Article 41 – marks an epochal shift: for the first time, the Charter recognises the legal relevance of future generations. School is where this must become experience, not formula.

The territory of Agrigento offers, in this context, an extraordinary point of identity. Agrigento is the city of Empedocles, the philosopher who first elaborated an organic conception of the cosmos: not a machine composed of parts, but a living organism traversed by forces in perpetual creative tension: *Φιλότης*, the Love that connects, and *Νεῖκος*, the Strife that divides. In the context of the ecological crisis, this legacy is not antiquarian curiosity: it is a didactic key. *Φιλότης*, the force that connects, that cares, that shares, is not merely an ethical value. It is a systemic necessity.

To hold this conference in Agrigento is to choose a place that embodies, in its very history, the question we are asking: how do we orient technology toward care rather than domination? How do we translate intergenerational responsibility from a moral imperative into daily institutional practice? The school is the institution in which, day after day, it is decided which force to cultivate. Office IV – Territorial District of Agrigento is pleased to extend its greetings to this conference, in the awareness that the work undertaken here contributes to building the cultural conditions without which no ecological transition is possible.

Educating for Wellbeing: Promoting Healthy Lifestyles

Fausto Giambra

The *Formare al benessere* [Educating for Wellbeing] project was developed within the framework of activities promoted by social cooperatives engaged in environmental and cultural promotion, with the aim of disseminating a vision of wellbeing understood as a balance between physical health, psychological dimension, and environmental quality. This is a concept that appears simple but is in practice difficult to translate into everyday habits, especially in a contemporary context marked by accelerated and often unsustainable consumption patterns.

Hence the need to intervene at the educational level, beginning with younger generations, through awareness-raising and training initiatives that promote more conscious lifestyles: a balanced diet, physical activity, the recovery of more sustainable rhythms, and a greater attention to the relationship between the individual and the environment. The project develops within existing events and contexts, into which moments of reflection and concrete actions are introduced – such as the promotion of quality local products capable of combining wellbeing, culture, and territory.

Activities are organised between Sicily and Calabria, and include sporting events, street food festivals, and workshops aimed at schools, with the objective of promoting a food culture that prioritises quality over price and recovers the value of culinary traditions. Food, in fact, is not only nourishment: it is also memory, identity, and a relationship with the land.Attention is devoted to inland areas, today subject to depopulation but potentially capable of offering new forms of quality of life, especially in a context in which remote working makes greater mobility possible. From this perspective, wellbeing takes shape as a complex condition that concerns not only the individual but also the environmental, social, and infrastructural characteristics of places.

Finally, the project is part of a broader reflection on the global consequences of contemporary development models: what appears distant – geographically or environmentally – is deeply connected to our everyday choices. Promoting wellbeing therefore also means developing a greater awareness of one's own responsibilities and contributing to the construction of a shared vision capable of orienting individual and collective behaviours towards more sustainable models.

Introduction to Session I – Framing the Theme

Mario Bisson

The opening of the conference invokes the very meaning of the gathering as a space for dialogue and exchange, rather than a mere occasion for the unidirectional transmission of knowledge. In this perspective, the conference is understood as an active moment, in which dialogue – with younger generations in particular – becomes an integral part of the process of constructing knowledge.

The theme of the environment is introduced in a broad perspective that moves beyond a sectoral vision toward the concept of ecosystem. This implies an approach capable of integrating different dimensions – environmental, social, cultural – and of reading contemporary phenomena in a systemic key.

Within this framework, it is emphasised that every form of scientific knowledge should not be understood as definitive truth, but as a provisional synthesis, open to discussion and critical revision. The possibility of questioning the interpretations put forward constitutes, in fact, an essential condition for the progress of research.

The introduction thus lays the groundwork for the contributions that follow, highlighting the need for an interdisciplinary and open approach, in which design emerges not only as a projective practice but as an interpretive tool capable of contributing to the understanding and transformation of contemporary systems.

One Health: Keeping Agriculture within Planetary Boundaries

Federico M. Butera

Introduction

In recent decades, the global environmental crisis has made it increasingly clear that we need to understand the limits within which the Earth system can continue to function stably. It is within this context that the 'planetary boundaries' approach was developed from 2009 onwards by an international group of scientists led by Johan Rockström (Rockström, 2009). The aim of this research programme was to identify the main processes – both natural and anthropogenic – that govern the functioning of the Earth system, and to define indicators and thresholds for each of them capable of signalling when these processes enter a state of risk.

The approach is like that used in medical science about the human body: just as there are physiological parameters that allow us to assess the state of health of an organism (blood pressure, temperature, oxygen levels), so too is it possible to monitor the planet's 'metabolism' through specific indicators. Exceeding these thresholds signals a state of imbalance that can compromise the stability of the entire system.

Exceeding planetary boundaries

Nine critical processes have been identified, and for each one, one or more indicators have been defined, along with their respective threshold values that must not be exceeded in order not to compromise their proper functioning. Together, these limits form the 'operating space' within which humanity can develop without destabilising the Earth system.

The nine critical processes identified are (Figure 1):

- The CO_2-O_2 cycle, altered by the release of greenhouse gases into the atmosphere, leading to climate change
- The vital processes that ensure the integrity of the biosphere, threatened by biodiversity loss and species extinction
- The process of land surface transformation, through changes in land use
- The water cycle, altered by groundwater extraction and the creation of canals and reservoirs

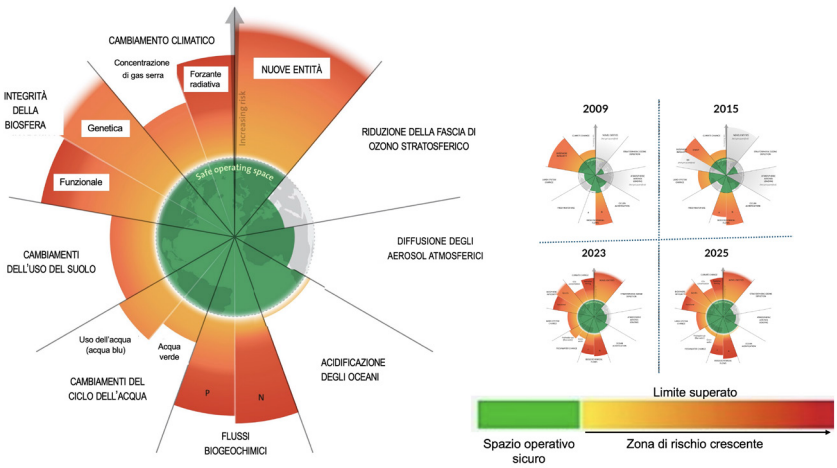
- Biogeochemical flows, namely the nitrogen and phosphorus cycles, altered by the use of artificial fertilisers
- Ocean acidification, caused by rising atmospheric CO_2 concentration
- Processes involving combustion, resulting in the production and dispersion of atmospheric aerosols, which contribute to climate change
- The oxygen-ozone cycle in the upper atmosphere, altered by the release of fluorinated compounds that damage it, causing a reduction in the stratospheric ozone layer that protects us
- Production processes that lead to the continuous introduction of new entities into the biosphere, including millions of new chemical compounds and organic substances.

The current situation is particularly worrying. In 2009, three limits had already been exceeded; by 2015, this had risen to four; by 2023, six; and by 2025, seven.

The overall picture is that of a rapidly deteriorating system. To continue with the analogy of the human body, one could say that the planet is seriously ill.

The crossing of the climate change threshold is generally attributed to carbon dioxide emissions. However, this view is oversimplified. In fact, greenhouse gases – that is, those that contribute, through the greenhouse effect, to rising global temperatures, causing climate change – also include methane and nitrous oxide, which have an impact approximately 30 and 300 times greater than that of CO_2, respectively.

Fig. 1

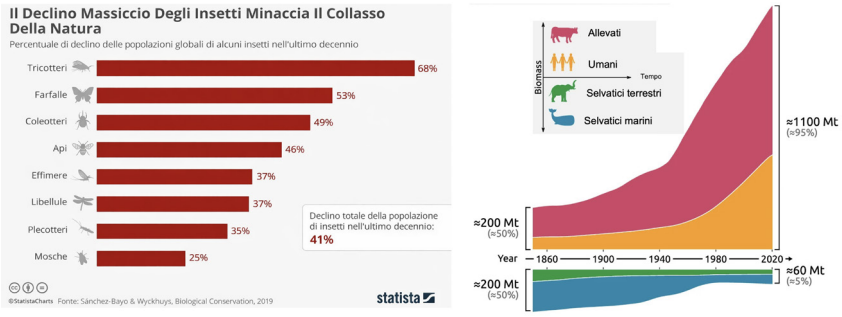


A significant proportion of these emissions is linked to the food system. It is estimated that around two-thirds of emissions come from industry, transport and construction, whilst around one-third is linked to the way we produce, process and consume food. This figure implies that even a complete replacement of fossil fuels with renewable energy would not be sufficient to halt climate change unless action is taken on food systems.

The biosphere, soil and resource use

A second critical area concerns the alteration of the biosphere, which manifests itself through the loss of biodiversity. In recent decades, there has been a drastic reduction in insect populations (McCarthy, 2019) and a radical transformation in the distribution of mammalian biomass (Figure 2). Whereas at the end of the 19th century the total mass of mammals was evenly distributed among humans, farmed animals and wildlife, today the situation is profoundly unbalanced: almost the entire mass consists of humans and farmed animals, whilst the wild component represents a minimal proportion (Greenspoon, Krieger, Sende, 2023). This indicates a profound alteration in ecological balances.

Fig. 2



Soil, a complex and fundamental ecosystem, has also been severely compromised. Healthy soil is characterised by a rich presence of microorganisms, insects and fungi; intensive farming practices have progressively depleted this biodiversity, compromising its fertility.

Land use represents a further critical factor (Figure 3). Almost half of the planet's habitable land is devoted to agriculture, but of this area, 80% is used to support livestock farming, both as pasture and for feed production, and only 16% is directly used for human consumption ((Ritchie, Roser, 2024), of which around 30% is wasted (Rezaei, Liu, 2017).

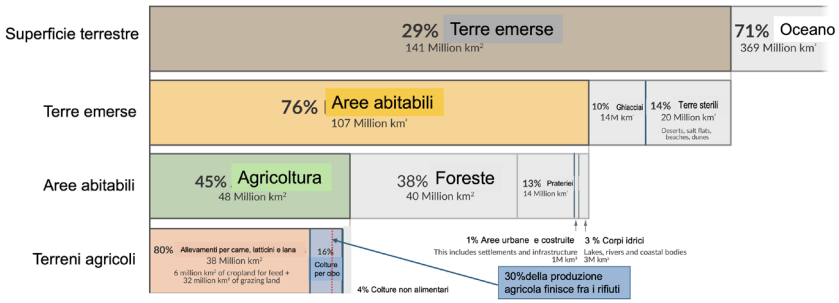
Land-use change has a dual negative effect: on the one hand, it reduces CO_2 absorption capacity (for example through deforestation);

on the other, it releases carbon accumulated in the soil into the atmosphere, further contributing to the greenhouse effect.

The water cycle is also severely disrupted: around 70% of available freshwater is used for agriculture (Raghavendra, 2024).
Added to all this are alterations in biogeochemical cycles, particularly those of nitrogen and phosphorus, linked to the massive use of synthetic fertilisers introduced from the early 20th century onwards. These fertilisers contribute both to greenhouse gas emissions and to phenomena such as water eutrophication, which drastically reduces aquatic biodiversity.

No less rapid has been, since the second half of the 20th century, the proliferation of new substances in the air, water and soil: millions of new chemical compounds, previously non-existent in nature or present only in minute quantities. One need only think of the plastics that have invaded the Earth's habitat and, in their microscopic form, have even found their way into our bodies, or of all the pesticides and dyes, to name but a few of these new substances. To these must be added the flow of antibiotics and hormones used in intensive livestock farming, with the former having led to the emergence of antibiotic-resistant microbes, causing serious harm to human health.

Fig. 3



The food system and the global crisis

The food system therefore has a substantial impact on as many as six of the seven overshoot limits and emerges as one of the main factors putting pressure on the Earth system. The problem is not the quantity of food produced, but rather the way in which it is produced, distributed and consumed.

Although global production is theoretically sufficient to feed the world's population, there are profound inequalities. Hundreds of millions of people suffer from hunger, whilst over two billion

live in conditions of food insecurity; at the same time, there is a widespread increase in obesity and related diseases, often concentrated among the poorest sections of the population (FAO, IFAD, UNICEF, WFP & WHO, 2025).

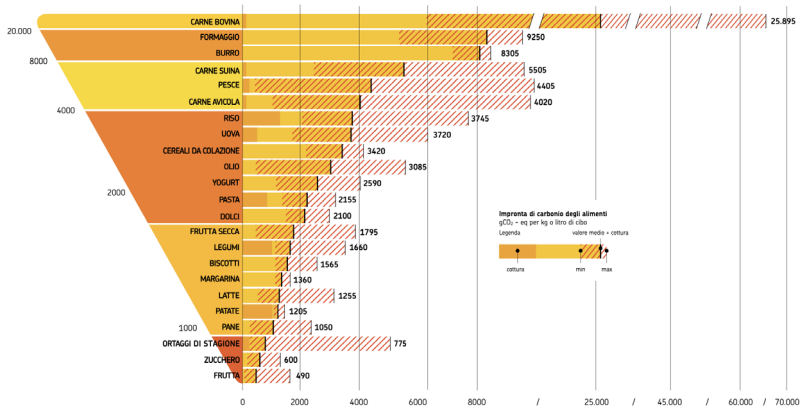
This paradox highlights the distortions of the contemporary food system, which prioritises profit-driven production models over human and environmental health.

One particularly significant factor concerns the true cost of food. Market prices do not reflect the environmental and health costs associated with production. If these costs were internalised, many products – particularly those of animal origin – would be significantly more expensive, unlike pulses which, for the same nutritional value, have a low environmental impact.

A comparison of different food types highlights significant differences in greenhouse gas emissions (BCFN, 2016): for the same protein intake, meat has a much higher carbon footprint (greenhouse gas emissions per unit of weight or volume) than pulses (Figure 4).

Added to this are the health costs: it is estimated that unbalanced diets contribute to millions of deaths each year and generate extremely high global economic costs.

