CONTEXTS

SYSTEMIC DESIGN ASSOCIATION

Cosmotechnic encounters: Designing with foodwaste, landscapes, and livelihoods

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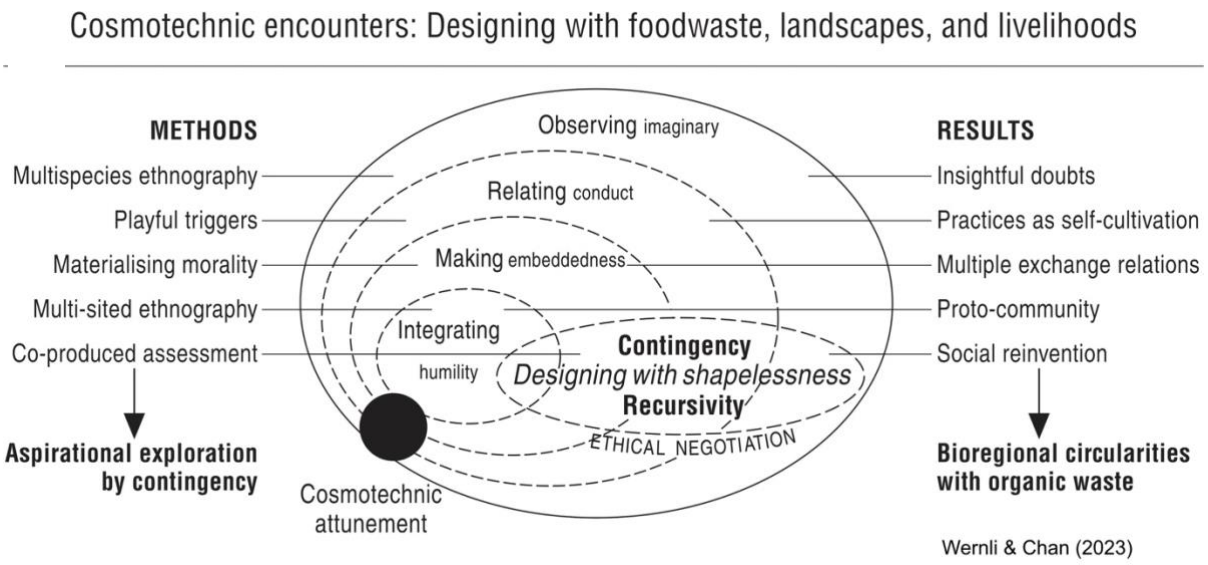
Abstract

Organic wastes are vital for farming, energy generation, and carbon capture—embodying 'naturally' the ideal of circularity. However, due to their messiness and weight, organic matter arrives with biological and sociotechnical challenges. What kind of imaginaries, recovery practices, and contingencies are required to reclaim and revalue such 'lively' material? Pursuing this, how can we mitigate the detriment of urban food waste and, in turn, regenerate regions impacted by climatic and economic precarity? In response, we conducted a series of collaborative encounters with farmers, chefs, retailers, and biotech entrepreneurs in rural Hong Kong to explore what a reverse supply chain might involve that redirects organic wastes from the city to agricultural landscapes. We took insight from Yuk Hui's cosmotechnics vision, design studies, and diverse economies for differentiating a broader spectrum of economic possibilities. Following this embeddedness with interdependent livelihoods enables us to live in fullness with the world, particularly with organic waste as the foundation for contributing to a circularity that tangibly interlinks humans, nonhumans, cities, and the countryside to different futures. Such constellations can manifest varied instances of economization—the mutually regenerative and stabilizing relationships which facilitate exchange. They also embody a cosmological imaginary that reconfigures local economies predicated on designing with the shapelessness of contingency: staying put with what easily is ignored while relinquishing determinist categories, fragmentation, and totalizing systems.

Keywords: Bioregional design, Careful circularities, Cosmotechnics, Diverse economies, Fermentation, Field inquiry

Visual Abstract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Introduction

This paper is concerned with the collaborative design of connecting local resource systems with *reverse* logistics critical for an organic waste circular economy in Hong Kong. Our effort goes against the grain of prevalent economic logic that considers waste as inevitable. Confronting our "Waste Age" (McGuirk, 2022), we realize how well-established *forward* logistics expedite food from field to plate while the reverse logistics of returning organic wastes to local soils are mostly missing (Nele & Lou, 2019). We take inspiration from ancestral Hakka farmers and Tanka fisherfolk in Hong Kong, renowned for their frugal and inventive ways of bringing organic residues to fruition on local lands and waterways. Our exploration for redrawing the economy in more circular terms involves diverting (some of) Hong Kong's three thousand tons of daily food waste from landfills or biodigesters to farms. Doing so averts greenhouse gas emissions from rotting organic matter and supports regenerative agriculture practices and rural livelihoods.

We view this journey as a renegotiation of terms with what and how we waste. Keeping waste foregrounded, living with it closely, and employing its reproductive forces as provocation is crucial to envisioning and enacting new orders, relations, and responsibilities. Such lived continuity of multiple otherness and cosmological awareness also has animated the ancestral resiliency among Hakka and Tanka people. Pursuing this agenda together with others also confronts us with another dominant paradigm. Presently, many parties in the circular policy arena concentrate on sweeping technical expansion of existing waste management systems, like incineration, gasification, or fuel-refinery of organic waste. It reiterates the modernist determination to a massive 'out of sight,' 'set and forget' type of approach that reduces the complexities of human affairs to engineering post-hoc modifications under the disguise of economic 'growth', technical 'progress,' or urban 'sustainability.'

This calculated sensemaking that abandons the immediate relation to its environment stems from a tradition of "design that has become a cosmology without a world" (Bonnet et al., 2019). Thus, in our view, the focus on this type of technical oversimplification remains too small. What we notice in organic waste is an invitation to think much larger: to reconnect with the materials and their ecologies, to explore with other people, organizations, and communities the systematic rearrangement of economies that regenerate multiform livelihoods while tangibly responding to the challenges related to climate change.

We take aspiration from Daoist thought and direction from diverse economies scholarship for using organic waste as a chance to "think and act with the world" (Miller & Gibson-Graham, 2019, p. 3), with the fullness of mutualist accountability (Hui, 2017) that enables us to live—a fullness that includes both ancient and future technologies, market and non-market exchange for constituting the entangled, ecological, social, and economic capacities of 'livelihood' (Miller, 2019). Taking up the mandate to act with and account for the world profoundly engages us in the work of design.

As a field, systemic design has always maintained the connection between making, anticipating, and living (Çalışkan & Wade, 2022). Living with the world by design entails admitting the value intrinsic to what is easily wasted or overlooked, including the possibility of stretching our anticipatory thinking by collaborating with nonhuman actors and people outside of our comfort zone. In this article, we explore coevolutionary terms of circularity, subordinated to a cosmologically aware sociality that reframes our analysis of bioregions based on the quality of human and nonhuman relationships—a contextuality from which they are far too often eliminated. Reimagining the circularity of territorial metabolism as a livelihood dynamic with cosmological grounding brings people, everyday life, and more-than-human

conditions back into a shared journey of circular reinvention while also politicizing the advancement of integrated landscape and economic systems.

In this paper, we aim to gain a fuller understanding of how technical diversity relates to local organic waste economies by engaging with soil-cultivating practitioners in Hong Kong. Instead of a critique focused on ideals or shortcomings of circularity discourse, our aspirational exploration draws on Daoist cosmotechnics, design research, anthropology, and diverse economies–in the next section–to conceptually prioritize (Table 1) organic waste as undeterminable and thus, open for socio-technically mediating our terms with the world. Inadvertently, our research is a proposal for mutual reconfiguration. With this ambition and through structured encounters, this study contrasts then the circular imaginaries of practitioners for articulating an ethical framework and rehearsing the reintegration of organic waste. In the final sections of this paper, we describe how social experimentation with organic wastes involves us in mobilizing contingencies of interdependent livelihoods in direct contact with ecological, economic, and social dimensions across the city and the bioregion all at once.

Table 1. Overview of sections and concepts engaged

1 Introduction	**2 Background**	**2.1 Cosmotechnics**	**2.2 Circularities**	**2.3 Co-digestion**
Design in the Waste Age	Performativity	Traditional ecological knowledge (TEK)	Indeterminacy	Interdependent livelihoods
Worldless cosmology	Coevolutionary systems	Cosmotechnics attunement	Inventing the social	'World of Eaters'
Cosmotechnic vision	Everybody designs	Human-opposed nature	Regenerative cultures	Fermentive praxis
Interdependent livelihoods		Vital nourishment	Hacking the social	'Collaborative contaminations'
Strategic design		Reflective practitioner	Feral systemic design	
		Daoist reflective practitioner	Bioregional design	
		Rituals of cooperation	Economization range	
		Community organizing	Diverse economies	
		Enframing and runaway cybernetics	Careful circularities	
			Transf. social enterprise	
	3 Methods	**4 Results**	**5 Discussion**	**6 Conclusion**
	Materializing morality	Vital nourishment	Cosmotechnical difference	Defuturing
	Playful triggers	Economization processes	Contingency and shapelessness	
	Co-produced assessment	Diverse economies	Aspirational exploration	
	Multi-sited ethnography		Social inventiveness	
	Multispecies ethnography			
	'Explication de texte'			

Background: Cosmotechnic difference in design, economies, organics

The larger context for this study is the ever-intensifying technical mediation and the ascendance of circular economy frameworks in many policy landscapes. In Hong Kong, circularity—in combination with cybernetic technologies, platforms, and automation—has been premised on recoding 'waste as opportunity,' which is understood as transforming what is 'underutilized' into feedstock for endless remanufacture or boosting energy production (Wong, 2021).

