Dr. Betti Marenko

Reader in Design and Techno-Digital Futures

Central Saint Martins, University of the Arts London

b.marenko@csm.arts.ac.uk

www.bettimarenko.org

Stacking Complexities:
Reframing Uncertainty through Hybrid Literacies

Abstract

In a context increasingly defined by post-normal science (Funtowicz and Ravetz 1993) it is acknowledged that complex world problems cannot be addressed by one discipline in isolation. To face increasingly uncertain futures it is therefore crucial to develop approaches that work *with* uncertainty. Because of its future-facing nature and current drive to tackle world challenges, design has a leading role to play in this endeavour. The article proposes a research framework informed by the development of *hybrid literacies* – transversal toolkits across design, technologies and futures studies – that can furnish learners with transdisciplinary skills. These are deemed necessary to address uncertainty and complexity by deploying speculative-pragmatic, imaginative practices that foster modes of working, learning and unlearning together. To illustrate this approach, the article draws on the ongoing collaboration between two academic institutions renowned respectively in the field of Art and Design (Central Saint Martins, University of the Arts London) and Science and Technology (Tokyo Institute of Technology) to offer a personal reflection and insights around transdisciplinarity and *hybrid literacies* in action.

> What I resist is those sad generalities where you are always right,
> and each time you are right, the world is poorer.
>
> Isabelle Stengers in conversation with Marcel Savransky (2018).

The purpose of this article is to offer insights for the development of *hybrid literacies* within the *transdisciplinary* space where design, technologies and futures meet. The aim is twofold: to establish a rationale for the need of transdisciplinarity built around a *constellation* of concepts; and to zoom in onto the value of this approach for a design education fit for 21st century challenges. My starting point is a rather banal observation: it is not sufficient to assemble ad-hoc teams (designers, practitioners, scientists, sociologists, technologists, students, assorted experts, researchers, various 'stakeholders') hoping that the sheer variety of backgrounds and perspectives will activate transdisciplinarity. Conceptual tools are needed to support any transdisciplinary enterprise. I propose that these conceptual tools must be made explicit, 'put on the table' upfront for discussion, and refined so that they become robust enough to scaffold transdisciplinary work, yet sufficiently nimble to allow for adventurous explorations of the unknown, *together*. I sense that it is precisely from this term – *together* – that I must begin. What does it take to imagine, design and inhabit spaces of experimentation, collaboration and reflection, *together*? How can situations of this kind be crafted? How do we – design educators, practitioners, change-makers - come in close proximity with each other to create togetherness? While being together is about being close, it is not about wishing to be similar, nor striving for sameness. Does *together* contain dispute, friction, perplexity, misunderstanding, hostility too? I sense it does. The extent to which this is foregrounded is vital to any transdisciplinary project that wants to thrive and create impactful change.

The article is organized in three sections. The first - *a constellation of concepts* – presents some ideas that have found their way in my work. As they reflect my position at the moment of writing (December 2019) this constellation should be seen as provisional as

the situation it purports to analyse. My reflections are illuminated by philosopher Isabelle Stengers' work on how to articulate the elusive process through which different modes of thinking can meet. The second section - *why 21st century design needs transdisciplinarity* – offers a succinct rationale for a tighter connection between design and transdisciplinarity, with attention to a critical literacy around technologies. The final section – *hybrid literacies for a design pedagogy of divergence* – builds on the previous two to propose a roadmap through a reflection on the ongoing collaboration between Central Saint Martins, University of the Arts London and Tokyo Institute of Technology.

1. A Constellation Of Concepts

- divergence
- ecology/ethology
- minor
- pluriverse
- symbiosis

divergence

Stengers (2019) suggests not to read divergence as 'divergence from' – whether we are dealing with other ways of thinking and doing, other practices, theories, perspectives, standpoints. Divergence is not about comparison. It is not *between,* but *inherent* to other ways of thinking and doing as they go on producing themselves through what they pay attention to, what matters to them, and through their own radical heterogeneity. To avoid falling into the trap of comparison, divergence should be seen as non-relational, with a focus on the affirmative potential of divergent elements to coexist, communicate, create entanglements – also through friction, dissonance and disharmony. Divergence becomes an enabling and spacious concept that, literally, opens up room for dissent. Often, when divergent paradigms meet, a breakdown in communication occurs. Rather

than taking this crisis as a proof of the impossibility of translation, Stengers reminds us that this is what challenges us to find, each time, a commensurability of sort. The powerful implication is that this can only be situated (i.e. 'of that specific situation'), created (i.e. 'not given') and therefore never neutral (i.e. 'political)'. The cultivation of heterogeneity is vital not only to address complexity, but also to resist to and counteract the stifling reduction of imaginative capacities, the eradication of divergence and the mounting "desertification of all modes of existence" (Stengers and Debaise 2017, 14).

