

Bringing Home Recursions: Co-Crafting Environmental Self-Implication in Adult Design Education

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This report is about an explorative co-crafting course applying the notion of recursive publics to adult learning and pro-environmental activation, which aimed to engage a diverse cohort of learners towards patterns of eating, living, and engaging that promoted wellbeing and a healthy environment. This two-month-long, university-endorsed study in Hong Kong saw 22 participants fermenting their urine in which to grow an edible plant (*Lactuca sativa*), thereby creating a material relationship between their bodies and the environment. Technologies were employed to bring people physically together for greater emancipatory engagement inside the shared material condition. When analyzed, these technologies revealed their potential for opening or restricting the synergies from combined purpose, expertise, and immanent life processes in recursively profound and playful ways. This civic-tech study offers a recursive self-implication approach to design education as a collective negotiation process for navigating unknown territory to converge a myriad of expertise and intended beneficiaries.

#co-crafting practice

#civic-tech education

#recursion

#urine fermentation

#pro-environmental activation

Design Education and Societal Change

Design for societal change has a long tradition. It covers a broad range of activities that have in common participatory approaches to researching, generating, and pursuing outputs towards collective and social aims (Armstrong et al. 2014). Among others, Buckminster Fuller, Victor Papanek, Richard Buchanan, John Thackara, and Bruce Mau made a case for socially responsible design (Thorpe and Gamman 2001). However, social responsibility often is subservient to the dominant narrative of human mastery with its unquestioned faith in technological solutions, perpetual growth economy, and narrow assumptions about ‘the good life’ (Scott 2009).

Tackling environmental issues in socially more deliberate ways makes it imperative for design education to foster capabilities that allow learners to engage with systemic change more confidently, playfully, and to co-evolve with increasing complexity (Dubberly et al. 2010). It means not getting caught up in minute resource circulations, technical solutions, or individual consumer practices since they tend to cement our unsustainable path dependencies; the given economic arrangement and infrastructures that are socially enacting thus pre-programming our elemental functions and responsibilities (Hawkins et al. 2019). If, instead, the material and ethical considerations are to direct systemic change in production and consumption, then shifting tastes and preferences comes to the fore. For example, reconstituting our food culture where our ways of eating are regenerating soils and seas (instead of depleting them) necessitates forms of learning with systemic and social scope (Barber 2014).

Reliance on subject-driven, teacher-centered instruction, and individualised modes of self-formation would be in opposition to the range of competencies needed for contributing to societal adaptation (Swann 2002). In response, there has

been a call for education approaches oriented on developmental criticality and collective evidence generation, which help establish design strategies for effective social interventions (Souleles 2017). In this view, practices like participatory action research, applied ethnographies, and real-world experimentation better equip learners to contribute to societal processes in more preventive and preconfigurative ways while increasing the collective potential to thrive on turbulence (Sonne and Tønnesvang 2015).

By reviewing a small case study in communal learning that integrated multiple forms of technical engagement, this article attempts to trace the factors that build capacities both in learners and the cohort. The study stems from a larger research project investigating localised, citizen-led upcycling approaches for the ecological reintegration of organic by-products. The research draws on data obtained from a two-month duration, university-endorsed explorative work alliance with 22 households in Hong Kong named ANTHROPONIX. Between the ensuing five biweekly co-crafting sessions, participants agreed to collect and ferment their urine at home for growing crops, thus moderating the mutual wellbeing of plants and humans for provoking health-promoting responses in the conduct of eating, self-care, and civic engagement. This article draws on data from co-crafting sessions and a broad range of exchanges that recorded the reactions to and perceptions of technically assisted, self-directed learning. The participants’ concerns are shared here to explore some of the complexities of socially engaging with technologies in the fluid continuity of everyday life and biological circulations. In concluding, the article considers what this may mean for the curriculum in pro-environmental design education.

Civic Technologies, Craft Activism, and Urine Fermentation

Increasingly, socially engaged design coincides with segments of the current do-it-yourself movement that seeks to identify the elements in life that generate tangible value and nurture healthy relationships with each other and the planet. Responding to the decline in the quality of one's livelihood, communities, and environment, the motivation to reduce the reliance on others faraway for satisfying basic provisional needs brings people together, who strive to produce the substantiating conditions of their own lives (Busch 2014; Hayes 2010; Wagner 2007). For reclaiming their ethical and material responsibilities, activist citizens resort to concrete interventions of technical self-empowerment to imagine and explore new ways of association, production, and collaboration as seen in independent media, radical homemaking, urban farming, maker culture, tech-based activism, public labs, or citizen science (Fan et al. 2019).

These civic technology movements extend beyond the open-source ideology of programmers or hackers and include people from various backgrounds by evolving around a shared concern of advancing social, environmental, and democratic issues (Hagel et al. 2010). Rather than just celebrating technology and gathering around 'tech for tech's sake,' civic-tech movements question the broader society, its values, and politics that technology is thriving on. Spurred by civic responsibility, a can-do spirit, and efforts of pitching in, collectives of practice are forming ad-hoc communities, based on the notion of "adhocracies" (Bennis 1969). Bringing diverse demographics together into a reconciliatory process where differences are acknowledged, previously unknown approaches can emerge, people move past predispositions, and create openings for more horizontal and self-organised arrangements (Rushkoff 2019). Here, people assemble to

realise what they want to see happening in the real world by building things that are not incentivised by the market.