Yet, with diminished manufacturing and agriculture sectors, there is little appetite for recycled materials in Hong Kong, and such undifferentiated approaches to technologies become inappropriate as organizational logic for economic reform. For these reasons, managerial circularity and technologies seem to serve primarily as political palliative or apology for our current lives predicated on continued economic growth and accelerated consumption, thus perpetuating a deepening ecological crisis.

The impulse we follow here is to read the dangers behind circularity, waste, and technology as sites of indeterminacy and possibility. Perhaps more than in other domains, reimagining the meaning of waste confirms the performativity thesis (Marres & Lezaun, 2011), whereby to understand the world also requires us to constitute it—to participate in its design. Performativity here is an actionable point of departure to change society grounded in dialectical orientation that identifies and enacts a range of previously unknowable possibilities. It means engaging with continuous systems change as a central strategy of design practice (Sevaldson, 2019), with the notion of coevolutionary "dancing with systems" (Meadows, 2002) over time. Certainly, as Manzini (2015) asserts, everybody designs, but are societal formulations like technological and economic arrangements designable? The unanswered question remaining for us might be: What kind of circularity gets drawn, by whom, and to what ends? Here, central insights from cosmotechnic philosophy, strategic design, and diverse economies, as listed above (Table 1), can open possibilities for exploring 'waste' in ways that regenerate interdependent livelihoods and natures.

Cosmotechnics, Reflection-in-Living

Philosopher Yuk Hui (2017) has recently proposed that if we accept the multiplicity of 'natures,' then it must also be possible to speak of the multiplicity of 'technics.' The conceptualization of technics argues that humanity is instantiated by its technologies, which make them political and thus an arena for scrutiny. Hui asserts that technics vary in their functional, aesthetic, ontological, and cosmological aspects. His Daoist framework of cosmotechnics implies the integration of cosmic and ethical principles through technical activities for underpinning the inherent plurality and cosmological dimension of technology. Because cosmotechnics integrates experiential, non-instrumental notions of the natural order, we engage Hui's Eastern framework with existing socioecological conceptions (Figure 1) to introduce it to systemic design discourse.

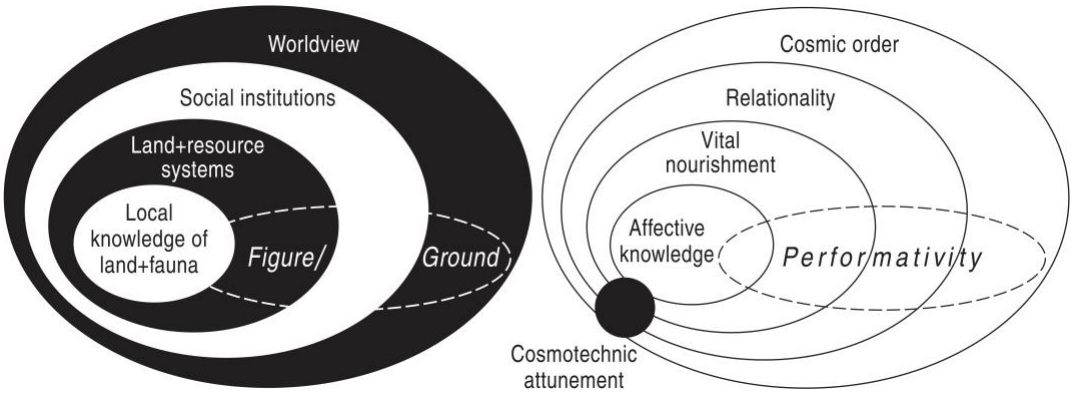

Figure 1. The Traditional Ecological Knowledge framework (left) adopted from Berkes (1999) with figure/ground mutuality correlated to cosmotechnics vision with underlying ethical navigation (right).

Berkes (1999) has proposed the Traditional Ecological Knowledge (TEK) framework to examine alternative cosmologies from localized practices of resource regeneration. It identifies four coaxial dimensions, anchored in (1) local knowledge of biota and landscape, (2) systems of environmental practices, (3) codes and institutions of social conduct, to constitute (4) a worldview comported by ethics and belief systems. Each layer is interconnected and, in unison, functions as a feedback loop with cosmological footing through which ancestral knowledge systems both constrain and empower autonomy.

Yuk Hui refers to this cosmological boundedness as "figure/ground" that brings focus to local conditions of emergence, including multiple and distinct histories within sociotechnical processes. Situating Berkes' model of socioecological epistemology in the Daoist context of cosmotechnics (Table 2), the four modalities corresponding to TEK are:

- Integration, based on (1) affective knowledge of milieu and local customs,
- Praxis, manifesting from (2) technics and skills—insufficient on their own, relying on the
- Relationality of (3) resonance through negotiating social life, as well as
- Observation of the (4) cosmic-ethical order.

Cosmotechnics is realized through the unification of making and living, whereby the very question of how to conduct a well-lived life urges the affective containment and contingency of every technical activity or system. In this Daoist proposition, multiple natures are formless and unmeasurable, yet require multiple technics—informed by sociopolitical sensibility—to manifest themselves.

Table 2. Cosmotechnics glossary, related to indigenous conceptions and the study's results

Eastern conceptions	Ideogram	Translation	Modalities	Indigenous conceptions	Corresponding findings
Affective knowledge of milieu and customs	風土人情 [fengtu renqing]	Regional characteristics	Integrating	Local knowledge of biota and landscape	Humility (affective knowledge)
Relational currency to embrace the unknown	感應 [ganying]	Resonance	Making	Systems of environmental practices	Embeddedness in life praxis
Subordinating skills to eco-social alliances	器 [qi]	Tool, technics, container	Relating	Codes and institutions of social conduct	Provision and shared excess
Ways of living in here-and-now	道 [dao]	Cosmic order ('the Way')	Observing	Worldview	Shared imaginary
Vital nourishment in cosmic respiration	氣 [ch'i]	Breath-energy	Performativity	Figure/ground (correlation of differentiated with undifferentiated)	Ethical negotiation through explorative aspiration

- Synthesized from Hui (2016; 2017) and adapted from Berkes (1999).

Understanding practices of circularity in cosmotechnics terms is then about the back-and-forth movement across the four lived dimensions of integrating, making, relating, and observing. Rather than imposing willful 'fixes' or 'solutions' onto a nature opposed to humans (Descola, 2013), more differentiated natures become a continuous life force. *Natures* emerge from a transversal performativity that generates life when concentrated, and dissolves life when dispersed through situated, enacted practices (Jullien, 2007). In Daoist thought, this cosmic 'breathing-with' is the ultimate principle of living well since human life is always provisional. Thus, remaining vigilant to the interworkings of receiving from and giving to otherness (human or not) is the essence of nourishing life in oneself. Such intersubjective and ethical performativity extends Schön's (1984) ideal of a reflective practitioner that pivots on the individual and self-consciousness. In extension, cosmotechnic 'reflection-in-action' enables the practitioner to be simultaneously cognizant of and synchronized by the innate disposition of all that matters with spontaneity and enjoyment (Tan, 2020).

The cosmotechnic emphasis on other-regarding considerations and "attuned responses-in-action" is touched upon in Sennett's (2012) radical repair praxis, which does not simply fix what is broken, but reconfigures broken social relations by renewing cooperation. Systemic circularity then depends on the concretized and contextual experience from working within the communities in question for adequately responding to (pre)existing legacies, dispositions, and capabilities (Dorn & Dickman, 2022). In addition, the cosmotechnics vision seeks reciprocal 'vitality-in-action' for communities that unconditionally include all human and nonhuman life.

Pivotal to Yuk Hui's cosmotechnic analysis is the focus on how technological environments produce two systematically different patterns of acting in the world, namely, "enframings" and "sympoiesis" (Hui, 2021). In enframings—the acting *upon* the world—technology is deployed as an 'apparatus' from a stance of domination that, in effect, relegates all beings to a readily exploitable stockpile (e.g., standing reserve). Ostensibly, enframings make people and their systems insensitive to limits and interdependencies of the nonhuman kind (Plumwood, 2009). In contrast, *sympoiesis*—the acting *with* the world—foregrounds the performative back-and-forth of technological attunement with nature that brings forth what can be considered a socioecological embedded dance of agency. This agential resourcefulness of cosmotechnics comes from the awareness that humans and nonhumans can never be fully known or controlled, used, or standardized. It is precisely when relations and roles are not rigidly defined or hypostatized that the agents involved become authentically resourceful to each other.

Perera (2023) indicates how cosmotechnics' decentering of Western enframings with groundless technical objects and technocratically projected innovation can redirect systemic design along alternate practices conscious of their embeddedness. Technocracy insists on large-scale engineering approaches that focus on 'effectiveness' in the short term rather than account for 'having many effects' (Mol, Moser & Pols, 2010) in the long term. Already, Fry (2007; 2020) explores how Daoism and Confucianism, with their residual powers, can open alternative ways of designing. By exploring cosmotechnics as an interpretative framework, this research refuses a binary opposition between nature and culture, East and West, global and local. Asia has already undergone unprecedented technological acceleration that makes a simple return to ancient cosmologies no longer viable. Abandoning orientalist and romanticist notions, we engage with cosmotechnics as a provocative "dis-orientation" (Hui, 2016) for exploring a locality capable of appropriating and transforming the global from *within*.