ecology of practices: staying in the minor mode

An ecology of practices is a set of tools for thinking that "address and actualise the power of the situation, that make it a matter of particular concern, in other words, [that] *make us think*" (Stengers 2005). As design educators, practitioners, change-makers, we need tools for thinking anew, tools that allow us to *think through* what is happening, especially right now. Gilles Deleuze and Félix Guattari write about 'thinking *par le milieu'* to describe the particular situation of finding yourself in the middle of something. This expression hinges on the multiple meanings of the word *milieu*, in French *middle*, *surroundings or habitat*, and also *medium*. NOTE 1 'Thinking par le milieu' therefore means both thinking 'through the middle', without grounding definitions or an ideal horizon, without a specific beginning, or end, or teleology; but also thinking 'with the surroundings', which stresses the entanglement of something with its habitat. There are two observations to make. First, that no practice can be taken as disjointed from its habitat. Only by locating a practice within its habitat – which means understanding how it emerges from and is entangled with it – can we understand it and grasp its ethical standpoints. This matters because it is about the profound alliance between the *ethos* of a practice – its crucial concerns, what it pays attention to - and its *ecology* – the way it defines, and is defined by, its surroundings, its habitat, its home. Put differently, there is no ecology without ethics. While this definition of ecology emphasizes relationality as the capacity not just to cultivate heterogeneity, but to 'stay with' heterogeneity even in (especially in), difficult, friction-full and troubling times,

ethics on the other hand offers a way of mapping practices in terms of their affective encounters with their habitat: on the ground of what they can and cannot do, their capacities, affinities and powers. NOTE 2

A second observation is that Stengers' ecology of practices operates in a *minor* rather than in major key. Again, this is a concept drawn from Deleuze and Guattari (1988). The opposition minor/major should not mislead us into thinking that minor means smaller, weaker, less significant or vernacular. The difference between minor and major is not a quantitative one. A minor mode – like an arrow launched into the world, or like a witch's flight NOTE 3 – is a simmering line capable of attracting new forces, generating new thoughts, producing new affects. It possesses a generative potential: the potential to disturb the major with its creativity. While the major mode is the standard by which things are measured – take the Eurocentric/white design canon - the minor is the disruption that makes change possible, a relay through which forces are condensed and released – take the seismic reorientations to the above mentioned canon under the push of radical discourses coming from the Global South. Minor practices have a high coefficient for divergence, tend towards collective agency and are immediately political, whether in literature, languages or design (Marenko 2017). They have an unruly vitality. They are like "seeds, crystals of becoming whose value is to trigger uncontrollable movements of deterritorialization of the mean of majority" (Deleuze and Guattari 1988, 117). Crucially, the minor mode "collectively produces a divergence without a dream of convergence" (Stengers 2005a, 158). The minor mode is an adventure that does not wish to become major.

pluriverse

The pluriverse is not only about a plurality of views about the world. The pluriverse is the co-existing of many worlds and of many ontologies – where the plural (*ontologies*) signals the different ways of inhabiting the richness of multiple worlds. Pluriverse means to recognise that these multiple ontologies coexist in time and space in ways that are ontologically non-hierarchical. Acknowledging this is the first step at uncovering and

repairing how the pluriverse has been violently colonized by the project of modernity. NOTE 4 The pluriverse speaks of worlds that are constantly in the making, and whose plurality means "divergences that communicate, but partially, always partially" (Stengers 2019, 189). This raises the questions: How do we work out in practice the encounter of a plurality of ontologies? How do we foster the formation and propagation of 'connective tissue'? How do we facilitate connections without enforcing blueprinted grooves? How do we create encounters?

It may be useful to recall that, as Deleuze writes in *Practical Philosophy* (1988), creating encounters is an art, the very art of the *Ethics* itself. As such it requires experimentation, an adventurous mindset and the willingness to leap into the unknown. Every encounter is the encounter of different affective horizons. Every encounter is an event that creates and sustains a relation among different standpoints. It is precisely this 'situatedness' of each standpoint that enables the pluriverse. To participate to the pluriverse we must enter the encounter with the awareness that "each standpoint in situating itself becomes able to assert the legitimacy of other diverging standpoints" (Stengers 2019, 189). In this process of creating encounters lies the hope for relations that catalyse deep questioning, mobilize invention and build capacity against homogeneity, against the capture of lifeworlds and against the eradication of divergences. Ultimately, it is a project of building resisting and resistant relations. It matters greatly, then, how we imagine these relations, how we conceptualize them and how we 'figure them out' in practice. NOTE 5 One of the many possible ways of doing this 'figuring out the pluriverse' is by thinking through symbiosis, and the production of symbiotic events.

