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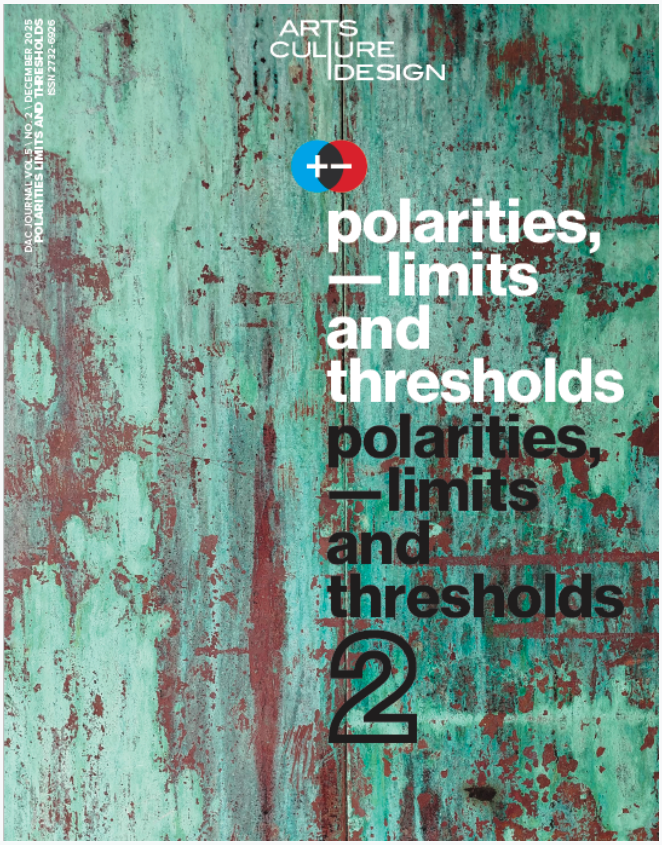
POLARITIES, LIMITS AND THRESHOLDS



Designing at the Edge: Critical Food Futures, Posthuman Ethics, and the Politics of Taste

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ARTICLE

DESIGNING AT THE EDGE: CRITICAL FOOD FUTURES, POSTHUMAN ETHICS, AND THE POLITICS OF TASTE

ABSTRACT

This article examines how contemporary food design practices, spanning from speculative artefacts to commercial innovations, balance the tensions between nature and technology, authenticity and simulation, critique and scalability. Through a comparative analysis of four case studies (The Sausage of the Future, Edible Growth, Perfect Day, and NotCo), we explore how food design shapes the ethical, sensory, and systemic dimensions of food. Drawing on critical design theory, posthumanist thought, and decolonial perspectives, the study challenges the dominance of techno-scientific narratives and advocates for more inclusive, culturally grounded, and multispecies approaches to food futures. We propose a typology based on two key dimensions - symbolic depth and systemic traction - to assess how food artefacts mediate cultural meaning and infrastructural change. This framework invites a shift from novelty-driven food design to practices rooted in ethics, care, and epistemic diversity.

INTRODUCTION

Food design today unfolds at the intersection of intensifying polarities between nature and technology, tradition and innovation, local and global, and visibility and marginality. These polarities are not merely oppositional forces but sites of dynamic tension, where design operates as both a cultural mirror and a material mediator. They reveal how food, once anchored in ritual, place, and multispecies entanglement, is increasingly shaped by abstraction, digitization, and speculative narratives. Whether through cellular agriculture, precision fermentation, or algorithmically-generated recipes, what we eat is no longer merely a reflection of agricultural or culinary traditions but a product of techno-scientific imagination and geopolitical structures. These changes signal not just a shift in what food is, but in what food means, and for whom.

As such, food becomes a space where limits are both transgressed and re-imposed: ecological limits (e.g., planetary boundaries), sensory limits (e.g., taste as a human-centric sense), and epistemological limits (e.g., who is authorized to produce knowledge about food). At the same time, food design increasingly engages thresholds, critical junctures where ontologies and worldviews collide and recombine. These thresholds are not simply technological tipping points but moments of ethical, cultural, and political significance: thresholds between the human and the nonhuman; the natural and the artificial; and the speculative and the systemic. The emergence of artificial, intelligence (AI) in recipe development, the use of synthetic biology to replicate dairy without cows, and the performative politics of edible installations all point toward new configurations of taste, ethics, and agency.

Situated within the expanding field of critical food design (Vodeb, 2017; Tharp & Tharp, 2019), this article examines how food artefacts participate in and shape these transformations. Critical food design interrogates not just the functionality or sustainability of food systems but the values, ideologies, and sensory hierarchies embedded within them. Whose futures are being designed? Whose knowledge counts? And what kinds of food futures are thinkable or desirable? To ground these questions, this article offers a comparative analysis of four emblematic case studies: The Sausage of the Future; Edible Growth; Perfect Day; and NotCo. Each project inhabits different positions across two key heuristic dimensions: symbolic depth; and systemic traction. These two axes are not linear measures but interdependent forces that help map how artefacts function across the threshold between provocation and implementation.

Building on speculative design theory (Dunne & Raby, 2013; Tharp & Tharp, 2019), which positions design as a mode of inquiry rather than solution, it is possible to develop posthumanist ethics (Haraway, 2023) and decolonial design perspectives (Escobar, 2018; TallBear, 2019), which unsettle anthropocentric and Eurocentric assumptions about food, innovation, and relationality. These frameworks enable us to see food design not merely as product development or culinary experimentation, but as a form of world making, a practice that engages with limits (planetary, ethical, perceptual) and crosses thresholds (ontological, cultural, systemic).