Indeed, this research on mobilizing excess food locally is in itself a consequence of one-way, linear global supply systems. At the same time, the global can be opened up to a locality for discovering many deeply-situated, hence diverse, ways of acting *with* the world. Thus, for Latour (2017), the conventional

distinction between the global and the local is no longer valid. Our age of planetary climate change easily renders 'scale' irrelevant or profoundly different from its hierarchical construals. How we act in local terms may bring about indirect but accumulatively consequential effects on the global, often regardless of our intention. Daoism takes to its heart that human beings are inextricably woven into the fabric of their natural environment. When organic waste goes rotten, then society is rotten too. When the climate is changing, then humans inevitable must change too. There is a certain "pan-relationalism" (Rorty, 2021) at work here: what happens between organic waste streams and greenhouse gas aggregation, local weather and intercontinental ocean currents, weeds and crops, microorganisms and humans is no less important than the industrial outflows of global food production and consumption. Such 'pan-relationalism' also connects to the cosmic 'allness' of transversal provisionality in Daoist cosmotechnics introduced above (Table 2), whereby nature and technics come together at once.

Localized, Careful Circularities

In this study, we apply the cosmotechnic imaginary and use organic waste as an opportunity to explore how to live well with the complex circularities regenerating our biophysical foundation. With our cosmotechnics inquiry, we take the critique of circular policy discourse as the point of departure for negotiating the terms of what we waste. By learning to live better with waste, we intend to exploit its indeterminacy and ambiguity as sites of possibility. As Alexander and Sanchez (2019) remark, the "classificatory order of waste" becomes both a moral and political enactment because it determines, thus forecloses, its associated meaning and real-world value (pp. 1–2). From this follows that peoples' thinking on waste is changeable. Also, what becomes of waste is changeable too.

Reconstituting technocratic circularity through 'participating in the design of the world' for Marres, et al. (2018) signals that performativity has shifted from critical insight to common sense (Wahl, 2021). The task then is to go beyond circular critique and instead, as Kelty (2018) notes, to get together with others to hack the terms of circularity stricken in outdated, poorly maintained systems. Here, socioecological vulnerabilities become valuable leverage points for exploiting life-affirming forms of sociality, mobilization, and reinvention (Guibert, 2022). Some momentum is already underway once we have identified where to look. For example, Hong Kong's regional neighbour Singapore has recently introduced the aspirational policy goal to become a Zero Waste Nation by 2030, in which diverting organic waste from disposal will play a significant role.

Increasingly, waste reduction targets demand all kinds of experimentation with organic waste as an integrated part of bioregional economies (Shiva, 2020; Luthe, 2017; Brewer, 2021) that hybridize design, science, and education for living well with the localities of landscapes, volatile climates, and exchange relations. Çalışkan and Callon (2009) extensively studied the dynamics of marketization: the valuation, pacifying, pricing, and commodification of goods. By initiating the debate on exchange relations, they noticed and highlighted that commodification is only one among many instances of 'economization.' With such economic performativity as a starting point, diverse economies scholars (Gibson-Graham & Dombroski, 2020) identify a wide range of options for revaluing organic residues: from community composting, public soil yards, cooperative enterprise, trading or gift exchange, paid or unpaid human labor, nonhuman labor, common or private assets; to diverse substitutions of materials, money, time, and risks (Morrow & Davies, 2020; Healy et al., 2019). From a design viewpoint, diverse economies often operate on a small scale, which lends robustness to the idea of circularity. They become the first, deeply situated steps toward potentially scaled-out and multiplied economic innovation.

Co-digestion in Interdependent Livelihoods

This study draws on perspectives from science and technology studies, diverse economies, and strategic design to confront the Waste Age with a broader spectrum of exchange relationships and sustenance activities bound to locality—including our microbially-enabled lives. Taking direction from diverse economization, this study cosmotechnically reflects-in-living "with the fullness of the interdependencies that make us" (Miller, 2019) a circularity, enmeshing humans, nonhumans, cities, and countryside into ethical negotiations of our futures.

Miller and Gibson-Graham (2019) describe with "interdependent livelihoods" how all beings earn a living through the triple-symbiosis of what makes us (receiving life), whom we are making (giving life), and how we compose our relational self (actualizing life). Following this, organic matter can be seen as integral to coevolutionary nourishment in our "world of eaters" (DuPuis, 2015), whereby humans rely on pre-existing microbial habitats for digesting food (allopoieisis), redistribute or discard ever-present excess feeds (alteropoiesis), and constitute their livelihood (autopoiesis)—directed by appetite and satiety. This builds on Maturana and Varela's (1972) foundational 'autopoiesis' concept of self-creation in biological systems whereby the autonomy in all life form is a matter of interdependence. In this view, fermentation—the openly social collaboration between domesticated microbes and human volition—becomes a circular livelihoods practice for confronting metabolic disconnects with close attention to the integrity of co-digesting processes.

Fermentation, the crafted expression of digestion that institutes intraspecies dealings between food webs and inner ecologies, is also a metaphor for good governance. Tied to lead-times of microbial successions and their "whiff of uncertainty" (Maroney, 2019), the fermenting practitioner learns to live with the cosmo-politics of consequences after choices have been made, persisted, and worked through in "collaborative contaminations" (Tsing, 2015). Extending this spirit of experimentation and cosmotechnics-led systemic design, researchers conducted a field inquiry that encountered key constituencies in Hong Kong that work with or are from local soil ecologies. The encounters revolved around the donation of gallon-sized condiment bins filled with kitchen scraps, which researchers had collected and artisanally fermented into Bokashi soil amendment. Respondents were invited to rehearse in their full-life context what would be involved in developing a reverse supply logistics whereby circular ambitions meet the 'realities,' ambiguities, and uncertainties of forging new ways forward. This research adds to a trajectory of systemic experimental design of exchange relations. We argue that such efforts support how design and diverse economies might spur future circularities to be envisioned, enacted, and enjoyed.

Methods: Collaborative and empirical encounters

The study is comprised of a four-month long field inquiry that prompted a broad range of agriculturists in Hong Kong to respond on material terms to localized soil revitalization with the integration of organic wastes. This research was jointly funded by the Hong Kong Polytechnic University and Zero Foodprint Asia, an eco-hospitality foundation.

Organic wastes consisted of discarded meal leftovers from the university canteen that researchers hand-sorted, layered, and processed inside Bokashi containers with rice bran (polishing residue) from a rice mill near the campus that was microbially activated with bamboo fungi extract (mycelium). Stored at room temperature and shielded from sunlight, Bokashi fermentation essentially pickles the organic wastes within two weeks, and thus retains excess nutrients for several years. Also, with its lowered pH

value, Bokashi ferment obtains a pleasant sweet-acidic 'nose,' similar to rice wine, thus increasing acceptance and decontamination (Quiroz & Céspedes, 2019). Regenerative farmers outside Hong Kong already apply Bokashi ferment directly as multi-use organic input to newly opened planting beds or in composted form to enrich soils, and feed chickens, vermicultures, or insect farms (Love, 2022).

The agricultural-productive purpose is crucial to create circular value for Bokashi ferment. Thus, researchers launched a structured field inquiry (Figure 2) among farmers and biotech companies in rural Hong Kong to explore their readiness, ambitions, and applications toward integrating local organic wastes instead of relying on imported fertilizers. Integral to the research team was permaculture expert Shing who has been advising local farmers on soil revitalization for over a decade. The team, including the two authors, brought complementary expertise to this exploratory intervention from agronomy, community development, cultural economy, and media practice. It allowed the researchers to invite respondents into a scientifically-guided, contextually-informed, open-ended research journey.

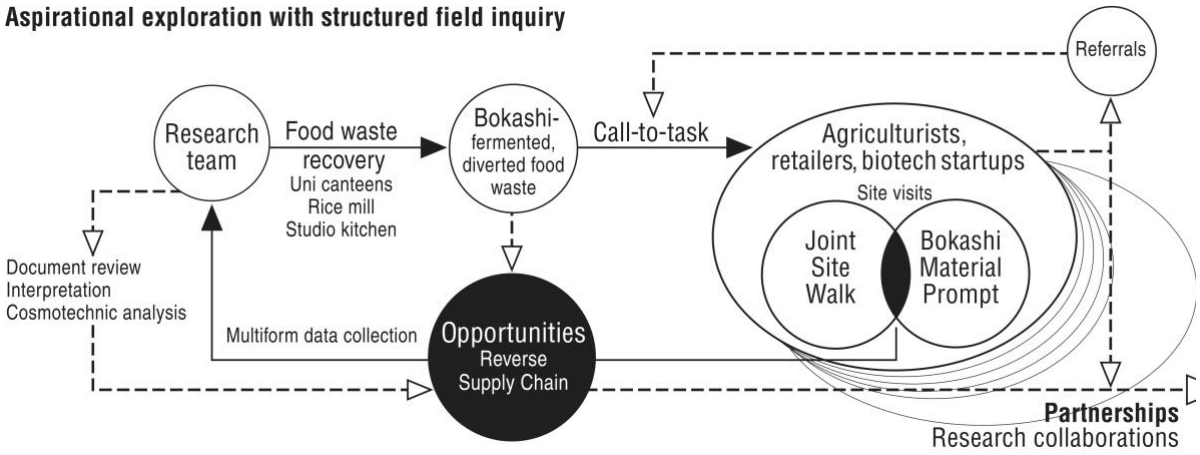

Figure 2. The field inquiry involved the generation of Bokashi-fermented food waste and a call-to-task for facilitating collaborative encounters with local agriculturists, site visits animated by dialogical site walks, and material prompting.