Fig. 4



Towards a sustainable diet

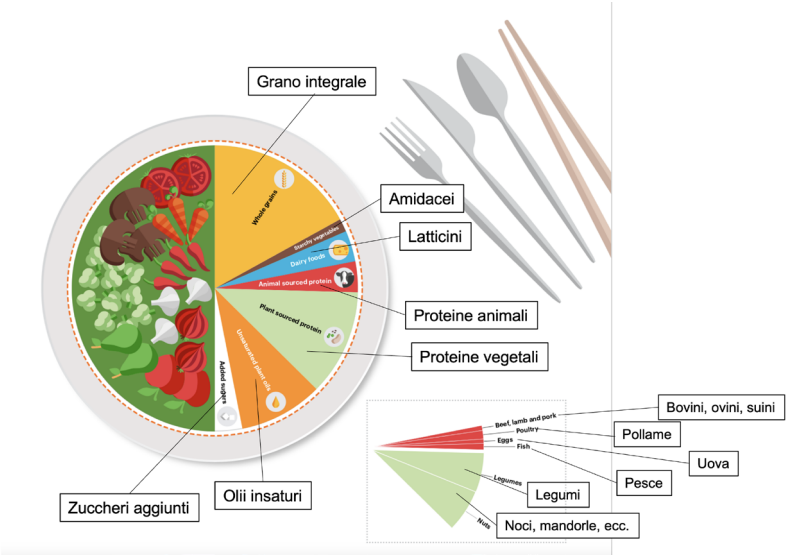
Numerous scientific studies, including those published in "The Lancet", have shown that a healthy diet is also a sustainable diet (Willet et al., 2019).

The main recommendations include (Figure 5):

- a high intake of fruit, vegetables and pulses;
- a significant reduction in the consumption of meat and dairy products;
- the use of whole grains;
- a preference for unsaturated fats;
- a restriction on ultra-processed foods.

This diet is also the one that minimises the environmental impact associated with food production, because there is a correlation between human health and environmental sustainability: what is beneficial for the body is also what reduces the impact on the planet.

Fig. 5



Conclusions: beyond the linear model

The dominant production model is linear: extract-produce-consume-dispose, and it has also been applied to agricultural production, in contrast to the functioning of natural systems, which are instead based on closed cycles.

For millennia, human societies operated according to models closer to natural ones; the transition to a linear system is relatively recent and coincides with the development of industrialisation. Since the advent of agriculture, food has always been produced without the use of artificial fertilisers or pesticides, and the energy used was entirely renewable: solar energy and human and animal muscle power. At a certain point in our history, hydraulic and wind power—both also renewable—were introduced, in the form of watermills and windmills. Admittedly, productivity was lower than it is today,

and with the productivity of the past we could not feed the current world population.

Today, however, scientific knowledge and available technologies – including regenerative agriculture, agroecology, advanced monitoring systems and artificial intelligence – make a transition to more sustainable, circular, production models possible, ensuring productivity levels comparable to those of industrial agriculture whilst significantly reducing environmental impact.

The challenge we face today is therefore not solely technological, but systemic and cultural, because it involves substantial changes both in the production model and in our eating habits: rethinking food systems means addressing one of the main cruxes of the contemporary ecological crisis and redefining the relationship between human activities and the Earth system.

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Captions

Fig. 1 – Planetary boundaries trespassed (Credit: "Azote for Stockholm Resilience Centre, based on analysis in Sakschewski and Caesar et al. 2025")
Fig. 2 – Decline in insect populations (left) and changes in mammalian biomass (right)
Fig. 3 – Land use
Fig. 4 – Carbon footprint of the most common foods (average values, gCO_2eq per kg or per litre, including cooking)
Fig. 5 – A healthy diet for people and the environment

De-sign. Lost in Transition, Time to Solve It

Rūta Valušytė

Contemporary society is characterised by a condition of permanent transition, in which economic, social, and technological systems are simultaneously under pressure from environmental crises, geopolitical tensions, social inequalities, and technological acceleration. In this scenario, design occupies an ambivalent position: still widely interpreted as a practice tied to form and product, it is increasingly recognised as a discipline capable of intervening in systemic processes and transformative dynamics. This contribution examines this ambivalence, arguing that design's apparent disorientation in the current transition is precisely the condition that makes its redefinition both urgent and possible.

Design and Transition: A Structural Condition

The crises traversing contemporary societies – climate change, sustainability pressures, demographic ageing, social inequality, geopolitical conflict, and threats to democratic systems – are not independent phenomena but deeply interrelated. Geopolitical tensions are frequently rooted in competition for resources, making sustainability not merely an ethical choice but a strategic necessity. A further complicating factor is the growing role of artificial intelligence, which simultaneously introduces new risks and amplifies existing inequalities.

One significant inversion deserves attention: whereas the post-war decades saw a progressive shift from military to civilian production, the current moment witnesses the reverse – the logics of conflict re-entering and reshaping productive systems. This shift has direct implications for design practice and its social mandate.

Design as Political and Social Practice

The political and social dimensions of design are not new. Since the 1960s it has been evident that design is not neutral: behind the expressions of pop culture lay global tensions that pushed designers to question dominant norms and models. Yet the political role of design is not uniform across contexts. In Western democracies it has functioned primarily as a critical tool and instrument of social transformation; in the countries of the former Soviet bloc, design was frequently deployed as ideological propaganda embedded in everyday objects.

In the current geopolitical climate, design is once again assuming political relevance – contributing to the construction of resilience and to the support of democratic processes. Participatory design practices and the development of communicative devices for collective action demonstrate that design operates well beyond the object, functioning as the infrastructure of social processes.

De-sign: Etymology and Redefinition

A productive starting point for rethinking design is etymological. The term derives from *de-signum* – the capacity to distinguish, give meaning, and leave a significant mark in relation to other elements. This etymology resists the reduction of design to formal or aesthetic activity, foregrounding instead its strategic and intentional character. The connection with the Greek *techne* – operative knowledge, the art of making – reinforces this reading: design is not decoration but a form of knowing through doing.

From this perspective, design emerges as an activity oriented toward the construction of meanings and the configuration of relations between systems, rather than the production of objects.

From Product to Systems: The Evolution of Design

Design is a young discipline, but one characterised by a remarkable capacity for transformation. Its trajectory can be traced from the design of products, through the design of processes and services, to the support of systemic transitions. In this sense, design functions as an "in-between" discipline, operating across fields and adapting to emergent needs.

Recent scholarship has introduced the notion of a "fifth order of design", in which designers no longer limit themselves to creating artefacts but intervene in social and systemic challenges, contributing to the orientation of complex transformations. Design becomes, in this reading, a tool for rendering possible futures explorable – not predicting them but giving them form.

Mission-Oriented Design and Future Scenarios

In conditions of uncertainty and crisis, design increasingly assumes a mission-oriented character: it is oriented not toward the fulfilment of predefined briefs but toward the construction of intentional actions capable of guiding transformations.

One of the most significant emerging directions is the conceptual shift from the Anthropocene to the Symbiocene – a framework in

which human beings are no longer positioned as dominant actors but as participants in a system of relations with other species and with the environment. Design, in this perspective, is called upon to design for complex ecological systems, exploring forms of interspecific coexistence and collaboration.

Speculative design projects such as the Silk Pavilion developed at the MIT Media Lab illustrate this possibility: the designer defines initial conditions, while the process is completed by non-human actors. A complementary direction is oriented toward care – the promotion of wellbeing, equity, and quality of life – engaging design in complex social contexts through participatory practices.

Resource Efficiency and Systemic Design

Many current approaches to sustainability remain focused on production optimisation or recycling – interventions that prove insufficient without a corresponding transformation of consumption and distribution models. Design can contribute to rethinking these systems through strategies that combine technological innovation with service models. Product-as-a-service frameworks, in which access replaces ownership, offer one significant example: operating simultaneously at the levels of product, service, and system, design contributes to the construction of more sustainable models.

Design, Research, and Interdisciplinarity

The role of design extends into the field of research. Used as a methodology, design generates knowledge through practice (*research through design*), producing results that are simultaneously theoretical and applied. Yet design occupies an ambiguous position within academic systems: classified as an artistic discipline in some contexts, it loses recognition in scientific research; assimilated to the sciences in others, it risks losing its projective dimension.

This ambivalence reflects design's intrinsically hybrid nature, which demands interdisciplinary and, in many cases, anti-disciplinary approaches. Abductive thinking – introduced by Charles Sanders Peirce – is particularly relevant here: the capacity to generate new hypotheses by combining existing data with creative intuition represents a cognitive mode especially suited to complex and unpredictable problems.

Conclusions: Time to Go Off-Road

The current condition demands a paradigm shift. Educational and cultural systems have long privileged linear and predictable solu-

tions; contemporary challenges require approaches that are open, experimental, and non-linear. What is needed is a capacity for *wrong thinking* – the willingness to leave established paths, explore alternatives, and question the status quo.

Design, by its nature, possesses this capacity. Its transdisciplinary dimension, its openness to dialogue between forms of knowledge, and its projective vocation make it a strategic resource for addressing systemic challenges. In an era of compounding crises, design cannot limit itself to responding to predefined requests: it must actively contribute to the construction of new scenarios, orienting transformations toward futures that are more equitable, sustainable, and democratic.

Ecology and Human Destiny in the Techno-Anthropological Circle

Dario Russo

1. The Three Factors

What are the three main ecological problems of our time? One might answer: climate change, biodiversity loss, and global pollution, including the accumulation of waste. These closely intertwined phenomena generate increasingly unmanageable economic and social crises. All of them are significantly aggravated by three factors: two widely recognised and one almost entirely overlooked. The two well-known factors are geopolitical competition and self-representational consumerism. The third – far less familiar – is what I call the techno-anthropological circle.

Geopolitical competition. The great powers, on which all states directly depend, struggle to reach agreement on common energy policies and the management of global resources. Each has developed its own civilization and its own worldview, often difficult to reconcile with the others. Bluntly put, these are empires – older or newer – that aim to project power. We can debate for hours about the rule of law, social justice, and universal rights – concepts largely derived from the Franco-American Enlightenment tradition – but the reality remains: geopolitical competition. If tomorrow a truly clean and perfectly renewable energy source were to emerge, produced on a global scale by a power capable of dominating its industrial supply chain – China in the case of solar panels, for instance – another power would immediately move to prevent that hegemony, with the United States first in line. Not for ecological reasons, but to avoid a strategic imbalance (*Il tempo della Cina* [*The Time of China*], Limes, 12/2025). The same applies to climate change. While many countries fear the melting of permafrost, in Russia some see opportunities: new arable land in Siberia, access to vast mineral resources and the opening of the Arctic route, which would connect the Atlantic and the Indo-Pacific far more rapidly (*A qualcuno piace caldo [Some Like It Hot]*, Limes, 11/2024). When this happens – for it seems to be a matter of time – it will be a double disaster for us in the Mediterranean world, not only ecological, because the Mediterranean – which Braudel called «espace liquide [liquid space]» (1949/1999, p. 16) – will no longer lie at the center of trade routes. Hence Trump's interest in Greenland (*Morire per la Groenlandia* [*Dying for Greenland*], Domino, 2/2026). But this

Fig. 1

is not the focus of my contribution. I therefore leave readers to the excellent geopolitical journals now widely followed here in Italy as well, such as *Limes* and *Domino*.

Self-representational consumerism might seem, at first glance, a problem more within our reach as responsible individuals. After all, we could all avoid buying the latest iPhone model. But this is a simplification. The matter is far more complex, far more insidious. If we think about it for a moment, almost nothing we buy – at least in the West, and now increasingly across affluent parts of the world, from the Emirates to the Chinese coast – corresponds to what we actually need. Real, practical need. The greater part of our consumption corresponds instead to a symbolic need, a social need, one might even say a spiritual one. And this has enormous implications. Not only because the fundamental characteristic of human beings is the consumption of cultural practices, but also because our consumption habits are instruments of social relation: we communicate with our fellow humans – an activity we cannot do without – through products, services, and devices that reflect our aesthetic choices. It is no coincidence that Donald A. Norman, one of the key theorists of contemporary design, wrote a book significantly titled *Emotional Design: Why We Love (or Hate) Ev-*

eryday Things (2004). Note: we love or hate; we do not merely use or discard. In this book he identifies three levels of design's action: the behavioural, corresponding to use value; the visceral, which drives us to buy something without asking either what it is for or what it costs; and the reflective, by which we purchase what holds value for us. We find ourselves, then, in the realm of spirituality, however much this may coincide with plain marketing. Similarly, philosopher Fulvio Carmagnola, in *Il consumo delle immagini. Estetica e beni simbolici nella fiction economy* [*The Consumption of Images: Aesthetics and Symbolic Goods in the Fiction Economy*] (2006), has explained how products – material and immaterial – correspond today to embodied or imaginary symbols. And a form of product has spread that is distinctive enough to have become paradigmatic of our age: the hypercommodity (*ipermerce*), that is, the commodity elevated beyond itself (Carmagnola, Ferraresi, 1999). But this too is a relatively well-known phenomenon. We need not linger further, and may leave such delights to aestheticians, semioticians, and sociologists.

What I intend to address is the third factor aggravating ecological crises: the techno-anthropological circle; an interpretive framework for the human recently developed in philosophy by Maurizio Ferraris (2025a). It begins with nature, our animal soul; this is hybridized by technology; from there we ascend to the world of spirit (culture), distilling consciousness, which then descends back onto our nature in the form of reason [Fig. 1]. This expression – techno-anthropological circle – denotes a form of recursiveness and contains within it two key terms: technology and human. Both are, in fact, anything but uncontroversial. They can be interpreted in very different ways and carry behind them long and often conflicting theoretical traditions. It is therefore worth pausing on these two concepts – technology and human – and attempting to clarify, as far as possible, how they operate.

2. Technology and Its Discredit

Let me pose a question immediately: is technology a good or a bad thing? The question is not rhetorical. We live in an age in which decades of dystopian narrative – from Isaac Asimov's novels to *2001: A Space Odyssey* (Kubrick, 1968), from *Terminator* (Cameron, 1984) to *Blade Runner 2049* (Villeneuve, 2017) – have consolidated in the collective imagination a deep mistrust of the machine and of technological progress. This suspicion is not without historical and philosophical roots, but it risks leading to hasty conclusions.

Where does the discredit of technology that ran through the twentieth century come from? One significant moment is the dawning

awareness, during the First World War, of a destructive capacity never seen before: machine guns, lethal gases, military aviation, devastating bombs. For the first time, entire populations – civilians, not only soldiers – were drawn into the massacre. Technology revealed its destructive, almost demonic potential; it seemed to turn against humanity itself (Ellul, 1954).

Perhaps the most significant moment came after the Second World War. I am not referring to the two atomic bombs dropped on Japan – Hiroshima and Nagasaki – but to the Nuremberg Trials, where Nazi leaders loyal to Hitler were tried and convicted of crimes against humanity. Twelve of the twenty-two were sentenced to death, but not all. Among those who escaped the death penalty was Albert Speer: the Führer's architect and Minister of Armaments, whose contribution probably delayed Germany's capitulation by a couple of years. In his final statement of 31 August 1946, he said something disarming: he accepted his share of responsibility but added that Hitler's dictatorship had been the first to make full use of modern technical means to dominate its own people. Radio and loudspeakers had deprived eighty million people of independent thought; telephone, teleprinter and radio allowed orders from the highest authorities to reach every level, where they were executed without any criticism. Every individual thus became an uncritical functionary of a gigantic techno-bureaucratic apparatus. Technology, in other words, was not merely a tool: it had become the very device of domination. Here was the argument of a highly intelligent man trying to save his own skin: the greatest guilt falls not on men, but on technology.