In lieu of monetary motivations, these collective tech practices rely on inspiration, commitment, and social bonds. Through extensive collaborations in person or distributed at scale, tech-enabled communities can fulfill their potential and establish complementary infrastructures like citizen-led online polling, environmental science monitoring, or convivial restoration efforts (Tu 2019; Galán 2017; Büscher and Fletcher 2019). Such tech engagement usually takes place in "surplus economies" (Garber 2013) or "gift economies" (Mauss, 1990), where people make time and resource investments without an explicit agreement for immediate or future returns. The ANTHROPONIX course was invested in the meaningful upcycling of human urine and sought to animate these modes of non-transactional exchanges between people and the natural environment within the terms of "biological economies" (Pavone and Goven 2017; Carolan 2016) for engaging in more imaginative ways with nutrient cycles, food systems, and more-than-human health interactions.

Biological economies are about making the immanence of life processes the conversational point of departure in technological and social organisation, to expose more collective and performative learning approaches. Inside biological economies, the human body is in a metabolic relationship with the natural environment, which implicates all life forms through digestion; our organism can absorb nutrients only because gut bacteria are breaking them down for us. All life depends on this eating-through-each-other system. Approached from these intrinsic biological interdependencies, common categories like food producers and food consumers are then replaced with the notion of living inside the "world of eaters" (DuPuis 2015), thereby decentering what is assumed to be

restricted to the human world. Conversely, digestion as a paradigm is also a viable proposition for social organisation. Keeping close relations with ‘untrustworthy’ partners (from unsavoury bacteria to ambiguous institutions), paying attention to collaborative processes (from fermentation to tactful persuasion), and living with the consequences (from messy mishaps to wicked path dependencies), can make us safer in the long run (DuPuis 2015). In response, civic-tech movements are facilitating a conversation with technological development. Such conversational capacity-building is not restricted to the digital realm and includes all other forms of skilled, worldly engagement like handmade and craftwork. Here, available resources return into the creation and exchange of ideas, images, and goods as ways of re-making and thus enlivening vital connections to place and people (Garber 2013).

Anthropology indicates how people and environments thrive best together, not in a ready-made, prefabricated world, but in a continuously self-implicating, skilled dialogue with the immanence of life processes. It means that the activities of inhabitants (person or microbe alike) contribute inherently to the participative decay and renewal that all involved depend upon. In this living world-in-formation, inhabitants, and place are intrinsically entangled with each other rather than externally linked (Ingold 2011). What brings people together is an animated way of being alive and open to the world that embraces discovery, astonishment, and the pulse of sensory experience. For motivating changes in people’s perception and behavior, regarding their basic bodily functions (like eating and excreting) and their relationship with other living entities, the focus in this co-crafting course has been on building a collective process of enablement for urban dwellers. A purposeful tension was created between upholding values of the handmade – like bodily sensing capabilities or cultural heritage (Ihde 1978) – with the ubiquitous and dematerialising efficiency of digital

technology (Pallasmaa 2009; McCullough 1996) by complementing high-touch techniques of urine fermentation and plant nurture with science-assisted monitoring for biochemical substances. For overcoming the limiting schisms like tradition versus progress, creativity versus conservation, the hand making was given purpose in an unusual context to loosen its operational confines (Ravetz et al., 2013).

In this kind of relational knowledge production, skills and expertise are the gateways for restorative work and the sensory influencers that propel it. Restorative skills like recovering, repairing, fermenting, maintaining, or contemplating allow us to suspend restrictive control regimes of prediction or purity (Caslav Covino 2004), so that previous value-laden decisions that are deemed political are pulled back into the discussion. For disrupting unhelpful assumptions, the educational intervention needed to reach beyond its utility and relate craft expertise and biological resource cultivation directly with the everyday lives of people for imbuing them with personal fulfillment, community participation, and cultural relevance. Drawing literally from the agitating action of fermenting bacteria, the co-crafter can reconceive her life as a transformative process with agency in larger movements of change (Katz 2011).

Recursive Publics and Lab-at-Home Learning Practice

Tech-enabled activism comes with vastly divergent socio-political purposes. The thriving of radical political groups on tech-media platforms or survivalist movements appropriating do-it-yourself culture provides two samples. Thus, design education is challenged to foster a self-awareness that technologies and automation can be used repressively when established ground rules of the social contract are ignored, such as rights, duties, responsibilities, and accountability (Fan et al. 2019;

Rushkoff 2019). For discerning technical engagement both in aspirational and self-critical terms, a guiding concept can be Christopher Kelty's (2008) "recursive publics." The recursive public is a functional unit within society, constituted around the concern for maintaining its own existence and mandate. It means that members of a recursive public are strongly self-invested in the continuous upkeep of their material and ethical arrangement since it ensures the adaptability of public functioning that they rely on. This kind of co-regulated technical engagement assists a public to imagine itself as a public by practising and presenting an actual alternative to existing forms of power. For example, recursive concern groups evolving around online data use or reviving probiotic food tradition become self-aware.

Nurturing civic society means that technological engagement with existential purpose can help the public to become more vigilant to understanding and imagining itself.

Recursive publics do not just collaborate; they also contemplate on the implications of their collaboration. It can be a mutually reinforcing situation, where people keep collaborating because as they collaborate, they think and learn about this very collaboration (Fan et al., 2019). Such an interiorised form of accountability is vital for the creative reinterpretation of priorities and identity in persons and groups underlying decision-making processes and self-organisation (Bendell 2018). Recursion emerges when the group's internal diversity becomes the socially cohesive pivot for engaging with the broader context in adept ways, and thus, adapting its operational logic into areas like open-source modality or inclusive wellbeing.