This research for provoking organic circular systems gives us initial insights into how circularity with a cosmotechnic perspective can enable a set of collaborative encounters that are all at once material, ecological, and social. Here, the coherence of making a livelihood while promoting life for others as the basis for regenerating life overall can transcend the human and nonhuman, urban and rural divides.

Working with Shing, we soon realized how this cosmotechnic emergence was precarious too. The Covid-19 pandemic interrupted many circular relationships as they were forming. During repeated lockdowns and border closings, food and fertilizer supply chains were interrupted, highlighting Hong Kong's import overreliance. Many smallholder farmers close to Shing contracted Covid and ceased their operations, underscoring the need for systemic change to improve food resiliency. It is this shared vulnerability that provided the rationale for our intervention.

Ethnographic Sampling and Setting

Between 14 July to 18 November, 2021, the research team conducted 34 site visits with a diverse range of 23 respondent groups from industry, government, and academia. The field inquiry included site touring and conversations ranging from 45 to 180 minutes. What most of the stakeholders have in common is their interactions with soils as a crop-growing medium. Site visits took place at production farms, orchards, allotment gardens, rooftops, balconies, restaurants, retail outlets, waste treatment facilities, and science labs across Hong Kong. The eclectic sampling reflects the need to approach the complexity of reintegrating organic wastes in a highly fragmented society by provoking inventiveness across sectors.

Researchers enrolled stakeholders with a call-to-task for responding to Hong Kong's precarious food future and helping pioneer research on organic resource recovery. The call resonated with the long-standing legislative debate about a waste charging scheme and complete dependence on cross-continent food supply chains temporarily interrupted by border closings during the pandemic. Researchers distributed the call widely through word of mouth and text messages in their circles, established through previous work in local agriculture. The networks and contacts included food retailers, citizen concern groups, agricultural organizations, eco-startup incubators, educational foundations, and personal friends. Moreover, during site visits, some respondents made spontaneous referrals and introduced researchers to third parties. It led to unlikely encounters with biophilic advertising agencies, garden supply boutiques, and indoor crop factories that forced researchers to reconcile their circular nutrient vision with vastly differentiated outlooks on agriculture. Aside from the differences, all respondents had in common a generosity for inviting researchers to their operational premises and discussing their practices in relation to soil care or organic matter.

The field inquiry focused on Bokashi fermentation, in an attempt to interlock city kitchens with rural soils since most organic waste still burdens landfills, waterways, and the atmosphere (Nele & Lou, 2019). Site visits also focused on the practical and logistical challenges provoked by the organic matter. Researchers approached the site visits as open journeys incorporating people, places, and organics with structured activities to capture respondents' experiences, values, and aspirations—including speculations about the future evolution of their collective ideas in different, yet connected, places (Marcus, 1995).

Critical in this field inquiry process was the manifestation of "the things that matter" (Verbeeck & Kockelkoren, 1998). Respondents were presented with Bokashi-fermented food waste during the visit to stipulate the circular supply chain from their perspective. Asking respondents to adopt and use one Bokashi bin served as a "playful trigger" (Akama et al., 2007) to engage with the world beyond human concerns (Figure 3).

Figure 3. Site visits with biotech entrepreneurs closely inspecting a Bokashi bin (left) and with garden service providers leading to impromptu soil application test of Bokashi at their rooftop operation (right).

Structure of Site Visits with Multispecies Probing

Researchers facilitated the site visits with respondents around two codesign activities: (1) a circular site walk with respondents to take stock of the operation's current flow of organic resources, and (2) an encounter with Bokashi as the centerpiece for reimagining circular contingency strategies with localized fermentation.

Activity 1, joint site walk: Walking around the respondent's workplace in a circular fashion aptly embodied the focus of the visit—outlining circular economies with the given operation as the starting point. Respondents were asked to provide a tour of their operation, introduce themselves, and point out their matters of concern regarding organic inputs, outputs, and discards. This process provoked instant possibilities. For example, the operators of an educational farm with waste materials from their rice paddies and food outlets said they were looking for ways to reuse these substances, which were currently going straight to the dump. Walking together also allowed for thoughtful silences and reflections on the materials encountered. Over the extended observation period, it became possible to build a typology of behaviors around specific categories of organic matters and how they were dealt with.

Activity 2, Bokashi material prompt: Researchers and respondents gathered around a full Bokashi bin introduced by researchers and placed on a table. This material prompt represented the localized circular stages of returning fermented food waste to the land, including residue production, separation, collection, processing (fermentation), refining (composting), farming, harvesting, and retailing—interwoven with transportation. Originating from this prompt, researchers asked respondents, first in silence, to draw connections to their operation on hand and comment on what may enable such circularity and what may hinder it. This was followed by a conversation about site-specific implementation and sociometric dependencies (Healy et al., 2019), imagined or real, at each circular stage. During one of our visits, the proprietors of an urban gardening service started an impromptu planting trial with the Bokashi material on their rooftop to evaluate the possibility of using it as fertilizer. The microbial prompt also informed our "multispecies ethnography" (Gionata & McCardle, 2019) and directed attention toward healthy interactions in soils, plants, and animals, including humans.

Multiform Data Collection and Cosmotechnic Analysis

Our research material included audio recordings, field notes, photographs, artifacts, and document collection from the site visits. Conversations were held in Cantonese and English. Transcripts and interviews were translated by the authors, one of whom is a native speaker of Cantonese. Multi-sited ethnography also entailed documenting the respondents' online presence since agriculturists engage in social media to learn how their activities unfold virtually and interface with others in the wider public.

Researchers evaluated the data using the basic hermeneutic method known as "explication de texte" (Fowler, 1986). The literary interpretation involves (1) the analyst gradually developing a sensibility for the subject matter from the text that correlates observations with stated reflections; (2) acquiring content literacy by examining the narrative structure, including connotations or implicit resonances; followed by (3) a dialogical process of reading alternated by studying theory for analyzing the textual and observational that inform each other. Eventually, a complete picture emerges consistent with the respondents' experiences and the researchers' inquiry goals.

We drew on Yuk Hui's cosmotechnics (2017) to observe how respondents' interior priorities attune to more-than-human demands in the pursuit of ecologically sensible design (Boehnert, 2019). As we

analyzed the ethnographies, we sought to find in them the four cosmotechnical categories of (1) humility, (2) praxis, (3) provision, and (4) imaginary that we gauged with the following validation statements:

1. Humility: 'This group recognizes the importance of soil, microbes, plants, and animals in successful harvests—this respect is also enacted.'
2. Praxis: 'This group tackles wastefulness without asking for upfront benefits or blaming others, yet working with others on countermeasures.'
3. Provision: 'This group promotes ecological coexistence by reclaiming resources and protecting biodiversity.'
4. Imaginary: 'This group is experimenting with alternative ways of living together, exploring new relationships with traditions, knowledge, and social formats for diversifying futures.'

The very classification of what may be considered 'homogenized' or 'diversified,' 'waste' or 'value,' 'useless' or 'useful' can easily trap us in the static binaries of compliance and noncompliance. Particularly scholarly classification can restrict how knowledge is represented and reinforce the power dynamics between who is classifying whom and on what grounds (Alexander & Sanchez, 2019). Taking classification as a salient cosmotechnic concern, we approached our inventory of attributes as a formulation of resistance by asking our research team member and agriculturist Shing to define the validation statements above.

In the context of conventional urban classifications, whereas farmers' voices are vastly absent or neglected, Shing suggested these four categories to be considered "reverse hierarchical." These are meant to open social conventions to scrutiny, negotiation, and modification rather than locking them into definite rankings. Shing formulated these categories in dialogue with the entire research team, which were then used to review the conversations and observations from each respondent group. Waste and local agriculture that currently lack social representation and commitment requires profound reimagination. As part of an open-ended inventory process to assess consequent explorative partnerships (Table 3), the research team evaluated how the expressions of each respondent group corresponding to cosmotechnical criteria on a four-point scale of 0 for 'not present'; 1 for 'weak'; 2 for 'medium'; and 3 for 'strong'. The following list (Table 3) represents an index of cosmotechnical criteria among the 23 respondent groups visited. This account does not propose to be unbiased, precise, or sufficient. Instead, it underscores the importance of beliefs, motivations, techniques, and experimentation when designing for circular repair.

Table 3. Groups engaged during field visits and open inventory cosmotechnic characteristics

RESPONDENTS	INDUSTRY	Humility	Praxis	Provision	Imaginary	Value
Food localization platform	Food retail	3	3	3	3	12
Soil research field lab	Concern group	3	3	3	3	12
Farmers' collective	Agriculture	2	3	3	3	11
Family production farm	Agriculture	3	3	3	2	11
Industrial compost social enterprise	Waste management	3	3	3	2	11
Informal urban slope gardeners	Urban home gardening	3	3	3	2	11
Eco-living resident group	Concern group	3	3	3	2	11
Leisure garden group	Rural gardening	3	3	2	2	10
Dual-family leisure garden	Rural gardening	3	3	2	2	10
Hillside villagers	Rural gardening	3	2	3	2	10
Housing estate lawn gardeners	Urban home gardening	2	2	3	2	9
B2C landscape/garden service	Service provider	3	2	1	3	9
Environmental education NPO	Education	2	3	2	1	8
Farmers' market management (inner city)	Food retail	1	2	2	2	7
Housing estate allotment garden	Urban home gardening	2	2	2	1	7
Homeowners' garden society	Urban home gardening	2	2	1	1	6
Family production/education farm	Agriculture	1	2	1	1	5
Biotech startup (black soldier flies)	Waste management	0	1	2	2	4
Leisure garden collective	Rural gardening	0	1	2	1	4
Business coaching educational farm	Education	0	1	1	1	3
Farmers' market management (outskirts)	Food retail	0	1	1	0	2
Educational orchard with restaurant	Education/tourism	0	0	2	0	2
B2B Landscape/garden service	Service provider	0	0	1	0	1
Aquaculture investment group	Precision agriculture	0	0	1	0	1

By fielding soil stewardship with the Bokashi ferment prompt, our goals were to survey the existing knowledge base, contemplate future experimental interventions, and liaise with potential partners for enacting a more cosmotechnical world that does not exist but is worth uncovering. The following section discusses the results by correlating the cosmotechnical criteria with the empirical commitment manifested from the collaborative encounters.