This suggestion was taken up, philosophically unpacked, and elaborated by Martin Heidegger, first in a series of lectures delivered in Bremen in 1949, then in the essay *Die Frage nach der Technik* [*The Question Concerning Technology*] (1954), in which he formulates the idea of technology as «Entbergung [unconcealment]» (Heidegger, 1954, p. 87) that risks reducing everything to «Bestand [standing-reserve]» (Heidegger, 1954, p. 85). The idea proved compelling and spread rapidly in Italy as well, through philosophers such as Emanuele Severino (1998) and Umberto Galimberti (1999).

To say that technology is guilty is like attributing the murder of Julius Caesar to the daggers rather than to Brutus and Cassius. It is like trying to teach etiquette to cutlery. The morality of the table knife – if one can speak of such a thing – lies only in the fact that its tip is rounded. As a technical supplement, however, the knife is structurally extra-moral (Ferraris, 2025a, p. 39) [Fig. 2].

Artificial intelligence – the most advanced technology of our time – is potentially lethal, but not as such. Only in the hands, or rather

Fig. 2

under the fingertips, of those who use it maliciously. Admittedly, by its very nature, it is more dangerous than the atomic bomb. Not because it is more powerful, but because it is infinitely more accessible. The atomic bomb requires specialized infrastructure that no one can build at home; it is the preserve of a few powers that keep each other in check. Artificial intelligence, by contrast, is within everyone's reach, under countless fingertips, and is already acting – even now – in a military direction: the new wars are also fought with smartphones and drones (Ferraris, 2025a, pp. 37–38).

The problem, however, is not to catechize technology. There is already far too much ethics in artificial intelligence systems, as the flourishing philosophical debate on the topic demonstrates, emblematically represented by Luciano Floridi's *The Ethics of Artificial Intelligence: Principles, Challenges, and Opportunities* (2022). Nonetheless, if someone were to go to a library to find information on poisons with the intention of committing suicide, they might perhaps carry out their plan. If instead they were to ask ChatGPT "what is the best poison to commit suicide with", ChatGPT would express regret at learning they were going through a difficult time and suggest speaking with a therapist or a family member.

Fig. 3

The problem, then, is not technology; it is the use we make of it: our stupidity, our shortsightedness, the gross errors we commit against ourselves. Returning to the techno-anthropological circle, the task is to activate consciousness and reason, orienting human nature toward ecologically compatible needs and aspirations, toward genuinely effective solutions that do not end up backfiring on us; as happens all too often in the manner of Wile E. Coyote, Super Genius [Fig. 3].

3. Why Us, and Only Us?

To understand how to activate this consciousness and reason, we must first take a step back and ask: why have human beings – and not other animals – developed sophisticated civilizations and technical tools capable of exponentially multiplying their natural capacities? Why us, and only us?

Of course, if we believe we were created in the image and likeness of God, the problem does not arise. We were perfect, in a state of nature, in the Garden of Eden. Then Eve saw fit to pluck the fruit of sin from the tree of the knowledge of good and evil – the same fruit that, not coincidentally, appears bitten on the back of millions of smartphones – and from there, let us say, the his-

Fig. 4

tory of humanity took a rather complicated and, one might add, irreversibly transformative turn [Fig. 4].

Or we might think that the human being is alien to this planet: the product of a bold genetic engineering experiment, whereby a particularly evolved ape – terrestrial – was hybridized with the genome of technologically advanced aliens, the so-called Travelers, or ancient astronauts. This thesis is advanced by certain authors of considerable appeal and by a great deal of science fiction (Sitchin, 1976; Biglino, 2011), starting from an observation that is in itself not unreasonable: the human being does not seem made for any habitat on Earth. If this were the case, the matter would be settled: we are not of this planet, and our intelligence would only confirm it.

If instead we hold that the human being evolved, like other animals, through a very long process of adaptation until becoming what it is, the question remains unanswered: why do we use glasses, video projectors, and armchairs, while other animals do not? Why have we developed this sophisticated and ever-growing multitude of techniques, while other animals have not?

One might then think that the reason lies in brain size: humans would simply be more intelligent because endowed with a larger

Fig. 5

and more powerful brain. But this is not the case. The bottlenose dolphin (*Tursiops truncatus*), the most studied dolphin species, has a brain mass greater than ours in absolute terms and only slightly inferior in relative terms; and yet its brain is capable of performances no human being could match. For example, differentiating the activity of the two hemispheres: while one keeps watch, the other dozes. A faculty that, on reflection, no one would mind having. So, if dolphins are so intelligent, why do humans hold conferences on dolphins while dolphins do not hold conferences on humans? Simple: we came out of the water; they did not. Unlike us, fins never developed prehensile capacity, which meant they could not manipulate objects, build tools, light a fire, sit around it to tell each other stories, invent myths…

Not only that. The dolphin is perfectly adapted to its environment. As is a tick, a spider, or a cat. The human being is not: it is a maladjusted, incomplete animal, «not yet stabilized as a type [das noch nicht festgestellte Tier]», as Nietzsche observed (1886/1968, p. 68). The featherless biped is born premature, slow to develop, and naturally ill-equipped: weaker, slower, and more fragile than most of the animals with which it must compete and from which it must defend itself, lacking fangs, claws, scales, armour, horns, or venom. An ideal candidate for species extinction [Fig.5].

Fig. 6

Here the real “miracle” occurs. Need drives the human being to compensate for its deficiencies through technical supplements. The first is most likely the stick: it digs, extends the arm toward forbidden fruit – long before Eve – and serves as weapon, club, or javelin. The stick, not the chipped flint, is probably the oldest technical supplement; it has simply not survived the millennia because the material is perishable. The chimpanzee also uses a stick to satisfy a need, but after using it, it leaves it there. The human does not: it takes the stick back to the cave and capitalises it.

It does the same with every other technical supplement, investing time in the construction of something useful, confident that the tool will repay it with interest. Thus, from a stick or a bone we arrive at the spaceship, as Kubrick recounts in *2001: A Space Odyssey* (1968); and then, looking to the most advanced technology of our time, at artificial intelligence [Fig. 6].

If the stick is the first material technical supplement, the first technique of all is most likely the upright posture: the very foundation of the human condition. Around two million years ago, the human being, unlike the chimpanzee, made a definitive choice for the upright position: the oldest technique of all, predating even

fire. Far from painless: the upright posture is fraught with grave consequences. The organs are compressed downward, the spine suffers, and women are forced to give birth after nine months rather than eighteen. Hence the prematurity of human infants, who require parental care for an incomparably longer period than other animals: a cat is self-sufficient at four months; a human is not at four years, nor at forty, nor, for that matter, at eighty.

And yet the upright posture brings decisive advantages. It facilitates communication: one need only think how complicated it would be to hold a conference on all fours. It frees the hands from their locomotor function, allowing them to specialize in the manipulation of objects, the direct premise of technology. It relieves the mouth of its prehensile function, making it available for the emission of sounds conducive to language. An exaptation thus occurs: the phenomenon whereby an organ develops a function different from the one for which it originally formed. The vocal cords, which originally served to prevent pieces of food that were too large from obstructing the airways, acquire an entirely new vocation.

What would a human being be in a state of nature? A non-human, a not-yet-human. The human infant, to become such, must be educated. Indeed – as Kant (1803) affirms – it is the only animal that can be educated; and must be. Others, at most, can be trained. But in doing so one alienates them from their own nature, adulterating them: the circus lion jumping through the ring of fire, the elephant playing sadly with a ball. The uneducated human, by contrast, is a contradiction in terms: he must pass through technology to develop himself. Technology, therefore, makes us human. Not the other way around.

A striking example. The Massaco – a very rare population of the Mato Grosso, in the Brazilian Amazon – have never had contact with other ethnic groups, at least as far as we know, since their ancestors crossed the Bering Strait to reach the American continent. Some would not hesitate to call them savages: they live naked. If a human being in a state of nature were to exist, could it be even less technological than a Massaco? We cannot approach them – making one's way into the Amazon rainforest would not be prudent, and they would not take it well – so we can only observe them from above, at a distance. And yet: they are indeed naked. But all of them – men and women, adults and children – grip a stick, that is, a technical supplement. Furthermore, they walk on two legs and they speak – which is by no means obvious – meaning that someone taught them to do so, having in turn learned from someone else: cultural transmission. Without it, one might doubt that their ancestors would ever have crossed the Bering Strait. The

Fig. 7

moral: even the least technological human being that could exist is, as a human being, technological. And it could not be otherwise.

This may seem obvious, but it is not: at the origin of the human there is a technical supplement, in this case a stick. The riddle that the Sphinx poses to Oedipus recalls this with great effect: what animal walks on four legs in the morning, two at noon, and three in the evening? The human, obviously. Which means that the human being incorporates technology – the stick – already at the ontological level: the stick – that is, technology – forms part of the very definition of the human and distinguishes it from all other animals. It is indeed the only one that not only uses tools but is also able to capitalize them. It is no coincidence that the word "imbecile" derives from the Latin *in baculum*, meaning literally "without a stick", that is unprovided, ill-equipped. In short, the human animal is not the one that uses tools; it is the one that cannot exist without them.

The thinker who most strenuously argued that the human being was good, pure and happy in a state of nature, contentedly basking in it, and was then – for some reason – corrupted by technology and society was Jean-Jacques Rousseau. Memorable are the words with which Voltaire commented on the *Discours sur*

l'origine et les fondements de l'inégalité parmi les hommes [*Discourse on the Origin and Foundations of Inequality Among Men*] (1755): «On n'a jamais employé tant d'esprit à vouloir nous rendre bêtes; il prend envie de marcher à quatre pattes quand on lit votre ouvrage [Never has so much ingenuity been employed in trying to make us all into beasts; reading your work makes one want to walk on all fours]» (Voltaire, 1755/1823, p. 47). Voltaire adds, however, that having lost this habit for some sixty years, he does not feel like taking it up again. But it does not end there: it would be very pleasant – Voltaire continues – to go to America and fraternize with the indigenous populations of Canada, but his poor health counsels against straying too far from European doctors. Voltaire's sarcasm ultimately says something very simple: returning to walking on all fours means slamming the door in the face of humanity [Fig. 7].

4. The Techno-Anthropological Circle

At this point it is worth asking: how does the techno-anthropological circle concretely work? We are born. We are newborns: we know nothing, we have no values or feelings; only drives, emotions, sensations, perceptions, exactly like other animals. And yet we evolve spiritually. Why? Because, as Erik Satie observed in 1924: «Je suis venu au monde très jeune dans un monde très vieux [We are born very young into a very old world]» (cit. in Lajonie, 1985, p. 373). That is: we are immersed from the very beginning in the techno-anthropological circle. At first, we are governed by elementary drives alone: eating and sleeping. Then come coloured ribbons, puppets, games, fairy tales, comic strips, cartoons. We begin to elaborate ideas, to transcend our first nature – the animal one – progressively assuming a second, founded on technology, culture, and civilization. Whether we like it or not [Fig. 9].

And to begin with, we truly do not like it. The education we undergo is a long and anything but spontaneous affair: we must learn to sleep at night, to eat at regular hours, to walk, to speak. The education of a human infant is more complex than the training of an astronaut! This is made possible – and necessary – by a remarkable characteristic of *homo sapiens*: neoteny, that is, the retention of juvenile traits in the adult, which manifests itself in a prolonged period of growth. Compared to other animals, we remain "children" for an exceptionally long time, which allows us to explore learning in the most varied and not strictly programmed forms: an evolutionary window without precedent in the animal world (Lorenz, 1963). It was by no means easy to acquire what we today take for granted; and had no one taught us, we would never have learned it: we would not speak and would still be groping about somewhere in the world. Never mind the Massaco.

The reasoning holds. The human develops technology to compensate for its natural inadequacy, capitalizes a growing quantity of technical supplements and increases its power, far surpassing all other animals, to the point of becoming a danger to a great number of species, and for some time now to itself as well. We will return to this point. First, however, it is worth asking: what does all this have to do with spirit? What does spirituality have to do with technology? Why should the ensemble of technical supplements be the very condition for the emergence of the world of spirit, from which consciousness and reason descend?

The world of spirit is the sedimentation of the prolonged encounter, over very long stretches of time, between the animal soul and the panoply of technical apparatuses – the human capital that defines our second nature. Spirit is not the fruit of a Pentecost, nor the Creator's trademark, nor a set of faculties deposited in us by a nature that would have equipped us with neurons for language, literature, cordiality, and the bump for mathematics. It is a hybridization. Without technology it is not possible to access the spiritual level. We are what we are because we are what we inherit from learning and culture, which is the sedimentation of technologies in becoming. Where does that delicate monster we call "consciousness" come from? From the hybridization of soul and automaton and the consequent birth of spirit; not like a mushroom springing from the ground, but from language, education, rites, and libraries.

When we speak of technology, moreover, we are not referring solely to the computer, the wrench, or artificial intelligence. Technology is what the human produces by hybridising its own first animal nature – a purely theoretical condition, that of the human in a state of nature –: everything that would not exist in nature without human ingenuity driven by need. This encompasses not only material objects, such as the mobile phone or the microphone, but also immaterial ones, such as the passport or the law: social objects of which no other animal would know what to make, from which we distil values, aspirations, and worldviews. To put it in Ferraris's words: technology «non è solo picchiare su un chiodo per appendere un quadro, ma dipingere il quadro, e poi tutto ciò che compone lo spettacolo di arte varia dell'umanità: maledire, benedire, promettere [is not only hammering a nail to hang a picture, but painting the picture, and then everything that composes the variety show of humanity: cursing, blessing, promising]» (Ferraris, 2025a, p. 157).

From the world of spirit, we distil consciousness and reason, understood as the faculty of attributing purpose. Thus, we attribute meaning to things in a world around us that is, by its very nature, chaotic and objectively meaningless. The meaning we attribute

varies from culture to culture and from individual to individual within the same culture. Because there is in it a subjective element – significant to varying degrees – not reducible to perfectly repetitive and immutable patterns. Spirituality is simultaneously moral and amoral: it is not in itself either good or bad; it ranges from pure philanthropy, the desire to care for one's neighbour, to the mafia association, up to genocide. It forms in the human mind when, mastering increasingly complex techniques during the long phase of education and learning, one begins to savour adolescence. «È in questo contesto e sotto questa pressione che potrà coltivare aspirazioni come diventare "qualcuno" (ammiraglio o pornostar, influencer o cartomante, stalker o eremita), compiere viaggi esotici, vestirsi appropriatamente: tutte ambizioni inconcepibili per un castoro, e invece sin troppo prevedibili in un umano [It is in this context and under this pressure that one may cultivate aspirations such as becoming "someone" (an admiral or a porn star, an influencer or a fortune teller, a stalker or a hermit), undertaking exotic journeys, dressing appropriately: all ambitions inconceivable for a beaver, and yet all too predictable in a human]» (Ferraris, 2025, p. 164). Spirit thus reacts back upon the first nature, determining new purposes and new needs, satisfiable through ever more refined technical supplements.