Rather than assuming that design is an inherently progressive or benevolent force, we approach it as a boundary practice, one that operates at the edge of disciplines, species, and worldviews. In this view, food artefacts are not simply edible objects but mediators of value, power, and possibility, capable of shaping more just, multispecies, and pluriversal food futures, or of reinforcing extractive, anthropocentric, and techno-centric systems.

2. CROSSING THE EDIBLE LINE: FOOD AS A THRESHOLD PRACTICE

Recent issues related to our food systems, such as climate change, post-natural innovation, and shifting sensory authorities, have led to food design emerging as a critical discipline between speculative imagination and lived ecologies. Lab-grown proteins, AI-generated recipes, and 3D-printed meals have increasingly blurred the boundaries between human authorship and microbial, algorithmic agency in the food innovation sector. These innovations (or not) raise urgent questions, such as what we design, who designs it, and for whom it is designed.

Building on foundational design theory, this reflection begins with Simon's conception of artificial systems - as artefacts "synthesized to attain goals" (Simon, 1996, p. 4) - and proposes that food design reframes food not as something granted for humans, but as a purpose-driven cultural interface. As Simon (1996) further affirms, "to design is to devise courses of action aimed at changing existing situations into preferred ones" (1996, p. 111), highlighting design's inherently transformative intent - a useful lens for evaluating food systems shaped by speculation and techno-scientific ambition. Drawing on critical and speculative design (Dunne & Raby, 2013; Tharp & Tharp, 2019), food anthropology (Korsmeyer, 2017), and posthumanism (Haraway, 2023), the study resists reducing food design to something aesthetic, novel artefacts, or system optimization. Instead, it frames food design as a contested territory that negotiates tensions and boundaries between innovation and tradition, visibility and marginality, and simulation and authenticity.

The reflection conducts a comparative analysis of four representative cases - The Sausage of the Future from Carolien Niebling (Niebling, 2017), Edible Growth from Chloé Rutzerveld, NotCo, a software of AI (Giuseppe) for food product innovation from Matias Muchnick and Kim Pichara, and Perfect Day, a company of plant-based dairy products from Ryan Pandya and Perumal Gandhi - to examine how food design products shape the sensory, symbolic, socio-cultural, and political dimensions of food innovation. It challenges the trend of correlating visibility or novelty with critical value and questions the dominance of techno-scientific imaginaries. By drawing on decolonial and relational design frameworks (Escobar, 2018), this article aims to decentre extractive modes of futurity and reorient food design toward plural epistemologies, place-based practices, and multispecies ethics.

Speculative projects often serve as discursive provocations, but their systemic impact is diminished when they are disconnected from community engagement. Conversely, commercially scaled design projects frequently reproduce industrial logics while presenting themselves as sustainable. To navigate this double bind, the article positions food design as an interplay of symbolic review and infrastructural intervention, asserting that radical possibility depends on scalability, participation, and cultural pluralism.

The article pursues two aims: first, to articulate a refined typology of food design futures that distinguishes between speculative critique and systemic innovation; second, to reveal the ideological structure and epistemic gaps embedded in contemporary food-tech narratives. Through this critical lens, the article advances a politically attuned, multispecies-sensitive, and decolonial vision for designing future food systems.

3. POLARIZED PLATES: CONCEPTUAL FAULT LINES IN FOOD DESIGN

Contemporary food design sits at the intersection of multiple polarized uncertainties - nature versus technology, authenticity versus simulation, visibility versus marginality. These binaries produce ideological consequences, shaped by divergent ontologies, economic structures, and cultural imaginaries. Speculative design and food-tech innovation navigate these fault lines, generating new sensorial scripts and reinforcing distinctive ways of envisioning the future.

3.1 SPECULATIVE AND CRITICAL DESIGN FRAMEWORKS

The foundational work of Dunne & Raby (2013), Tharp & Tharp (2019), and Vodeb (2017)

frames many food design artefacts as discursive provocations rather than products. These artefacts operate within critical design traditions that emphasize speculation, rupture, and aesthetic alienation. As Tharp and Tharp (2019) observe, "discursive design embraces ambiguity as a method to provoke reflection, not resolution" (2019, p. 28), highlighting the intentional open-endedness and discomfort these artefacts introduce. However, their circulation often remains privileged to elite or academic design audiences. Such inscriptions of novelty may risk overvaluing aesthetic disruption as inherently radical, without considering its structural or long-term implications. As Vodeb (2017) reminds us, "design is never innocent - it either reinforces or resists the dominant order" (p. 17), prompting the need to critically assess the underlying ideologies speculative projects reproduce or resist.

3.2 POST-HUMANISM AND MULTISPECIES AUTHORSHIP

Post-humanist and new materialist thought - exemplified in Haraway's (2023) work - questions traditional notions of design agency and intention. In the context of food innovation, the delegation of creativity to AI (e.g., NotCo's "Giuseppe" algorithm) or microbial fermentation (e.g., Perfect Day cultivation) calls for a reconceptualization of design as multispecies co-creation. Rather than discovering agency in the designer, these emerging systems distribute authorship across humans, algorithms, and microbial ecologies. Critically, such distributed design frameworks demand new theoretical tools to examine ethics, accountability, and intention across biological and machinic actors.

3.3 DECENTERING TECHNO-SCIENTIFIC NARRATIVES

Despite claims to universal innovation, dominant food design narratives often reflect the techno-scientific imaginaries. To decenter this monocular view, decolonial and indigenous frameworks present critical perspectives. Escobar's Designs for the Pluriverse (2018) advocates for design paradigms grounded in radical interdependence, autonomy, and world-making from plural epistemologies. His critique of capitalist, extractive design systems offers a powerful lens to reimagine food design not only as innovation but also as a practice embedded in autonomy, ecological care, and cultural meaning.