Findings: Experimentation with localized economization

It is beyond the scope of this article to present all the learnings from the field inquiry with agriculturists. However, we can distinguish four interrelated insights pertinent to careful circularity for recovering organic resources. Engaging Yuk Hui's concept of cosmotechnics through multispecies ethnography, we can see the emerging circularities intertwined perspectival, material/ecological, economic, and societal dimensions: (1) undesigning waste shaped by insightful doubts; (2) soil care practices as forms of self-cultivation; (3) socioecological mutations configure the terms of exchange relations; (4) people and situations come together in localized regeneration; and (5) design as equipment for social reinvention.

Undesigning Waste Shaped by Insightful Doubts

All respondents were able to reflect on how soil-revitalizing Bokashi ferment is underpinned by questioning the impact of human activity in the metabolically intertwined world. Contrary to wasted organics that rot in landfills or become sterilized in electric compost machines, fermented organics have an aliveness that is communicable. Respondents that fermented and composted their organics already shared the basic realization that harmful waste is not inevitable and the ability to 'unwaste' can be acquired since wasting has been learned too.

This sensibility for how to contract and spread aliveness manifested on some regenerative farms we visited. Here, the farmers forego industrial fertilizers and chemicals to avoid harming other lives. They make livelihoods from growing forgotten rice varieties and dozens of crops. Also, soybeans and weeds are considered companion species to the rice. In ensemble, they cover the soil, retain moisture, and, through photosynthesis, stimulate its microorganisms while sheltering paddy frogs, mole crickets, and eels. Such an ecosystem and bounty of aliveness also attract and service predators. One farm we visited reported how a wild boar had invaded days before and devoured the potato field, leaving behind fecund manure in its wake.

We also encountered indoor farm operations that were much less accommodating to the Bokashi proposition. They exist to make efficient use of vacant warehouses and grow vegetables predictably on demand. Separated through the window and control screen to avoid contamination, we encountered carps—stacked up in five layers of fish tanks—nibbling on imported pellet feed. The fish's excrement fertilizes the crops suspended above, growing in artificial light calibrated to optimize leaf coloring, nutrition specs, and taste.

From a cosmotechnics perspective, one could tell the story from the vantage of the carp fish exposed to data points inside the 'clean room' aquaculture that is unable to partake in the vibrant food web that incorporates the Bokashi. In contrast, the paddy eel is embedded in mutual exchanges of movements, alimentary abundance, and aptitudes across bacteria, plants, people, and landscapes. This kind of cosmotechnical observing for multispecies, generative assemblages not only denotes how many coexisting lineages give rise to multiple futures, it also shapes worldviews on how social arrangements and one's knowledge are always incomplete and provisional, and thus we are surrounded by initially unknowable, coevolutionary possibility.

Soil Care Practices as Forms of Self-Cultivation

The visits engaged respondents' noses with a Bokashi smell test. They also engaged their hands to examine how the material qualities of fermented organics could be harnessed for implementing a circular supply logistics. Although fermenting organics does require lead times for microbial activation and maturation, it is simultaneously stabilizing the putrid materials. This means that those storing, hauling, and applying the organics do not have to deal with foul odor and decay. Without reliance on external electricity and chemicals, fermentation also suppresses unwanted foodborne pathogens and weed seeds for use in compost, farmlands, or feedstock.

Subjecting one's operation to the multispecies collaboration required by Bokashi fermentation means abiding by orderly procedures (source separation), aligning with biological timelines (microbial successions), and providing hospitable conditions (clean containers) for materializing logistics of renewed ecological and economic possibility. When we visited a farm collective, Shing pointed out how such a regenerative praxis, once in place, can be expanded to include more problematic organic waste, including cooked foods and even manures. The collective farmers collect veggie scraps from wet markets to be composted, fruit peels to be brewed into enzyme concoctions, and tofu pulp and mushroom residue to be worked straight into topsoils (Figure 4). The visible strength of their crops growing on rich soils out of such amendment helps build more robust ecosystems that are better able to withstand pest infestations, insect attacks, and weather extremes.

Figure 4. Tofu residue, citrus peels, and spent mushroom substrate for soil replenishment at farm collective (Photos: authors).

Cultivating soil-bound others includes cultivating the self since the praxis, which is subject to ever-changing conditions, depends on constant adaptation. Thus, more cosmotechnically-inclined practitioners among our respondents find themselves in the creative tension between balancing technical activity and economic feasibility with the ethical demands of the environment.

Socioecological Mutations Configure the Terms of Exchange Relations

Discussing economic feasibility with organic circularity and soil care praxis with respondents both incorporated and escaped the mechanism of pure marketization. Obviously, many conversations we conducted about Bokashi organic ferment revolved around how this lively matter could be rendered into a

readily pacified commodity; this option raised initial interest among academics from food engineering or tech startups in waste management seeking ideas to secure government grants for their preconceived agendas. In response, Shing and some respondents pointed out that organic circularity cannot be just about short-term goals and self-interest.

When visiting a food localization retail platform, the possibility of capitalizing on currently empty return-haul trucking for getting organic material from households to farms was explored. As part of community-supported agriculture, the platform distributes weekly vegetable bags (Figure 5) based on what the associated local farms are harvesting. Should a typhoon inundate the fields, there will be no harvest; and should drought or insects impact the produce, the imperfections will show. The retailers maintain a close social infrastructure with their customers to navigate these contingencies. All these relationships can help build local circularity, but the big challenge is how value and price are assigned to the system. Researchers discussed, with the directors of the food localization platform, if and how the recovery (including hauling) of kitchen scraps could be incorporated into the pricing structure of their vegetable distribution. Waste removal can be part of a commercial proposition, but that transaction is not the end of the story. An average farm in Hong Kong could receive and reintegrate up to 100 cubic metres of organic waste annually. Yet, since dumping waste is still basically free of charge in Hong Kong, landfilling is still the cheapest option. If there were a substantial tipping fee involved, returning organic waste to the farm would become an act of 'gifting,' and a completely different understanding of value system and exchange relations would have been enacted.

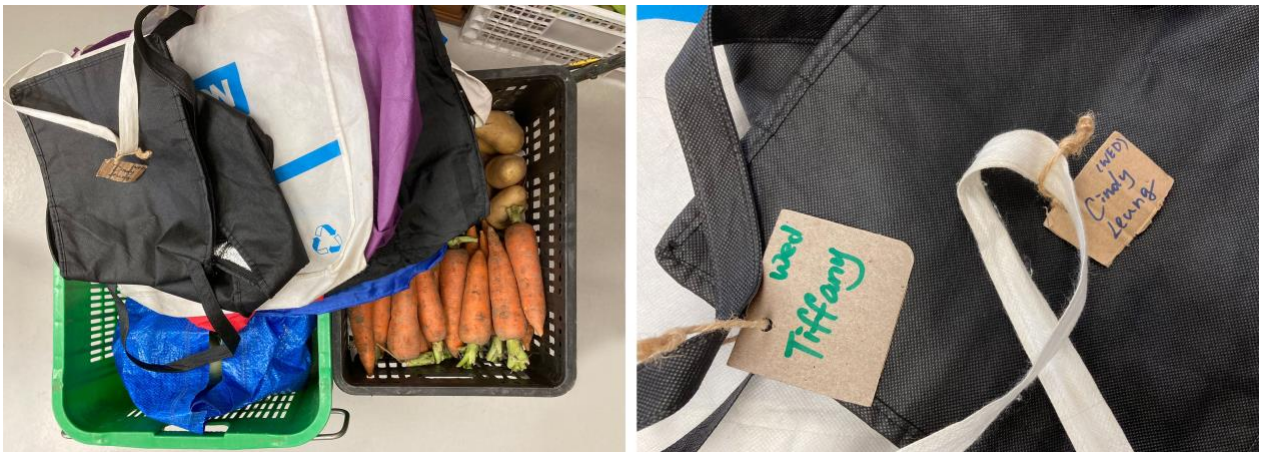

Figure 5. Reused carrier bags for weekly veggie deliveries at the food localization platform (Photos: authors).