The reinterpretation of choices inside everyday life is also shaping novel constellations of collaborators who discern experiments for alternative ways of making-things-together, and opening up the potential of "disruptive normalities" (Manzini

2019). Current tech-enabled, making-things-together differs from the 1960s counterculture and its ensuing do-it-yourself movement, which sought to repurpose prevalent consumer culture via the acquisition of goods, books, and tools as a way of expanding shared consciousness. Sold on the premise of idol devotion and consumption, the 1960s counterculture was gradually overtaken by libertarian takes on entrepreneurship that would undermine the very civic regulation and social visions that initially had animated it (Turner 2006; Pinon and Lafarge 2019). In a shift away from consumerism, recursive making-things-together refers to grass-roots efforts of affective collaborations. It positions people and groups as reflective contributors who inhabit a participatory democracy where process and outcomes are considered in terms of whether they connect people and foster social change that accounts for equity and thriving (Garber 2013). The transformational potential stems from a critical examination of the fundamental principles by which humans live together with each other and with other-than-human agents in the world.

Recursive communities are experimenting with agency and the overarching purpose in social niches where the feedback loops inside the relationships of environment/person, authority/citizens, group/member, or body/mind are encouraged and scrutinized. A feedback loop is a circular activation of affecting-through-being-affected and articulating-through-listening for eventually acting-through-understanding towards a negotiable goal— thus, arriving in an initially unknowable territory (Wiener 1954; Sonne and Tønnesvang 2015).

The critical question then is how differences are negotiated across different publics and activity domains. Here, design education can provide safe, conversational spaces where experiments with people-technology relationships are run and where it is necessary to keep attending to socio-material feedback loops to develop

collaborative systems that continue to adapt future action based on consciousness for past performance. This has implications for sound leadership and for setting out a collaboration dynamic that continues to be modifiable so that the arrangement does not congeal into a static, impenetrable construct.

In response, the ANTHROPONIX case study aimed at an adaptive pedagogical approach for keeping the conversation relevant to what was emerging in person, group, and context. The technical activities were carried by “complementary polarity” (Sonne and Tønnesvang 2015). This meant implicating studio practice with home application; altering individual tasks with group exchanges; contesting bio-data monitoring with intuitive self-awareness; and oscillating general instruction with individual reflection, thereby correlating decision-making with personal accountability. This way, the purpose of technical engagement remained negotiable, and the learners could stay self-contracted in a continuum focused on engendering the thriving of the whole (Wahl 2016). This complementarity emphasised the broadening of the learner’s response repertoire, which forms the basis for developmental leaps, rather than correcting isolated aspects and actions.

Tech-enabled activism based on convening-through-collaborating across diverse life domains can be both resilience-building and fragile (Fan et al. 2019). Therefore, the author deemed it worthwhile to understand these recursive dynamics and the efforts involved in more detail by analysing the ANTHROPONIX experimentation. Within this university-endorsed case study, the researchers derived ethnographic data from four types of sources, including course documentation, co-crafting participants, facilitators, and data analysis.

Course Documentation

The ANTHROPONIX learning venture invited the public to become test growers of a renewable, urine-powered, water-based horticulture as illustrated in the workflow diagram and photograph of the planter device (fig. 1 and 2). In spring 2017, the eight-week-long study was structured around five biweekly co-crafting sessions, each with a thematic focus like nutrient fermentation, water-based horticulture, and human/plant anatomy, which is represented in the presentation slides (fig. 3). The sessions consisted of guided peer-to-peer exchange, lectures to introduce technical concepts, and skill acquisition with the simple horticultural contraptions — made up of modular components as depicted in the planter device (fig. 2), which were handed out one session at a time. This modularity required participants to attend every session for securing access to tools, materials, and the exchanges needed for advancement. Participants were asked to bring their material experiments regularly back to the sessions for joint consultation, as documented in the cohort photographs (fig. 4 and 5).

Most of the co-crafting activity took place at the participants’ homes, where they were asked to collect, examine, and ferment daily, 20ml samples of their morning urine to be transformed into fertilizer for growing lettuce (*lactuca sativa*). In close collaboration with environmental microbiologists, the author had developed a process for household-level urine fermentation whereby source-separated fresh urine is infused with propagated lactic acid bacteria (generated from sauerkraut). The controlled fermentation in airtight containment stabilizes and acidifies urine over three weeks, thus neutralising its malodours (Andreev et al. 2017). Each fermenting urine specimen became part of an annotated self-examination passage (Meiselman and MacFie 1996) that involved medical dipstick testers (urinalysis), diet monitoring, and plant development tracking. Participants consolidated

this into an intricate food diary, *The Journal of Mutual Flourishing*, as depicted in the graphic (fig. 6). For access to mutual assistance, participants established a text messaging group that ensured connectivity between co-crafting sessions.

Co-Crafting Participants

The cohort of learners consisted of 22 participants, 19 Hong Kong-born and three born overseas, with an equal ratio of 11 men to 11 women, aged between 22 and 58 years from diverse socio-demographic backgrounds. The majority (85%) were dwellers of apartments and shared households. The participants enrolled themselves because the curriculum promised ‘a one-of-a-kind skill-up occasion’ for the hygienisation of small quantities of urine to be used for indoor planting. The participants answered to a widely distributed public call of the ‘urban ecology adventure’ to which a total of 40 candidates applied online. Participants were selected based on their tolerance for open-ended experimentation, willingness to commit time, and how their personal backgrounds brought diversity to the cohort. All participants responded to at least two semi-structured interviews, one before and one after the course, totaling 54 interviews with the duration ranging from 45 minutes to three hours (average was about one hour). The self-assessing interviews were primarily focused on learner’s motivations, observations, and reactions regarding their learning experience. Researchers established multiple datasets for each participant, from session transcripts, online text logs, home visit exchanges, self-documentation, and field notes to ensure triangulation.