symbiosis

Symbiosis - from the Greek συμβίωσις = co-living (σύν=with, and βίος= life) - describes the situation where practices, agents, or living beings enter into a co-relationship defined by shared interests. While symbiosis describes the generic cohabitation of different organic agents (animal and/or vegetal), Stengers points out that co-living should not be seen as 'having the same interest in common'. Rather, "diverging interests now need each

other. Symbiotic events are a matter of opportunity, of partial connection, not of harmony" (Stengers 2019, 188). In nature there are several types of symbiotic relationships, some characterized by mutual advantage (e.g. hermit crab and sea anemone); some with only one agent's advantage, but with no damage to the other (e.g. barnacle and whale), or *phoresy* when one agent hitches a ride from another (e.g. flower mite and bee); some characterized by a clear disadvantage for one of the parties (parasitism). These relationships are far from static. In their becoming-symbiotic they enact divergence, diversity and plurality also by the non-harmonious means of friction, power imbalance and volatility. Precariousness and vulnerability are an intrinsic aspect of symbiotic relationships. NOTE 6

Stengers exhorts us to take a risk when encountering what diverges from our standpoint. *Dare to know*, she writes, drawing from the Roman poet Horace's motto '*Sapere aude. Incipe*', but diverging from the conventional reading that takes this expression as one of the guiding beacons of the Enlightenment. Instead, she reminds us that the verb 'to know' in Latin is '*sapere*', which also means 'to taste'.

> Dare to taste if you wish to become able to know: this is not a formula
> for a conquering enlightenment but of a cautious, relational exploration,
> and a situated one, as the effects are never 'objectively' good or bad,
> but are not 'only subjective' either. They are related to what is at stake
> in the situation (Stengers 2018, 409).

'Daring to know' is also 'daring to taste' but without the need to verify, test or substantiate. It is about learning that *what* is learned is inseparable by *how* it is learned, and that, therefore, it has always to do with *unlearning*. By entering into encounters with the indeterminate, we precipitate divergences that will force us to think, to open our eyes to see the world in a different way, to make us *unlearn*.

This constellation of concepts – divergence, ecology/ethology, minor, pluriverse, symbiosis – is proposed as a compass to orient possible journeys into transdisciplinarity, and it should not be taken as a prescriptive map. Rather it wants to indicate *a* possible

route into transdisciplinarity. The next section focuses on the value of this approach in challenge-driven modes of design education.

2. Why 21ˢᵗ Century Design Needs Transdisciplinarity

How do we establish fruitful collaborations across disciplines - especially across design, technologies, futures studies? This question can be reframed as: how do we deal with systemic uncertainty and growing complexity? Clearly, contemporary world problems are interdependent. In a context described as post-normal science (Funtowicz and Ravetz 1993) complex problems resist being addressed by isolated disciplines. As design educators, practitioners, change-makers, we need to develop the knowledge necessary to manage increasingly uncertain futures. To do so, it is time to stop seeing complexity as "some cursed and inescapable source of 'wicked problems'" (Miller 2018), and acknowledge that the epithet 'wicked' has run its course (Turnbull and Hoppe 2019). Let's prototype instead collaborative strategies that not only embrace uncertainty, but also dare to turn uncertainty into a resource, a material to work with. What counts in addressing the problems that are urgent today – climate catastrophe; aging population; urban mobility; digital inequity; truth crisis; pandemic; social injustice - is *reframing* them; it is asking new and different questions. Transdisciplinarity furnishes us with tools (for thinking, knowing and relating to the world) that afford the navigation of uncertain turbulent terrains; it casts in sharp relief the epistemological shift from *interpreting* the world as a homogenous entity - the fiction conveyed by the misleading and yet so familiar expression 'real-world' problems - to *attuning to* the multiplicity of worlds we also contribute to create (Morton 2018).

By establishing collaborative strategies with a plurality of modes of knowledge-making, methods, and perspectives, transdisciplinarity builds an expanded vision where common concerns (shared, divergent, or both) can materialize. Design is at the forefront of this endeavour because it has the capacity to spearhead speculative-pragmatic interventions that privilege the discursive (Tharp and Tharp 2018), and the shift from problem solving to problem finding (Agid 2019; Boehnert 2018; Hunt 2014; Marenko 2018). This

manoeuvre, however, can be sustained only through the production of salient and uncomfortable questions outside the established boundaries of disciplines – be them design practice, process philosophy, science and technology studies, futures studies. As I suggest, this can be done by framing transdisciplinarity as a process of *invention*.

transdisciplinarity: inventing the new

In his book *Bergsonism* (1991) Deleuze makes a distinction between invention and discovery that is worth revisiting. Discovery has to do with simply stated problems that already contain their own solution, which simply need to be uncovered. Discovery concerns something that already exists and would certainly happen sooner or later. Invention, on the other hand, creates what did not exist before: what "might never have happened" (Deleuze 1991). Because invention is concerned with the creation of the terms by which a problem will be stated, it is invention, not discovery, that pertains to a genuine transdisciplinary field. For Deleuze the activity of thinking is often misconceived as the search for solutions to problems, a prejudice rooted in the social and pedagogical system of formal education (school, university), where the teacher poses the problem and the pupil solves it by dis-covering the 'right' solution. Hard not to be reminded of that type of (design) education whose relentless focus on efficient problem-solving at all costs ends up jeopardizing creativity, criticality and risk-taking.