The circle entails that, once a stage is reached, one feels the need to access the next. If someone manages to make a fur coat to protect themselves from the cold, they must then refine the techniques of hunting and hide-working, so as not to be the only – and hated – fur-wearer on the planet. And perhaps, centuries later, their descendants, having developed new sensibilities, will have to resort to synthetic furs, which in turn imply further knowledge and further techniques. The techno-anthropological circle turns in one direction only: it is not possible to go back by reducing one's technical capacity. That would run counter to the second nature: the one that emancipates us from the animal world and characterizes us as human beings.

And it is here that design may intervene, called upon to give technology an ethical direction in an ecological key. «È quanto meno opinabile» – Ferraris observes (2025, p. 279) – «che l'evoluzione segua una marcia trionfale, e l'unica consolazione è che l'involuzione e la decrescita sono ancora peggio [It is at the very least debatable that evolution follows a triumphal march, and the only consolation is that involution and degrowth are even worse]». But to understand concretely in which direction to orient this evolution – and why the techno-anthropological circle risks backfiring on us precisely on the ecological front – it is worth considering two emblematic cases: the automobile and plastic, often cited as the principal agents of planetary pollution.

5. Two Emblematic Cases: The Automobile and Plastic

Let us begin with the automobile: a curious case of the heterogony of ends. This vehicle took shape at the end of the nineteenth century, when a far from trivial ecological problem arose. The streets of major American cities were an open sewer: submerged in manure, constantly traversed by horse-drawn carriages whose "emissions" had come to be regarded as a serious public health problem. The health authorities of the largest American cities actively encouraged the replacement of horses with automobiles; and relative to this sanitary urgency, the difference between an electric car and a petrol car seemed entirely secondary (Nosengo, 2008, p. 85). For ecological reasons, then, the automobile was promoted; and it effectively cleaned up the cities. And yet, a century later, that same automobile would become one of the principal defendants in the environmental disaster it had been meant to avert.

But the curious case of the automobile is less paradoxical than that of plastic: a material that over time has taken on such unforeseeable contours as to lead us to turn to Roberto Mercadini, a theatrical storyteller who makes paradox his privileged instrument, and to his monologue *Attenti agli androidi* [*Beware of Androids*] (2018).

In 1492, when Christopher Columbus set sail from Palos heading west, he was firmly convinced he would reach Asia. Instead, it turned out that between Europe and Asia lay another continent: America. This is precisely the discovery of America.

In the same way, if today we were to set sail from the Californian coast heading west, we might expect to reach Asia. Instead, between America and Asia a new "continent" has been discovered, since the 1980s. It is called the Great Pacific Garbage Patch. An immense island – roughly six times the size of France – made of refuse, mostly plastic, kept trapped and relatively compact by the currents of the Pacific subtropical gyre. A continent no one would ever have wished to discover.

This is not merely a matter of the destruction of oceanic flora and fauna, intolerable as it is. Our very survival is at risk: not that of the planet, which can get along perfectly well without us, but that of human beings as a species. And this is not a natural calamity: it is entirely of our own making, the fruit of technology and industrial production. How could we have let this happen?

The paradox of this story lies precisely here: it all begins as a game; or rather, because of a game: billiards. We are around the

Fig. 8

middle of the nineteenth century, when billiard balls were made of ivory, obtained from elephant tusks. Their production entailed a considerable cost, not only monetary but ecological: the killing of approximately 12,000 elephants every year. So, an American billiard manufacturer offered a prize of 10,000 dollars to the chemist who could synthesize an alternative material. The result: in 1869 celluloid was produced, the first plastic material in the world. Yes, plastic was invented for ecological reasons.

And then? Then it was all an enthusiastic and irresistible progression. In 1907 Bakelite was born; in the 1920s, polyvinyl chloride, the so-called vinyl, used to make records; in 1933, polyethylene; in 1935, nylon (polyamide); then polyethylene terephthalate (PET), used to make plastic bottles; in 1954, polypropylene, and so on. By the 1950s we were already in the age of plastic, just as it was entering Roland Barthes's *Mythologies* (1957), proliferating and transforming itself into the most astonishing objects, all wrapped in that «étonnement perpétuel [perpetual wonder]» one feels observing them (Barthes, 1957/2014, p. 188) [Fig. 8].

In a very short time, plastic was used to reconfigure a great number of products, contributing to a profound renewal of lifestyles. It insinuated itself into homes and utility spaces, initially taking the

Fig. 9

form of modest everyday objects, before colonizing entire living rooms and giving free rein to ever less conventional forms: from the *Safari* sofa (Archizoom, Poltronova, 1966) to the far better known *Sacco* Zanotta (Gatti, Paolini e Teodoro, 1969), on which Paolo Villaggio reclines in *Fracchia la belva umana* (Parenti, 1981). Without plastic – expanded polyurethane in particular – neither Pop nor Radical design would exist. It was plastic – not sinuous steel nor noble marble – that conferred auratic surface on the polychrome Memphis furnishings, such as the *Carlton* bookcase (Sottsass, 1981), later auctioned for several tens of thousands of euros (cf. Russo, 2012, pp. 153–182).

There is no doubt that plastic is a precious material: it should be used with care, not squandered. No other material possesses a comparable metamorphic capacity, and it is so malleable that it can give form to human dreams. Yet these dreams have turned into nightmares, in a sea of troubles that founder on that same immense island of refuse (Gabrys, Hawkins, Michael, 2013). How is it possible that a material conceived for ecological purposes is today responsible for a planetary disaster? The answer is very simple, as Mercadini (2018) observes: human stupidity. How else to define a production system in which plastic – a material that takes centuries or millennia to decompose – is used to make disposable objects? [Fig. 9] It would be like inventing a fluorescent fabric

Fig. 10

and then using it to make camouflage suits. Equally stupid, if less paradoxical, is the behaviour of the individual who, after using a plastic object, instead of placing it in the recycling bin, prefers to throw it in the street, in parks, in the sea. Simply because it is more convenient.

Therefore, anyone who thinks the plastic problem can be solved by calling for its abolition should reflect on one point: the problem is not plastic itself, but the wrong use we make of it. We are the cause of the ecological disaster in which we find ourselves immersed, not plastic. We, and our stupidity. Mercadini (2018) concludes: it is perfectly fine to find new materials to replace plastic, cleaner forms of energy. But we must remember that alongside this technological evolution, we need to bring about an intellectual, mental, cultural, ethical evolution. Otherwise, these technologies will be nothing but new cyborgs ready to sweep us away. Otherwise, we are merely designing our own catastrophe. Otherwise, we are taking aim to deliver the shot that will sink us. [Fig. 10]

The techno-anthropological circle is therefore not a condemnation, but a responsibility. The three ecological problems with which this contribution opened – climate change, biodiversity loss, global pollution – are not the poisoned fruit of technology as such, but of the use we make of it: shortsighted, wasteful, lacking the

long-term vision that the circle itself would make possible. Human destiny is not written in technology, but in the consciousness and reason that emerge from it. It is up to us to decide whether to use them.

Notes

1 This liquid space, in more recent geopolitical analyses ((*L'Italia al fronte del caos. Il Medioceano conteso erode la Penisola* [*Italy on the Front Line of Chaos: The Contested Medioceano Erodes the Peninsula*], *Limes*, 2/2021), takes on the term *Medioceano*, meaning not (so much) a medium of connection between the landmasses of Europe, Asia, and Africa (*Mediterraneo*: literally, the sea in the middle of the lands) but a medium of connection between the oceans, the Atlantic and the Indo-Pacific (*Medioceano*: literally, the middle ocean).

2 Design objects are configured as goods whose primary destination is rhetorical and social, goods that are simply embodied symbols (Carmagnola, 2006): material forms capable of condensing and conveying cultural meanings. Carmagnola re-reads this symbolic dimension in the light of the imaginary, showing how the value of objects resides in their capacity to activate shared narratives, expectations, and desires. The embodied symbol thus becomes a «simbolo immaginario [imaginary symbol]» (Carmagnola, 2006, p. 5): a node in which the object inserts itself into what the author defines as a *fiction economy*: an economy founded on the production and consumption of images, stories, and symbolic values.

3 The hypercommodity (*ipermerce*) is thus configured as a highly desirable consumer product: a commodity that transcends itself, exceeding its use function and its material status to become charged with values, expectations, and narratives capable of shaping and orienting desire.

4 Albert Speer's final statement at the Nuremberg Trials (31 August 1946) is reported in his autobiography (Speer, 1969).
5 The example is taken from Ferraris, 2025b.

6 With the upright posture, gravity acts vertically on the entire column of abdominal and pelvic organs. This explains the frequency of prolapses (uterus, bladder, rectum), inguinal hernias and prostate problems: pathologies extremely rare

in quadrupeds, where the weight of the organs is distributed horizontally and supported by the ventral abdominal wall. The spinal column of our ancestors was arched, as in quadrupeds, structurally suited to bearing a horizontally distributed load. With the upright posture, it becomes a vertical load-bearing column, forced to withstand stresses for which it was not originally designed. Hence its "S"-shaped curvature (lordosis and kyphosis), which distributes loads more effectively but nonetheless generates hernias, protrusions, sciatica, and arthrosis: pathologies almost exclusive to the human species. If we measure the degree of neurological and motor development with which other primates are born, an "equivalent" human infant should remain in the uterus for approximately 18 to 21 months. The zoologist Adolf Portmann spoke of an "extrauterine year": the first year of a newborn's life would still be a gestation, only external. The problem is that the upright posture has narrowed the female pelvis – for biomechanical reasons related to bipedal locomotion – while the human cranium has enlarged enormously (Portmann, 1944). Birth after nine months is therefore an obligatory evolutionary compromise: if it lasted longer, the foetal skull would be too large to pass through the birth canal. The result is a neurologically immature infant that completes its development outside the womb.

7 Exaptation applies to living organisms and technical apparatuses alike. It accounts for both the evolution of dinosaur scales into bird feathers and that of the telephone (a machine for speaking) into the mobile phone: a multifunctional object, far more than merely a speaking device, even *smart*, that is, intelligent. Just as dinosaur scales had no purpose related to flight, so the mobile phone was not designed to incorporate a constellation of entertainment-related activities such as photography, music, and social sharing; cfr. Ferraris (2025a, pp. 102–107, 208–210).

8 The Sphinx's riddle does not appear explicitly in Sophocles' *Oedipus Rex*, which presupposes it as known to the Athenian audience. The canonical version is transmitted by Pseudo-Apollodorus, *Bibliotheca*, III, 5, 8.

9 The etymology of "imbecile" is nonetheless contested. Alongside the derivation from *in baculum* ("without a stick"), some scholars propose *in bacillum* ("without a small rod", with reference to physical weakness) or a derivation from *beccus* (beak, with reference to the mouth). The Treccani dictionary accepts the derivation from the Latin *imbecillus*, composed of *in-* (privative) and *baculum* (stick), in the sense of "one who cannot hold a stick", hence weak, incapable. The modern meaning of "person with cog-

nitive deficit" is relatively recent and dates to nineteenth-century psychiatry.

10 The fur example (animal/synthetic) is taken from Ferraris, 2025a, pp. 127–128.

11 The case of plastic – framed within the history of design and developed from Mercadini's creative prompt – has been addressed previously by the present author in a text not coincidentally titled "Il paradosso della plastica" (Russo, 2021, pp. 43–53).

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Captions

Fig. 1: The techno-anthropological circle – Nature. Technology. Spirit. Reason. And again.
Fig. 2: The knife is not to blame.
Fig. 3: The new wars are also fought with drones. The difference from the atomic bomb? Anyone can get it.
Fig. 4: Wile E. Coyote, Super Genius – technology turned against those who use it.
Fig. 5: The forbidden fruit, today.
Fig. 6: No fangs, no claws, no venom, no horns – an ideal candidate for extinction.
Fig. 7: Technical supplement – from the stick to AI.
Fig. 8: Voltaire, having read Rousseau, gets down on all fours – to the great satisfaction of the dogs present.
Fig. 9: Perpetual wonder.
Fig. 10: Everything around decomposes. The cup does not – it resists for centuries.
Fig. 11: The shot that will sink us.

Introduction to Session II
Food, Culture and Systemic Design

Dario Russo

The second session of the conference opens with a reflection on the role of design within contemporary transformations, and in relation to the themes of ecology and food systems. At first glance, the association between design, food, and environment might appear improper – especially if design is understood in its most widespread sense, tied to the form of objects. Contemporary design has, however, progressively expanded its field of action, configuring itself as a discipline capable of operating on complex systems.

One speaks today of systemic design, strategic design, service design, and policy design: domains that attest to how the project no longer concerns solely the configuration of artefacts, but the organisation of relations, processes, and decisions. In this sense, design can be understood as a "hinge" discipline, capable of connecting different forms of knowledge and activating forms of integration between traditionally separate fields.

A useful conceptual reference for understanding this transformation is the figure of the "royal art" evoked by Plato: a practice capable of orienting and coordinating other techniques, deciding when and how to deploy them. Design, in this perspective, contributes to defining the framework within which problems are posed and addressed, before intervening on them directly.

A reflection on the term "technique" also makes it possible to question a distinction often taken for granted: that between the technical and the artistic dimensions. The term derives from the Greek *techne*, which denotes at once art and operative capacity. Design positions itself precisely in that hybrid space where aesthetics and function are profoundly intertwined.

The hybrid nature of design translates into an intrinsically transdisciplinary vocation. Unlike multidisciplinary approaches – which involve the co-presence of multiple disciplines – or interdisciplinary ones – which favour their interaction – design tends to produce new syntheses in which disciplinary boundaries are transcended. The result is a novel configuration capable of generating perspectives that exceed the sum of the knowledge involved.

The conference is conceived as a space for critical dialogue and construction, not for the exposition of already consolidated knowledge. The contributions presented should be understood as stimuli, hypotheses, and points of view to be discussed and, where necessary, challenged. The audience – and students in particular – is called upon to play an active role, participating in the process of knowledge elaboration.