Facilitators

The author was part of the facilitator team that included a product designer, a research assistant, and a communication specialist who played vital

roles in developing the study. The facilitators were interested in exploring ways of contemporising ancient resource cultivation models of fermentation for agroecological use (Schmidt, 2014) and considered its implications for relational health orientation in everyday social life and its extension into a co-crafting curriculum.

Data Analysis

Data collected from these sources was interpreted and analysed using the concept of recursion outlined above to discern the influencers of transpersonal motivation and mental flourishing in person and group. Since prolonged, nurturing commitment (Carolan 2016) depends on the adoption of mutually beneficial goals (Hester and Gore 2015; Gore et al. 2018), the craft collaboration needed to account for the fluidity of emotional states in participants (Brooks 2019). To enhance rigor in the analysis, reflections from the facilitator team, field notes from longitudinal observation (Marshall 1981; Lempert 2007), peer scrutiny, and family members’ statements were used to deliver multiple datasets for each participant from multiple sources. Despite utmost consideration for data collection and triangulation, self-reported data and tacit knowledge can rarely be independently verified (Schein 1987). In response, the efforts substantiated from the participants’ journal-keeping, props appropriation, and their physical presence during the extended contact time were accounted for to establish and understand the emotional fluctuations in the self-regulation dynamics (Sheldon and Hoon 2007; Fitzsimons et al. 2015) of the co-crafting group. The outcome and findings of this curriculum are discussed with the participants’ statements from which three main themes emerged – attitude, purpose, and collaborative synergies – and presented in the following sections.

Recursions in Attitude with Initiation of Happy Accidents

With untested planting procedures, unreliable biometric instruments, and uncontrollable variables of dietary intake, ambiguity loomed large in ANTHROPONIX, which assembled people, health concerns, family life, sanitation, and weather conditions. Deliberately, all involved were brought into uncertain positions to unbound status, expectation, and discovery. Ultimately, the course required learners to let go of routine participation and acquire deeper, more dynamic modes of thinking and acting as expressed by Vincent, a plant-loving musician in his thirties, “It was an experiment after all, and things do happen we cannot expect.”

Already on day one, when participants returned home, they found urine sample *Number 1* dispersed throughout their bathrooms. The carbon dioxide of hardworking lactic acid bacteria was more potent than the lid of the urine tube. Only hours after the course began, the facilitators had to abandon their designer’s pride and launch fearlessly into damage control, admitting lack of preparation while imploring participants to tightly duct-tape the lids. It paid off that participants were explicitly briefed on the implicit uncertainties of the course. Despite the mess in 22 Hong Kong bathrooms, nobody quit. Instead, the collective urine leak was, in the words of several participants, a “happy accident.” The exuberant chemical reaction had made the impact of the urine fermentation palpable since it did not smell bad—rather acidic. Because everybody encountered the same problem, the incident was a heightened moment of group initiation. It primed the participants’ attitudes for bigger challenges yet to come as Vincent pointed out, “In fact, I was a little bumped in the second week when the lactic acid bacteria were not as strong; why not keep it as constant agitation? We can just tape it down; it’s no big deal.”

An adverse combination of out-of-season seeds, down-scaled planter size, and insufficient aeration of the urine solution made it (almost) impossible to grow the lettuce. Yet precisely these limitations opened opportunities to “play with the imperfect” (Gaver et al. 2003) through intervening or appropriating as described by Cella, a participating bioscience teacher, “You are not establishing how it is supposed to work; you want people to try different things and then share what has worked best.” At large, participants embraced the challenges and displayed resourcefulness in their attempts to rescue the floundering plants by experimenting with numerous seed varieties or exploring improvements to the fertiliser solution. Stipulated trial-and-error learning that fosters self-reflection and solution-finding is directed by expertise instead of power (Leithwood et al. 2008). Since advancement depends on the acquisition of necessary skill or knowledge, rather than following centralised prescriptions, like Clemens, a part-time farmer in his twenties noted, “It’s certainly good to bring together people with different expertise; and interestingly, peers who didn’t stick to the rules actually seemed to yield better results.”

Such flattening of status can engender a “feeling of shared ownership” (Muller 2002) where the unfamiliarity of the situation requires flexibility of interpretation, and collaborators are bound to “continuously assess the uncertainty” as long as it persists (Bijker et al. 1987). For people who expect consistency or instant results, this requires interpretative flexibility, which can be overly demanding (Gaver et al. 2003) as indicated by Cella: “It was difficult to get satisfactory results, and the chances are that people will be disappointed.” This resolve to adapt to the unsatisfactory situation through broadening its purpose was also the crucial first step to self-initiated, extended learning. Most participants found the resolve in adapting to the technically unsatisfactory situation. The shared experience of obstacles, frailty, and “impotentiality”

(Agamben 2011) engendered not only emotions of frustration but also the full gamut of positivity, genuineness, and courage (Brown 2012) for letting go of external impositions and adapting deliberately from within as outlined in the next section.