World problems have no given solution. That is why they *are* problems. Thus, they must be approached with a spirit of invention that mobilizes heterogeneous, divergent, messy components not to achieve a predetermined outcome, but to generate new research questions, themes and concerns. Thriving on the unanticipated, this process facilitates "emergent insight, knowledge and interaction that could not have been foreseen or designed in anticipation of a specific outcome or solution to a problem" (Blassnigg and Punt 2013). Transdisciplinarity is not only about transcending disciplinary boundaries to forge problem-driven inquiries; it is also about "letting the inquiry in itself drive the methods, tools and theoretical formations in order to stimulate the identification of new

concerns, insights and topics that emerge from the cross-fertilisation of rigorous and *imaginative* scholarly research" (Blassnigg and Punt 2013).

transdisciplinarity: not just a 'third space'

As "a methodological self-reflection on new research processes" (Osborne 2015) transdisciplinarity is necessary when problems cannot be addressed by existing disciplinary knowledge, not even in multi-disciplinary or interdisciplinary teams. The distinction between transdisciplinarity and other modes of knowledge production is important. While both *multi-disciplinarity* (when a topic is studied through several disciplines at the same time) and *inter-disciplinarity* (when shared methods and knowledge are created), work within the boundaries of established disciplines, transdisciplinarity operates in *between* disciplines. Its purpose is creating boundary-crossing, hybrid zones of contact. This is not just the creation of a 'third space' – at best reductive and derivative, at worst a Trojan horse for the reterritorialization of disciplinarian boundaries. As artist Andrew Yang, whose work sits at the intersection of biology, history of science, and visual arts, remarks, the aim is creating *nth spaces* that "do more than simply replicate their own norms indefinitely but instead propose novel, adaptable and robust ones that still lack a complete map. The artist, scientist, writer, philosopher, or activist could be one and the same person – and authentically so – working in great uncertainty to redescribe the world in motion" (Yang 2015, 320). NOTE 7 This notion of agents simultaneously inhabiting a multiplicity of roles (and personas) emerges also in the account of the collaborative activities this article outlines, of which more later.

Yang's powerful image of nth spaces should not be taken as suggesting unprecedented freedom of thought, lack of rigour or the rejection of methods. Transdisciplinarity does not mean *anything goes*. To reduce transdisciplinarity to 'fuzzy' boundaries is "a serious intellectual collapse" (Osborne 2015). Instead, to ensure that attempts at transdisciplinarity do not deteriorate into an empty dialogue with no method, transdisciplinarity should not be confused with interdisciplinarity and multidisciplinarity,

especially in relation to global issues; nor should it be used as a gap-filler to facilitate communication across fields, or to create shared platforms to accelerate knowledge exchange (Blassnigg and Punt 2013).

Caution should be exercised to avoid seeing 'design' and 'technology' or 'science' as static fields that enter transdisciplinary activity as monolithic entities. To reprise the point above, let's be vigilant of too-neat Venn diagrams visualizing 'third spaces'. Any discipline, field, practice keeps on changing, and is changed by, the way it encounters the world. Transdisciplinary knowledge production is never finished. On the contrary, it keeps on growing, following a non-linear, rhizomatic, spiralling trajectory. As Guattari observes in the essay *Transdisciplinarity Must Become Transversality* (2015), transdisciplinary research is a process that is "called on permanently to modify, to reconstruct, its object". In similar vein, anthropologist of technology Lucy Suchman remarks that "methods for studying science and technology, like their research objects, are both already made and always in the making" (Suchman 2012). To imagine this emerging landscape where to participate to a world in the making is both to create and be created, it is inspiring to draw on philosopher Karen Barad's notion of *quantum ontology*:

> There are no pre-existing individual objects with determinate boundaries and properties that precede some interaction, nor are there any concepts with determinate meanings that could be used to describe their behaviour; rather, determinate boundaries and properties of objects-within-phenomena, and determinate contingent meanings, are enacted through specific intra-actions, where *phenomena* are the ontological inseparability of intra-acting agencies (Barad 2012, 6).