TallBear's (2019) feminist-Indigenous scholarship proposes caretaking relations as an alternative to settler colonial futurities, exposing the ways design and science have historically erased Indigenous kinship with the land and multispecies relations. Her framing emphasizes spatial, relational ethics over progress-driven narratives, challenging design to operate in dialogue with land, community, and ancestral memory.

Other scholarship, such as the emergent concept of indigenous presence in design (e.g., Dorr et al., 2024), or the growing literature on the biocultural restoration of indigenous foodways (Howard, 2022), foregrounds relational design rooted in territory, reciprocity, and indigenous-led priorities. These perspectives underscore the political stakes of designing food systems in ways that restore sovereignty, rather than simply securing market access.

Bridging these frameworks requires attending to the ontological ruptures proposed by both posthumanist and decolonial thought. Haraway's "becoming with" (2007) and situated knowledges challenge human exceptionalism, while TallBear (2019) emphasizes Indigenous kinship systems, land-based epistemologies, and caretaking relations beyond human dominance. Both argue for an ethics grounded in relational inter-

dependence, undermining western binaries of nature vs culture, subject vs object, and design vs environment.

Together, these approaches propose a vision of design not as innovation from above, but as emergent co-creation across species, lineages, and ecosystems, demanding accountability not only to future consumers, but to ancestral relations, microbial collaborators, and territorial beings. This convergence invites food design to operate as a site of ontological negotiation, where design can both reproduce and reconfigure the logics of domination or reciprocity.

3.4 ANALYTICAL OPPORTUNITIES AND GAPS

While the current literature robustly critiques innovation imaginaries and speculative modalities, it often operates in silos, addressing theoretical provocations and decolonial critique in parallel rather than in an integrated manner. Food design scholarship can benefit from actively bridging the gap between speculative and design theorists (Dunne & Raby, 2013; Haraway, 2023; Korsmeyer, 2017) and decolonial and multispecies practitioners (Escobar, 2018; TallBear, 2019; Howard, 2022). This integration calls for direct attention to:

— Authorship and agency: Who claims credit in design outcomes when microbial or algorithmic systems shape the process?

— Scalar impact: How do designers and institutions translate discursive prototypes into infrastructural or community-engaged transformation?

— Epistemic inclusivity: Which knowledges do design imaginaries foreground or silence, and whose worlds do they make visible, or erase?

3.5 SUMMARY

This literature review constructs three critical moves: first, it situates speculative food design within a lineage of critical design theory; second, it problematizes post-humanist authorship and distributed agency in emergent food innovations; third, it foregrounds decolonial, indigenous, and relational frameworks to challenge techno-scientific dominance. Together, these strands provide new theoretical ground for examining the political, aesthetic, socio-cultural, and systemic capacities of food design.

4. FROM SIMULATION TO DISRUPTION: PATTERNS ACROSS THE EDIBLE SPECTRUM

This analysis adopts a qualitative, interpretive research approach grounded in critical design studies and comparative analysis. The purpose is not to measure technological efficacy or consumer behaviour, but to examine how specific food design artefacts operate symbolically, ethically, and politically within emerging systems of production and meaning.

The methodology aligns with practice-based and interpretive research traditions in design (Frayling, 1993; Kimbell, 2012), emphasizing the analysis of artefacts as cultural texts that articulate systemic tensions and aesthetic ideologies. Drawing on principles of discursive design (Tharp & Tharp, 2019), the study examines artefacts not for their usability or efficiency but for the narratives they propose and the futures they implicitly endorse or exclude.

Figure 1
The Sausage of the Futures.
© Carolien Niebling
Figure 2
The Sausage of the Futures.
© Carolien Niebling

4.1 CASE SELECTION

Four design projects were selected for comparative analysis:

THE SAUSAGE OF THE FUTURE

A speculative design project by Carolien Niebling, this initiative proposes new typologies of sausage using plant-based and fermented ingredients. Through its provocative presentation and departure from traditional meat aesthetics, it challenges the logic of mimicry and encourages more diverse and sustainable food futures.

Rather than mimicking meat, this project exemplifies a “discursive object” in the Tharpian sense - it disrupts consumption norms and “invites viewers to consider new frameworks, not just new forms” (Tharp & Tharp, 2019, p. 42). Its strength lies in its capacity to generate dialogue about food futures beyond traditional product innovation.

EDIBLE GROWTH

Developed by Chloé Rutzerveld, this bio-design prototype combines 3D printing with living organisms (seeds, spores) to produce food that evolves. It visualizes a symbiosis between natural growth and technological fabrication, offering a speculative model for local, self-sufficient, and sensorially rich food experiences.

PERFECT DAY

A biotechnology company focused on producing dairy proteins (casein and whey) through microbial fermentation without involving animals. While it replicates the texture and taste

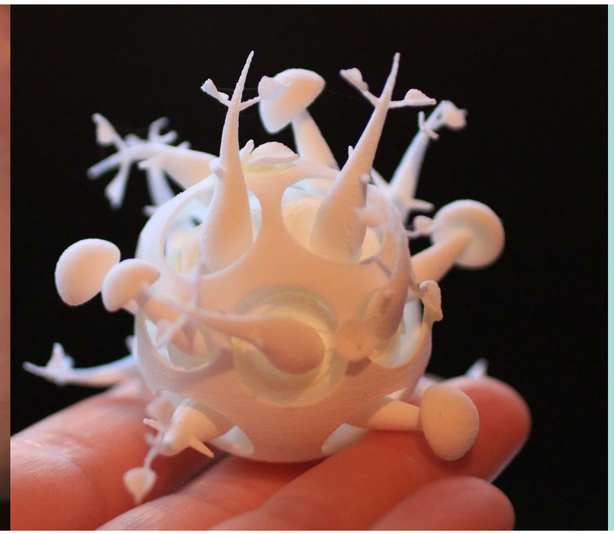


Figure 3
Edible Growth.
© Chloé Rutzervel
Figure 4
Edible Growth.
© Chloé Rutzerveld

of conventional dairy, it raises questions about consumer transparency, industrial control, and the shifting boundaries of what we consider “natural” food.