This approach responds to the need to restore to design a public function capable of bearing on social and cultural processes. In a historical moment characterised by systemic crises, the project cannot limit itself to responding to contingent needs: it must contribute to orienting transformations, assuming a responsibility toward the future.

Between “Zero Kilometres” and “Zero Time” – A Comparison of Italian and Japanese Food Cultures

Hiroyuki Anzai

Introduction

The comparison between Italian and Japanese food cultures provides a unique vantage point for reflecting on the relationship between food, territory, technology, and society. Italy and Japan share common traits – including high life expectancy and strong gastronomic identities – they have developed profoundly different models regarding the concept of food quality.

The Italian concept of Zero Kilometres (km 0), centered on territorial proximity, stands in contrast to a logic prevalent in the Japanese context that can be defined as Zero Time. In this system, priority is given to absolute freshness, guaranteed through advanced logistical infrastructure and technology.

The Global Spread of Italian Cuisine in Japan

A significant element of this comparison is the extraordinary diffusion of Italian cuisine in Japan. There are thousands of Italian restaurants throughout the country, with a widespread presence that makes this cuisine familiar to a vast majority of the population.

This phenomenon creates a paradoxical perception: some Japanese claim that “the best Italian food is found in Japan”. This is a provocative statement that refers less to the raw quality of ingredients and more to the capacity for reinterpretation, adaptation, and systematization of Italian cooking within a different cultural and technological context.

Km 0 and Zero Time: Two Models Compared

The Italian model is historically founded on a relationship with the territory: food quality is linked to local origin, seasonality, and short supply chains. The value of a product lies in its provenance and its connection to the cultural and landscape context.

The Japanese model, while sharing a focus on the quality of raw materials, develops instead around the management of time. Fresh-

ness becomes the dominant criterion and is guaranteed through highly efficient logistics: widespread cold chains, punctual transport, and precise home deliveries. In Japan, this refrigeration system is not limited to commercial distribution but extends to the final consumer, maintaining high quality standards even in highly urbanized and globalized environments.

Technology and Food Culture

Japanese culture has developed a strong trust in technology as a problem-solving tool. This approach is reflected in the food system, where technological innovation is used to optimize preservation, distribution, and food safety.

A significant example is the "one-third rule", which requires food products to be withdrawn from shelves well before their expiration date to ensure peak freshness. However, this system also results in side effects, such as increased food waste. While the technological approach guarantees quality and safety, it risks creating rigidity and inefficiency, revealing the limits of a model based exclusively on technical optimization.

Crisis and Transformation: The Case of Japan

Traumatic events can trigger significant shifts in cultural models. In Japan, the 2011 earthquake and tsunami represented a turning point, causing a crisis in the food supply chain, particularly regarding fish.

The disruption of infrastructure exposed the vulnerability of a system heavily dependent on logistics and immediate freshness. This prompted a reflection on the need to integrate different models, reclaiming traditional practices of food preservation and processing that had been gradually abandoned.

Cultural Learning and the Comparison with Italy

Comparing the Japanese model with the Italian one has played an important role in this rethinking process. Through direct experiences – such as field visits, workshops, and exchanges with Italian students and institutions – a different conception of the relationship between food and culture has emerged.

In Italy, the value of food is not determined solely by freshness, but also by context, tradition, processing methods, and the cultural meaning associated with the products. Items that are not immediately "fresh" can be perceived as high quality precisely because of

their history and territorial roots. This comparison has challenged certain assumptions in Japanese food culture, highlighting how quality can be constructed through culture, not just technology.

Towards a Hybrid Model

In recent years, we have observed a progressive evolution of the Japanese model toward the integration of diverse elements: maintaining high standards of freshness while becoming more open to practices of transformation, preservation, and cultural appreciation of food. Simultaneously, the Italian model faces globalization and innovation processes that challenge some of its traditional characteristics.

The comparison between Zero Kilometres and Zero Time should not be seen as an opposition, but as a productive tension from which hybrid models can emerge – models capable of uniting territory, technology, and culture.

Conclusions

Dialogue between different food cultures highlights not only differences but also opportunities for mutual learning. The cases of Italy and Japan show that food is the result of a complex balance between material, cultural, and technological factors.

In this perspective, design can play a fundamental role – not so much in producing immediate solutions, but in fostering processes of cultural reinterpretation and transformation, contributing to the construction of more conscious and sustainable food systems.

Gastro-Physical Design. Multidimensionality of Food

Carla Langella

Introduction

In a world characterized by rapid and profound technological advancements, growing consumer expectations regarding environmental issues, and widespread concerns about global health, the role of food science and technology has become increasingly crucial. Addressing these complex challenges requires innovative approaches capable of ensuring food safety, strengthening the resilience of food systems, promoting sustainability, and safeguarding public health. Within the scientific and academic context, numerous initiatives are moving in this direction, including the International Union of Food Science and Technology (IUFoST) World Food Congress, which brings together international experts on food innovation and sustainability; the International Electronic Conference on Foods, dedicated to innovation and sustainability in the food sector; and the AI for Food Product Development Symposium, held in 2025 at the University of California, Davis, focused on the application of artificial intelligence to food design and the development of new food products.

Over the last decade, the discipline of design has assumed an increasingly significant role within this context, operating across its different dimensions, from *design for food* to *design with food* and *food design*. Contemporary design operating in this field engages with complex and hybrid contexts in which heterogeneous forms of knowledge converge. The relationship between food, perception, and design represents a particularly fertile field of research in which design culture intersects with the humanities, economics, science, medicine, and technology.

The concept of gastrophysics, as defined by Charles Spence (2017), refers precisely to this convergence between gastronomy, psychophysics, and sensory sciences, with the aim of understanding and designing the food experience in multisensory terms (Langella, Russo, & Scalisi, 2024).

Two main strands of gastrophysical design can be identified. The first, environmental in nature, concerns the design of the physical and perceptual properties of the elements external to the human body during the eating experience. It in-

cludes the design of dining spaces, furniture, tableware, packaging, and communication devices related to food products. The second strand focuses instead on the physico-sensory characteristics of food itself, namely the aspects that interact directly with the oral cavity. This area includes food design, ingredient selection, as well as the definition of preparation tools and processes, all of which are closely connected to the concept of taste and to the effects of food on health.

Gastrophysics and Multisensory Perception

Pleasure and appreciation represent central factors in consumers' food-related and behavioural choices (Köster, 2009). Design is capable of modulating these aspects by intervening in the sensory qualities of foods, tools, environments, and modes of consumption. Through the control of variables such as texture, temperature, colour, shape, sound, aroma, lighting, and tactile interaction, design can influence taste perception and users' emotional engagement, contributing to making the food experience more desirable, memorable, and rewarding.

From this perspective, design does not merely enhance the aesthetic dimension of consumption but also assumes a strategic and persuasive role, orienting behaviours and habits toward potentially healthier and more sustainable lifestyles. Design interventions can foster greater awareness of the relationship between food, health, and the environment by promoting everyday practices based on nutritional balance, waste reduction, attention to food quality, and the valorisation of local and seasonal resources. In the design of new food products, design can proactively intervene in the quality of flavour, understood as a complex combination of olfactory, gustatory, and trigeminal perceptions occurring during tasting and influenced by tactile, thermal, painful, and kinaesthetic stimuli (Auvray & Spence, 2008).

From a physical perspective, foods can be interpreted as complex systems perceived through different experiential layers (Aguilera, 2005). During the various phases of the gustatory experience, including biting, chewing, and swallowing, food is progressively fragmented and releases aromatic compounds that interact with the oral cavity. In this process, a complex multisensory perception of taste is activated (Spence, 2015), involving predominantly unconscious physiological and psychological mechanisms.

During consumption, foods and beverages release numerous chemical compounds into the mouth, distinguished into volatile and non-volatile substances, which are responsible for the differ-

ent sensations related to taste and smell: the former predominantly activate the olfactory system, while the latter involve gustatory and somatosensory receptors (Delwiche, 2004; Small & Prescott, 2005). Tactile, irritative, and thermal sensations instead derive from the activation of chemosensory and somatosensory receptors located within the oral cavity (Prescott, 2012).

Unlike taste and aroma, which mainly depend on the activation of the olfactory system, mouthfeel is primarily associated with the material and mechanical properties of food and constitutes a component of the gustatory experience upon which design can intervene more incisively. It presents strong analogies with the morphological, tactile, and interactive qualities of objects with which design traditionally operates (de Wijk et al., 2003). Within this perspective are situated the research activities developed within the Hybrid Design Lab, an interdisciplinary laboratory for research, design experimentation, and teaching founded in 2006, where designers and scientists – particularly bioscientists – collaborate in the development of new science-driven products and services.

Interdisciplinary Research and Experimental Context

The Hybrid Design Lab is characterized by a hybrid approach in which design and science coexist within a shared environment aimed at achieving common objectives. For many years, the laboratory operated within the Science Center of Città della Scienza in Naples, fostering direct dialogue with the field of scientific dissemination and with a broad audience composed largely of young people.

This context made it possible to develop projects extending beyond academic research toward communication and education through exhibitions, installations, and interactive devices. Among the exhibitions developed at Città della Scienza, *Food Evolution 4.0* explored the relationship between evolution and human nutrition, with particular attention to transformations of the body, the brain, and tools, through a biocultural perspective highlighting co-evolutionary processes in order to understand the dietary and nutritional adaptation of human beings to changing social and physical environments. The exhibition *Food Transition*,, on the other hand, presented the results of research aimed at employing methods, tools, and practices from design, art, and science to improve the quality of the relationship between people and food, with particular attention to the possibility of encouraging and facilitating healthy lifestyles and behaviours grounded in the values of Mediterranean agro-food culture, which can support preventive

actions and reduce the effects of diseases (Attaianese, Caruso, & Langella, 2023; 2024; 2025).

Design and Gastrophysics for Well-being in Made in Italy Food Design

Gastrophysics proposes new paradigms for managing innovation processes underlying food products and services in relation to consumers' psycho-physical well-being. Within this framework, design acts as a catalyst for socio-cultural, economic, environmental, technological, and political transformations involving nutrition and health, responding to increasingly urgent demands for food security, sustainability, circularity, innovation, and community empowerment. In the cultural and productive landscapes of the Mediterranean, food has historically represented a significant identity element, internationally recognised and appreciated for its virtuous combination of conviviality, multisensory gratification, attention to detail, and well-being. The Mediterranean dietary model has also acquired added value in terms of sustainability due to its connection with short production-consumption cycles based on proximity, reduced energy impact favoured by mild climates that limit the need for greenhouses, and lower water consumption compared to meat-based dietary systems, thanks to the extensive use of plant-based resources rooted in Mediterranean biodiversity. Designers operating within the food sector are therefore required to employ methods, tools, and practices derived from both design and food sciences critically and responsibly, in order to improve the relationship between people, food, and the environment. Particular attention is devoted to the possibility of encouraging and facilitating healthy lifestyles grounded in the values of Mediterranean agro-food culture, capable of supporting preventive actions aimed at reducing health risks and improving quality of life.

From this perspective, a key role is played by the transfer of the latest scientific knowledge concerning the benefits of the Mediterranean diet and by the opportunity to translate the valuable cultural and productive heritage connected to it into contemporary lifestyles capable of strengthening the competitiveness of Made in Italy. Through collaboration with disciplines such as neuroscience, bioengineering, and personalised medicine, food design can intervene in the relationship between nutrition, health, and human evolution, envisioning future food scenarios and identifying solutions consistent with increasingly pressing demands for well-being, health, and sustainability. Within this context, design plays a crucial role in making such knowledge accessible and understandable through devices and tools that foster food awareness. Scientific literature highlights the benefits of the Mediterranean

diet, whose antioxidant, anti-inflammatory, and soothing properties, together with the presence of vitamins, minerals, and fibres, constitute a valuable heritage to be translated into contemporary lifestyles, as they contribute to the prevention and reduction of various diseases. Neurobiological studies have also shown that the consumption of foods typical of the Mediterranean diet, such as vegetables and fish, may positively affect brain development and cognitive abilities.

These scientific insights open new and unexplored fields of experimentation for design, which is capable of conveying the values and potential benefits of Mediterranean food culture through artefacts able to integrate into the frugality and frenetic rhythms of everyday life, eventually becoming tools for psycho-physical well-being and care. Design possesses a strong persuasive potential capable of encouraging people to adopt beneficial behaviours and choices related to health by making them simpler, more enjoyable, emotionally engaging, and persistent over time. This capability is reinforced by the communicative dimension of design, which translates scientific knowledge regarding the relationship between food and health into accessible and memorable representations, thereby increasing awareness and supporting informed decision-making.

Alongside the consolidated reputation of Made in Italy and the advantages deriving from Mediterranean biodiversity, there is now the opportunity to develop food products characterised by a strong identity grounded in science and technological innovation and enriched by a high experiential value. Such products may eventually replace pill-based supplements, often perceived as pharmaceutical products, through alternative consumption modalities closer to gratifying foods such as candies or small snacks. These products must integrate hygiene, portability, adaptability to dynamic lifestyles, pleasantness, and multisensory stimulation. Interdisciplinary research demonstrates that food pleasure is closely related to the physical and sensory properties of food itself: large yet lightweight volumes, complex textures achieved through stratifications or inclusions such as seeds, roots, or grains, and diversified tactile and gustatory stimuli related to differences in density, hardness, acidity, and sweetness. These characteristics differ significantly from conventional dietary foods, which are often perceived as monotonous, dry, and unappealing.

Such innovations may also have significant implications for food intended for specific pathologies or contexts of vulnerability and food poverty. Many therapeutic diets impose rigid nutritional regimes that deeply affect patients' quality of life, requiring attention

not only to nutritional aspects but also to psychological, cultural, social, and economic dimensions. Within this scenario, design becomes a strategic tool capable of making medical prescriptions more accessible, acceptable, and sustainable, contributing concretely to individual and collective well-being.

Within the Hybrid Design Lab, products, graphic devices, and audiovisual contents are developed through the integration of advanced scientific knowledge and innovative digital technologies, such as 3D printing and artificial intelligence. The aim is to design solutions capable of attributing to food not only a nutritional value but also a therapeutic and preventive one, while simultaneously enhancing Mediterranean food culture, biodiversity in production processes, and the multisensory and convivial dimensions of consumption. These aspects are translated into synesthetic experiences oriented toward health, well-being, and pleasure. In this context, gastrophysics is applied mainly in relation to the gustatory dimension rather than the environmental one and is employed as an analytical and design tool for the development of food-related products through the integration of principles, tools, and methods derived from contemporary sciences. In the design of innovative well-being-oriented foods, qualities such as texture, consistency, temperature, colour, shape, composition, and interaction among ingredients are interpreted as design variables. Design intervenes by modulating these aspects, contributing to the construction of richer, more conscious, and meaningful food experiences. In this perspective, food is no longer considered merely an object of consumption but rather a complex system of relationships involving production, preparation, communication, and use.