Barad's image helps us to see transdisciplinary research as an ongoing, negotiable, process, as a mode of knowledge in-the-making with the potential to emancipate research and enquiry from staleness and predictability (Esser and Mittelman 2018). This becomes especially relevant in the context of the neoliberal university. For global studies scholar Manfred Steger transdisciplinarity rekindles "innovative forms of academic creativity in the current neoliberal educational environment" (Steger 2019, 765), which, as widely

reported, can stifle creativity with its obsession with metric, rankings, and quantification. NOTE 8

A thorny issue remains. Namely, the extent to which a process-oriented, uncertainty-embracing, negotiable-to-the-point-of-liquid mode of knowledge production has traction with the neoliberal university model, with its fetishization of flexibility, agility, resilience, and appropriation of nomadic and rhizomatic thought. It would be disingenuous to ignore the appeal that the kind of transdisciplinary research I advocate here, once packaged as 'knowledge exchange', yield for a highly competitive, commercially-driven, deregulated knowledge economy landscape. If anything, this should spur design educators, practitioners and change-makers to pursue transdisciplinarity with the awareness that their research choices always have politics, and that transversal methodology is always implicated in whatever it creates.

3. Hybrid Literacies For A Design Pedagogy Of Divergence

This last section builds upon the previous two to offer my personal reflections on some aspects of the ongoing collaboration between Central Saint Martins, University of the Arts London and Tokyo Institute of Technology. As an experiment in testing hybrid methodologies and developing hybrid literacies across design, technologies and futures, this collaboration is a petri-dish for a transdisciplinary pedagogy of divergence and a problem-driven design education fit for 21st century planetary challenges. This section is also the most personal as it draws on my role in and my account of collaborative activities to reflect on my learning on transdisciplinarity. This is were the title of the article becomes clearer: my ambition of using process philosophy to critique technologies so to reorient design research through transdisciplinarity in the context of this inter-institutional collaboration is like contending with a Jenga-style precarious architecture of *stacking complexities*.

For the past three years a core team from both institutions has engaged in exploratory and experimental activities on how to work together across art and design (Central Saint

Martins) and science and technology (Tokyo Institute of Technology). Initiatives so far include: a symposium investigating the nature of the experiment in art and design and science and technology; vision-building workshops with students, faculty and industry partners; intensive hackathons; informal *cafés philosophique* and *scientifique*; a colloquium on transdisciplinarity; mutual visits and network-building activities; residencies for designers, theorists, scientists, artists. What all these activities have in common is the desire to test process-driven, situated, hybrid methodologies that would bring together in an experimental and experiential manner informed by intellectual curiosity and learning-by-doing, tools and approaches from art and design with tools and approaches from science and technology ones. NOTE 9

As one of the Residencies recipients I spent one month at Tokyo Institute of Technology in 2018 , and returned several times as WRHI Specially Appointed Professor. NOTE 10 During my time in Tokyo I taught the elective course "What Design for the Post-Anthropocene?" and worked in close collaboration with Professor Kayoko Nohara, expert in Translation Studies in the Department of Transdisciplinary Science and Engineering, School of Environment and Society at Tokyo Institute of Technology; and with Central Saint Martins' faculty members and fellow resident practitioners Heather Barnett (interdisciplinary scholar and artist) and Ulrike Oberlack (designer). The mix of theoretical and practical activities we cumulatively offered (talks, lectures, workshops, hackathons, study-visits etc.) attracted Tokyo Institute of Technology graduate and doctoral students from human-computer interaction, data and computer science, material, electrical, chemical, nuclear engineering etc. Collectively (together and asynchronously) we contributed to the joint research project *Existential Wearables*, an experimental, speculative-pragmatic investigation of the impact of future technologies on the daily urban experience of Tokyoites. This project functioned as a test-bed where inputs from philosophy, art and design practice, material research, STS, translation studies were tested in a variety of educational settings, and where many of the ideas presented here began to take shape. *Existential Wearables* culminated in a public event that, alongside talks, discussion and audience hands-on engagement with materials,

showcased the design prototypes built by the students, reflecting concerns about environmental change, the search for personal space, and the challenges of meaningful interpersonal communication of urban experience. NOTE 11

My role as 'theorist in residence' entailed articulating insights on how to situate, analyse and critique received notions of technology, design and futures, using a transdisciplinary approach that brought together the theoretical lens offered by process philosophy with the tangible interventions of design practice. This speculative-pragmatic approach informed my contributions, from the formal setting of the accredited course to the intimate space of the *café philosophique* I hosted at Tokyo Institute of Technology. This event stands out as a space where, using the notion of 'encounter' as a discussion prompt, we began to unpick some of the assumptions baked in our own respective fields - to start with my own, informed by the Eurocentric canon of 20th century French philosophy.