The ethics of animal-free fermentation hinge not only on sustainability claims but also on the transparency and legitimacy of technological substitutions. As Sandler (2014) notes, “technological food innovations must be assessed not only for their benefits, but also for what they displace- ecologically, economically, and culturally” (2014, p. 101). Perfect Day’s replication of dairy taste may obscure broader concerns about centralization, consumer autonomy, and food sovereignty.

NOTCO

A food-tech company that uses an AI algorithm (“Giuseppe”) to create plant-based versions of familiar animal products. It leverages data and machine learning to simulate taste and texture while maintaining conventional food formats. Though positioned as a sustainable innovation, it also reinforces the aesthetics and logic of industrial food systems.

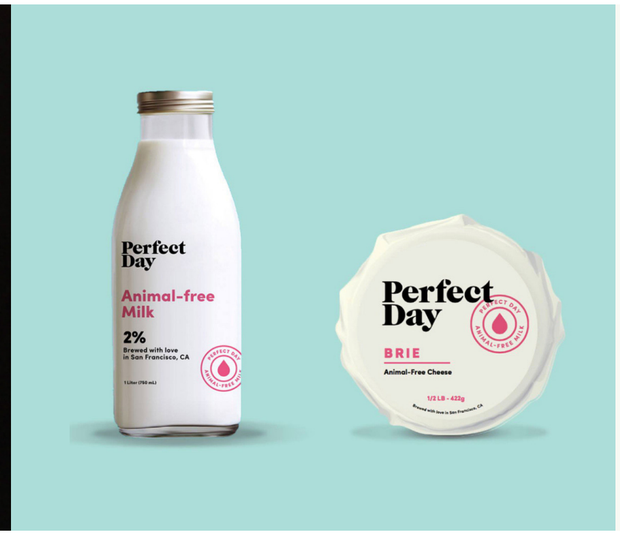
These cases were chosen based on the following criteria:

— Relevance to current polarities in food design (e.g., authenticity vs simulation, nature vs technology);

— Diversity in design typology (speculative vs commercial);

— Richness of available documentation (visual, discursive, technical);

— Symbolic and epistemic impact on contemporary food discourses.



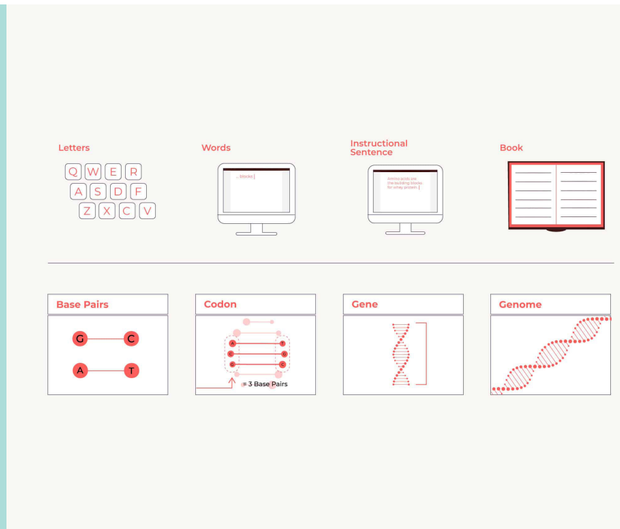


Figure 5
Animal-Free Milk Product.
© Perfect Day
Figure 6
Process.
© Perfect Day

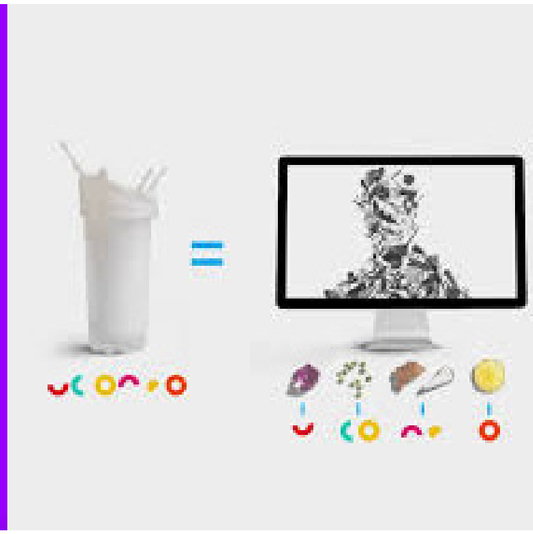


Figure 7
Giuseppe AI.
© NotCo
Figure 8
Giuseppe AI.
© NotCo

The selection comprises both speculative projects (The Sausage of the Future, Edible Growth) and market-oriented innovations (Perfect Day, NotCo), enabling a cross-comparison of discursive intention and systemic traction.