Among the projects developed within the Lab are functional snacks with reduced caloric content and high gratifying potential, consisting of expanded or multilayer systems enriched with ingredients characterised by different consistencies. Gastrophysics highlights how, beyond basic taste sensations such as sweet, salty, bitter, and sour, more articulated perceptions linked to porosity, stratification, crunchiness, and the presence of material inclusions also play a central role. Current design challenges involve the development of new nutraceutical foods and food supplements that are easy to transport and consume, as well as domestic tools capable of simplifying and accelerating their preparation. Food design can also make a significant contribution to disease prevention by responding to medical-scientific recommendations such as the intake of antioxidant nutrients, the reduction of fats and sugars, and the promotion of slow and conscious eating habits. This also implies the capacity to savour, perceive, and modulate sensory and multisensory stimuli according to the latest neurophysiological knowledge.

Possible design proposals include functional nutraceutical snacks with innovative characteristics for the food sector, such as foams, sticks, gels, multilayer sheets, and sprays capable of supporting Italian companies in developing competitive products consistent with international demands for health, prevention, and well-being. If healthy foods are often perceived as lacking sensory appeal — monotonous in colour, weak in flavour, compact, and dense, as frequently occurs with protein bars — research within the Hybrid Design Lab instead focuses on expanding and diversifying perceptual experiences. By inserting inclusions characterised by different textures and flavours into the food matrix, variable sensory configurations are obtained that surprise during mastication, generating diversified tasting sequences and creating more engaging and gratifying consumption experiences. At the same time, the temporal extension of the eating experience is pursued through the control of consistency and density. Many conventional functional foods are extremely compact and highly caloric, concentrating large amounts of nutrients and calories in small volumes. Through foaming and stratification processes, air and volume are introduced into the food structure, reducing specific weight and prolonging consumption time. Expanded foods not only increase oral involvement and the perception of fullness but also foster more extended sensory gratification over time. Functional foods can thus be conceived as "enhanced" in nutritional and nutraceutical value, offering intense and prolonged gustatory experiences while maintaining a high ratio between beneficial nutrients and low caloric content through innovative processes borrowed from advanced material science, such as foaming, gelification, stratification, and composite structures. The application of advanced technologies and scientific knowledge to food design therefore makes it possible to integrate well-being and pleasure, overcoming the traditional dichotomy between healthy eating and sensory gratification.

Alongside food design, the Lab also develops tools and devices for food self-production and consumption. The increasing tendency toward domestic food preparation, intensified by the pandemic, has highlighted growing interest in practices aimed at controlling food quality, authenticity, and healthiness. Within this context, design can intervene through the development of domestic tools for cultivating superfoods and alternative proteins, such as bioreactors for spirulina production, home fermenters, or systems for the continuous cultivation of edible mushrooms (Langella, 2023). These devices contribute to transforming self-production into a sustainable, accessible, and integrated everyday practice. The design of tableware, glasses, and cutlery may also contribute to the

diffusion of healthier eating behaviours. Plates designed to suggest balanced nutrient proportions can encourage the consumption of vegetables and beneficial foods while limiting the intake of sugars and fats. Similarly, specifically designed cutlery and containers can facilitate the consumption of delicate foods such as salads and fruit (Fig. 1), preserving their fragrance, consistency, and mechanical integrity. Specially designed lunch boxes and transport systems can also support healthy eating practices within work environments and daily mobility contexts (Fig. 2).

Tasting kits designed to optimise sensory experience and allow the full perception of aromatic nuances, fragrance, and the peculiarities of local products whose beneficial properties have been scientifically recognised may contribute to the enhancement of local productive districts (Fig. 3). This is the case, for example, of walnuts, associated with positive effects on brain functions (Brombo, Bonetti, & Zuliani, 2017), or tomato varieties rich in antioxidants such as lycopene. Such devices simultaneously foster greater food awareness, encouraging the consumption of local products and promoting practices oriented toward health and sustainability. Accessories designed for children, aimed at fostering a more conscious tasting experience and appreciation of the perceptual nuances related to gastrophysics, may contribute to the development of healthy food cultures while supporting the prevention of eating disorders (Fig. 4).

Finally, design can facilitate the acceptance of new sustainable dietary practices, such as insect consumption, through perceptual and communicative mediation strategies. In these cases, design intervenes by reducing evocative elements that may generate cultural or psychological rejection while instead enhancing positively perceived qualities such as crunchiness, lightness, or innovation. The use of insect flours that are not visually recognisable, the adoption of naming strategies not explicitly associated with the food's origin, and the use of chromatic and sensory codes distant from entomological imagery constitute design strategies aimed at facilitating the acceptance of new sustainable protein sources (Fig. 5).

Materials, Sustainability, and Upcycling

One of the research areas explored within the Hybrid Design Lab concerns the use of agro-food waste for the design of new materials and products. Through upcycling practices, design contributes to transforming residues into resources by developing solutions that combine environmental sustainability and innovation.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

This approach is part of a broader vision in which design intervenes not only on the final product, but on the entire life cycle of the product-system, contributing to the reduction of environmental impacts and to the promotion of more responsible and sustainable production models.

The *WasToy* project integrated principles of ecodesign, circular bioeconomy, and biomaterials with the aim of developing sustainable and renewable toys produced through the upcycling of agro-food waste, introducing children to the themes of sustainability and circularity.

Within the research conducted at the Hybrid Design Lab, collections of new materials were developed for evaluation by children and conceived simultaneously as playful tools useful for gathering perceptual and behavioural feedback from users. Scientific and educational games were also created using the experimented materials, with the aim of enhancing and communicating the potential of biomaterials derived from food waste.

Conclusions

Gastrophysics highlights the multidimensional nature of food, emphasizing the complexity of the relationships among perception, culture, technology, environment, and health. Within this framework, design emerges as a discipline capable of integrating different forms of knowledge and intervening systemically not only in the design of food products, but also in the construction of experiences, behaviours, and cultural models.

The encounter between design and techno-scientific disciplines related to food opens up new design scenarios and professional perspectives oriented toward experimentation, sustainable innovation, and the enhancement of Mediterranean food culture. Through the design of environments, communicative artefacts, utensils, packaging, and functional foods, design is capable of conveying values related to health, conviviality, sustainability, and psycho-physical well-being, translating them into everyday practices and contemporary lifestyles.

Design also possesses a strong persuasive capacity, enabling it to orient behaviours and food-related choices by making certain actions simpler, more enjoyable, engaging, and enduring over time. In this sense, it can actively contribute to the diffusion of healthier and more sustainable dietary models by supporting users' awareness through educational tools, communicative devices, and consumption systems designed on the basis of the latest scientific

knowledge concerning the relationship between food and health. Emerging challenges related to the design of the food of the future involve the need to develop foods and food systems capable of simultaneously responding to nutritional, environmental, cultural, and experiential demands. Design intervenes in this field by working on form, texture, sensory perception, and food communication, contributing to making sustainable food sources more acceptable, enhancing phytonutrients, and promoting circular economy practices based on the reuse of agro-food waste as resources.

At the same time, design can contribute to the construction of new food-related behaviours through objects and devices that regulate the timing, modes, and rituals of consumption, fostering a more conscious relationship with food. Educational tools, tableware, interfaces, and self-production food systems demonstrate how design can operate not only on a functional and aesthetic level, but also on cognitive, social, and cultural dimensions.

Within this perspective, food becomes a privileged field of experimentation for contemporary design, understood as a transdisciplinary practice oriented toward well-being, sustainability, and the construction of new forms of relationship among individuals, environments, and production systems.

Notes

1 Curated with Marina Melone, Valentina Perricone, and Gabriele Pontillo, and presented at Città della Scienza from November 21 to November 24, 2019. The exhibition was part of the 33rd edition of *Futuro Remoto, ESSERE 4.0 – Stories of Revolutions in Science and Technology, from Leonardo da Vinci to the Present Day.*

2 Curated with Carla Giusti and presented at Città della Scienza from November 24 to December 3, 2021. The exhibition was part of the 35th edition of *Futuro Remoto – TRANSITIONS.*

3 National Research Project of Relevant Interest (PRIN 2022) coordinated by the Politecnico di Milano (Principal Investigator: Valentina Rognoli), in collaboration with the IPCB of the National Research Council (Unit Coordinator: Giovanna Gomez d'Ayala) and the University of Naples Federico II (Unit Coordinator: Carla Langella).

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Captions

Fig. 1. Sensory Dishes: plates designed to encourage and facilitate fruit consumption. Design by Valeria Papa and Maria Bellanca, coordinated by Carla Langella with Gabriele Pontillo and Roberta Angari.
Fig. 2. Sarada: portable lunch box for salads designed within the AIRCampus project. Design by Carmine Pappalardo, Claudia Scarlatella, and Alessandro Antonio Telesca, coordinated by Carla Langella, Erminia Attaianese, Ivo Caruso, and Nunzia Coppola, with Giovanna Nichilò and Morena Barilà.
Fig. 3. Sunder: cutlery set designed to amplify multisensory engagement during the tasting of Sorrento PGI walnuts, a Slow Food presidium. Design by Cinzia Gervasio, Claudia Improda, Simone Martucci, Vincenza Pellegrino, and Alessia Schettino, coordinated by Carla Langella with Gabriele Pontillo and Valentina Perricone.
Fig. 4. Feel Eat: recycled cork placemat designed to educate children about the gastrophysical properties of food. Design by Raffaella Sepe with Carla Langella and Giovanna Nichilò.
Fig. 5. Kit designed to promote the consumption of insect flour. Design by Nicola Guidoboni, Luigi Leopizzi, Luca Locci, and Lorenzo Marchionni, coordinated by Carla Langella and Daniela Piscitelli, with Maddalena Mometti.

From Everyday Practice to a System of Values. Design, Food and Active Ageing between Body, Space and Service

Mario Bisson

Introduction

Over the past few decades, design has progressively redefined its epistemological status, shifting from a discipline primarily oriented toward the production of objects to a reflective practice capable of intervening in complex socio-technical systems. This transformation entails a substantial change in the way design itself is conceived: no longer as a punctual solution to predefined problems, but as a device capable of configuring relationships, infrastructures, and the conditions of possibility for action (Buchanan, 1992; Manzini, 2015). Within this framework, design engages with domains marked by high levels of complexity and interdependence, in which material, symbolic, and social dimensions are inseparable.

Among these domains, food constitutes a particularly relevant field, not only because of its centrality in everyday life, but also because of its capacity to make visible the articulations between body, culture, and social organization. Eating cannot be reduced to a biological function or to a practice of consumption; rather, it must be interpreted as a situated, culturally codified, and socially mediated practice through which identities are constructed, meanings are negotiated, and structures of power are reproduced (Fischler, 1988; Counihan & Van Esterik, 2013). In this sense, food operates as a relational infrastructure, connecting individuals, territories, and productive systems within complex networks of interaction.

The adoption of practice theory makes it possible to move beyond an individualistic understanding of food behaviour, shifting attention from actors' choices to the dynamic configurations that make such choices possible (Shove, Pantzar, & Watson, 2012). Practices emerge from the interaction between materials, competences, and meanings, and become stabilized over time through processes of social reproduction (Reckwitz, 2002). This perspective implies that change cannot be understood as the mere modification of individual preferences but requires intervention in the systemic conditions that structure practices themselves.

In this context, design assumes a critical role: it does not merely intervene in artefacts, but operates on the configurations that sustain practices, contributing to the redefinition of relationships among actors, resources, and contexts. Design thus becomes a form of «infrastructuring the everyday», capable of affecting the ways in which practices are made possible, accessible, and meaningful. This shift is particularly significant in the field of food, where transformations in production systems, modes of consumption, and social relations require new interpretative and design tools.

At the same time, demographic transformations related to population ageing raise urgent questions concerning the sustainability of care systems and quality of life in later life. The paradigm of active ageing, promoted by the World Health Organization, introduces a perspective that goes beyond the health dimension, emphasizing participation, autonomy, and the social recognition of individuals (World Health Organization, 2002). In this scenario, food assumes a strategic function, as an everyday practice capable of articulating bodily, relational, and symbolic dimensions, and of contributing to the construction of forms of inclusion or, conversely, exclusion.

Despite the growing attention devoted to food and ageing, many design approaches continue to privilege solutions oriented toward efficiency or nutrition, overlooking the complexity of food experience and its role in the construction of identity and social relations. This contribution positions itself critically in relation to such approaches, proposing an understanding of food as an integrated system in which body, space, and service constitute interdependent dimensions of experience.

The body–space–service model, derived from service design studies, is used here as an analytical device for understanding how food practices are configured within complex relational systems (Meroni & Sangiorgi, 2011). The body represents the site of embodied experience, space defines the material and symbolic conditions of action, while service organizes relationships among actors and resources. The interaction between these dimensions makes it possible to interpret eating not as an isolated event, but as a situated and dynamic process.

The aim of this contribution is twofold. On the one hand, it seeks to articulate a theoretical framework that integrates systemic design, practice theory, and food studies to understand the complex nature of food experience. On the other hand, it explores the role of design in transforming practices, with reference to the context of active ageing, highlighting how design can contribute to the

construction of food systems that are more inclusive, sustainable, and oriented toward the quality of experience.

The structure of the text reflects this dual perspective. The first section analyses the relationship between systemic design and food practices, positioning food as a cultural and material infrastructure. The second section examines active ageing through case studies and design practices, highlighting the potential of design as an infrastructure of care and participation. The third section offers a theoretical synthesis, articulating the body–space–service model as an interpretative framework for value-oriented design.

In this sense, the contribution aims to shift the discourse on food from a functional dimension to a systemic and relational one, showing how design can operate not only on solutions, but also on the conditions that make practices possible. Food thus becomes a privileged field for questioning the role of design in the construction of everyday life, understood as a space in which body, culture, and politics intersect.

1. Systemic Design and Food Practices: From Everyday Behaviour to the Construction of Meaning

From everyday practice to a system of values, contemporary design can be understood as a systemic practice capable of intervening in complex socio-technical configurations in which objects, services, environments and behaviours are deeply interconnected (Buchanan, 1992). From this perspective, design is not limited to the formal definition of artefacts; rather, it extends to the construction of relationships among actors, infrastructures and cultural contexts, contributing to the production of new scenarios of meaning and action (Manzini, 2015; Cross, 2006). Design thus assumes a strategic role in mediating between material and immaterial dimensions, operating as a device capable of orienting social practices and systemic transformations (Julier, 2013).

Food practices represent a privileged field for observing these dynamics, since food is located at the intersection of biological needs, symbolic systems and social organisations (Counihan & Van Esterik, 2013). Eating is not a neutral or merely functional act, but a culturally codified practice that reflects norms, values, identities and power relations (Douglas, 1972; Fischler, 1988). In this perspective, food becomes a particularly fertile field of inquiry for understanding how material and symbolic dimensions intertwine in the construction of everyday experience (Mintz, 2002).