We were often reminded of how, without any municipal waste charging scheme in Hong Kong, there is no monetary incentive to reuse organics. But waste (re)validation restricted to a commercial proposition does not tell the entire story. Local farms using fermentation and compost can receive large amounts of organic waste, and their ability to grow food and store carbon from it suggests that the 'gift' may be a more suitable way of valuing the work in this system. Put in an ecological context, it is wondrous bacterial and fungal life disinfecting putrid matter with worms digesting, thus altering the physical properties and even vermin-shaping local habitats and agricultural possibilities. Shing suggested to see in organic waste a portal for rethinking peri-urban metabolism on a holistic scale. A genuinely aspirational and circular organic economy would not just grow cash crops, but also generate fiber plants

like hemp to address climate change in agriculture, textile, and construction industries. Growing hemp (together with seasonal guild plants) not only fixes carbon in the soil at an exceptional rate and more quickly than any tree species, industrial hemp can also be mixed as feedstock into concrete where its fibers reduce the carbon footprint of the construction industry. Thus, large-scale cultivation of hemp could, all at once, change the nature of the built environment, enhance viability of local farms, and address climate change (Luthe, 2017).

People and Situations Come Together in Localized Regeneration

The discursive arena opened by the field inquiry provided a generative format of civic participation. Staging mobile conversations around waste-induced soil health between actors who typically are not connected showed the importance of building alliances from a base of trust and mutuality. The question of how to replenish the nourishing processes that pass through each of us (Jullien, 2007) and how to become more accountable has opened a mutual space for ongoing social experimentation toward moving organic wastes from the city into rural farms.

Researchers also visited a soil-directed farm lab where farmers, scientists, and functionaries come together to implement soil care, carbon storing, and open-source sensor systems. When we visited, the field lab was working with a coalition of ecologists, nutritionists, and product designers to interlock soil health with human thriving. By developing an inexpensive handheld spectrometer (Figure 6) for monitoring the nutrient density of crops, the initiative renders visible mutually nourishing interrelations.

Figure 6. Development of nutrient density scanner at the soil-directed field lab (Photos: authors).

After concluding the site visits, researchers kept feeding back the insights and progress of their ongoing organics' economization journey. Maintaining good rapport with many respondents helps to keep up momentum and build social capital among farmers, food industrials, and academics. Overall, applying the cosmotechnic stance to future work for researchers meant claiming a position between the bipolarity of what is conventionally considered 'fitting' or 'unfitting' relationships. This cosmotechnic modality complicates preconceptions and demands reimagination before entering differentiated, value-creating interventions, choosing appropriate technologies, or forging partnerships.

The ensuing work alliance with farmers, a food localization platform, and a hospitality foundation helped launch a social pilot that revolved around recovering excess food, multi-purposing farmland, and

enacting practical innovations toward bringing soils and people into mutually balancing exchanges. In cosmotechnic terms, these projects brought forth iterations of purpose and organizational diversity, which required continued learning from all involved (Wernli & Chan, 2023).

Importantly, our collaborative encounters were not just one-off events for gauging co-productive possibilities in the given moment and situation. Beyond the immediate food waste cycling mission on hand, the encounters set a fertile ground for cooperation over the years to come. One gardening service provider subsequently became an advocacy partner for cohosting educational events. The eco-living resident group continues to consult researchers for strategizing compost implementation in their inner city housing estate. And researchers increasingly rely on the applied urban ecology expertise from the landscapers and biotech startups encountered to validate the design proposals of their design students and colleagues.

Toward the end of the collaborative encounters, Shing mentioned how the process allowed him to inject fresh energy and voices into his work and renew connections among his farming colleagues. Reigniting these sidelined conversations is crucial when many, including Shing, work tirelessly over a long period with little immediate reward and against the grain of the system. Cosmotechnic advancement requires such infrastructures of empathetic exploration whereby resources are being pooled, positions can be exchanged, risk-taking becomes safe, and the experience is mutually energizing.

Design as Equipment for Proto-communities and Social Reinvention

What these findings suggest is that cosmotechnic experimentation requires the complexity and richness of reality to be enacted (Çalışkan & Callon, 2009). Design in this field inquiry had a socially integrative and strategic role to play. During the site visits, walking conversations and microbial prompts were deployed to make often neglected elements tangible inside an economy that is both manifesting and debatable (Gibson-Graham & Dombroski, 2020). The design activities were conducive to relational and speculative exploration, prompting respondents to evaluate not only what resources, practices, and technologies could be appropriated, but also when and where these demands arise. Material artifacts here served an essential intermediary role for resourcing respondents in communicating ideas to others and carrying forward the possibilities outlined during the field visits.

Advancing cosmotechnics' sensibilities in systemic design depends on opening a holding space through the deliberate staging of strategic conversations and activity. A design space is formed where ambiguity and indeterminacy are both commanding and enabling while inspiring participants to form a proto-community of practice around regenerative integration of organic waste. Proto-communities are conducive on a personal and collective level to prototyping with our very ways of living—mentally, materially, economically, and socially.

Collective learning and action in this research ultimately prompted the question: what if we reorganized ourselves so that what we eat and how we handle our waste become essential acts of cohabitation and citizenship? A coordinated approach to wicked challenges started to take shape by enrolling broader economic imaginaries, dormant social capabilities, and underused civic spaces as revitalizing infrastructures for better aggregating, refining, and distributing organic wastes.

Discussion

Encountering agriculturists in Hong Kong, we explored cosmotechnics and diverse economies to prioritize how interspecies respect and the making of mutualistic livelihoods can shape and change practice. It was our foray to shift design away from Waste Age perpetration toward a conversation about the principles of our discipline and the environments we seek to create (Buchanan, 2019).

The cosmotechnical accountability proposed in this research offers a complementary Eastern way of rediscovering the relations and possibilities between multiple natures, technologies, and systems. Cosmotechnics foregrounds the continuity between the world and human society, the constant rhythmic transformation of all matter to-and-from it emerges, and the refined observation of higher orders. Daoism refers to these ongoing, coregulating flows as "Wu Wei": effortless action in relation. The cosmotechnics dimensions identified above make explicit how engaging with localized awareness in technical activities can merge and reveal cosmic and ethical orders relating to the sustenance of life. It is crucial to acknowledge the unique circumstances that bring them into existence. Beyond its local specificity, the field inquiry revealed two overarching, creative tensions that emerge in cosmotechnics engagement: (1) designing with shapelessness, and (2) designing with shapelessness facing timelessness.

Designing with Shapelessness

Essentially, technological activity in the Eastern view is an extension of the body that seeks a way of life realized through making-in-relation. Working within one's reality and limitations enables the cosmotechnic unification of relating to, making of, and living with a symbiotic local life. This commitment to a well-lived life in close relation to others also determines the choice of one's tools and exchange relations. Tools that do not contribute to this vision can be simply ignored from a sense of healthy deliberation. Thus, the use of technology is more ambivalent and indeterminant. This is not about reactive Luddite technological resentment, but comes from an attitude of real-world accounting that calculates what capacities are already available, what can be learned and adopted from them, and what else is needed. There are always more powerful technologies present, but they can be deliberately refrained from use, silently foregone, unused, and put aside, while other technologies are adopted, and some that have been forgotten are reinstated.

Contrasting the Western fascination with 'efficiency,' 'quality,' and 'scalability,' cosmotechnics' principles entail more self-instructing categories like 'orderliness,' 'housekeeping habits,' 'needs mediation,' 'recursivity,' or 'contingency' (Hui, 2019). Contingency emphasizes the unpredictability of events and encounters within lived togetherness that pull the design imaginary into a multitude of life domains required for coevolution beyond mere productivity (Perera, 2023). Living with this contingency and environmental embeddedness also runs counter to the 'tragicist' staging of crisis whereby specific mistakes are seen as causing irreparable consequences, perpetrators are singled out, and thus impeding any responsive action or hope. Cosmotechnical contingency means that universal symbiosis, once broken, can be restored in self-engaging, iterative, and pragmatic ways, which is also known as recursivity.

Such Eastern wisdom on technology and interdependent livelihoods suggests a "shapelessness" (Markov, 2023), whereby tools are chosen based on intangible propensities like exerting reexamination, refrain, frugality, or generosity sparked by foresight. Shapelessness also contrasts shape-fulness, our tendency toward prediction, mastery, and regimes of control that prevent us from staying attuned to natural cycles or social matters, and thus obstructs overall adaptability, continuity, flourishing, and futures. It differs from Western views whereby the technical extension of one's body is more akin to the

staging of singular spectacles that turn things (including organic matter) into props, props into impressive combinations, and combinations into 'groundbreaking' solutions or disasters to be freely dispensed.

Designing with Shapelessness Facing Timelessness

In a time of encroaching catastrophes and polycrisis, neither 'tragicist' Western thinking nor Daoist ways of living can solve real-world issues and open futures. Cosmotechnics can be understood as a call for enactments of concretized solidarity that allow differences and divergences for constantly learning to adapt, cohabit, and thrive in the face of disruptions to come. For mutual advancement, a new meeting of Eastern wisdom with emancipatory Western thought is required. Design that can at once think with the 'timelessness' of multiple socio-political crises (Hui, 2020) toward their overcoming with the Eastern enactment of lived 'shapelessness' can provide the social performativity required for mutually desirable outcomes. The former politicizes daily life while the latter enacts "endless stinginess and endless generosity" (Markov, 2023) where appropriate. This boundedness to the everyday is reflected in the cosmotechnic attributes outlined in the sections above that emphasized: subordination to ecological orders, unrepentant action-taking, enacted resourcefulness, and instantiated exchange relations. The collaborative encounters in this research have shown how acting *with* the world constantly foregrounds what is commonly taken for granted or ignored, like wastes, soil ecologies, behaviors, local insights, or economic imaginary. At the same time, these contingencies become the very springboard toward community-based and timely adaptation.