Recursions in Purpose with Harm Awareness from Within

The study's original intention was to observe how participants change their eating behaviour when experiencing how the plants' flourishing depended on the integrity of their urine. This unifying purpose resonated in some participants with long-standing personal quests, as Mike, a middle-aged exhibition designer, noted, "Yeah when you told me about this course, it was already something I was thinking about; the missing part of the loop in hydroponics." The circulatory nutrients proposition also captured surprising aspirations as illustrated by Wilma, a middle-aged veteran gardener: "I was sure that the result is not good, so I joined! I knew this setup is very limited, but I was simply interested in what would happen." Therefore, this wilful engagement against better judgment known as "akrasia" (Adler 2002) was about finding mental closure by witnessing where the journey could lead.

The horti-technical setup for growing urine-powered plants was both desirable and doomed. Cella describes how ANTROPONIX offered both a practical entry point and focus: "It seems easy, like you can grow your plants by collecting urine and water—then off you go! That's simple enough that people will think, I don't need much space, I can hide it under my sink and do it." As it turned out, the real value was not in the procedures' utility, instead, in its contemplative cues. The 'urban ecology adventure' came equipped with dye-tester strips and reference charts for monitoring urine constitution, plant nutrients' deficiency, eating behaviour, and body care. This not only valorised

the urine but led to an overarching, health-related interrelatedness as described by Oscar, an arborist professor, "Everything in this set-up connects; your body, your life, your heart, even your sleep. It's in your house, in your washrooms, and in your bedroom."

Health indicators, data, and charts (for humans and non-humans alike) do not matter unless they are connected to the subject's moment-to-moment experience (Rushkoff 2019). Thus, each co-crafting session featured topical presentations that sought to make the science behind the procedures more humanly relatable, to keep actions better attuned to the regenerative properties of lactic acid bacilli and lettuce plants. Facilitators introduced topics like *Participatory Urban Metabolism* or *From Chlorophyll to Haemoglobin*, emphasising interexistent, biological relations. Rendering microscopic imagery next to art-historic anatomical conceptions "enlivened" ecological principles (Holdrege 2010) as noted by Elisa, a nursing student:

"You show the plant seed next to the human embryo; this way I can very easily connect myself with nature. People usually think how they are different from plants, but when you look closely and put them side by side, you can clearly see the linkages."

Embedding scientific education inside the co-crafting sessions was not just an effort to counteract the increasing separation between science research and technological development (Fan et al. 2019). Humanly-relatable science was also meant to inspire a sense of awe, to shift attention away from self-focus toward the "complicity of reality creation" (Rushkoff 2019) as indicated by Vincent, "I pick up little stuff here and there every week I come; like the weird stuff, for example, that plant roots need oxygen. In this moment of my life, such knowledge is something I am interested in, which made me keep coming back."

Beyond the instrumentality of nutrients capture, urine is a highly intricate and personal substance. Active journal keeping around the urine's integrity provided the locus for engaging in a conscious dialogue with oneself, as stated by Elisa, "The cool thing with this journal is that it starts your imagination, and then it really helps me to very lightly reflect on what I did that day." The urine and fertiliser monitoring relied on time-sensitive dye-testers, perceptive cognition, and routine disruptions, which could be delicate to coordinate as Clemens explains, "After I have done the urine testing in the washroom, I want to eat. So, during or after breakfast, I work on the journal. But sometimes, I forget the test strip. Thus it becomes dried up, and the indication colours have changed..."

The tracking regime drew attention to the limitations of such bio-pedagogic methods (Halse 2010) and led to their contestation in participants like Mike who found reassurance in the capabilities of his inherent sensorium:

"Because the results of the test strips sometimes seemed random, I felt that I could rely more on my senses than the test strips."

This reflective practice (bringing attention to an inherent handicap) led to an adaptive reconfiguration in participants where personal conduct became the result of "social enactments of meaning" (Sonne and Tønnesvang 2015) through the oscillating authority between self and otherness as indicated by Helga, a retired, plant-loving accountant, "In the journal, you have a row called 'normal' for the urine test values; initially that was very alerting, but later, I feel like I don't need this strip to tell me if I am okay or not." The emancipatory engagement with technology was about the critical dialectic of internal and external meaning that mobilised, rather than predicted the sensing, thus signifying and acting in the very present moment (Zinker 1977).

During the exit interview, Richard, a participating college student, confessed how he had ingested flu medicine during urine collection and found himself trapped in a potentially eternal feedback effect of pharmaceuticals—if he were to eat his urine-derived lettuce, "In *week two* of pee collection, I took some flu pills because I caught a cold. If I ate the lettuce sprouting in my pee, does it mean that I keep ingesting the medicine and may get addicted to it [laughing]?" The laughter of Richard originated from instructive insight. Once such breaches are exposed, they can direct how to prevent harm and what to do next, like minimise toxins, share unassuming doubts early, and live with the consequences as fully implicated inhabitants of the 'world of eaters.' Harm-aware revelations stemmed from the recursive interplay of people and perspectives. The key to experiencing one's insight was to perceive how it resonated with the context by belonging to something greater than oneself, as the next section indicates.

Recursions in Collaboration with Consensus from the Unexpected

ANTROPONIX participants were wrapped up in recursive dialogues, all at once, with themselves, household members, peers, and facilitators. This kind of co-crafting reveals a material *con*-versation – turning *together* – where the inner determination of the experimenter engages dynamically with the external resistance of what is unfolding (Glanville 1999).

Elisa explains how this circular generativity with her family spurred the insistence for further exploration:

"At the beginning, they think, I am crazy. Yet, after I show them the plants that grow successfully in the urine tubes, I find that their attitude has changed. They can see the sprouting leaves and realise it's not just an experiment about the urine alone. I believe working toward such a result is important."