Food may be interpreted as a genuine cultural and material infrastructure, since it organises networks of production, distribution and consumption while at the same time conveying meanings linked to identity, memory and belonging (Fischler, 1988). Every food item incorporates histories, agricultural practices, technical knowledge and social traditions, becoming a device through which societies define themselves and their values (Appadurai, 1986). From this perspective, the food system cannot be reduced to a linear sequence of operations; instead, it must be understood as a complex ecosystem in which human and non-human actors, infrastructures and narratives interact (Latour, 2005).

Practice theory offers a particularly effective interpretive tool for analysing this scenario, because it makes it possible to read behaviour as the result of the interaction among materials, competences and meanings (Shove, Pantzar, & Watson, 2012). According to this approach, practices are not simply individual actions, but dynamic configurations that emerge from the interplay of heterogeneous elements (Reckwitz, 2002). Materials include objects, technologies and spaces; competences concern skills and knowledge; meanings include values, norms and cultural representations (Shove et al., 2012). The evolution of food practices therefore depends on the joint transformation of these three elements, rather than on isolated factors (Warde, 2005).

Within this framework, food-related behaviour cannot be interpreted as a purely individual choice, but rather as the result of systemic conditions that shape possibilities for action (Shove, 2010). Consumption habits, methods of food preparation and forms of conviviality are influenced by material infrastructures, resource availability, distributed competences and shared systems of meaning (Goodman, 2016). By intervening in these elements, design can contribute to modifying practices, not by imposing change from above, but by creating favourable conditions for the emergence of new behavioural configurations (Manzini, 2015).

The body-space-service model makes it possible to further develop this perspective by offering an integrated interpretive framework for the food experience (Meroni & Sangiorgi, 2011). The body represents the locus of sensory experience and learning; space constitutes the context in which practices take place; and service organises the relationships among users, resources and infrastructures (Sangiorgi, 2011). The experience of food therefore emerges from the interaction among these three elements, configuring itself as a complex and situated system (Meroni & Sangiorgi, 2011).

The body plays a central role in the definition of food practices, since habits, preferences and modes of interaction with food are constructed through it (Ingold, 2013). Sensory experiences, taste memories and embodied competences help structure the relationship with food, making it deeply rooted in lived experience (Fischler, 1988). However, the body is not a purely biological entity; it is shaped by cultural and social processes that orient behaviours and perceptions (Counihan & Van Esterik, 2013).

Space, in turn, cannot be considered a simple neutral container, but rather an active element in the construction of the food experience (Lefebvre, 1991). The environments in which food is consumed influence modes of interaction, social relations and the meanings attributed to the act of eating (Julier, 2013). The configuration of spaces, the arrangement of objects, the organisation of activities and sensory atmospheres all contribute to defining practices, orienting behaviours and expectations (Norman, 2013).

Service, finally, represents the organisational and relational dimension of the food experience, making resources, time and forms of participation accessible (Meroni & Sangiorgi, 2011). Through service design, it is possible to structure systems that facilitate interaction among actors, improve accessibility and promote new practices (Sangiorgi, 2011). In this sense, service is not an accessory element, but a fundamental component in the construction of the contemporary food system (Manzini, 2015).

The integration of body, space and service therefore makes it possible to interpret food as a complex experience that cannot be reduced to a purely functional or aesthetic dimension (Meroni & Sangiorgi, 2011). By intervening in these dimensions, design can contribute to transforming food practices, promoting more sustainable, inclusive and conscious models (Papanek, 1971; Escobar, 2018).

2. Food, Active Ageing and Case Studies: Design as an Infrastructure of Care, Autonomy and Participation

Active ageing represents one of the main areas in which the relationship between design, food and everyday practices assumes strategic relevance. According to the World Health Organization, active ageing does not coincide solely with the maintenance of physical health but concerns the possibility for older people to continue participating in social, cultural, economic and community life under conditions of autonomy and dignity (World Health Organization, 2002). From this perspective, food is not simply a means of nutrition, but becomes an instrument of relationship,

memory, identity and care (Fischler, 1988; Counihan & Van Esterik, 2013).

Food practices in later life involve bodily, cognitive, social and environmental aspects. With advancing age, taste, smell, chewing ability, mobility, autonomy in meal preparation and access to places of purchase or consumption may change (World Health Organization, 2015). However, reducing nutrition in older age to an exclusively nutritional issue risks obscuring the complexity of the food experience (Warde, 2005). Eating also means maintaining rituals, remembering family practices, sharing time with others, recognising oneself in established habits and feeling part of a community (Douglas, 1972; Mintz, 2002).

From this point of view, design can intervene by constructing systems capable of supporting food autonomy without turning the older person into a mere passive recipient of assistance (Manzini, 2015). The goal is not only to provide an efficient service, but to design conditions of participation, choice and recognition (Papanek, 1971). A meal delivered at home, a social canteen, a shared kitchen or an intergenerational workshop do not produce the same type of experience: each configuration organises the relationship among body, space and service differently (Meroni & Sangiorgi, 2011).

A useful case study is represented by community meal programmes aimed at older people, which are widespread in various European and North American contexts. These programmes are not limited to the distribution of food; rather, they create opportunities for sociality, informal monitoring of wellbeing and prevention of isolation (World Health Organization, 2007). The value of the service does not lie solely in the nutritional content of the meal, but in the possibility of transforming the food moment into a relational device (Sangiorgi, 2011). The presence of a shared space, recognisable rituals and trained staff or volunteers contributes to creating continuity, trust and a sense of belonging (Lefebvre, 1991).

A second significant case concerns intergenerational kitchens and workshops, in which older people, young people, families and operators share activities related to food preparation (Kaplan, 2001). In these contexts, the food knowledge of older people becomes a cultural resource rather than a remnant of the past (Petrini, 2007). Recipes, techniques, memories and gestures are transmitted through action, transforming the kitchen into a space of reciprocal learning (Ingold, 2013). In this case, service design must organise time, tools, roles and modes of participation so that the practice is accessible, safe and meaningful (Meroni & Sangiorgi, 2011).

A third area concerns meal delivery for older people, which in recent years has been the subject of design rethinking. Home meal delivery can respond to concrete needs linked to reduced mobility or loneliness, but it also risks intensifying isolation if it is designed as a simple logistical transaction (World Health Organization, 2015). For this reason, some advanced models integrate delivery with moments of relationship, wellbeing checks, meal personalisation and continuity with local services (Manzini, 2015). In these cases, design does not concern only packaging or the booking interface, but the entire ecosystem of care that connects the user, caregivers, operators, the kitchen, the territory and institutions (Latour, 2005).

The case of the Refettorio Ambrosiano can also be read in relation to these themes, since it shows how the quality of space and hospitality can modify the social meaning of the meal (Bottura & Gadia, 2017). The transformation of a disused place into a carefully designed and hospitable environment highlights how food, when placed within an attentive design framework, can become an opportunity for dignity and recognition (Food for Soul, 2024). This principle is particularly important for active ageing as well: food spaces dedicated to older people should not be perceived as places of marginality, but as environments of participation and value (World Health Organization, 2007).

The Slow Food movement and food communities offer a further point of reference, especially regarding the role attributed to gastronomic memory, biodiversity and local knowledge (Petrini, 2007). Older people may be considered custodians of food competences rooted in territories, capable of countering the homogenisation of consumption and transmitting sustainable practices (Goodman, 2016). From this perspective, active ageing does not concern only the maintenance of individual autonomy, but also the social recognition of the contribution that older people can offer to the community (World Health Organization, 2002).

Urban food policies also play a central role. An age-friendly city must guarantee access to markets, neighbourhood shops, canteens, urban gardens, spaces of sociability and food services capable of responding to different needs (World Health Organization, 2007). Although the Milan Urban Food Policy Pact is not addressed exclusively to the older population, it offers a useful framework for understanding how food can become an issue of integrated urban governance (Milan Urban Food Policy Pact, 2024). Access to healthy food, the reduction of waste, support for local networks and the construction of inclusive food systems are all elements

that directly affect the quality of life of older people (Morgan & Sonnino, 2010; Morgan, 2015).

In this scenario, design operates as a connective practice. It relates different scales: the everyday gesture of eating, the domestic space, territorial services, community networks and urban policies (Buchanan, 1992). The challenge is not only to design more ergonomic products or more efficient services, but to build systems capable of supporting autonomy, relationships and biographical continuity (Norman, 2013). For an older person, being able to choose what to eat, where to eat, with whom to eat and how to participate in the preparation or sharing of a meal means maintaining an active role in everyday life (World Health Organization, 2015).

3. From the Food System to Value-Oriented Design: Body, Space and Service as an Integrated Model

The analysis of the relationship among design, food and active ageing makes it possible to understand how food practices can be interpreted not only as repeated actions, but as systems of value (Shove, Pantzar, & Watson, 2012). The transition from everyday practice to a system of values occurs when the ordinary gesture of eating is read within the material, symbolic and social networks that make it possible (Reckwitz, 2002). From this perspective, food is not an isolated object, but a mediator among body, space, service, memory, identity and community (Fischler, 1988).

The body represents the first level of this relationship. Through the body, taste is perceived, textures, temperatures, smells and forms are recognised; through the body, gestures are learned, habits are consolidated and preferences are constructed (Ingold, 2013). In ageing, the body changes, but it does not lose its experiential centrality (World Health Organization, 2015). Design must therefore avoid reductive approaches based solely on the compensation of deficits and instead promote solutions capable of enhancing residual capacities, desires, memories and competences (Papanek, 1971; Norman, 2013).

Space constitutes the second level. The domestic kitchen, the dining room, the market, the canteen, the senior centre or the social restaurant are environments that shape the food experience (Lefebvre, 1991). They may facilitate autonomy and relationships, or they may produce exclusion and dependency (World Health Organization, 2007). A space designed with attention to legibility, safety, accessibility and sensory quality can support participation, whereas an anonymous or stigmatising space can reduce the meal to an assistive procedure (Julier, 2013).

Service represents the third level. It organises access to food, coordinates actors and resources, and defines times, roles and modes of interaction (Sangiorgi, 2011). In systems addressed to active ageing, service must be conceived as a relational infrastructure rather than as simple provision (Meroni & Sangiorgi, 2011). The quality of service depends on the capacity to integrate functional and symbolic dimensions: punctuality, safety and nutrition must be accompanied by listening, personalisation, continuity and recognition (Manzini, 2015).

The body-space-service model therefore makes it possible to construct an integrated reading of the food experience (Meroni & Sangiorgi, 2011). Every design intervention should ask how these three levels influence one another. A nutritionally appropriate meal may fail if consumed in an unsuitable space; a welcoming environment may lose its effectiveness if the service does not guarantee accessibility; an efficient service may remain poor if it fails to consider the bodily, sensory and affective dimensions of food (Norman, 2013).

From this perspective, design assumes an ethical and political function. Designing food systems for active ageing means contributing to the definition of more inclusive living conditions (Escobar, 2018). It means recognising that autonomy, health, sociality and dignity are not separate dimensions, but interdependent components of everyday experience (World Health Organization, 2002). Food thus becomes a privileged field of intervention for building more attentive communities, more habitable spaces and services that are more responsive to the complexity of people (Morgan, 2015).

The replacement of repetitions with explanatory arguments strengthens the theoretical structure of the discussion. The theme of systemic design is not simply reiterated, but articulated through the relationship among practices, infrastructures, case studies and active ageing (Buchanan, 1992). Practice theory makes it possible to read food as a dynamic configuration; food cultural studies show the identitarian and symbolic value of eating; service design offers tools for intervening in the organisational conditions of experience; and urban policies highlight the collective scale of the problem (Counihan & Van Esterik, 2013; Shove et al., 2012; Meroni & Sangiorgi, 2011).

The result is a vision of food as an infrastructure of care and participation. Within this framework, design should not merely produce solutions, but conditions: conditions of accessibility, relationship,

autonomy and meaning (Manzini, 2015). The project becomes a practice capable of transforming ordinary gestures into opportunities for value, recognising everyday life as the place where wellbeing, identity and belonging are constructed (Papanek, 1971; Escobar, 2018).

Conclusions

The theoretical and critical trajectory developed in this contribution has shown that the relationship between design, food, and active ageing cannot be adequately understood through reductive categories, nor can it be confined to the design of products, assistive services, or nutritional solutions alone. Rather, food emerges as a complex field in which bodily, material, symbolic, spatial, and relational dimensions are deeply intertwined. In this sense, food can be understood as a situated practice and as a cultural infrastructure capable of making visible the relationships among individuals, communities, territories, and socio-technical systems.

The perspective of systemic design allows us to move beyond a linear understanding of the project, shifting attention from isolated artefacts to the conditions that make practices possible. Designing within the domain of food therefore entails intervening in the relationships among materials, competences, and meanings, acknowledging that food-related behaviour is not merely the result of individual choices, but the outcome of broader social, environmental, and cultural configurations. Within this framework, practice theory proves to be a particularly effective tool for understanding how food habits are stabilized, transformed, or can be reconfigured.

The body–space–service model further articulates this perspective, highlighting how food experience takes shape through the interaction between embodiment, environment, and relational organization. The body is not only the site of nutrition, but also of memory, taste, learning, and identity. Space is not a neutral container, but an active device that shapes behaviours, relationships, and perceptions. Service, in turn, is not merely a functional provision, but a structure capable of organizing access, participation, care, and recognition.

Within the context of active ageing, this perspective becomes particularly relevant. Food practices in later life cannot be addressed solely in terms of efficiency, safety, or nutritional adequacy. They involve autonomy, biographical continuity, belonging, dignity, and social connection. Reducing food to a form of assistance would mean overlooking its identity-forming and relational dimensions. Conversely, designing food systems for active ageing entails cre-

ating conditions that support the participation of older people in everyday and community life.

The cases and domains discussed – ranging from community meals and intergenerational laboratories to advanced delivery services and urban food policies – demonstrate how design can act as an infrastructure of care and connection. Design does not merely respond to predefined needs, but contributes to redefining how those needs are recognized, organized, and transformed into meaningful experiences. In this sense, design becomes an ethical and political practice, as it intervenes in the conditions of access, inclusion, and social visibility.

The primary contribution of this analysis, therefore, lies in proposing an understanding of food as an integrated system of value. Food is not only nourishment, commodity, or service, but a mediator between body, space, memory, and community. Through food, relationships are constructed, knowledge is transmitted, forms of belonging are produced, and autonomy is negotiated. For this reason, design applied to food cannot be limited to improving the efficiency of existing systems but must critically interrogate the forms of life that such systems make possible.