4.2 ANALYTICAL FRAMEWORK

Each project was analysed employing a four-dimensional comparative framework designed from the literature review:

— Materiality and Technology: Ingredient origins, fabrication methods, and the ontological framing of food (e.g., lab-grown vs fermented vs printed);

— Aesthetics and Sensoriality: Visual, textural, and multisensory strategies that encode values or challenge norms;

— Narrative and Discourse: The framing language and rhetorical devices used to position each artefact within cultural and systemic debates;

— Ethical and Political Implications: Questions of transparency, participation, food sovereignty, and justice embedded in the design logic.

This framework draws inspiration from critical design (Dunne & Raby, 2013), food ethics (Sandler, 2014), sensory anthropology (Korsmeyer, 2017; Howes, 2021), and post-humanist critique (Haraway, 2023; Escobar, 2018). It allows for multi-scalar interrogation - attending not just to artefact-level design decisions, but to the broader systems of knowledge, legitimacy, and power in which they circulate.

4.2.1 DATA SOURCES AND ANALYTICAL PROCEDURES

This study draws on publicly available documentation for each selected project, including websites, design publications, visual materials, media interviews, and academic commentaries. The analysis applies a qualitative interpretive approach to these materials, grounded in constructivist epistemology and critical design studies.

Each project was coded using the heuristic dimensions outlined below - Materiality and Technology, Aesthetics and Sensoriality, Narrative and Discourse, and Ethical and Political Implications. Coding focused on identifying:

— Visual strategies (e.g., mimicry, estrangement, multisensory emphasis);

— Discursive narratives (e.g., sustainability rhetoric, cultural imaginaries);

— Epistemic positions (e.g., anthropocentric, multispecies, algorithmic);

— Systemic orientation (e.g., critique, compliance, scalability).

While not exhaustive or ethnographic, this approach allows for multi-scalar analysis that attends to both representational and ideological aspects of each case.

HEURISTIC DIMENSION	**ANALYTICAL FOCUS**
Materiality and Technology	Ingredient origins, production methods, ontological framing (natural/synthetic/etc.)
Aesthetics and Sensoriality	Sensory coding, visual design, texture, temporal aesthetics
Narrative and Discourse	Cultural/ethical stories told, rhetorical framings, future imaginaries
Ethical and Political Implications	Justice, participation, food sovereignty, ecological responsibilities

Table 1. Analytical Framework. Source: Authors.

4.3 EPISTEMOLOGICAL POSITIONING AND LIMITATIONS

This research adopts a constructivist epistemology, viewing food artefacts as culturally situated expressions rather than neutral solutions. It resists instrumental or purely market-oriented analyses, focusing instead on symbolic meaning, aesthetic disruption, and epistemic diversity.

However, the study acknowledges several limitations. First, although the selected cases vary in type, they exclude grassroots, Indigenous, and non-Western food design initiatives - voices that play a critical role in shaping a more plural understanding of innovation. Second, the analysis relies on publicly available documentation and secondary data; incorporating deeper ethnographic or participatory methods would offer richer insights into user perceptions, affective responses, and community co-design processes.

Future studies can build on this work by examining food artefacts in context - through sensory ethnography, participatory design labs, or collaborations with communities that actively resist dominant food-tech paradigms.

ANALYTICAL DIMENSIONS	**KEY QUESTIONS**	**THEORETICAL ANCHORS**
Materiality and Technology	What are the sources and fabrication methods of the food artefact? How is food framed (natural, synthetic, hybrid)?	Post-humanism, Biotech Design, Artificial Systems (Simon, 1996; Haraway, 2007)
Aesthetics and Sensoriality	How does the artefact appeal to or disrupt sensory expectations? What cultural, ethical, or futuristic narratives does the project construct or reinforce?	Sensory Anthropology, Aesthetic Theory (Korsmeyer, 2017; Howes, 2021)
Narrative and Discourse	What are the visual/textural strategies used?	What are the visual/textural strategies used?
Ethical and Political Implications	How does the project address justice, transparency, inclusion, and ecological responsibility?	Food Ethics, Decolonial Theory, Systems Design (Sandler, 2014; Escobar, 2018; TallBear, 2019)

Table 2. Analytical Framework Matrix. Source: Authors.

5. FROM SIMULATION TO DISRUPTION: PATTERNS ACROSS THE EDIBLE SPECTRUM

This section analyses four selected food design projects - The Sausage of the Future, Edible Growth, Perfect Day, and NotCo - through the analytical framework introduced in Section From Simulation to Disruption: Patterns Across the Edible Spectrum. These projects were chosen for their ability to illustrate a spectrum between speculative provocation and commercial implementation. The analysis does not assess technical feasibility or consumer response but instead focuses on how each project articulates narratives, aesthetics, and systemic ideologies within the field of food design.

5.1 THE SAUSAGE OF THE FUTURE (CAROLIEN NIEBLING)

This speculative design project challenges meat typology by proposing new forms of sausage made from plant-based and fermented ingredients. Rather than imitating traditional meat aesthetics, the design leverages texture, form, and colour to provoke reimagined sensory expectations.

MATERIALITY AND TECHNOLOGY Relies on artisanal techniques and non-animal proteins, foregrounding fermentation as both a material and cultural process.	**AESTHETICS AND SENSORIALITY** Disrupts mimicry; prioritizes visual experimentation and culinary estrangement to challenge what a sausage can be.
NARRATIVE AND DISCOURSE Frames food as a designable medium beyond nostalgia or substitution. Aligns with Tharp & Tharp's (2019) "discursive object" capable of shifting conceptual paradigms.	**ETHICAL AND POLITICAL IMPLICATIONS** Critiques industrial protein logic by opening aesthetic alternatives. However, its speculative nature limits public engagement and systemic integration.

Table 3. Critical Analysis of The Sausage of the Future. Source: Authors.