One of the fundamental challenges of transdisciplinary work is how to bring together in a meaningful conversation disciplines that have radically different histories, epistemologies, literatures, working habits, research models, writing processes, publication conventions, and social and political commitments – even, like in our case here, also different institutional apparatuses, cultural practices, spoken languages, nationalities. Misunderstanding and comprehension gaps can happen given the many stacks involved. For us, at *inter-institutional* level the challenge was how to develop nuanced understandings about two distinct epistemic cultures: Tokyo Institute of Technology, with its discrete research labs each with embedded teaching programs, and Central Saint Martins, with its nine programmes each with courses and research activities. Inter-institutional modes of communication were effectively strategized around key individuals and their existent social capital, expertise and networking capacity. Another stack was *intra-institutional*, with relations and learning opportunities built within each institution and then cascaded across and outward. While several channels (e.g. informal networks, official reporting structures, social media platforms, public and semi-public events) were deployed to communicate and disseminate outputs, what became evident was the role of not-necessarily-planned conversations across faculty of the two institutions. These

loosely crafted forms of experiential learning supported more conventionally structured collaborative activities. By not discounting any opportunity to make meaningful interaction through the valorisation of the 'impromptu' or 'trivial', this manoeuvre was fundamental to expose tacit assumptions on both sides, and to gently disarm ensuing misunderstanding. While transdisciplinary research is fraught with many drawbacks, the issue of *tacit knowledge* is certainly one of the knottier. What may seem a perfectly good idea on paper or in conversation might generate further complications because of assumptions each partner has on the other's epistemology, system of values and methodology. I learned to be attentive to tacit knowledge by drawing on translation as a process.

Transdisciplinarity and translation have more in common than just the prefix *trans-*: namely, a degree of *productive ambiguity* in comparable methodological, epistemological and ontological challenges. Staying with this ambiguity and using it as a resource can outwit the pitfalls of tacit knowledge. For instance, how we talk with colleagues about ours - mine and theirs - respective disciplines matters greatly. Attention paid to linguistic nuances and to the 'tone' of the exchange should be acknowledged as a component of transdisciplinary research. Terminology is not just a reflection of reality. Rather, it is a form of *boundary work* that filters, directs attention and claims a specific territory (Klein 2017). Put differently, the question of knowledge-making, and what in each disciplinary field – whether philosophy, nuclear engineering, translation studies, or product design - counts as knowledge, cannot be separated from how one talks about it. This demands of us researchers and educators that we remain alert of *whom* we are talking to, and mindful of using sectorial expressions, field-specific terms and local jargons that could be downright incomprehensible to 'outsiders'. I learned (and am still learning) how to 'translate' terms recurrent in my practice (of theorist working in design) without losing complexity, by launching them as bridges toward the other. For Klein "the most valuable parts of transdisciplinary exchanges comes from the opportunities they create for collaborators to *translate* [emphasis added] the content and the value of their work for one another" (Klein 2017, 118). This is even more relevant to an endeavour like ours not

'only' transdisciplinary, but also highly trans-cultural and trans-linguistic. With an international core team spanning four different nationalities, operating mostly in Japan and using English as lingua franca, distinctive manners of communicating entered the transdisciplinary process, together with idiosyncratic ways of enacting multiple belongings and conflicted identities. I learned to treat these instances as precious elements in an emergent co-constitutive process. Frank discussions about how to translate 'what counts as knowledge' into meaningful research questions, were crucial to our progress.

Perhaps paradoxically, I also learned the *power of silence* - the intentional and radical use of silence as a space for reflection, deliberate suspension, anticipatory interval and pause void of words where new thoughts can coalesce. If it seems a contradiction (how can explicit discussions coexist with productive ambiguity and powerful silence?), it should rather be seen as a manifestation of the divergence discussed earlier, where resisting the need to recompose differences can yield generative creation. Silence is a powerful pedagogical technique that affords sustained reflection, ideal for intense idea-generation and pattern-building; by diluting the clamour of dominant voices in a group discussion, it empowers equally all participants, even the most introvert or less confident of us – for instance, 'silent brainstorming' during vision-building workshops on how to imagine and design alternate futures; or the insertion of (no-expectation) silent pauses during conversations and learning activities. The revelation – maybe banal, but how often is silence overlooked? – was that silence is a mine of insights; it boosts reflection, increases self-awareness, can steer towards new mindsets. By 'staying with' powerful silence and with productive ambiguity I learned that divergence does not have to mean antagonism; that collision does not have to mean communication breakdown; that these moments can become openings. This, I learned, is possible by cultivating an atmosphere where an unbound *circulation of affects* enters transdisciplinary work: not only the positive and encouraging ones - enthusiasm, praise and accomplishment - but also reticence, confusion and doubt (Fitzgerald 2014).