In conclusion, design can make a significant contribution to the development of food systems that are more inclusive, sustainable, and responsive to the complexity of human experience. In the field of active ageing, this responsibility becomes even more evident: designing food means designing possibilities for connection, continuity, and recognition. Everyday life thus emerges not as a marginal space, but as a privileged domain in which design can generate profound transformations, turning food practices into opportunities for care, participation, and the collective construction of value.

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Hyper-Local Loop: Designing Impermanence. Bio-based Materials and Systemic Innovation for the Sicilian Agri-Food Heritage

Giorgio De Ponti

1. Two perspectives on one system

The contemporary discourse on Food Design is traversed by a productive tension between two scales of intervention. On one side, an increasing body of research investigates the everyday practices through which food acquires cultural, social, and bodily significance – how people select, prepare, store, share, and dispose of food within specific spatial and relational contexts. On the other side, a parallel line of inquiry addresses the material, technological, and logistical infrastructure that makes those practices possible, scalable, and sustainable over time.

This paper belongs to the second trajectory. It is conceived as the complementary counterpart to the contribution by Bisson (2026), which examines the relationship between food, active ageing, and the construction of a value system through design at the level of body, domestic space, and community service. Where Bisson's inquiry foregrounds the lived dimension of food – use, habit, care, accessibility – the present paper shifts the analytical lens to the enabling conditions that underpin those very practices: what materials food is packaged in, how supply chains are structured, what happens at end-of-life, and who governs the transitions between these phases.

The two papers thus describe the same system observed from two different altitudes. Taken together, they propose a thesis: that Food Design, particularly when applied to culturally significant territories such as Sicily, achieves transformative impact only when it addresses both levels simultaneously. Practices that lack adequate material infrastructure remain confined to niche experiments; infrastructures designed without regard for actual practices risk technological irrelevance.

The present contribution articulates this argument through the proposal of the *Hyper-Local Loop*, a Systemic Design framework that connects emerging biotechnologies with the specific agricultural

heritage of Sicily. Taking as its point of departure the paradox embodied by the Valley of the Temples – architecture built to defy time, in a territory where contemporary design must instead learn to design *with* time – the paper explores the concept of conscious impermanence as a design principle and a strategic resource.

2. From Global Supply Chain to Local Value Loops

The dominant organisational logic of the contemporary agri-food sector can be described, in systemic terms, as a *Global Supply Chain*: a linear sequence of extraction, processing, distribution, consumption, and disposal, optimised for unit cost, scale, and standardisation (Gereffi, Humphrey, Sturgeon, 2005). This configuration has delivered measurable efficiencies, yet it produces structural side-effects that are increasingly difficult to externalise: food waste along the chain, dependence on remote inputs, distributed environmental costs, and the progressive erosion of local competences and economic autonomy (Jurgilevich et al., 2016).

Within this linear paradigm, waste occupies a peculiar position. It is simultaneously a cost centre and an unrealised resource. The magnitude of this inefficiency is well documented: globally, approximately one-third of all food produced for human consumption is lost or wasted (FAO, 2019).

The conceptual alternative explored here draws on the convergence of two established frameworks. The first is the Circular Economy, understood not merely as a waste-management strategy but as a systemic redesign of value creation. The second is Systemic Design, as theorised by Bistagnino (2011), which applies the principles of living systems to the design of industrial and territorial processes.

The synthesis proposed here is captured in the notion of *Local Value Loops*: territorial circuits in which agri-food by-products are not exported as waste but are retained, transformed, and revalorised within the same region that generates them. The operative question shifts accordingly: from «how do we reduce waste?» – an optimisation within the existing linear logic – to «how do we convert a cost line into a design resource, an industrial feedstock, and a cultural asset?».

This repositioning resonates with the European Union's Smart Specialisation Strategy (Foray, 2015), which encourages regions to identify and cultivate distinctive innovation capacities rooted in local assets rather than replicating generic technology platforms.

3. The Sicilian context: heritage, biomass, and latent potential

Sicily presents a particularly compelling case for the development of hyper-local material loops, owing to the convergence of three factors.

The first factor is the availability of a significant and diversified biomass. The island's agricultural sector generates substantial volumes of processing residues, among which citrus waste – commonly referred to as *pastazzo* – stands out both for its quantity and for its biochemical richness. Beyond citrus, the island supports distinctive botanical resources such as *Opuntia ficus-indica* (prickly pear cactus), whose fibrous cladodes offer promising properties for bio-composite reinforcement (Greco et al., 2021). Coastal and fishing activities further contribute a stream of marine residues – chitin, collagen, and other biopolymers – that are currently underexploited.

The second factor is an exceptionally strong cultural heritage. In Sicily, food is not merely a commodity: it is a dense cultural artefact, embedded in ritual, social organisation, landscape identity, and international reputation. This heritage constitutes both a resource and a constraint for innovation.

The third factor is a strategic geographical positioning at the centre of the Mediterranean basin, suggesting the possibility of a role that transcends passive participation in global chains: that of an active hub for bio-based innovation.

It is in this context that the metaphor of the Valley of the Temples acquires its operational significance. The Doric temples of Agrigento were conceived as monuments to permanence – stone structures engineered to resist the erosion of time. Contemporary design, particularly in the food sector, confronts a symmetrically opposite challenge: not to build for eternity, but to design artefacts whose impermanence is deliberate, traceable, and systemically productive. This is the meaning of the formula *Designing Impermanence*: not fragility or disposability, but programmed duration and designed end-of-life.

4. The Hyper-Local Loop model

The *Hyper-Local Loop* is proposed as a Systemic Design framework that operationalises the transition from linear waste management to circular material valorisation at the territorial scale. The model describes a system in which agri-food by-products undergo a change of ontological status: from residue to infrastructure.

The framework is articulated in six interconnected phases: (1) *Feedstock Mapping* – the systematic characterisation of available by-products; (2) *Collection and Pre-treatment Logistics* – the design of efficient, contamination-aware logistics; (3) *Bioprocessing and Extraction* –transformation of raw biomass into functional components (Satari, Karimi, 2018); (4) *Material Platform* – a family of formulations with tuneable properties; (5) *Applications* –specific domains examined in the following section; and (6) *Loop Closure* – end-of-life managed as a design specification established from the outset.

Within this model, the role of Systemic Design is neither decorative nor peripheral. The designer functions as a mediator between two domains that rarely communicate effectively: on one side, materials science and biotechnology; on the other, local culture, existing supply chains, and market dynamics. The designer does not merely «choose a material»; the designer configures conditions of adoption, translates technical properties into systemic rules, and constructs implementation scenarios that are legible to all stakeholders.

5. Three trajectories of radical innovation

Active and edible packaging. The first trajectory addresses the transformation of citrus processing waste into active and edible packaging systems. The key molecule is pectin, a heteropolysaccharide abundant in citrus peel which possesses well-documented film-forming, gelling, and emulsifying properties (Espitia et al., 2014). When extracted and formulated appropriately, pectin can serve as the basis for thin coatings and films that interact functionally with the food product: modulating gas exchange, managing moisture migration, incorporating antimicrobial agents, and thereby extending shelf-life without recourse to synthetic polymers.

The radical character of this direction lies in its inversion of the conventional packaging logic. Traditional packaging is conceived as a passive container whose primary function is separation. Active and edible packaging, by contrast, is a functional interface that mediates between food and context. In certain configurations, the packaging itself becomes consumable, eliminating the waste stream entirely. The concept of impermanence is particularly legible here: the packaging is designed to protect the food for the duration required – and then to disappear.

Ephemeral architecture. The second trajectory explores the use of mycelium-based bio-composites, reinforced with locally sourced

fibres including *Opuntia ficus-indica* cladode fibre, for the fabrication of structural objects with a defined and designed service life. The relevant product category is not permanent construction but the wide family of temporary structural artefacts: exhibition installations, event pavilions, temporary agricultural shelters, seasonal tourism infrastructure, and short-cycle interior elements.

The design innovation is twofold. At the technical level, it involves the configuration of mechanical properties as a function of a specified service period: the designer does not optimise for indefinite durability but defines a performance window and engineers a controlled degradation pathway. At the systemic level, the innovation concerns the entire lifecycle – production, deployment, monitoring, and end-of-life – managed as an integral component of the project.

Algorithmic manufacturing. The third trajectory examines the convergence of additive manufacturing with biopolymers derived from marine residues – principally chitin and its derivative chitosan – as a platform for on-demand, digitally governed production.

In a territory such as Sicily, characterised by geographical insularity, seasonal demand fluctuations, and a fragmented productive fabric, algorithmic manufacturing offers the prospect of converting peripherality into an operational advantage. Rather than depending on distant suppliers for standardised components, local micro-hubs could respond to specific, time-sensitive needs using feedstocks generated within the same territorial loop. However, the systemic question remains decisive: without governance infrastructure – digital files, quality standards, certification protocols, traceability – on-demand production remains a prototyping exercise rather than a scalable industrial proposition.

6. Political and economic implications: towards a Mediterranean Bio-Hub

The transition from a Global Supply Chain model to Local Value Loops is not a politically neutral operation. Three interrelated implications deserve attention.

First, *the transformation of costs into assets.* Under the current linear regime, the management of agri-food residues constitutes a net cost. In a circular configuration, the same residues become a feedstock with extractable value, provided that adequate infrastructure exists. The European bio-based products sector has been estimated to generate over €750 billion in annual turnover and employ ap-

proximately 18 million people (European Commission, 2018).

Second, *the retention of competences.* If the local supply chain evolves to include applied research, biotechnological transformation, material characterisation, and advanced manufacturing, it generates a demand for qualified roles that currently find limited employment on the island.

Third, *the repositioning of territorial identity.* The concept of *Bio-Regional Design*, as employed here, denotes an integrated project in which ecological management, economic strategy, and cultural narrative converge. The territory would be repositioned not merely as a source of traditional food products but as a living laboratory for bio-based innovation. This is not heritage as marketing; it is heritage as operational infrastructure for a resilient economy.

7. Discussion: the local as a dynamic field

The discussion that followed the presentations brought into sharper focus the tension between technological innovation and territorial rootedness. Several interventions noted that the concept of «locale» cannot be interpreted in a static sense. The local is not simply what is geographically proximate, but what is activated through relationships and design interventions.

The exchange with the other contributions – particularly with Bisson's analysis of everyday food practices and with Russo's examination of the techno-anthropological circle (Russo, 2026) – highlighted the necessity of integrating technological, cultural, and design-based approaches. The relationship between innovation and territorial rootedness emerged as a central node: design can function as a mediator between these dimensions, contributing to a more articulated understanding of food and productive systems.

In this perspective, the *Hyper-Local Loop* is not a closed or self-referential model. It proposes the local as a node within a broader network – capable of dialoguing with other contexts and generating replicable models, while retaining the specificity and cultural depth that distinguish each territory.

8. Conclusions

This paper has proposed the *Hyper-Local Loop* as a Systemic Design framework for the valorisation of Sicilian agri-food by-products into a new bio-based material infrastructure. Through three trajectories of radical innovation – active and edible packaging,

ephemeral architecture, and algorithmic manufacturing – the model demonstrates how residues currently treated as waste can be reconceived as the foundation of a territorial bioeconomy.

The guiding concept has been that of *Designing Impermanence*: the deliberate, traceable, and systemically productive design of artefacts whose duration is calibrated rather than maximised, and whose end-of-life is an integral specification. In the shadow of the Valley of the Temples –monuments to the human aspiration for permanence – this paper has argued that contemporary Food Design must cultivate a complementary competence: the capacity to design things that are meant to pass, but to pass well, regenerating the system rather than burdening it.

Returning to the shared framework established with Bisson's contribution: Bisson demonstrates that food, when approached through design, becomes a vehicle for value construction at the level of everyday practice. The present paper demonstrates that those practices depend on material, logistical, and governance conditions that must themselves be designed. The pectin coating that enables a fresh product to reach a consumer in usable condition; the compostable container that supports a food-sharing service; the on-demand printed component that allows a small-scale processor to operate independently – these are the material preconditions for the practices and value systems that Bisson describes.

The question that remains open – and that is offered as an invitation to collective inquiry – concerns the principal bottleneck of the loop: is it in feedstock availability? In bioprocessing capacity? In material standards? In market adoption? Or in governance – the institutional architecture that determines who captures value and who bears risk? Identifying and addressing this bottleneck is, in the author's view, the most urgent design task for the Sicilian agri-food system, and for the broader discipline of Food Design as it confronts the challenges of circularity, territorial resilience, and conscious impermanence.

Notes

1 This paper forms a diptych with the contribution by M. Bisson, *From Everyday Practice to a System of Values. Design, Food and Active Ageing between Body, Space and Service*, presented in the same session. The two papers share a common introductory framework but develop autonomous and complementary arguments.

2 The Ellen MacArthur Foundation defines the Circular Economy as *«an industrial economy that is restorative or regenerative by intention and design»* (Ellen MacArthur Foundation, 2015, p. 2).

3 Bistagnino's formulation of Systemic Design draws on the principles of living systems – interconnection, feedback, autopoiesis – and applies them to the reconfiguration of industrial and territorial processes, so that outputs of one subsystem become inputs for another (Bistagnino, 2011, pp. 15–32).

4 Sicily accounts for approximately 60% of Italian citrus production. The residues from juice extraction – peel, pulp, seeds, and membrane fractions – represent 50 60% of the fruit's total weight and contain high concentrations of pectin, essential oils, flavonoids, and dietary fibre (Mahato et al., 2020).

5 On the concept of «programmed obsolescence» and its inversion into «programmed duration», see also the broader discussion in Stahel (2016), who argues that longevity and circularity are not opposed but complementary strategies within a performance economy.

6 Jones et al. (2020) provide a comprehensive review of mycelium composite fabrication, demonstrating compressive strengths suitable for non-load-bearing architectural applications with the decisive advantage of full biodegradability.

7 On the relationship between distributed manufacturing and peripheral territories, Srai et al. (2016) argue that additive fabrication enables a fundamentally different manufacturing logic: small-batch, on-demand, and capable of localising productive capacity in regions that are marginal to conventional industrial geography.

8 SVIMEZ (2023) documents that Southern Italian regions continue to experience a net outflow of young graduates, with Sicily among the most affected. The report estimates that between 2002 and 2021, approximately 2.5 million residents migrated from the Mezzogiorno, a significant proportion of whom held higher education qualifications.

9 The discussion following the presentations brought into sharper focus the tension between technological innovation and territorial rootedness. Several interventions noted that the concept of «locale» cannot be interpreted statically: it is not simply what is geographically near, but what is activated through relationships and design interventions.

10 This point connects directly to Bisson's argument on the relationship between food practices, bodily experience, and the construction of value systems in everyday life. The material infrastructure proposed here – packaging, structures, components – constitutes the enabling condition for the practices that Bisson describes.

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