Most participants soon realised how the currency to learning was in the involvement with others, including close family. Hence many referred to the course as “camp experience” due to its intensity with knowledge-packed sessions, group dynamics, and unforeseen situations. The face-to-face engagement was an active choice, which helped establish good rapport when extraordinary circumstances warranted extraordinary efforts, or as Vincent puts it, “It’s a sense of common experience by overcoming common trouble.” In ANTHROPONIX, this connectivity of people and place had essentially two ramifications. One was the self-directed demand for expertise, the other, a “generativity” (Avital and Te’Eni 2009) from unforeseeable consensus and synergies. For example, when the set-up’s technical inferiority was evident, most participants realized how there was added value in belonging to a surprisingly passionate group of learners. Surprising here is about spreading astonishment and infusing the process with excitement. Such affective dimensions sent essential signals to peers about the mutually held relationship in the group as Cella acknowledged,

“Actually, what I liked most was to witness how others were excited; to see that there are actually people in Hong Kong interested in fermenting their urine—that kind of blew my mind because I thought that’s impossible.”

Encouraging peer-to-peer feedback during the co-crafting sessions provided pivotal knowledge dividends, the redistribution of personal insights in the group to increase the mutual advancement potential.

Regular group sharing, and progress reports as a way of joint consultation, gave the opportunity to appreciate each other’s contributions and contemplate the shared struggle as noted by Felix, an agricultural researcher and educator,

“In the end, everybody was giving a little presentation which revealed other people’s approaches; how they improvised, modified and made things work. They were happy to share their journey, and it was interesting how they had their own discoveries.”

For somebody like Becky, a college student who resigned midway from active participation vis-à-vis staggering obstacles, such showings could help to self-validate one’s personal performance in relation to the group and prompt restorative action, “I suddenly discovered the interesting bits about the course because some peers actually managed to grow real plants! So, I needed to know for myself how the plants can be helped to grow.”

In the face of demanding plants and ambiguous technology, it was helpful to let go of external impositions, expectations, and beliefs and instead rely on consolidating ideas, common sense, and intuition for connecting to what was in the here-and-now. Change here emerges from a trust that the present potential in people and places will supply all that is needed for relevant transitions to be made (Beisser 1970).

Recursions at Crisis point With Conversational Forward Search

ANTHROPONIX, as a problem-based learning proposition, pulled participants inadvertently into a collective rescue mission. At crisis point, the confrontation with technical mishap, non-human agency, unfulfilled expectation, and the limits of mastermind thinking raised the profound question of *how to proceed* as co-crafters. In a society, culture, and politics where design practices have been widely co-opted, asking *how to proceed* becomes a global activity without precedent. It identifies the punctuation point we are at in the evolution of design practices. It also boldly admits to the precarious nature of the way forward and what might

be required and adopted by designers and activist citizens to address the new conditions in which we find ourselves; the perplexing space between fraught technological feasibility and natural forces of living systems. Most participants' adept convergence with cycles of mutual influences (Glanville 2014) – including the integration of failure and immanence of life forces – into their learning journey can be considered the essence of design praxis that is increasingly necessary going forward.

In this light, the success of this learning experiment is measured by the degree of self-regulation in co-crafting for undermining human centrism, where the individual becomes derivative and not foundational in the making of reality. Relational systems such as biological economies do not have self-defined spatial or temporal boundaries, human or otherwise (Debaise 2012). It is the recursive relationality of our 'world of eaters' that provides catalysis for the continuing individuation of the terms (including humans).

The challenge of overturning human centrism, rationalism, and legacies of mastery are here understood as definition and reaffirmation of persistence as a design task: for learning what to do when no one knows what to do in profound as well as playful ways. This pursuit of design as collective discovery into an unknown territory requires the expertise of myriad disciplines and intended beneficiaries for minimising unintended consequences. In response, ANTHROPONIX socially enacted small-step conversations that converged into previously unthinkable and courageous ways of adapting by shifting perspectives, exerting diligence, and aspiring for improvement. At the core of this heartening adaptation that resonated with most participants was the rhythmic and complementary continuum between self/others, action/reflection, private/public, waste/resource, and despair/diligence that opened the middle-ground for unleashing unexpected insight, interiorised reorientation, overarching purpose, and disruptive leaps.

Conclusion

Social adaptation processes and environmental restoration require modes of design education beyond the linearity of inputs and outputs. It requires to see the context, people, and their technical activities as contributors to benefits and consequences in complex circularities.

Whatever the technology is, it never will replace the requirement for human dedication. It means that technology is employed in education in ways that do not repress the passion required for social transformation but rather to help those kinds of passions to flourish. The task of design education then is to engage with technologies in emancipatory ways where technologies are not approached for their own sake but how they transcend the possibilities in people themselves, as citizens, as community members, and as metabolising body/minds. Gilbert Simondon (1980) refers to this technological emancipation as "reintegration of technicity" where the transformative forces intrinsic to tools, machines, and technologies are confronted by a resilient social psyche that is aware of its own material contingency, rather than being left to passive-reactionary adjustments of mass consumption, technocratic management, and populist resistance (Bardin and Menagalle, 2015). This humanising imperative in technological engagement can help develop more collectively shaped technologies based on the living continuity of moment-to-moment experience and non-human agency.