Concluding remarks

My reflections try to capture learning experiences that have occurred progressively but not necessarily evenly; with important insights, turns or resolutions surfacing often unexpectedly in the 'wrong' places and not according to devised plans - indeed, at times, almost despite them. As I post-rationalize, I also ponder whether transdisciplinary learning should be described as an acquisitive, mutual, transformative, distributed, *slow* process that happens in the spaces in-between plans; as an experiential activity that, because of its liminality, tends to resist close jurisdiction, micro-management and top-down monitoring. Thus, the challenge is maintaining balance between sticking to a blueprint and letting the process unfold organically; navigating open-endedness and spontaneity, while retaining guidelines; in short, enabling the coexistence of different kinds of togetherness and opportunistic symbioses.

To circle back to my opening question – what does it mean to be together? – I learned that situations that offer little or minimal way to ascertain whether 'togetherness', let alone 'transdisciplinarity', are effectively developing, can be reframed as different modes of enacting what togetherness may be. Not so much as a compact unit of intents, or as a neat pie chart built around a clearly defined common goal, but rather as a dynamic wave characterized by its own (not necessarily regular) rhythm made of peaks and valleys, hesitations and frayed edges, generating *distributed non-hierarchical accountability.* The difference is between togetherness as a state (something to seek, build and achieve), and *togetherness as a becoming* ontogenetically processual. The image that illustrates this is a stacking assemblage of horizontal and vertical components intersecting each other and traversed by diagonal ones. Transversality - the potential of relations to cultivate and establish further relations - concerns a diagonal (minor) mode that unlocks the orthogonal mechanic of verticality and horizontality, and releases hitherto latent potential. It is precisely the gesture of welcoming and making space for *unexpected transversalities* that activates 'stacking complexities' and creates spaces of learning and unlearning. Here I am getting closer to transdisciplinarity in action, which asks of us to become sensitive to culturally-situated practices and discourses; to become at ease even

without the reassurance of a singular conceptual framework; to learn to operate in situations where we may be performing multiple roles (and having to redefine what being 'productive' means in each of them). This is one of the values of transdisciplinary work: the acknowledgement that participants (from the core team to the occasional public) perform more-than-one position, inhabit more-than-one situation: novice and expert, generaliser and particulariser, knower and doer, thinker and practitioner, artist and activist. The list goes on, to reiterate Yang's point earlier, each position advocating *a* type of knowledge, and enacting *a* way of distinctly taking part. For this plurality of roles to be enacted in safety and solidarity, a priority of any transdisciplinary project should be the creation of informal and convivial arenas characterized by bridge-launching, low-pressure to inhabit and perform multiple roles, the slow decanting of ideas.

While, broadly, the collaboration outlined here concerns how the encounter of the humanities, design and 'hard' sciences highlights different interpretations of 'creativity', 'experimentation', 'agency' my interest remains in unhinging assumptions on how the nexus technology-future is articulated through design. This, I argue, demands *hybrid literacies* – across critical technologies and design futures *literacies* - to assist in sense-making around technological innovation. Crucially these terms must be plural: literac*ies*, plural technolog*ies*, plural future*s*. Thus, *stacking complexities* too.

How to negotiate stacking complexities? By observing boundary-crossing processes – whether boundaries are disciplinary, cultural, linguistic, conceptual. What disturbs established perspectives and subject-specific conventions is precious because it brings new objects into view, place practices into unexpected configurations, create new constellations among existing ideas. The process of heterogeneous components coming together to create something that did not exist before their encounter is a process of *becoming hybrid*. Here I take the hybrid as a contingent entity whose composite nature affords epistemological 'lockpicking' that unhinges dualistic narratives (Latour 1993).

Transdisciplinarity itself is about contending with forms of hybridity or, better, processes of *hybridizations*.

For me, this has to do with building capacity to ask questions and speculate on futures that are different from those envisioned by techno-determinist standpoints. This can be done by cultivating an approach at once creative and critical to the understanding of technologies through design practice; an approach that eschews the tendency towards a linear, solution-led approach, and fosters instead problem-finding, inquiry, and the crafting of hybrid literacies. *Hybrid literacies* are transversal literacies rooted not only in knowledge acquisition, but in knowledge deployment for mindset change. By combining modes of knowledge-production they promote sense-making capacities attuned to complex and unpredictable scenarios. Hybrid literacies are opportunity-seeking and transversal. They operate in that diagonal and minor mode that uses boundary-crossing, uncertainty and risk as materials to work with; they turn stacking complexities into chances for learning and unlearning. Guattari reminds us that for transdisciplinarity to become transversality - across science, society, aesthetic, politics – we must continually invent, experiment and design its conditions as they will not happen spontaneously.