Cosmotechnic designing *with* the world also reminds us how every system, human-made or not, entails two primary features: recursivity and contingency (Hui, 2019). Recursivity is understood as iterative performance of action toward feedback, while contingency are social matters of natural cycles, practicalities, power, and traditions that coproduce lifeworlds. Recursions in this research are meant to provide ongoing and future knowledge dividends to all respondents, and answer equally to requests for collaborations with households, industries, and communities. They are also meant to enter the field of action with the explicit understanding to account publicly for its ongoing insights, successes, and failures. Recursion and contingency then propose a systemic design that becomes an "equipment for social learning" (Bonnet et al., 2019). Artificial systems programmed to accomplish specific functions or living organisms capable of pursuing goals triggered through contact with their environment act only recursively on themselves. Yet, for the system model to be more than a predetermined construct of cause-and-effect, there needs to be contingency to remain fully adaptable to the environment that it is engaging with or emerging from. The vision of cosmotechnics serves this objective by commanding adaptive strategies for ever-redirecting recursive loops. By navigating the given contextual recursivities related to organic wastes, this research has foregrounded the importance of contingency, the indeterminate shapelessness, to act with the world in more adept ways.

Close attention to contingency points to waste as the outcome of societal fragmentation that easily defies any potential connection to a formidable past or a reintegrative whole. Emphasizing contingency also includes "going nowhere at all" (Alexander & Sanchez, 2019, p. 18) as opposed to heading into predetermined futures. 'Going nowhere' in this research meant staying stubbornly put to our bursting landfills, chronic distractedness, and our own shortcomings, including unhelpful preconceptions. This mode of limbo or suspension may allow the remediating value of an alternative path to be realized over time and space—or never be resolved at all.

Cosmotechnic shapelessness is present when recognition or compliance with given classification schemes is resisted, when our future directions remain undetermined, and any totalizing systems are refused. Instead, shapelessness in timelessness demands us to engage wholeheartedly with the deep-seated fragmentations of our present situation and build a durational agency with unlikely partners. Designing with shapelessness is about opening a third cosmotechnic modality for persistently occupying a space beyond waste and value, beyond local and global, beyond technology and nature, beyond responsibility and convenience, beyond scarcity and accumulation, beyond market and state, beyond bottom-up and top-down. Daoist philosophy refers to this opening of the third space as the "Middle Path" (Li, 1995). Thus, instigators who design toward shapelessness find themselves in the space of ethnographically grounded speculation or engagement with reconfiguration processes by actively brokering across and between social spheres that regulatorily, managerially, scientifically, or morally are kept apart, as evidenced in the case of organic wastes.

The cosmotechnic instigator working through the dissolution and relinquishing of economic and societal categories inadvertently becomes an interlocutor for "coproductive uncertainty" (Wernli, 2021). It comes from the acknowledgment that future pathways are rarely derived from master plans, grand narratives, or regulatory regimes. Instead, they emerge from facilitating an ongoing dialogue between peoples' desire to plan and shape futures and the contingent events and realities beyond their control. In a similar vein, instigators designing with shapelessness also have to acknowledge that their knowledge is impartial too. It requires what Unger and Keats (2004, pp. 279–280) refer to as "negative capability," the ability to suspend judgment about something before learning more about it. Designing with shapelessness then means to withstand doubts, stay open to what is not readily understandable, resist the urge to explain away what is puzzling, and to accept the impossibility of a singular conclusion. Learning together through shapelessness requires a readiness to undergo change oneself, including one's perspectives, positions, and conduct.

This radically open approach to embodying differentiated collective encounters within interpersonal, technical, and environmental systems—beyond mere function or utility (Hui, 2020, p. 265)—is a promising prospect beyond research on organic waste. For example, it can be brought together with other cultural-historical approaches to technology toward ecosystems of distributed biological and technical cognitions (Hayles, 2017) or locally instantiated economies devoted to coproduction in relation to close others (Jacob, 2021; Miller, 2019). Cosmotechnics subordinates recursivity to contingency. The primacy of contingency (Rorty, 1989) entails a pan-relationality to displace technological dominance, universal anthropocene, and enframing exploitation. This dynamic of interdependency make cosmotechnics conceptually versatile and applicable to other fields.

Conclusion

In Hong Kong, the weather is overheating while soils are starving, and with them, so are the livelihoods and futures of rural and eventually urban communities. Concurrently, harmful and wasteful linear industrial food production and consumption processes continue relentlessly. There is an urgency for symbiotic approaches in the design of future technologies, landscapes, and economies.

Through this research that staged and rehearsed how to live well with the metabolic fullness of the natural world, we have focused on ongoing experiments for reassigning urban organic wastes to farmlands on the rural margins. The study explicitly outlined the social reinvention, economic rearrangements, and collective action necessary to bring forward more localized, equitable, and circular futures (Fry, 2020). We

explored how such an aspirational vision can be provoked and enacted across farmers, kitchens, and sectors by design, assembling a diverse community of open-minded others, including fermenting microbes, in the commanding process of renegotiating cosmological imaginaries and economic organization. By design, circularity becomes a context for living-in-reflection with others about shared futures that are all at once material, cultural, and political—focusing on the social holding spaces required to experiment and learn together.

The Daoist cosmotechnics vision gives us an expanded sense of who else might be involved in enacting more diversified economic systems, yet also emphasizes what is practically required (or not) for their implementation. The self-instructing cosmotechnic principles of household directedness, durational accounting, contingent needs mediation, and scrutiny of context-blind tooling bring real-world grounding to the prevalent driving forces of single-minded productivity. In an applied convergence of Western with Eastern thought, we offer this as an alternative to prevailing forms of prioritizing and economization that reiterate business as usual; modernist 'solutions' that render excess organic matter out of sight, out of mind, but also beyond our livelihoods as a foundation for inventiveness and conviviality.

Cosmotechnics puts centrality on contingency—environmentally imposed adaptation for directing the recursive loops of the living, social, and technical systems we are part of. Close attention to contingency foregrounds our eco-social crisis as the outcome of societal fragmentation that demands the abandonment of dualistic categorizations. Contingency is also a call for action *with* the world by staying put to our wastelands, inattention, runaway climate crisis, and self-doubts since this mode of suspension is needed for more rehabilitating trajectories to be realized. Such cosmotechnic modality calls on designing with indeterminate shapelessness that is actively brokering opportunities across and between spheres of what regulatorily, managerially, scientifically, dogmatically, or morally tends to be discreetly separated.

Shapelessness in design with contingent, indeterminate suspension demands us to contemplate how diversification is integral to strategy, how resource governance remains accessible to all, and how people keep prototyping contingent with events and realities beyond their control and thereby build proto-communities as part of their everyday lives. This commitment to shapelessness is not just a matter of context but of systemic design with situatedness and mutualistic care. It is essentially about symbiotic survivability, or 'sympoiesis' in cosmotechnics.

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References

1. Akama, Y., Cooper, R., Vaughan, L., Viller, S., Simpson, M., & Yuille, J. (2007). Show and tell: Accessing and communicating implicit knowledge through artefacts. *Artifact: Journal of Design Practice*, *1*(3), 172-181.

2. Alexander, C. & Sanchez, A. (2019). Introduction: The values of indeterminacy. In C. Alexander & A. Sanchez (Eds.), *Indeterminacy: Waste, Value, and the Imagination*. New York and Oxford: Berghahn.
3. Berkes, F. (1999). *Sacred ecology*. New York: Routledge.
4. Brewer, J. (2021). *The design pathway for regenerating Earth*. White River Junction, VT: Chelsea Green.
5. Buchanan, R. (2019). Systems thinking and design thinking: The search for principles in the world we are making. *She Ji: The Journal of Design, Economics, and Innovation*, *5* (2):85–104. https://doi.org/10.1016/j.sheji.2019.04.001
6. Boehnert, J. (2019). Ecocene design economies: Three ecologies of systems transitions. *The Design Journal*, *22* (1): 1735–1745. https://doi.org/10.1080/14606925.2019.1595005
7. Bonnet, E., Diégo L, Monnin, A., & Allard, L. (2019). Le design, une cosmologie sans monde face à l'Anthropocène. *Sciences du Design*, 10:91–104. https://doi.org/10.3917/sdd.010.0097
8. Descola, P. (2013). *Beyond nature and culture*. Chicago: University of Chicago Press.
9. DuPuis, M. (2015). *Dangerous digestion: The politics of American dietary advice*. Chicago: University of Chicago Press.
10. Çalışkan, K. & Callon, M. (2009). Economization, Part 1: Shifting attention from the economy towards processes of economization. *Economy and Society*, *38* (3):369–398. https://doi.org/10.1080/03085140903020580
11. Çalışkan, K. & Wade, M. (2022). DARN (Part 1): What is strategic design? Social theory and intangible design in perspective. *She Ji: The Journal of Design, Economics, and Innovation*, *8* (3):299–318. https://doi.org/10.1016/j.sheji.2022.10.001
12. Dorn, E. & Dickman, T. (2022). Towards relational design practices: De-centering design through lessons from community organising. In *Proceedings of Relating Systems Thinking and Design (RSD11) 2022 Symposium*. Oct 13-16, Brighton, UK.
13. Fowler, R. (1986). *Linguistic criticism*. Oxford: Oxford University Press.
14. Fry, T. (2007). The futuring of the ancient—review of François Jullien, vital nourishment: Departing from happiness. *Design Philosophy Papers*, *5* (3):165–168 http://dx.doi.org/10.2752/144871307X13966292017676
15. Fry, T. (2020). *Defuturing: A new design philosophy*. London: Bloomsbury.
16. Gibson-Graham, J. K. & Dombroski, K. (2020). Introduction: Inventory as ethical intervention. In J.K. Gibson-Graham & K. Dombroski (Eds.), *The Handbook of Diverse Economies*. London: Edward Elgar.
17. Gionata, G. & McCardle, J. (2019). Multispecies design and ethnographic practice: Following other-than-humans as mode of exploring environmental issues. *Sustainability*, *9* (11):5032. http://dx.doi.org/10.3390/su11185032
18. Guibert, E. (2022). Feral systemic design: (Re)wilding methods and methodology for systemic architectural design. In *Proceedings of Relating Systems Thinking and Design (RSD11) 2022 Symposium*. Oct 13-16, Brighton, UK.
19. Hayles, N.K. (2017). *Unthought: The power of the cognitive nonconscious*. Chicago: University of Chicago Press.
20. Healy, S., Dombroski, K., Conradson, D., Diprose, G., McNeill, J., & Watkins, A. (2019). More than monitoring: developing impact measures for transformative social enterprise. In *Proceedings of UN Inter-Agency Task Force on Social and Solidarity Economy (UNTFSSE 2019) International Conference*, *25* (1):26. June 25-26, Geneva.
21. Hui, Y. (2021). *Art and cosmotechnics*. Minneapolis: University of Minnesota Press.
22. Hui, Y. (2020). One hundred years of crisis. *e-flux journal*, 108. Retrieved May 27, 2023, from http://e-flux.com/journal/108/326411/one-hundred-years-of-crisis
23. Hui, Y. (2019). *Recursivity and contingency*. Lanham, MD: Rowman & Littlefield.
24. Hui, Y. (2017). On cosmotechnics: For a renewed relation between technology and nature in the Anthropocene. *Techné: Research in Philosophy and Technology*, *21* (2–3):319–341. https://doi.org/10.5840/techne201711876
25. Hui, Y. (2016). *The question concerning technology in China: An essay in cosmotechnics*. Cambridge, MA: MIT Press.