In this effort, the ANTHROPONIX curriculum tried to approach the values attached to technologies, including the power differentials and individualism underlying them, not in opposition, but as the context for bringing forth their complements. In such complementarity, the individual's needs are balanced with those of the collective. Here jointly engaged uncertainties can prime critical intuition, where ideas are consolidated into common sense,

and essential human capabilities like tolerance to ambiguity, curiosity, and courage are reaffirmed. Real advancements typically are not attained in the absence of obstacles and hard work. They are attained because of them. In overcoming rather than avoiding distress also lies joy, belonging, and meaning. Engaging with these existential resources, both in person and group, is the beginning of accessing human development and can give relevant direction. Central to this dynamic is how ambiguity inherent to pursuing a unifying goal can bring about essentially enjoyable adaptation through recursive processes in attitude, purpose, and collaboration.

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Figure 1 (top): Educational eco-health experiment around the integrity of the urine. The ANTHROPONIX curriculum repurposes urine into something that becomes desirable for reconnecting with our biological foundation. This co-crafting curriculum engaged 22 people who wanted to learn how their urine and personal eating choices can influence the prospering plants growing out of it. *Photograph: Sarah Daher*

Figure 2 (bottom): The ANTHROPONIX planter device was a means to co-craft unprecedented and self-regulatory purposes into the urine. Each urine specimen became a time capsule in an annotated passage that integrated personal eating behaviour, shared anticipation, and experimenting with pragmatic ways of ecological engagement. *Photograph: Sarah Daher*

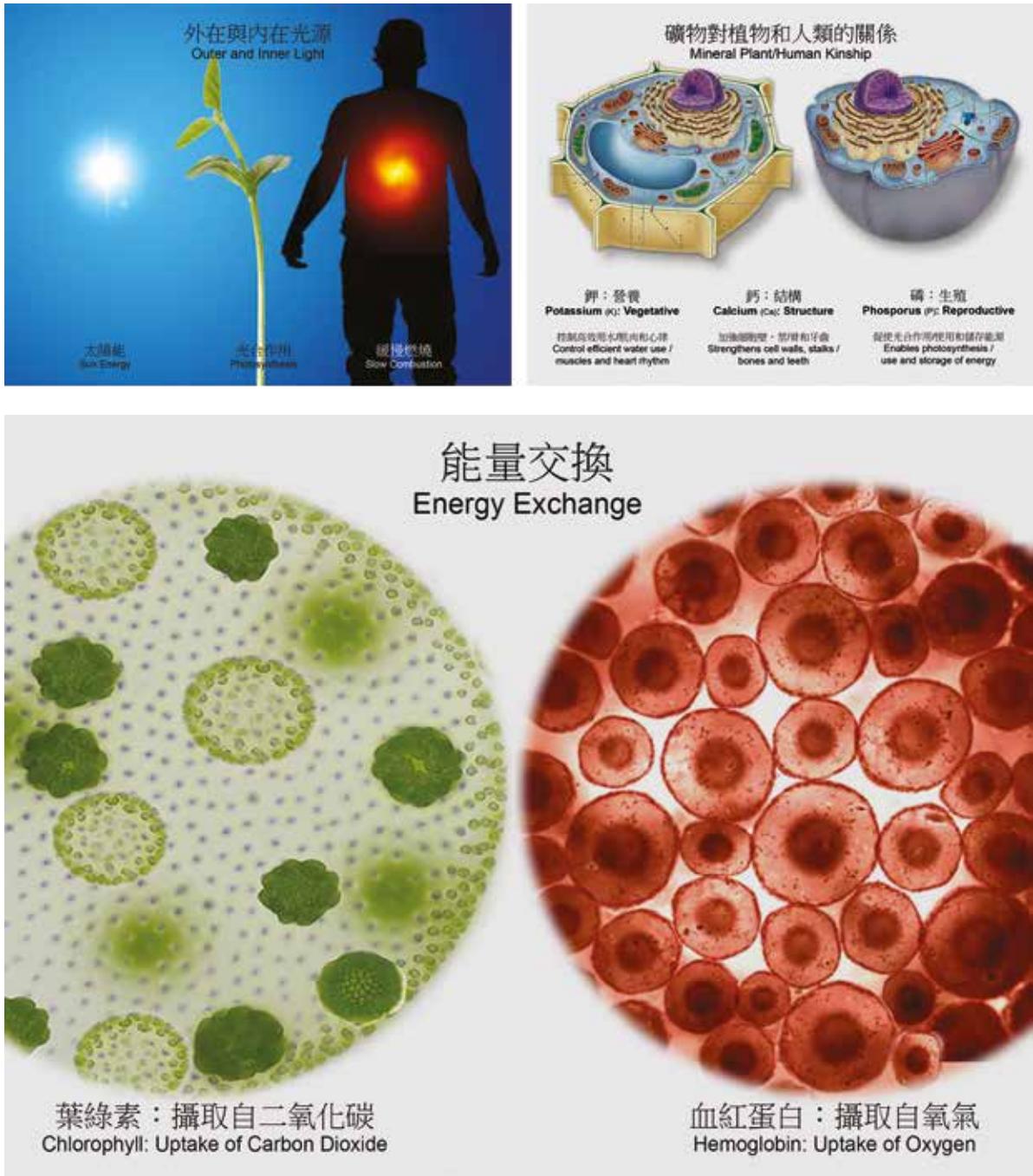


Figure 3: Humanly-relatable science with a focus on interexistent relations. Illustrations by the author.