Here's my own practical pointers to this aim:

- Work together but not to smooth contrasts, reduce complexity or explain divergences away in the name of a superior transcendent knowledge
- Pay due attention to the divergences that make up your ways of producing knowledge and resist the temptation of a single unified 'truth'
- Learn from the others not as they are, but as they become learners themselves
- Acknowledge that the creation of relationships is a localised, precarious, non-innocent event, therefore it can only be pragmatic and political
- Develop a healthy understanding of relativism and universalism by using *and…and….and…* rather than the *either/or* as your guiding mode
- Present yourself from the standpoint of your divergence

- Care about the participation of non-specialist publics so that new questions can be asked
- Commit to flat hierarchies so that all voices can be heard
- Treat any encounter as a space where learning coexists with unlearning.

If there is one thing I learned is that any project that aspires to be transdisciplinary must stay focused on, and be spurred by, that little prefix *trans-*. *Trans*-disciplinarity is first and foremost *trans*-gression: of boundaries, of expectations, of received assumptions. For social scientist Helga Nowotny knowledge itself becomes transgressive as it "seeps through institutional structures, like water through pores of a membrane. As with liquids in membranes, knowledge seeps in both directions, from science to society and society to science" (Gibbons and Nowotny 2001). This is a process with its own timescales, speeds and *slownesses*. Contrary to approaches that distil complexity into two-minute soundbites, easy-fix kits and measurable problem-solving, a slow mode acknowledges that time dedicated to conversation, silent reflection, idea-meandering, is a value and not a waste. As long as we pay attention, this is where ours - mine, yours - intentions, agencies and enactments cohabit with divergences, heterogeneity and lack of consensus.
Paying attention is accepting that there are radically divergent ways in which a situation matters. Paying attention is about asking questions, looking closely, resisting closures and silos, creating new modes, not by just erasing boundaries, but by building hybrid zones of exchange across them. Borrowing Stengers' words one last time, transdisciplinarity becomes "a way of thinking which challenges business-as-usual explanatory frameworks, […] a mode of thought which endeavours to activate what might be possible against the safety of probability" (Savransky and Stengers 2018).
Transdisciplinarity allows us to go beyond what exists already. It pushes us to disassemble systems of tacit, normative knowledge; to open our eyes not only to see the world as it is, but to imagine it, and prototype it in another way. It pushes us to make the present more complicated, more interesting, richer so that futures can be too. It is within this space of

risk, of the unexpected, and of positive uncertainty that the real adventure of thinking, and doing, and being *together* becomes palpably alive.

NOTES

1. *Milieu* should not be translated as 'environment'; rather, it describes the atmosphere and the circumstance where something or someone is embedded.

2. In his work on Spinoza, Deleuze describes ethology as 'the study of the relations of speed and slowness, of the capacities for affecting and being affected that characterise each thing" (1988).

3. The witch's flight is evoked by Deleuze and Guattari (1988; 1994) to signify the capacity of thinking, and to think anew, against, afresh. Stengers returns insistently to the witches to foreground the birth and development of scientific methodologies and of modern exclusionary knowledge.

4. For an excellent introduction see Querejazu (2016); also Escobar (2018).

5. 'Figuring out' points to the processual, in-the-making, nature of knowledge-building practices, that deal with the uncertain, the indeterminate and the expansive.

6. See Donna Haraway (2016) for ample discussion of symbiosis, symbiogenesis and sympoietics; and Timothy Morton (2017) for the notion of "symbiotic real" which stresses how symbiotic relationships are always fragile and contingent.

7. Tony Fry's notion of *border thinking* (2017) - "an intermediate space of thought and action based upon political and pragmatic acts of appropriation and bricolage" - is also relevant here. As he explains: "the borderland constitutes conditions of exchange in a dispositional space of between-ness wherein alienation and hypercritical reflection meet. It may also be materialized as an intercultural zone of encounter and discussion where information is exchanged, lifeworlds are translated, solidarity is built and friendships forged" (Fry 2017 11).

8. For a rigorous and unflinching assessment of "instrumental rationality" in universities see also Collini (2012; 2017). See also James Mittelman's book

Implausible Dream: The World-Class University and Repurposing Higher Education (2018).

9. For an extensive account of the collaboration between Central Saint Martins and Tokyo Institute of Technology: https://www.arts.ac.uk/colleges/central-saint-martins/about-csm/global/initiatives/tokyo/tokyo-tech

10. WRHI (World Research Hub Initiative) is a Japan government funded project established in 2017 at Tokyo Institute of Technology with the aim of promoting international collaborative research and fostering transdisciplinary exchange around current challenges confronting society. It comprises four hubs: Artificial Intelligence; Cell Biology; Materials and Devices; Social Implementation https://www.wrhi.iir.titech.ac.jp/en/

11. https://www.artscouncil-tokyo.jp/en/what-we-do/support/program/33038/

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