26. Jacobs, A. (2021). From tech critique to ways of living. *The New Atlantis: Journal of Technology and Society*, 63:25–42. https://www.jstor.org/stable/26966374
27. Jullien, F. (2007). *Vital nourishment: Departing from happiness*. New York: Zone Books.
28. Kelty, C. M. (2018). Hacking the social. In N. Marres, M. Guggenheim, & A. Wilkie (Eds.), *Inventing the social*. Manchester: Mattering Press.
29. Latour, B. (2017). *Facing Gaia: Eight lectures on the new climatic regime*. Cambridge, UK: Polity.
30. Li, R. W. (1995). *Ut pictura poesis: Keats, anamorphosis, and Taoism*. Doctoral dissertation, Vancouver: University of British Columbia Library, Faculty of Arts, Department of English. https://doi.org/10.14288/1.0088866
31. Love, J. (2022, October 4). Bokashi and worm farming at scale with guest Matt Arthur of BLH Farm. *The No-Till Flowers Podcast*, Philadelphia. Retrieved May 27, 2023, from http://notillflowers.libsyn.com/bokashi-and-worm-farming-at-scale-with-guest-matt-arthur-of-blh-farm
32. Luthe, T. (2017). Systemic design inspired by nature: Incubating a circular economy based on industrial hemp. In *Proceedings of the Relating Systems Thinking and Design (RSD6) Symposium,* Oct 13-16, Oslo.
33. Manzini, E. (2015). *Design, when everybody designs: An introduction to design for social innovation*. Cambridge, MA: MIT Press.
34. Marcus, G. E. (1995). Ethnography in/of the world system: The emergence of multi-sited ethnography. *Annual Review of Anthropology*, *24*:95–117. https://www.jstor.org/stable/2155931
35. Maroney, S. (2018). Sandor Katz and the possibilities of a queer fermentive praxis. *Cuizine*, *9* (2). https://doi.org/10.7202/1055217ar
36. Marres, N. & Lezaun, J. (2011). Materials and devices of the public: An introduction. *Economy and Society*, *40* (4): 489–509. https://doi.org/10.1080/03085147.2011.602293
37. Marres, N., Guggenheim, M., & Wilkie, A. (2018). Introduction: From performance to inventing the social. In N. Marres, M. Guggenheim, & A. Wilkie (Eds.), *Inventing the social*. Manchester: Mattering Press.
38. Markov, A. (2023, April 4). To the origins of technology: A review of 'A Question of Technology in China'. *Trinity Option Magazine,* 375:13. Moscow: Троицкий вариант.
39. Maturana, H. R. & Varela, F. J. (1972). *De Maquinas y Seres Vivos* (On machines and living beings). Santiago: Editorial Universitaria.
40. McGuirk, J. (2022, February 20). The waste age. *Aeon*. Retrieved May 27, 2023, from https://aeon.co/essays/ours-is-the-waste-age-thats-the-key-to-tranforming-the-future
41. Meadows, D. (2001). Dancing with systems. *Whole Earth*, 106:58–63.
42. Miller, E. (2019). *Reimagining Livelihoods: Life beyond economy, society, and environment*. Minneapolis: University of Minnesota.
43. Miller, E. & Gibson-Graham, J. K. (2019). Thinking with interdependence: From economy/environment to ecological livelihoods. In J. Bennet & M. Zournazi (Eds.), *Thinking in the world: A reader*. London: Bloomsbury Academic.
44. Mol, A., Moser, I., & Pols, J. (2010). *Care in practice: On tinkering in clinics, homes and farms*. Bielefeld, Germany: transcript press.
45. Morrow, O. & Davies, A. (2020). Creating careful circularities: Community composting in New York City. *Transactions of the Institute of British Geographers*, *47* (2):529–546. https://doi.org/10.1111/tran.12523
46. Nele, F. & Lou, L. (2019). The struggle for sustainable waste management in Hong Kong: 1950s–2010s. *Worldwide Waste*, *2* (1):1–12. http://doi.org/10.5334/wwwj.40
47. Perera, D. (2023). Footprint 35: Engaging cosmotechnical difference in architecture and urbanism: Cosmologies, technologies, worlds. *Footprint Delft Architecture Theory Journal*, March. Retrieved May 27, 2023, from https://journals.open.tudelft.nl/footprint/announcement/view/394
48. Perera, D. (2023). Design fictioning of a second-order kind: runaway cybernetics, futures of work, possibilities of engagement. *Enacting Cybernetics*, *1* (1):1–24. https://doi.org/10.58695/ec.3
49. Plumwood, V. (2009). Nature in the active voice. *Australian Humanities Review*, *46* (1):113–129. http://doi.org/10.22459/AHR.46.2009

50. Quiroz, M. & Céspedes, C. (2019). Bokashi as an amendment and source of nitrogen in sustainable agricultural systems: A review. *Journal of Soil Science and Plant Nutrition*, *19* (1), 237–248. https://doi.org/10.1007/s42729-019-0009-9

51. Rorty, R. (2021). Pan-relationalism. In R. Rorty & E. Mendieta (Eds.), *Pragmatism as anti-authoritarianism*. Cambridge, MA: Harvard University Press.

52. Rorty, R. (1989). *Contingency, irony, and solidarity*. Cambridge, UK: Cambridge University Press.

53. Sennett, R. (2012). *Together: The rituals, pleasures and politics of cooperation*. New Haven: Yale University.

54. Sevaldson, B. (2019). What is systemic design? Practices beyond analyses and modelling. In *Proceedings of Relating Systems Thinking and Design (RSD8) 2019 Symposium*. Oct 13–15, Chicago.

55. Schön, D. A. (1984). The architectural studio as an exemplar of education for reflection-in-action. *Journal of Architectural Education*, *38* (1):2–9. https://doi.org/10.1080/10464883.1984.10758345

56. Shiva, V. (2020). Designing with nature: Systems design for the well-being of the Earth community (Keynote). In *Proceedings of Relating Systems Thinking and Design (RSD9) 2020 Symposium*. Oct 9–17, Ahmedabad.

57. Tan, C. (2020). Revisiting Donald Schön's notion of reflective practice: A Daoist interpretation. *Reflective Practice*, 21:5, 686–698. https://doi.org/10.1080/14623943.2020.1805307

58. Tsing, A. L. (2015). *The mushroom at the end of the world: On the possibilities of life in capitalist ruins*. Princeton, NJ: Princeton University.

59. Unger, R. M. (2004). *False necessity: Anti-necessitarian social theory in the service of radical democracy*. London: Verso.

60. Verbeek, P. P. & Kockelkoren, P. (1998). The things that matter. *Design Issues*, *14* (3):28–42. https://doi.org/10.2307/1511892

61. Wahl, D. C. (2021, April 15). Circular economies and regenerative cultures. *Circular Asia*, *3*: *Systems thinking for the circular economy*.

62. Wernli, M. (2021). Collective wondering: Enabling productive uncertainty in agroecological codesign. *Codesign, Special Issue: Designing for Reimagined Communities*, *1* (18):95–114. https://doi.org/10.1080/15710882.2021.2001534

63. Wernli, M. & Chan, K. F. (2023). Provocation soil trust: Designing economies inside an interspecies world of feeders. *Journal of Cultural Economy*, *16* (4). https://doi.org/10.1080/17530350.2023.2239823

64. Wong, N. W. M. (2021). *The politics of waste management in Greater China: Environmental governance and public participation in transition*. London: Routledge.

65. Zilber, D. (2019, October 7). Fermenting culture. *Emergence Magazine*. Retrieved May 27, 2023, from https://emergencemagazine.org/interview/fermenting-culture