5.2 EDIBLE GROWTH (CHLOÉ RUTZERVELD)

A bio-design prototype combining 3D printing and living organisms to produce evolving food forms. This project visualizes a co-evolutionary model of food production that brings together human, machine, and biological elements.

MATERIALITY AND TECHNOLOGY Blends synthetic and organic processes to propose a temporally active, multispecies artefact.	**AESTHETICS AND SENSORIALITY** Presents food as a process - not a finished object - highlighting the aesthetics of decay, growth, and the lifecycle.
NARRATIVE AND DISCOURSE Critiques industrial stasis and suggests a symbiotic relationship between food and life systems.	**ETHICAL AND POLITICAL IMPLICATIONS** Points to localized, zero-waste futures but lacks pathways for scalability, accessibility, or broader cultural integration.

Table 4. Critical Analysis of Edible Growth. Source: Authors.

5.3 PERFECT DAY

This biotechnology company engineer's casein and whey proteins through microbial fermentation, enabling dairy production without the use of animals.

MATERIALITY AND TECHNOLOGY Exemplifies precision fermentation as a scalable biotech process that mimics the molecular properties of dairy.	**AESTHETICS AND SENSORIALITY** Promotes sustainability through technological substitution while preserving familiar consumer experiences..
NARRATIVE AND DISCOURSE Maintains traditional flavour and texture profiles to ease adoption.	**ETHICAL AND POLITICAL IMPLICATIONS** Raises concerns about opacity, proprietary control, and corporate centralization—despite claims of animal welfare and environmental responsibility (Sandler, 2014).

Table 5. Critical Analysis of Perfect Day. Source: Authors.

5.4 NOTCO – GIUSEPPE

An AI-driven company using machine learning (the "Giuseppe" algorithm) to generate plant-based alternatives that replicate animal-based food items.

— Materiality and Technology: Relies on large datasets to simulate flavour, aroma, and texture via novel ingredient combinations.

— Aesthetics and Sensoriality: Replicates familiar formats (e.g., burgers, milk) to ensure cultural legibility.

— Narrative and Discourse: Frames AI as an ethical, creative agent of food system reform—yet often instrumentalizes sustainability rhetoric for market acceptance.

— Ethical and Political Implications: Emphasizes efficiency and innovation but maintains techno-industrial paradigms. The role of AI in shaping taste raises epistemic and authorship concerns (Escobar, 2018).

MATERIALITY & TECHNOLOGY Relies on large datasets to simulate flavour, aroma, and texture via novel ingredient combinations.	**NARRATIVE & DISCOURSE** Frames AI as an ethical, creative agent of food system reform—yet often instrumentalizes sustainability rhetoric for market acceptance.
AESTHETICS & SENSORIALITY Replicates familiar formats (e.g., burgers, milk) to ensure cultural legibility.	**ETHICAL & POLITICAL IMPLICATIONS** Emphasizes efficiency and innovation but maintains techno-industrial paradigms. The role of AI in shaping taste raises epistemic and authorship concerns (Escobar, 2018).

Table 6. Critical Analysis of NotCo - Giuseppe. Source: Authors.

6. THE TASTE OF TENSION: ETHICS, ESTRANGEMENT AND DESIGN POLITICS

The comparative analysis demonstrates both convergences and divergences in how these artefacts navigate the ethical, sensory, and systemic thresholds of food design. Each case represents a particular tension between disruption and reproduction, opacity and transparency, and simulation and invention.

6.1 PATTERNS ACROSS ANALYTICAL DIMENSIONS MATERIALITY AND TECHNOLOGY

The Sausage of the Future and Edible Growth propose material redefinitions of food,

prioritizing fermentation, co-evolution, and processual aesthetics. In contrast, Perfect Day and NotCo utilize synthetic systems to replicate conventional products with high fidelity, advancing scalability but limiting ontological innovation.

AESTHETICS AND SENSORIALITY

The speculative projects provoke estrangement and invite new aesthetic imaginaries. Conversely, the commercial cases maintain aesthetic familiarity, reinforcing the sensory norms of industrial food systems. This dualism reflects divergent strategies for user engagement: invitation through disruption vs. acceptance through replication.

NARRATIVE AND DISCOURSE

All four projects deploy future-oriented rhetoric, but to different ends. The speculative projects act as discursive artefacts that provoke cultural critique. The commercial one's embrace techno-optimistic narratives, embedding their innovations in mainstream consumption without substantially altering food imaginaries.

ETHICAL & POLITICAL IMPLICATIONS

While all projects gesture toward sustainability, few engage with questions of food justice, sovereignty, or epistemic inclusion. Perfect Day and NotCo raise critical concerns around transparency, corporate power, and proprietary systems. The Sausage of the Future and Edible Growth, though more ethically ambitious in form, remain constrained by their speculative nature and limited accessibility.

6.2 EMERGENT TENSIONS

SIMULATION VS. AUTHENTICITY

Commercial artefacts simulate traditional food experiences to facilitate user acceptance, often at the expense of more profound transformation. Speculative designs disrupt sensory expectations, offering new symbolic registers but lacking reach or infrastructure for systemic change.

OPACITY VS. TRANSPARENCY

Precision fermentation and AI systems often obscure technical processes from the public. The reliance on proprietary algorithms and bioengineering in Perfect Day and NotCo raises questions about accountability and consumer autonomy.

FAMILIARITY VS. ESTRANGEMENT

Design decisions reflect assumptions about what users desire or can tolerate. The speculative projects assume that aesthetic discomfort may spark reflection, whereas commercial designs aim to avoid disruption and promote consumption.