Each horti-technical topic in the co-crafting sessions was represented by slide presentations that utilized microscopic imagery or art-historical references to put ecological principles and the interrelation of life forms in direct relation with human conceptions and experience. The side-by-side human-nonhuman comparisons made visual connections regarding energy cycle, anatomy, and perceptual systems and considered the possibility of isomorphism without resemblance.



Figures 4 (top) and 5 (bottom): Co-crafting sessions for emergent, self-directed learning. *Photographs by Sarah Daher.*

The five biweekly co-crafting sessions consisted of guided peer-to-peer exchange, lectures to introduce technical concepts, and skill acquisition with simple horticultural contraptions—made up of modular components that were handed out one session at a time.

This modularity required participants to attend every session to secure access to tools, materials, and the exchanges needed for advancement. Figure 4 shows how participants were asked to bring their material experiments of the previous week back for joint consultation. Figure 5 shows how more experienced participants explain the concept of anaerobic fermentation of sauerkraut to lesser acquainted peers.

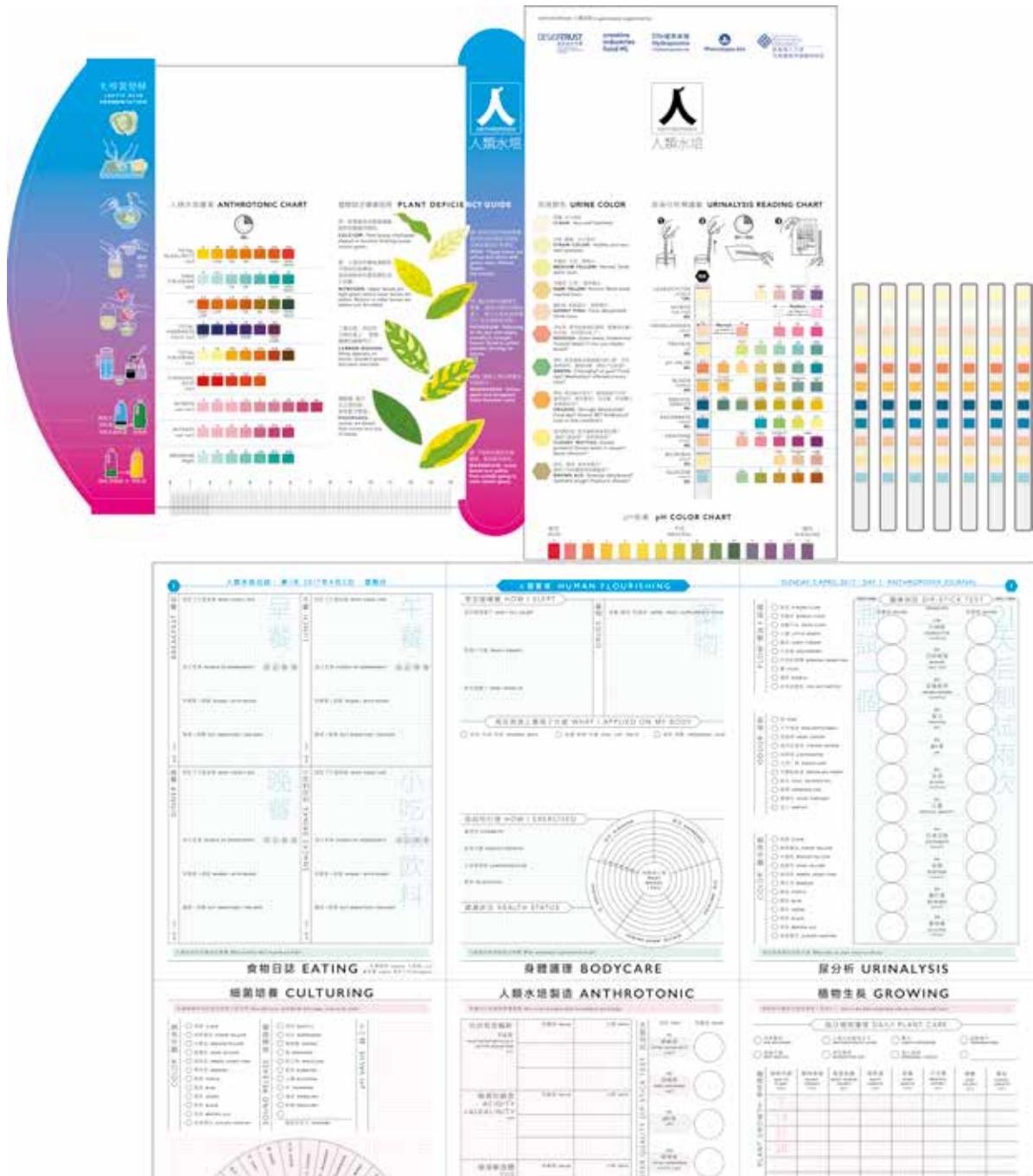


Figure 6: Journal of Mutual Flourishing as a practice of harm-awareness. Illustrations by the author.

The graphic on the top shows the sleeve of the journal (folded to DIN A5) that served as a reference guide and instructions for the biopedagogic monitoring of human, plant, and bacteria thriving. The graphic on the bottom shows an entry sheet of the journal. With the references on the sleeve, study participants tracked their eating

habits, Urinalysis values, odour of urine ferment, growing solution, and markers of plant development. Each diary entry sheet featured two parts, one for Human Flourishing (in blue), the other for 'environmental flourishing' (in red). On the day of urine collection, participants completed the 'human flourishing' part, and three weeks later, when the urine specimen was fermented and ready to use, participants would start monitoring 'environmental flourishing' in planting solution and vegetal offspring.

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Bio

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