DISCOURSE VS. INFRASTRUCTURE

There is a disjunction between speculative artefacts that critique the system and commercial artefacts that replicate it. Few initiatives bridge this gap to create participatory, community-driven design outcomes.

6.3 TOWARD A TYPOLOGY OF FOOD DESIGN FUTURES

The cases suggest an emerging typology across two axes:

— Symbolic Depth – from mimicry to invention;

— Systemic Traction – from provocation to integration.

To navigate the increasingly complex and often contradictory landscape of food design, where speculative artefacts meet commercial imperatives, and sensory innovation intersects with ecological urgency, we propose two conceptual heuristics: Symbolic Depth and Systemic Traction. These dimensions, drawn from critical design theory, post-humanist ethics, and decolonial critique, can serve as guiding criteria for evaluating food design artefacts beyond superficial novelty or scalability.

SYMBOLIC DEPTH			
DEFINITION symbolic depth guides to the extent to which a food design artefact interrogates, reframes, or transforms cultural, ethical, and epistemic beliefs about food, taste, nature, and identity.	**RATIONALE** building on dunne and raby's (2013) concept of "speculative design" and tharp and tharp's (2019) "discursive design," symbolic depth prioritizes the artefact's conceptual and affective resonance. it asks: does the design generate new imaginaries? does it reveal contradictions or make hidden systems visible? how does it re-script sensorial expectations or social rituals around food?	**INDICATORS** use of estrangement, ambiguity, or discomfort to provoke reflection (e.g., haraway's (2023) situated knowledge, korsmeyer's (2017) sensory ethics). engagement with epistemic plurality or marginalized perspectives (e.g., escobar's pluriverse, tallbear's (2019) caretaking ethics). critique of dominant norms (industrial taste, "naturalness," technological solutionism). articulation of multispecies or post-humanist values in design logic.	Symbolic depth alone does not guarantee impact. deep symbolism without pathways for translation or engagement risks remaining insular within design discourse.

Table 7. Heuristic Proposal Symbolic Depth to Evaluate Food Design Artefacts. Source: Authors.

SYMBOLIC DEPTH

Definition: Symbolic Depth guides to the extent to which a food design artefact interrogates, reframes, or transforms cultural, ethical, and epistemic beliefs about food, taste, nature, and identity.

Rationale: Building on Dunne and Raby's (2013) concept of "speculative design" and Tharp and Tharp's (2019) "discursive design," Symbolic Depth prioritizes the artefact's conceptual and affective resonance. It asks: Does the design generate new imaginaries? Does it reveal contradictions or make hidden systems visible? How does it re-script sensorial expectations or social rituals around food?

INDICATORS

Use of estrangement, ambiguity, or discomfort to provoke reflection (e.g., Haraway's (2023) situated knowledge, Korsmeyer's (2017) sensory ethics). Engagement with epistemic plurality or marginalized perspectives (e.g., Escobar's pluriverse, TallBear's (2019) caretaking ethics). Critique of dominant norms (industrial taste, "naturalness," technological solutionism). Articulation of multispecies or post-humanist values in design logic.

Symbolic Depth alone does not guarantee impact. Deep symbolism without pathways for translation or engagement risks remaining insular within design discourse.

SYSTEMIC TRACTION

Definition: Systemic Traction refers to the degree to which a design artefact actively engages with material infrastructures, regulatory environments, and sociotechnical systems to affect change across broader food ecosystems.

Rationale: Drawing from systems design (Jones, 2014), post-humanist pragmatism (Wilkie, 2018), and critiques of techno-solutionism (Escobar, 2018), this dimension evaluates whether a design project intervenes meaningfully in real-world systems, not just symbolically, but operationally.

INDICATORS

Capacity to influence or integrate into supply chains, policy, or public institutions. Commitment to transparency, access, and participation (especially for marginalized groups). Use of co-design, participatory, or community-based methods (e.g., Indigenous-led, feminist, or grassroots initiatives). Addressing long-term ecological and metabolic consequences (e.g., circular systems, food sovereignty).

	SYSTEMIC TRACTION		
DEFINITION	**RATIONALE**	**INDICATORS**	
Systemic Traction refers to the degree to which a design artefact actively engages with material infrastructures, regulatory environments, and sociotechnical systems to affect change across broader food ecosystems.	Drawing from systems design (Jones, 2014), post-humanist pragmatism (Wilkie, 2018), and critiques of techno-solutionism (Escobar, 2018), this dimension evaluates whether a design project intervenes meaningfully in real-world systems, not just symbolically, but operationally.	Capacity to influence or integrate into supply chains, policy, or public institutions. Commitment to transparency, access, and participation (especially for marginalized groups). Use of co-design, participatory, or community-based methods (e.g., Indigenous-led, feminist, or grassroots initiatives). Addressing long-term ecological and metabolic consequences (e.g., circular systems, food sovereignty).	Systemic traction can exist without symbolic innovation - e.g., commercial products that scale rapidly while reinforcing dominant ideologies. Without symbolic depth, traction may degenerate into compliance rather than transformation.

Table 8. Heuristic Proposal Systemic Traction to Evaluate Food Design Artefacts. Source: Authors.

Systemic traction can exist without symbolic innovation - e.g., commercial products that scale rapidly while reinforcing dominant ideologies. Without symbolic depth, traction may degenerate into compliance rather than transformation.

When applied together, Symbolic Depth and Systemic Traction enable a more nuanced assessment of food design projects across four quadrants:

	HIGH SYSTEMIC TRACTION	**LOW SYMBOLIC TRACTION**
HIGH SYMBOLIC DEPTH	Radical infrastructure (e.g., community labs, indigenous prototypes)	Speculative design (e.g., discursive artefacts)
LOW SYMBOLIC DEPTH	Commercial innovation (e.g., NotCo, Perfect Day)	Visual novelty, short-term concepts

Table 9. Heuristic Application Proposal to Evaluate Food Design Artefacts. Source: Authors

This typology invites scholars, educators, and practitioners to evaluate food design projects not only by impact or scalability, but by the extent to which they interrogate symbolic, cultural, and ethical assumptions.

Future empirical work could adapt this matrix for participatory evaluation methods, such as co-design workshops or sensory field testing, to assess artefacts from multiple epistemic standpoints (e.g., consumer-users, Indigenous communities, sensory minorities, microbial actors). This would allow the model to evolve beyond abstraction into reflexive design practice.

7. DESIGNING AT THE EDGE: TOWARD A REGENERATIVE FOOD IMAGINATION

This study critically examined how contemporary food design projects - both speculative and commercial - navigate the aesthetic, ethical, and systemic dimensions of emerging food futures. Through a comparative analysis of four cases, it articulated how food artefacts serve not only as material propositions but also as symbolic mediators of competing imaginaries: technological efficiency versus ecological interdependence, sensory familiarity versus cultural estrangement, and critical provocation versus market integration.

The findings challenge the assumption that visibility, novelty, or technological advancement automatically equate to critical value. Speculative artefacts, such as the The Sausage of the Future and Edible Growth, provoke reflection and aesthetic reimagination but often remain siloed in elite design discourses. Conversely, biotech innovations like Perfect Day and NotCo demonstrate scalability but tend to replicate extractive or opaque industrial models. Both ends of the spectrum reveal a standard limitation: a detachment from community-driven, relational, or justice-centred frameworks.

To move toward a regenerative and politically attuned practice, food design must be reframed not only as symbolic critique or technological intervention, but as a situated cultural practice - embedded in land, sensory sovereignty, and epistemic plurality. As Norman (2023) argues, "the role of design is not simply to make things attractive or easy to use, but to help guide people's values, choices, and the impact of those choices

on society and the planet" (p. 29). This view aligns with the need to reimagine food design as a mediating force between systems and communities, capable of engaging not only with form and function but also with care, responsibility, and cultural restitution. Expanding beyond techno-scientific futurisms and speculative aesthetics, food design must increasingly centre grounded methods, plural cosmologies, and multispecies ethics. In doing so, it can evolve into a meaningful tool for decolonizing systems, not merely aestheticizing their dysfunctions.

8. BEYOND THE PLATE: RESEARCH GAPS, FUTURE PATHWAYS, AND TRANSFORMATIVE POTENTIALS

This study is framed by some limitations that define both the scope and the opportunities for future work. First, the selection of case studies, while illustrative of contrasting design paradigms, remains situated within dominant techno-scientific imaginaries. The absence of grassroots, indigenous, or low-tech community-led initiatives represents a gap, particularly given their importance in challenging hegemonic narratives and offering situated, relational alternatives to mainstream food design imaginaries. As such, the study reflects a limited epistemic geography that warrants future expansion.

Second, the analysis relied on secondary data sources, including publicly available visual documentation, design publications, and media discourse. While these materials provide valuable insight into the representational and rhetorical strategies of each project, they do not capture the lived, affective, or political dimensions of how these artefacts are experienced, interpreted, or contested in context. Incorporating primary data through interviews, participatory methods, or ethnographic fieldwork could significantly deepen the analysis.

Third, the typology proposed in this article should be understood not as a predictive model or fixed taxonomy, but as an interpretive heuristic grounded in critical and speculative design theory. It serves to surface recurring tensions, epistemic positions, and design strategies within food innovation, offering a lens for critical reflection and comparative assessment. Its purpose is not empirical generalization or categorical closure, but to invite further inquiry into how food artefacts mediate symbolic depth and systemic traction within diverse sociotechnical configurations.

Looking ahead, several research pathways could meaningfully extend this inquiry. Embedding food design research within communities through participatory and ethnographic approaches, such as co-design, sensory ethnography, or collaborative prototyping, would help foreground alternative logics of value, authorship, and belonging. Equally important is the inclusion of decolonial, indigenous, and diasporic food design initiatives, which can counterbalance techno-optimistic narratives and expand the epistemological and ontological range of the field. Further exploration into material ecologies and multispecies design would also be productive, enabling a deeper engagement with the ethical and metabolic entanglements of food, microbes, nonhumans, and environments. Finally, longitudinal studies that trace food design systems over time, from prototyping to policy, from cultural adoption to infrastructural integration, would illuminate how speculative artefacts evolve within and across sociotechnical systems.

By embracing complexity, contestation, and plural ways of knowing, food design research can move from speculative promise to transformative practice. This shift demands not only more inclusive methodologies and expanded casework but also a commitment to reimagining how we design, relate, and nourish in an era of profound ecological and cultural transition.

This study also lays the conceptual groundwork for a more comprehensive research agenda aimed at developing an evaluative model for food design practices, grounded in specific heuristics such as Symbolic Depth and Systemic Traction. While these dimensions were proposed here as interpretive tools, future work can empirically test and refine them through comparative case studies, participatory evaluation methods, and interdisciplinary design research. Given the growing proliferation of food design projects emerging from universities and research centres worldwide - from ESAD.IDEA Matosinhos and ELISAVA to Politecnico di Milano, and others - there is a crucial requirement for shared frameworks to consider their cultural, ecological, and political contributions. Such a model could support not only academic inquiry but also guide professionals in the food industry, including food designers, academics, and institutions, in aligning food design innovation with ethical responsibility, epistemic inclusivity, and regenerative impact.

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